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The Intersection of Media Multitasking and Procrastination in Academic Performance

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by

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ABSTRACT

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Both media multitasking and procrastination have been shown in isolation to negatively affect academic performance. However, less research has focused on the intersection of these two constructs in the academic context. This thesis sought to bridge this gap by using an academic program coaching students with study tips to gather longitudinal survey data pertaining to media multitasking, procrastination, study habits, and academic performance. Counter to the hypotheses, media multitasking did not significantly correlate with grades, nor with procrastination. However, as hypothesized, procrastination did correlate negatively with grades and was also associated with greater stress, as well as reported binge studying intention and behavior. Additionally, the data did not support a hypothesized interaction effect between media multitasking and procrastination, whereby the two would amplify a negative impact on grades. Alternate explanations for the mixed results are offered, as well as suggestions that procrastination via digital media use may actually have remedial effects aiding academic performance.

Introduction

The rise of the Internet, social media, and smartphones has been heralded, for better or for worse, as the most influential catalysts for change in our time. These three have also been cited for fueling one of the most pervasive and growing forces in our psychological and social lives: media multitasking and the resulting distracted mind (Gazzaley & Rosen, 2016). Media multitasking extends to the workplace, where interruptions abound, stifling productivity and increasing stress; to the quality of social and family relations, where phones divide attention at dinner tables; and to safety, where accidents in driving and even walking arise due to smartphone use. One of the most pervasive effects likely lies in education and the lives of students who are immersed and thus especially susceptible to the costs of media multitasking. Research shows that when students media multitask with texting or social media in the classroom, their academic performance suffers (e.g., Junco & Cotten, 2011a, 2012). This problem can be pronounced because the temptation to media multitask can become ever-present for students who have their phones and laptops at hand even when in the classroom.

Before media multitasking became a phenomenon, other obstacles negatively impacted student performance, most notably procrastination. A large body of research going back decades looks at the negative effects of procrastination (e.g., Solomon & Rothblum, 1984). Indeed, Kim and Seo's (2015) comprehensive meta-analysis concludes that there is a significant negative correlation between procrastination and academic performance.

Given procrastination has been on the rise in recent years (Steel, 2007; Steel & Ferrari, 2013), and given media multitasking is also a potentially potent force that affects the attainment of goals and accomplishments, the natural question that arises is, what happens

when the two intersect? While plenty of research has been conducted separately on procrastination and media multitasking, there is scant work on this intersection in the context of academic performance or grades.

This thesis addresses this current gap in the literature. This is particularly valuable not only because research has focused on these phenomena in isolation, but there is good reason to believe that for students today these phenomena interact to a heightened degree: for students, media multitasking becomes a readily available means to procrastinate and the potency of media distractions can fuel more procrastination. For the student of today and very likely tomorrow, such obstacles are not going away anytime soon, making research on this matter especially pertinent.

To address this important gap, this thesis made use of a university-run program, which aimed to teach better study skills to students so as to improve academic performance. In doing so, the present research looked at constructs of media multitasking and procrastination in isolation and at their intersection. Below, media multitasking and procrastination and their relation to academic performance are reviewed, with emphasis on the theoretical mechanisms through which one's mind becomes habituated to distraction including temporal, cognitive, and affective impediments. Specifically, time loss compounds, cognitive capacity is negatively affected directly, as well as indirectly from associated stress, and short-term affective systems dominate. Thirdly, the much larger question of how these two variables might work in combination is addressed, specifically with the potential for compounding impediments.

Media Multitasking

Background on Media Multitasking

A review of definitions in the recent literature suggests that media multitasking is best described as the simultaneous pursuit of two or more largely independent tasks, where at least one of those tasks involves media (Xu, Wang, & David, 2016). However, some researchers are quick to stress that multitasking does not entail doing two tasks simultaneously, but rather very rapidly switching between tasks (e.g., Gazzaley & Rosen, 2012). While individuals can conduct some tasks at the same time, such as the canonical walking and chewing gum, whenever they are dealing with two tasks with separate higher-order goals, the cognitive systems in the brain do their best to rapidly switch between the tasks.

Research has also found that up to 95% of the US population media multitask daily, and on average individuals engage with at least one medium for one-third of the day, such as smartphone or television (Gazzaley & Rosen, 2016). Such statistics make sense given the reach of smartphones, which facilitate media multitasking. Polling data has found that 95% of Americans own a cellphone of some kind and 77% own a smartphone (Pew Internet Research, 2018). Given smartphones are so readily at hand, not to mention the abundance of other forms of ambient media and screens, the prevalence of media multitasking is unsurprising.

General Negative Effects of Media Multitasking

Media multitasking is associated with a range of negative outcomes. In terms of safety, examples include injuries and deaths from driving while texting (Nemme & White, 2010) and even walking while texting (Hyman, Boss, Wise, McKenzie, & Caggiano, 2010). Interpersonally, face-to-face relationships can be compromised by media multitasking at family dinners, outings with friends, or work activities (Turkle, 2011, 2015) as even the mere presence of a phone negatively affects empathy, closeness, and conversation quality in

dyads (Misra, Cheng, Genevie, & Yuan; 2016; Przybylski & Weinstein, 2012). Sleep problems and their negative outcomes have also been attributed to media multitasking with electronic screens (Cain & Gradisar, 2009; van der Schuur, Baumgartner, Sumter, & Valkenburg, 2018). Interruptions and self-initiated interruptions with email at work are also responsible for substantial losses in productivity due to the energy it takes to restart a task after an interruption (Gonzalez & Mark, 2004; Marulanda-Carter & Jackson, 2012). Further, other examples of everyday multitasking include work-family multitasking, effectively bringing the office home, but also to school functions, vacations, and even church (Gazzaley & Rosen, 2016; Turkle, 2011, 2015).

Negative Effects of Media Multitasking on Academic Performance

In the context of academics, the prevalence of media multitasking among college students is high. Jacobsen and Forste (2011) found that two-thirds of university students in their study engage in media multitasking while in class, doing schoolwork, or studying. Additionally, Sanchez-Martinez and Otero (2009) reported that half of students surveyed bring their cell-phones to lecture and leave them on. Similarly, a range of studies corroborate that an increasing number of students engage in academic work while media multitasking, like IM-ing, SNS use, or browsing internet videos (Grinter, Palen, & Eldridge, 2006; Huang & Leung, 2009; Junco & Cotten, 2011b, 2012).

One of the most common findings in this area of research is the negative effects of media multitasking while in the classroom. When in the classroom, Facebook activities are linked to poorer grades, despite other benefits that may come from being densely connected (Skiera, Hinz, & Spann, 2015). Similarly, Wood et al. (2012) reported that students do not learn as well in class environments that allow media multitasking with platforms like Facebook or MSN Messenger. Further, data has supported the claim that media multitasking

in the classroom with social networking sites and instant messaging decreases productivity and efficiency in the classroom (Bowman, Levine, Waite, & Gendron, 2010; Fox, Rosen, & Crawford, 2009; Jacobsen & Forste, 2011). Laptops have also been shown to be a risk in the classroom, whereby students may engage in distractive media multitasking that is related to decrements in academic performance (e.g., Fried, 2008; Kraushaar & Novak, 2010; Wood et al., 2012).

There are also other negative outcomes from media multitasking that are worth considering in the context of studying. Patterson (2017) found that during study time students who had low levels of media multitasking while studying (0-2 technologies) significantly outperformed students with high levels of media multitasking (7 or more technologies) on an academic exam. Likewise, Junco (2015) found that GPA declined the more freshman, sophomores, and juniors used Facebook while doing schoolwork. Finally, Carrillo and Subrahmanyam (2014) found that outside of the classroom, efficiency but not comprehension was compromised on a reading comprehension task where one group was interrupted by text messages as they read. However, both efficiency and comprehension were compromised when the assignment was conducted in the classroom. This study raises the important question of whether there are any disadvantages when students end up taking longer to complete assignments when repeatedly being interrupted, a point that will be returned to.

Specific Types of Media Multitasking and Negative Effects

Importantly, some specific types of technologies, more so than others, have been shown to foster stronger negative effects of media multitasking on academic performance, whether inside or outside the classroom. For instance, Junco and Cotten (2011a, 2012) looked at a range of possible variables and found that the only two that proved to be

negatively associated with GPA were checking Facebook and text messaging whether in the classroom or while studying. Similarly, Lau (2017) found academic use of social media, whether inside or outside the classroom, was shown to not compromise GPA, whereas playing video games or multitasking with social media during schoolwork did show a negative relation with GPA.

As these examples illustrate, there are a host of potential variables one can investigate as responsible for poorer academic outcomes. These variables are not just limited to the type of media multitasking technology but can include a range of relationships, including motivators, direct effects, and mediation of multitasking, among others. For instance, respective examples include anxiety and fear of missing out (Lepp, Barkley, & Karpinski, 2014), negative effects of task switching on productivity, (e.g., Rosen, Carrier, & Cheever, 2013), and time displacement in total hours studied (Kirschner & Karpinski, 2010). Given the range of potential variables that may impede one academically, this thesis focuses on three underlying dimensions that are especially pertinent to the investigation of media multitasking and procrastination. These include impediments that are temporal, cognitive, and affective.

Negative Impediments of Media Multitasking

Various types of underlying dimensions can be conceptualized to impede one's academic performance when media multitasking and procrastination are involved. First, because media multitasking and procrastination at their core involve cognitive and affective processes, these two dimensions are worth considering closely. Indeed, a line of literature in emotion and cognition has drawn attention to both the importance of appraisals and cognitive processes working in tandem with affective processes (Davidson, 2000; Lazarus, 1991, 1998) and especially in the context of coping with stress (Lazarus, 1993). In terms of

the cognitive dimension, the seminal study on media multitasking (Ophir, Nass, & Wagner, 2009) underscores the underperformance of heavy media multitaskers, compared to light media multitaskers, on various cognitive measures. Additionally, various ensuing research on media multitasking has pointed to the important role of the affective dimension, including emotional gratifications (Wang & Tchernev, 2012) and short-term mood optimization (Panek, 2014; Rebetez et al., 2015; Reinecke et al., 2018a). With procrastination, the mounting stress that comes from procrastinating takes an affective toll (Tice & Baumeister, 1997) and also fatigues cognitive capacities (Gazzaley & Rosen, 2016)

Additionally though, there is a temporal dimension that is central to both media multitasking and procrastination. That is, procrastination by its nature involves delaying tasks into the future despite negative costs (Steel, 2007), while media multitasking involves task switching that comes with costs that prolong the time needed to complete a task (Carrillo & Subrahmanyam, 2014; Rosen, Carrier, & Cheever, 2013). Because the temporal dimension is so integral to these two phenomena, it is considered alongside the cognitive and affective as dimensions that can act as impediments to academic performance.

This thesis considers these impediments as intervening or mediating processes; that is, these impediments are conceptualized as the ways through which media multitasking or procrastination lead to poor academic performance. Though testing these mediating dimensions is beyond the scope of this thesis, they are considered here so as to help conceptualize the means by which media multitasking can exert adverse effects on academic performance. Additionally, while it is beyond the scope of this thesis to fit all the nuanced potential relationships into a comprehensive model (e.g., feedback loops) that can be involved in such processes, this thesis aims to explore the higher-level model

conceptualizing the mediating role of these impediments on media multitasking's (or procrastination's) effects on academic performance.

Temporal impediments. Temporal impediments involve time costs/displacement, efficiency, and time pressure. To investigate time costs of media multitasking, it helps to highlight a few studies. Judd (2013) tracked the computer logs of 3,330 sessions in the University of Melbourne computer lab and found that the average amount of time on a task before task switching was 2.3 minutes. Only 10 percent of the sessions did not involve task switching, and the culprits for task switching were heavily email, social media, and texting. These findings were echoed by Rosen, Carrier, and Cheever (2013), who examined middle school to college students' use of task switching while they studied. They found students could not maintain studying for more than three to four minutes without switching tasks. This was the case even when the material was very important for their studies. Thus a clear *cost* to task switching is the inefficient use of time. The students in this study had 15 minutes of study time, but the interruptions from task switching led them to only use 9 minutes of it. As a result, students with demanding studies and schedules are left with less time to use effectively when they are in the habit of media multitasking.

An important distinction from Carrillo and Subrahmanyam's (2014) study mentioned above is that media multitasking with a reading assignment does not interfere with comprehension but does impede efficiency. In this study, the group that was interrupted with text messages while reading took longer to read, even after the interruption time was taken out; however, their comprehension did not suffer. However, it is important to note that in college, students do not always have a surplus of time, especially with the increasing load of papers and studying at the end of the term. Lost time can mean less time on other crucial assignments, less sleep, and less time rejuvenating with non-school activities. Therefore,

media multitasking has the potential to hamper effective time management in general, leading to downstream effects on academic performance as well as health.

Yet efficiency may not be the only downside to constrained time management. Gonzalez and Mark (2004) found that interruptions and their time costs lead individuals to produce rushed work under greater stress. The researchers found that in the workplace interruptions occurred every three minutes or so. Interestingly, it took individuals substantial time, ranging from two to 40 minutes, to recover from these interruptions and return to the task. When employees are strapped for time due to interruptions, it has been shown that they then work faster to compensate for lost time, but this leads to substantial costs, including greater stress, effort, and frustration (Mark, Gudith, & Klocke, 2008). While a student may have more free time at the start of the term and take on interruptions with less difficulty – as is the case in the reading comprehension task of Carrillo and Subrahmanyam (2014) – as time becomes shorter throughout the term, the lost time may translate into mounting stress, less time for thorough work, and resulting poorer academic performance.

Cognitive impediments. There are significant cognitive impediments from media multitasking as well. Cognitive impediments affect cognitive capacities and cognitive functioning, both of which Gazzaley and Rosen (2016) cite as processes central to goal setting and achievement. One important example comes from the seminal research by Ophir, Nass, and Wagner (2009), who looked at media multitasking by university students. They found that heavy media multitaskers perform significantly worse than low media multitaskers on tasks involving task switching and suppressing of irrelevant distractors. In other words, heavy media multitasking is negatively related to cognitive control capacities. The study also emphasizes that despite their own perceptions that they are better at multitasking, heavy media multitaskers actually do worse in this domain. As a result,

students may "feel" they are learning just fine when they media multitask in class, but their exams might show otherwise.

Junco and Cotton (2012) integrate theory into the cognitive costs of media multitasking. They draw on the cognitive science literature of Mayer and Moreno (2003) by suggesting that the auditory and visual channels of information processes are limited. Specifically, there is taxing of essential processing (i.e., the basic cognitive processes needed to make sense of learning material) and representational holding (what is held in working memory or "short-term memory"), while increasing incidental processing (that which responds and processes to superfluous information). In other words, a greater bottleneck occurs for processing that is essential. At the same time, more capacity is lost to resources going toward superfluous information. As Junco and Cotten suggest, this leads to the precluding of deeper learning, which can again impede academic performance.

Additionally, more recent research by Ward, Duke, Gneezy, and Bos (2017) has suggested that even the mere presence of one's smartphone comes with a cost in cognitive capacities by taking up cognitive resources. Their research found that those with their phones nearby performed worse on tests of cognitive capacity (working memory and fluid intelligence) than those with their phones in another room. In this way, the effects of one's tethered relationship to one's smartphone need not involve active multitasking but can take place on a subliminal level or in more passive forms with just the phone around. As a result, students who are closely attached to their phones while studying and while taking an exam may have their performance impeded.

Affective impediments. There are also affective impediments. Affective impediments arise from emotional states, drives, or impulses. To understand the affective side of multitasking, it helps to understand that the brain has two distinct neural systems that

underlie short versus long-term gratification (McClure, Laibson, Loewenstein, & Cohen, 2004). These systems have been linked to differences in self-control (Mischel, 2014). The claim explored in this theoretical discussion is that media multitasking habituates one toward short-term gratification. Such repeated reinforcement will lead to the weakening of the long-term neural gratification system and the strengthening of the short-term system. Such processes are also exploited in video game design as well as other media to create "compulsion loops" that work through short-term reinforcement via hits of dopamine (Han et al., 2011; Howard-Jones & Jay, 2016).

Other models like Gazzaley and Rosen's (2016) optimal forager model align with these claims. Gazzaley and Rosen suggest one's habits become akin to an animal like a squirrel that forages for food from tree to tree, sometimes optimally and sometimes suboptimally. However, modern technology has tended to encourage suboptimal habits, leading individuals to never stay long enough in one spot to reap substantial gains, but encouraging them to quickly move from place to place. Combining this with the insights from McClure et al. (2004) on neural systems and self-control from Mischel (2014), it can be said that media multitasking habituates individuals more to quickly seek short-term gratification. Because this gratification is often suboptimal, the resulting affective state leads one to seek more short-term gratification elsewhere, leading to another suboptimal chain of foraging.

In effect, multitasking can lead one to become short on time, cognitively spread thin, and affectively driven by suboptimal pursuits of constant task switching. The testing of these specific underlying dimensions is beyond the scope of this thesis. However, the theoretical discussion around these three domains of impediments gives support to the hypothesis that media multitasking negatively affects academic performance. Thus, it is

proposed that, consistent with previous research (e.g., Junco, 2015; Junco & Cotten, 2011a, 2012; Patterson, 2017):

- **H1:** Media multitasking will be negatively associated with grades.

Procrastination

Background on Procrastination

Procrastination has been framed in the literature as a self-control or self-regulatory failure (Steel, 2007). Yet, defining procrastination can prove difficult, as Steel notes that definitions for procrastination can be nearly as diverse as researchers on procrastination. Nonetheless, his meta-analysis and theoretical review define the term as follows: "To procrastinate is to voluntarily delay an intended course of action despite expecting to be worse off for the delay" (Steel, 2007, p. 7). In essence, it has been summarized as "to put off, despite being worse off" (Steel & Ferrari, 2013, p. 51). Gustavson and Miyake (2017) adapt this definition to the context of academic procrastination, which they define as: "the voluntarily delay of action on academic tasks despite expecting to be worse off for that delay" (p. 160).

The prevalence of procrastination is widespread and has been found to be increasing in recent years (Steel, 2007; Steel & Ferrari, 2013). Most people admit to procrastinating to some degree, and in the general population it has been reported that 15-20% of adults are chronic procrastinators (Steel, 2007). In the academic context, it has been estimated that over 70% of the student population procrastinate, with more than 50% claiming to procrastinate consistently and problematically (Day, Mensink, & O'Sullivan, 2000; Ferrari, O' Callaghan, & Newbegin, 2005). Additionally, those who procrastinate tend to want to reduce their levels of procrastination (Gallagher, Golin, & Kelleher, 1992). In sum, most students procrastinate and wish they did so less. For students who procrastinate, the

beginning of the academic term starts happy and enjoyable, as they postpone studying and work on assignments, but end up feeling stressed at the end of the term and wind up with poorer grades than non-procrastinators (Tice & Baumeister, 1997).

Importantly, in recent decades, some researchers focusing on the time management aspects of procrastination have begun to conceptualize different forms of procrastination that have strayed from the traditional meaning of procrastination. One distinction that arose stems from whether procrastination is seen as functional or dysfunctional (Kim & Seo, 2015). "Active procrastination" has been argued as a form of functional procrastination, where individuals deliberately delay tasks, but thrive on the rush of deadlines and are still satisfied with their results (Chu & Choi, 2005; Choi & Moran, 2009). This is in contrast to traditional "passive" procrastination whereby individuals wait till the last minute out of an inability to make decisions in a timely manner and, thereby, experience negative consequences.

Similar to the active and passive labels, Ferrari, O'Callaghan, and Newbegin (2005) categorize procrastinators as *arousal procrastinators* who get a thrill from working to the last minute and *avoidant procrastinators* who avoid work out of fears of failure or inadequacy. However, other researchers have responded that active procrastination is better categorized not as a form of procrastination, but simply as a form of effective time management or purposeful delay (Corkin, Yu, & Lindt, 2011; Pychyl, 2009). In this respect, active procrastination is not a form of true procrastination, characterized by its overall negative affect and outcomes, but instead becomes an oxymoron (Pychyl, 2009). This is not simply a matter of semantics; because, as Kim and Seo (2015) note, the underlying assumption of whether procrastination is adaptive or maladaptive will lead to different research results. As a result, this proposal looks at procrastination in its traditional

dysfunctional sense involving those who are failing at time management, rather than thriving on an effective form of well-managed delays. As a result, this thesis adopts the explicit definition of Gustavson and Miyake (2017) above whereby academic procrastination involves a delay of academic tasks, knowing the negative consequences that result from it.

General Negative Effects of Procrastination

Various negative outcomes have been associated with procrastination outside of the domain of academics. It has been estimated that procrastination in filing for taxes costs the average United States taxpayer $400 each year due to errors from hasty filing, which in 2002 resulted in $473 million in overpayments (Kasper, 2004). In the medical sphere, studies have shown that in addition to expense, procrastination is a chief reason why individuals do not get the prompt care from a physician that they need (Morris, Menashe, Anderson, Malinow, & Illingworth, 1990). In economic matters, individuals often start preparing for retirement when it is far too late (Akerof, 1991; O'Donoghue & Rabin, 1999), and similarly bankers have postponed key actions that have led to devastating financial consequences for nations (Holland, 2001).

Negative Outcomes of Procrastination in Academic Performance

One popular area of research into studying procrastination as a self-regulation failure has been to investigate the effects of procrastination on grades and academic performance, most of which draw a negative association. Effects on learning and achievement, including lower grades and course withdrawals, have been linked to procrastination (Aremu, Williams, & Adesina, 2011; Balkis, Duru, & Bulus, 2013; Kljajic & Gaudreau, 2018; Tice & Baumeister, 1997). As mentioned earlier, even in light of disagreement on specific measures, a recent meta-analysis by Kim and Seo (2015) found an overall negative association between procrastination and academic performance. Given these overarching

findings, it helps to consider what mechanisms may underlie these general effects. As with media multitasking, these include the same three categories of temporal, cognitive, and affective impediments.

Negative Impediments of Procrastination

Temporal impediments. How procrastination leads to a temporal impediment in a dysfunctional way is largely self-evident: students end up devoting less quality time to their studies and assignments but instead try to cram or "binge study" course content in the last minute. This is compounded by the fact that it is natural for individuals to underestimate how much time it will take them to accomplish a task (Buehler, Griffin, & Ross, 1994), and so, procrastinators are particularly prone to this error (Aitken, 1982). Additionally, there may be unexpected delays or obstacles that may lengthen the amount of time required, once again impeding the procrastinator (Tice & Baumeister, 1997).

Cognitive impediments. One of the most impactful cognitive impediments for procrastinators likely comes from the effects of heightened stress on cognitive capacities and processes. Excessive stress has been shown to negatively affect cognitive functioning (McEwan & Sapolsky, 1995; Sapolsky, 1996). Particularly, for students in the contexts of studying and test-taking, cognitive capacity can be impeded as a result of too much stress and anxiety (Tobias, 1985). How this stress unfolds over the lifecycle of the academic term is different for high versus low procrastinators. As mentioned, Tice and Baumeister (1997) found that while procrastinators feel less stressed and report less illness than non-procrastinators at the start of the academic term, by the end they are more stressed, report more illness, and end up with lower grades on all assignments. As a result, stress likely takes a significant toll on the procrastinator, affecting cognitive processes, which affect one's ability to perform optimally academically.

Affective impediments. Also, highly impactful for the procrastinator is the role of affective impediments. Importantly, stress also impacts affective experience, which can take a toll on students. These impediments can be seen when first considering that like Steel (2007), Sirois and Pychyl (2013) frame procrastination as a self-regulation failure between short-term and long-term trade-offs involving the present and future self. Specifically, poor emotion regulation of immediate mood can be central to procrastination. This occurs in response to an aversive task and negative feelings by prioritizing short-term mood repair over long-term goals. The framework by Panek (2014) distinguishes the consumption of a "guilty pleasure" consisting of a pleasurable consumption phase and a guilty post-consumption phase. Rebetez et al. (2015) and Reinecke et al. (2018a) make a similar argument that builds on the framework of procrastination as a form of short-term mood optimization, privileging the immediate mood and discounting the long-term mood. In effect, the procrastinator feels more drawn to the rewards of the present self, while the non-procrastinator works toward the goals of the more distant future self.

As a result, procrastination can lead one to be short on time and thus binge study, experience greater stress at the detriment of cognitive functions, and be spurred by affective drives that prioritize short-term pleasures over long-term gains. Together, these three impediments can negatively affect the academic performance of heavy procrastinators, which are in line with previous research (Aremu, Williams, & Adesina, 2011; Balkis, Duru, & Bulus, 2013; Kljajic & Gaudreau, 2018), as well as research suggesting greater resulting stress (Tice & Baumeister, 1997). Thus, it is predicted that:

- **H2:** Procrastination will be negatively associated with (a) reported stress when thinking about studying, (b) reported binge studying intention, (c) reported binge studying behavior, and (d) grades.

The Intersection of Media Multitasking and Procrastination

As the review of the literature and theoretical analysis has shown, both media multitasking and procrastination can predict poor outcomes academically, through similar temporal, cognitive, and affective mechanisms. It is natural to ask if these two phenomena commonly overlap, i.e., whether they share areas of influence, and whether their effects compound when they overlap. The following section begins with an overview of concepts in the literature pertaining to this overlap. Afterward, the specific overlap and resulting effects on temporal, cognitive, and affective dimensions will be discussed, along with hypotheses on the overlap and potential interaction, whereby the effect of two variables together is greater than the sum of the individual variable effects.

The Relationship between Procrastination and Media Multitasking

First, the concept of using the Internet for procrastination has been around for some time. It has been colloquially referred to as "cyberslacking" in the workforce, or more plainly "Internet procrastination" by academics (Lavoie & Pychyl, 2001). In a similar vein, Reinecke et al. (2018b) coin the term "procrastinatory Internet use" as delaying an intended activity by opting for Internet activity, despite expecting negative consequences. However, Internet procrastination is not necessarily the same as procrastination via media multitasking, though they can go hand in hand. Media multitasking involves frequent task switching across multiple media (e.g., switching between homework, instant messaging, text, online videos, music, and Facebook) whereas Internet procrastination need not (e.g., just surfing the Internet for 20 minutes or reading a blog).

This distinction is significant because media multitasking takes on a qualitatively different kind of experience with different consequences. First, both procrastinating and media multitasking habituate one away from the long-term delayed gratification of

schoolwork toward constantly switching toward short-term gratification of media use. As mentioned above, Panek (2014) frames media consumption in affective terms around a pre-consumption phase where consumption feels tempting, a consumption phase that is pleasurable, and a post-consumption phase marked by guilt. Furthermore, those low in self-control are more inclined to follow this path. Additionally, as has already been discussed, both Rebetez et al. (2015) and Reinecke et al. (2018a) conceptualize this in terms of short-term mood regulation.

Importantly, both media multitasking and procrastination are involved in this form of short-term mood regulation. As both media multitasking and procrastination feed into short-term optimization, they can result in similar outcomes, namely greater habituation. In effect, these two constructs can influence the affective impediments that negatively impact academic performance.

The resulting habituation can arise in the form of greater media use in the context of the endlessly available and potent short-term gratifications accessible on the Internet and through social media. Reinecke et al. (2018b) support this claim by outlining three reasons that the Internet and online media are such a powerful force that can pull in individuals, especially procrastinators. First, they argue that the ubiquity, portability, and constant presence of Internet technologies make their use "top of mind." Second, online media, such as social media and videos, offer endless opportunity for pleasurable experiences in a way that is especially appealing to procrastinators seeking short-term mood repair in the face of a difficult task. Third, as mentioned above, Internet and social media use become habitualized, making impulsive actions more common.

These facets of constant presence, pleasurable offerings, and impulsive habit will likely shape and increase the temptation of procrastination and media multitasking through

online means. Additionally, it is worth underlining that Reinecke et al.'s (2018b) study looked at only adolescents in the range of 10 to 19 years old and did not investigate the context of academics, but rather general psychological functioning. Nonetheless, their study did find that trait procrastination positively predicted Internet multitasking.

As a result, given this finding and the temptation for media multitasking and online procrastination to be ever-present for so many students, these constructs both likely have a negative impact on academic performance. Additionally, as it is likely that both negatively feed into the process of short-term mood regulation, it is predicted that:

- **H3:** Levels of media multitasking will be positively associated with levels of procrastination.

The Interaction Effect of Procrastination and Media Multitasking

Given that the impediments related to both media multitasking and procrastination can overlap, it helps to consider what effects their overlap may bring about. In doing so, it is important to reiterate the limited cognitive capacities that are central to goal setting and achievement (Gazzaley & Rosen, 2016), as well as the fact that media multitasking is negatively associated with cognitive control capacities (Ophir, Nass, & Wanger, 2009). As mentioned earlier, these limited cognitive resources can act as a bottleneck on the cognitive capacities central to learning (Junco & Cotton, 2012). What is proposed in this thesis is that because of this bottleneck, impediments to learning and academic performance do not simply detract in a purely additive way. Rather, because of this bottleneck, negative impediments can compound at the point of limitations in cognitive capacities.

The first line of impediments to consider in this bottleneck is maladaptive stress. Maladaptive stress can arise in the form of the three temporal, cognitive, and affective impediments, which can lead to poor academic outcomes. When one is pressed for time, as

is often the case with procrastination, and with procrastination and media multitasking, in particular, maladaptive stress can arise (Meier, Reinecke, & Meltzer, 2016), which can adversely affect all three categories of impediments. When such impediments are at work due to media multitasking and procrastination, temporal pressures increase stress and compromise efficiency (Carrillo & Subrahmanyam, 2014; Tice & Baumeister, 1997), cognitive functions are fatigued (Gazzaley & Rosen, 2016), and short-term mood optimization dominates (Rebetez et al., 2015; Reinecke et al., 2018b).

This cognitive taxing once again limits the cognitive capabilities, contributing to the compounding effect of the bottleneck. Furthermore, the key point here is that all this can happen together during the same period of time – and in the context of academics, especially toward the end of the term, this is a crucial time heavily influencing academic performance. In other words, the cognitive bottleneck can become severely taxed during this critical period. There would be reason to believe that such a coming together of impediments could be too limiting or even overwhelming, thereby negatively impacting academic performance.

Additionally, the cognitive fatigue and habituation to short-term mood optimization can be conceptualized as being particularly detrimental to difficult schoolwork with high cognitive load demands. For instance, high cognitive load tasks, such as writing a term paper, can prove especially difficult for students regardless of multitasking or procrastination (Klassen, Krawchuk & Rajani, 2008). These authors found that those they labeled "negative procrastinators" (i.e., the 25% scoring highest on a measure of procrastination) had higher procrastination on writing tasks, likely due to the challenging cognitive load. Importantly, the theoretical discussion outlined here explains why. In such cases, negative procrastinators may repeatedly "jump ship" by relying on short-term mood optimization to their detriment, likely due to fatigued cognitive capacities. In effect,

challenging term papers can become too challenging, as can studying extensive and complex material. Understandably, this can lead to poorer academic performance in these domains. Such examples suggest that procrastination and media multitasking, where one can readily switch off task, may lead to compounding effects as a result of the limited nature of cognitive capacities. As a result, this thesis tests the previously untested prediction that:

- H4: Media multitasking and procrastination will interact to have a greater negative effect on academic performance than their separate negative direct effects.

The relationships described above can be encapsulated in the conceptual model below.

| Figure 1 |

Here the temporal, cognitive, and affective dimensions include their interrelated phenomena, including stress. Additionally, as can be seen, these three impediments also act as mediators between media multitasking or procrastination and academic performance. Additionally, because the impediments in this model are not directly tested, the following figure shows just the relationships in a hypothesized model.

| Figure 2 |

Additionally, although this thesis does not test this in the conceptual model, it is worth considering how study habits may mediate the relationship between procrastination and academic performance. Particularly, procrastination may negatively influence study habits, which may represent some of the impediments in the model, thereby negatively impacting academic performance. Thus, the following research question is proposed:

- RQ1: Do study habits act as impediments that thereby mediate the relationship between (a) trait procrastination and (b) grades.

Method

Participants

Participants included (N = 278) undergraduate students at a Western university, enrolled in a large, gateway biology class. Seventy-two percent of participants identified as female, while 28% identified as male. Thirty-four percent of participants identified as first-generation college students. Fifty percent of students identified as coming from an immigrant family. A majority of the group was either Caucasian (32%) or Asian/Pacific Islander (27%), with a smaller percentage of participants identifying as Chicano (16%), East Indian/Pakistani (7%), African American (6%), Latino (3.9%), Pilipino (3%), Native American (1%), or other (3%). Students were primarily sophomores (63%), followed by juniors (26%), seniors (below 1%) and freshman (below 1%). As part of a wider initiative, administrators gave students the option to participate in an academic coaching program (ECoach) that consisted of the delivery of encouraging messages and tips to better their study habits. Students surveyed for the purposes of this study were part of this academic coaching cohort.

Procedure

Upon agreeing to participate in the academic coaching program, students gained access to an online portal through which they received messages once a week to aid their class performance. Upon initial entry to this portal, students filled out an online survey containing a battery of items, including items for this study, as well as those relevant to the wider program's interests. Students filled out surveys at the start and end of the quarter (an Initial Survey and Exit Survey) and after each of the two midterms (Post Midterm 1 Survey and Post Midterm 2 Survey). In addition, students consented to have their grades for the class, including two midterm grades and final exam grades, shared by the instructors for research and assessment of the program.

Measures

Independent variables. The following measures served as independent variables. The primary independent variable is listed, followed by any alternate variables. All independent variables were assessed in the Initial Survey.

Media multitasking. Media multitasking was primarily assessed through the Preference for Task Switching Subscale, a brief 4-item scale that assesses multitasking preference. This subscale comes from the larger Media and Technology Usage Attitudes Scale by from Rosen, Whaling, Carrier, Cheever, and Rokkum (2013), and included items such as, "When doing a number of assignments, I like to switch back and forth between them rather than do one at a time." Items were rated on a 5-point Likert scale from "Strongly Disagree" to "Strongly Agree" ($M = 2.58$, $SD = 0.95$). The four items formed a single-factor, reliable scale ($\alpha = .84$).

The Preference for Task Switching Subscale is not an exact measure for *media* multitasking, but rather a preference for multitasking in general. Still, there is very good reason to assume that, in filling out the preference for task switching items, students had media use top of mind. In one respect, these students are taking a survey in the context of an online academic portal geared toward better study habits. In this sense, it would be quite reasonable for students to interpret the tasks in this scale as primarily related to student-related tasks, such as homework, studying, and the impediments that come with task switching. Second, it is also quite reasonable to assume that the most prominent factor affecting being on or off task is media use. The constant availability of media has led to a substantial rise in media multitasking in recent years, especially among youth (Carrier, Cheever, Rosen, Benitez, Chang, 2009; Van Der Schuur, Baumgartner, Sumter, Valkenburg,

2015). In terms of academics, Jacobsen and Forste (2011) found that two-thirds of students engage in media multitasking while in class or while doing homework or studying.

Additionally, priming effects suggest that students very likely had media multitasking in mind when filling out the preference for task switching scale. First, this is very likely the case with the source of this scale: Rosen et al.'s (2013) Media and Technology Usage Attitudes Scale, which has a suite of measures and scales related to technology (e.g., a general media usage subscale and an anxiety/dependence subscale). Such context would very likely prime the participant in terms of interpreting task switching in the context of *media* multitasking. Second, the same effect is very likely at work with the Initial Survey in this thesis, which prefaced the preference for task switching scale with many measures related to academics and media use. In what follows, these measures are referenced in reverse order, with the first being closest to this task switching scale.

(1) Preceding the task switching scale, a technology dependence scale included three items related to dependence on cell phone use, Internet use, and technology in general. (2) The next proximate measure focused on student problems *both* in the context of academic work and problematic social media use. This included problems with attention in class and during homework due to social media, lost sleep due to social media, and arguments with others due to social media. Thus, media use in relation to academics is especially primed in this case. (3) Antecedent to this was a measure on using social media for escape, including using social media to take your mind off problems, unpleasant things, or negative feelings. (4) Finally, another scale assessed both non-technology related activities (e.g., exercising, socializing, or reading) and also media-related activities (e.g., using social media, watching YouTube videos, or browsing the Internet). Given these antecedents to the preference for

task switching scale, it is very likely that students had media strongly primed in relation to academics, and thus interpreting task switching in the context of *media* multitasking.

Procrastination. Trait procrastination was assessed with the Academic Procrastination Scale–Short Form (Yockey, 2016). This scale contains five short statements, such as "I put off projects until the last minute," rated on a 5-point Likert scale from "Not at all agree" to "Completely agree" ($M = 2.41$, $SD = 0.94$). The items formed a single-factor reliable scale ($\alpha = .90$).

Two additional scales tapped into more concrete procrastination behaviors. First, procrastination via social media use was assessed. Students were prompted to consider their social media use and the statement, "I use social media (e.g., Facebook, Instagram, Snapchat, and texting, etc.)..." and rate four conditions of social media use: e.g., "Although I have more important things to do," and "Although I had planned to get something done." Ratings were done on a 5-point Likert scale from "Never" to "Very often" ($M = 3.18$, $SD = 1.09$), and when combined, formed a single-factor, reliable scale ($\alpha = .94$).

Second, procrastination via online activities more generally was assessed with five items regarding engaging in media-related activities to avoid doing schoolwork. Students were asked, "How often do you typically engage in the following activities to avoid doing your schoolwork?" Items that were rated included the following: "Using social media," "Streaming or watch TV or movies," "Playing video games," "Watching YouTube videos," and "Browsing the Internet." These items rated answers on a 5-point Likert scale from "Never" to "Very often." However, the item for "Playing video games" did not load well with the other variables and this difference likely reflects that it is not primarily an *online* activity. The remaining four items formed a single-factor scale with marginally acceptable reliability ($M = 2.75$, $SD = 0.92$; $\alpha = .69$).

Dependent variables. The following measures served as dependent variables. All dependent variables were assessed only as part of the Initial Survey unless otherwise noted.

Binge studying intentions and behavior. Binge studying intention was assessed as a single item that was part of eight study habit items (for all eight, see the Possible Mediators section below). Students were asked on a 5-point Likert scale how much do "I intend to…" "binge-study right before a test" ($M = 3.46$, $SD = 1.09$),

In addition, binge studying behavior was assessed through a single item that had students evaluate their study habits retrospectively in the Exit Survey. Students were asked on a 5-point Likert scale how much they agree with the statement, "I tended to binge study right before a test." As a retrospective measure on binge study behavior, this item was included as part of the Exit Survey.

Stress. Two items, in a battery of other emotional items, assessed stress and worry around studying. Students were asked, "As you think about studying for MCDB1A in the upcoming weeks, please indicate how much of each of the following you feel." They rated on a 5-point Likert scale of "None" to "Very much" how much they feel, "Prepared," "Confident," "Encouraged," "Discouraged," "Worried," "Proud," "Stressed," and "Hopeful." The two items of stress and worry ($M = 3.52$, $SD = 0.98$) together achieved high correlation, $r(254) = .68$, $p < 0.001$. These items were included in the Initial Survey, Post Midterm 1 Survey, and Post Midterm 2 Survey; the variable used was from the Initial Survey.

Exam grades. Actual grades for exams were acquired from the instructors. Data for grades included two midterm grades, final exam grade, and overall grade in the class. Grades were represented by the sum of all exams, i.e., the two midterms and final exam ($M = 283.37$, $SD = 78.35$). Combined exam grades were out of a total of 450 points, with the lowest score being 86.00 (19%) and the highest being 412.33 (92%). Other grades, such as

extra credit, were excluded from the analysis because the university program was tailored only to exams.

Possible Mediators

Study habits. Variables pertaining to study habits were examined as possible mediators. Participants were asked to rate on a 5-point Likert scale how much they agree with various statements, ranging from "Completely describes me" to "Does not describe me at all," with analysis reverse coding these items. The first six of eight items were prefaced by the prompt, "I intend to…" with the statements that follow. Each statement is briefly labeled here to make future reference more concise: study diligence, "study 1-2 hours per night, even if there's no exam that week," (M = 3.36, SD = 1.00); reading diligence, "keep up with the reading" (M = 2.42, SD = 0.95); question notetaking, "make notes about questions I have from readings or lecturers," (M = 3.60, SD = 1.05); handwritten notes, "handwrite my notes," (M = 4.38, SD = 0.92); binge study intention,"binge study right before a test," (M = 3.46, SD = 1.09); and lecture attendance, "attend lectures," (M = 4.8, SD = 0.53). The final two items used a "Yes" or "No" response: slides review before class, "When lecture slides are available prior to lecture, do you typically look at them before class?" (61% Yes, 39% No); and printing slides for notes, "Do you print out lecture slides and take notes on them during class?" (65% Yes, 35% No).

Stress. Stress around studying (see above) was also evaluated as a possible mediator between trait procrastination and exam grades.

Results

Preliminary Analysis

Five demographic variables were tested in the preliminary analyses, including gender, identification as a first-generation college student, ethnicity, coming from an immigrant family, and year in school. Ethnicity has dichotomously coded with non-

Caucasians coded as 0 and Caucasians as 1. Together, these five demographic variables were tested for significance in correlation with the three primary dependent variables in this study: media multitasking (task switching preference), procrastination (trait procrastination), and academic performance (exam grades). Of the 15 bivariate Pearson Correlation tests, only 3 achieved significance. Gender significantly correlated with task switching preference, $r(244) = -.16$, $p = .01$. Identifying as a first-generation college student significantly correlated with exam scores, $r(244) = -.16$, $p = .01$. Additionally, ethnicity was found to also significantly correlate with trait procrastination, $r(252) = -.13$, $p = .03$. In the results that follow, hypotheses are tested first while excluding these three demographic controls. For any significant findings, analyses with these identified demographic controls are also presented.

Relationships between Media Multitasking, Procrastination, and Academic Performance

H1. Hypothesis 1 predicted that more media multitasking will negatively associate with grades. A bivariate Pearson Correlation was conducted between preference for task switching and exam grades. No significant correlation was found, $r(250) = .03$, $p = .66$. Thus, Hypothesis 1 was not supported.

H2. Hypothesis 2 predicted that procrastination will be negatively associated with (a) reported stress when thinking about studying, (b) reported binge studying intention, (c) reported binge studying behavior, and (d) grades. Three measures for procrastination were used: (1) trait procrastination, as well as the alternate measures of (2) procrastination via social media use, and (3) procrastination via online activities. These 3 variables were tested with the 4 dependent variables above through 12 separate bivariate Pearson Correlation tests (see Table 1). Trait procrastination was significantly correlated with all four dependent

variables: stress, $r(252) = .20$, $p = .001$; reported binge studying intention, $r(252) = .41$, $p < .001$; reported binge studying behavior, $r(151) = .41$, $p < .001$; and exam grades, $r(250) = -.18$, $p < .01$. Procrastination via social media use correlated significantly with the first three dependent variables, i.e., with stress, $r(252) = .31$, $p < .001$, reported binge studying intention, $r(252) = .31$, $p < .001$, reported binge studying behavior, $r(151) = .27$, $p = .001$, but failed to correlate significantly with exam grades, $r(250) = -.09$, $p = .15$.

Finally, procrastination via online activities also correlated significantly with the first three dependent variables, i.e., with stress, $r(252) = .22$, $p < .001$, reported binge studying intention, $r(252) = .34$, $p < .001$, reported binge studying behavior, $r(151) = .26$, $p = .001$, but failed to correlate significantly with exam grades, $r(250) = -.07$, $p = .24$. Partial correlations were then run on each of the 12 relationships above to test for any changes to the direction and significance levels after controlling for the 3 identified demographic variables: gender, identifying as a first-generation college student, and ethnicity. There were no meaningful changes as a result of adding these controls (see Table 1). Thus, Hypothesis 2 was supported by the main measure of procrastination, i.e., trait procrastination, and partially supported by the two alternate measures of procrastination.

| Table 1 |

H3. Hypothesis 3 predicted that levels of media multitasking would positively correlate with levels of procrastination. Three bivariate Pearson Correlation tests were run on preference for task switching and the 3 measures for procrastination listed above. None of the relationships achieved significance: for trait procrastination, $r(252) = .11$ $p = .07$; procrastination via social media use, $r(252) = .02$, $p = .73$; nor procrastination via online activities, $r(252) = .07$, $p = .30$. Controlling for demographics led to no changes in direction

or levels of significance for any of these correlations. Therefore, Hypothesis 3 was unsupported.

H4. Hypothesis 4 predicted that media multitasking and procrastination will interact to have a greater negative effect on academic performance than their two separate effects. To test this, a multiple linear regression was conducted to predict exam grades based on preference for task switching, trait procrastination, and their interaction. In line with previous results, it was found that preference for task switching was not a significant predictor (β = .05, p = .44) of exam grades. However, trait procrastination was a significant predictor (β = -.18, p < .01), which was also in line with the previous results. The interaction between these two variables on exam grades failed to achieve significance (β = .04, p = .56). No significant changes were found when the results were controlled with the identified demographics.

Analyses Exploring Direct and Indirect Mediation

Stress as a mediator between procrastination and exam grades. Given the significant correlation found between trait procrastination and exam grades, it was suspected that procrastination may lead to greater stress, which may negatively affect academic performance. Thus, stress around studying was tested as a direct mediator between the trait procrastination and exam grades relationship. However, it was shown via multiple linear regression that stress was not a significant mediator, (β = -.08, p = .36; see Table 2).

| Table 2 |

Study habits as mediators between trait procrastination and exam grades. Direct mediation tests were also conducted to assess if study habits could serve as mediators between the trait procrastination and exam grades relationship. Multiple linear regression analyses (see Table 2) were conducted to assess all study habit variables (for exact phrasing

of items, see Methods section above) as mediators. Block 1 used the enter method for the variables for gender, first-generation college student, and ethnicity. Block 2 also used the enter method for the variable for trait procrastination. Block 3 used stepwise entry for the variables of stress and study diligence, reading diligence, question notetaking, handwritten notes, binge-studying intention, lecture attendance intention, and slides review before class. The procrastination and exam grades relationship in Block 2 (β = -.17, p < .01) maintained significance in Block 3 (β = -.14, p = .03). Additionally, the only study habit variable to achieve mediation between the trait procrastination and exam grades relationship was question notetaking (β = .16, p = .01).

Study habits as mediators between media multitasking and exam grades. The next set of analyses looked at indirect mediation in the context of media multitasking and academic performance, given no direct relation between the two. Particularly, variables reflecting study habits were considered as mediators, based on the reasoning that media multitasking can interfere with successful study habits, which in turn can adversely affect academic performance. Eight variables on study habit intentions and behaviors (see Measures above) could be tested as indirect mediators between media multitasking (media multitasking → study habits) and academic performance (study habits → academic performance). To test the relationship between study habits and academic performance, bivariate Pearson Correlation tests were done with all eight variables in relation to exam grades. Of these eight, only three correlated significantly with exam grades: study diligence, $r(250) = .15$, $p = .02$, reading diligence, $r(250) = .15$, $p = .02$, and question notetaking, $r(250) = .19$, $p < 0.01$.

To test the relationship between media multitasking and study habits, bivariate Pearson Correlations were run between preference for task switching and each of the three

identified study habit variables, which proved significant for study diligence, $r(252) = -.22$, $p = .001$, and question notetaking, $r(252) = -.21$, $p = .001$, but not for reading diligence, $r(252) = -.05$, $p = .46$. Therefore, the evidence suggests that study diligence and question notetaking might indirectly mediate media multitasking and academic performance.

| Figure 3 |

Discussion

The purpose of this thesis was to investigate the effects of media multitasking and procrastination on academic performance, both in terms of their separate effects on academic performance and their interaction, taking into account relevant mediator.

Results Summary

Trait procrastination was found to negatively relate to exam grades and was also associated with stress and binge studying. Additionally, alternate measures for procrastination related to stress and binge studying, but not exam grades. In contrast, media multitasking did not significantly relate to exam grades. In addition, the media multitasking measure did not significantly relate to procrastination measures. Media multitasking and procrastination were then assessed to see if they interact to amplify a negative effect on academic performance greater than their two separate effects. The data did not support such an interaction effect.

Given the results for media multitasking on academic performance did not support the hypothesized model, follow-up exploratory analysis was conducted to test for indirect mediation. The results found that two study habits achieved significance as indirect mediators: study diligence and question notetaking. Particularly, preference for task switching negatively associated with both study diligence and notetaking, each of which then positively associated with exam grades. Additionally, given that procrastination did

show a significant relationship with academic performance, this leg of the model was tested for direct mediation by the same study habit variables, as well as stress. The findings suggested that one study habit – question notetaking – was a significant mediator. Specifically, procrastination negatively associated with question notetaking, which positively associated with exam grades. Finally, stress was assessed as a possible mediator in this relationship but did not achieve significance in this respect.

Results Discussion

Media multitasking. In making sense of these results, one of the first questions to consider is why media multitasking yielded null findings. On a basic level, this may be a result of the measure. The measure used was a three-item scale of preference for task switching (Rosen, Whaling, Carrier, Cheever, & Rokkum, 2013), which was part of a suite of other scales and measures contained in the Media and Technology Usage Attitudes Scale. One critical issue with this scale is that it is not a measure of *media* multitasking per se, but rather a preference for multitasking, i.e., one's preference for switching between tasks while working versus completing tasks one at a time. While one may suspect this to generalize to *media* multitasking, there is no guarantee that this will be the case.

However, it is possible to consider alternate explanations assuming there is no significant fault in the validity of the media multitasking measure. It was conceptualized that media multitasking works adversely on its own and in junction with procrastination by imposing adverse time constraints, reduced cognitive resources, and sidetracking into suboptimal affective pursuits. However, it may be the case that the conditions required to drive such effects are not substantially present in the conditions experienced by these students. For instance, as discussed earlier, when students do not face time constraints, multitasking via text messaging while engaging in a reading task does not adversely affect

comprehension or task performance (Carrillo & Subrahmanyam, 2014). It is conceivable that for these students, time constraints do not reach the levels that significantly impair academic performance.

Another process that may be occurring is that some form of media multitasking is actually conducive to better academic performance. This can be the result of social and emotional buffers and resources that come from supportive social relationships. For instance, it has been shown that individuals who engage in direct messaging of friends rather than passively consuming social media have greater social capital and emotional outcomes (for a review, see Verduyn et al., 2017). In relation to this, social and emotional well-being has been linked to greater academic performance (for a meta-analysis, see Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011). Therefore it is possible that media multitasking can enhance social capital and meaningful connections, which can provide more emotional drive and resources to study and perform academically, though overall this may not be enough to boost exam performance.

Additionally, media multitasking was shown to significantly relate negatively to academic performance through two indirect mediators: study diligence and question notetaking. Particularly, media multitasking negatively correlated with both study diligence and question notetaking, both of which positively correlated with exam grades. Although no certainty can be claimed, one could speculate as to the cause of the indirect mediation of study diligence. Study diligence, involving committing a set number of hours each day toward studying, requires greater focus and motivation; when one engages in increased levels of media multitasking that focus and motivation may be impaired, making it difficult to stay on task each day for 1-2 hours. The indirect mediation of question notetaking can also be explained by certain speculations. Developing and composing concrete questions

one has reflects a deeper level of study and engagement with course material. This is in contrast to more passive study where one is hurrying and trying to get through course content in a more superficial way. Media multitasking may encourage this superficial mode of studying, which again may impede academic performance.

Procrastination. The negative effects of trait procrastination largely fell in line with existing research on procrastination, stress, and academic performance (e.g., Tice & Baumeister, 1997). However, one of the most notable findings involved the different results of the three measures of procrastination: trait procrastination, procrastination via social media, and procrastination via online activities. All three measures significantly correlated with stress, reported binge studying intention, and reported binge studying behavior. However, only trait procrastination correlated with exam grades. It is logical to then consider why procrastination via social media and via online activities did not correlate significantly with exam grades. One process that may be at work is that, once again, media-related activity may also involve salutary and re-energizing experiences, especially when engaged in actively and in the context of meaningful relationships. This process may contribute to media multitasking and procrastination having some beneficial effects when studying. This would suggest that even in the context of increased stress and binge studying, positive effects, such as resulting motivation and drive, may not compromise academic performance overall.

Mediators. It is also worth exploring why certain mediators did not mediate the relationship between procrastination and academic performance. First, it appears quite reasonable to consider binge studying as a mediator between trait procrastination and exam grades, especially toward the end of the academic term or just before each midterm. This reasoning would suggest procrastinators will tend to put off studying and therefore binge

study to compensate, which may lead to poorer academic performance, given time pressure and increased stress. However, binge studying was one of the study habits that did not relate to exam grades. While no definitive reason can be determined, this could likely be the result of both procrastinators and non-procrastinators engaging in binge studying. That is, non-procrastinators may study well in advance, but *also* binge study before a test, so as to review thoroughly and keep learnings "fresh" in mind for exams. Second, it was determined that stress was not supported as a mediator in the procrastination and academic performance relationship. This may be because some amount of stress is actually beneficial for performance (Lazarus, 1966). This phenomenon, known as eustress, suggests that stress' effect on performance is curvilinear, such that a moderate amount of stress is optimal. Therefore, the null results in this thesis may derive from incorrectly mapping a linear relationship onto a curvilinear relationship.

Temporal, cognitive, and affective impediments. It is worth connecting the above findings to the theoretical framework of the temporal, cognitive, and affective impediments described earlier. This is most pertinent to the context of media multitasking, where the results substantially differed from what the model predicted. One possibility is that each of these three dimensions may not, in fact, be negative, or at least under certain conditions. It is possible that the extent and direction of each of these categories varies and that the "net" effect on academic performance will thus be a function of each of these temporal, cognitive, and affective dimensions taken together. This has already been raised as a credible possibility, whereby beneficial affective effects associated with active media use may drive better motivation and performance.

In contrast, it seems credible that with media multitasking the effect on the cognitive dimension likely has a negative effect under most conditions, given the ample evidence of

research supporting such a relationship (e.g., Gazzaley & Rosen, 2016; Junco & Cotton, 2012; Ward et al., 2017). Additionally, in the data presented in this thesis, the negative effect of the cognitive impediment can also be supported by considering the indirect mediators between preference for task switching and exam grades: study diligence and question notetaking. As noted above, study diligence and question notetaking require significant cognitive effort. This is in contrast to the quick, superficial studying and processing when cognitive resources are taxed or when one is short on time. Yet taken as a whole, it could be that these cognitive losses are outweighed by the affective gains of media multitasking.

In line with the speculations on media multitasking above in relation to existing research, the effect of the temporal dimension may depend on particular circumstances. Data suggests that when time pressure is minimal, there is no impediment to task performance (Carrillo & Subrahmanyam, 2014). However, when time pressures are in place, significant impediments arise, as is the case when time is limited in the classroom (Bowman, Levine, Waite, & Gendron, 2010; Fox, Rosen, & Crawford, 2009; Jacobsen & Forste, 2011). Thus, a more comprehensive model may need to consider when media multitasking has little to no effect on time pressure and when it does. In effect, it is likely better to treat the original three impediments as three "dimensions," that can vary in direction and magnitude based on particular conditions. A possible example of this "net" effect is presented in the following figure.

| Figure 4 |

In sum, future research would benefit from measuring each of these three dimensions in such contexts.

Limitations and future directions. Even though there were substantial limitations to this study, it is worth first noting the strengths. The study involved longitudinal data, tracking academic performance and related measures over the course of an entire 10-week academic term. Participants in this study were real students, all taking the same class, in a natural university environment. Additionally, while other studies may rely on self-reported grades or GPA, this study made use of actual exam grades.

However, there were nontrivial limitations to this study. The limitations of the media multitasking scale have already been addressed above. In addition, the limited sample size (N = 278) put constraints on the statistical power of this study. Additionally, another constraint came from the nature of the university-led program. Specifically, there were limitations on what could and could not be included in the surveys, both for efficiency but also alignment with the purposes of the program. As a result, variables such as demographics, certain study habit assessments, and time-intensive scales were to some extent out the hands of researchers involved in this thesis.

The limitations of measurement can also play an important role in future research. In particular, it would be beneficial to use multitasking measures that are measures of *media* multitasking. Baumgartner, Lemmens, Weeda, and Huizinga (2016) developed an economical 3-item scale that assesses media multitasking across a range of media, including television, social networking sites, messaging, and music. Additionally, because this scale was developed for adolescents, it may be particularly pertinent to the college environment. If time is not a limitation, researchers can accompany this scale with the lengthier Media and Technology Usage Attitudes Scale (Rosen et al., 2013). In addition to the preference for task switching subscale used in this thesis, this suite of measures also includes two relevant subscales: a general social media usage subscale and an anxiety/dependence subscale.

However, because the latter two subscales do not once again reflect explicit *media* multitasking, the Baumgartner et al. scale on its own is most strongly advised.

Additionally, future research into media multitasking could benefit from differentiating passive media consumption with active media engagement, such as direct messaging with closer friends. As mentioned above, it may be that media multitasking with active consumption of media may, in fact, enhance academic performance or act as affective buffers by providing students with increased emotional and social well-being, which can drive greater motivation and emotional resources for studying. By making such distinctions a more nuanced view of media multitasking may prove fruitful.

Finally, future research would benefit from intervention-based research. Specifically, can better media multitasking and procrastination habits be taught? One could consider this question, once again, in a more nuanced way, investigating how more positive uses of media multitasking could be leveraged in the context of academics. Within this context, researchers can further investigate how media multitasking techniques can accompany the broader umbrella of study habits that lead to improved academic performance. Interventions addressing these questions could work their way into longitudinal studies, such as this one, and go a long way into better understanding the mechanisms behind greater academic achievement.

Conclusion

This thesis sought to use an academic coaching program to assess relationships between media multitasking, procrastination, and academic performance. It was found that media multitasking did not significantly correlate with neither procrastination nor grades. Additionally, there was no support for an interaction effect between media multitasking and procrastination amplifying negative effects on grades. The measure for trait procrastination

did yield a significant negative correlation with grades. However, it is worth noting that measures of procrastination via certain kinds of media use did not yield a significant negative correlation with grades. In the context of procrastination and other academic domains, future research would benefit from better understanding the various kinds of media use and media multitasking, some of which may even have positive effects on academic performance.

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Tables

TABLE 1

H2: Procrastination as a Predictor of Negative Outcomes Related to Study and Academic Performance

	Trait Procrastination		Procrastination via Social Media		Procrastination via Online Activities	
	r	r_p	*r*	r_p	*r*	r_p
Stress (df = 252)	.20**	.22**	.31***	0.29***	.22***	0.22***
Binge Study Intention (df = 252)	.41***	.42**	.31***	.33***	.34***	0.38***
Binge Study Behavior (df = 151)	.41***	.40**	.27**	.31***	.26**	0.29***
Exam Grades (df = 250)	-.18**	-.17**	-.09	-.07	-.07	-.03

Note: r_p controlled for gender, identifying as a first-generation college student, and ethnicity.

$^{+}p < .10$. $*p < .05$. $**p < .01$. $***p < .001$.

T**ABLE 2**

Regression Analysis Testing Study Habit Variables as Mediators between Procrastination and Exam Grade

		Model 1	Model 2	Model 3
	Variable	β	β	β
Block 1	Gender	-.08	-.09	-.11^{+}
	First-generation college student	.13*	.13*	.13*
	Ethnicity	.06	.03	.02
Block 2	Trait Procrastination		-.17**	-.14*
Block 3	Question Notetaking			.16*
	R^2	.04	.03	0.2
	F for change in R^2	3.2*	7.0**	5.6*

Note: Blocks 1 and 2 used the simultaneous entry, and Block 3 used the stepwise entry. Question notetaking, "I intend to make notes about questions I have from readings or lecturers," was the only significant mediator among all the study habit variables. (For the other study habit variables and their phrasing, see the Methods section.)

$^{+}p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.

Figures

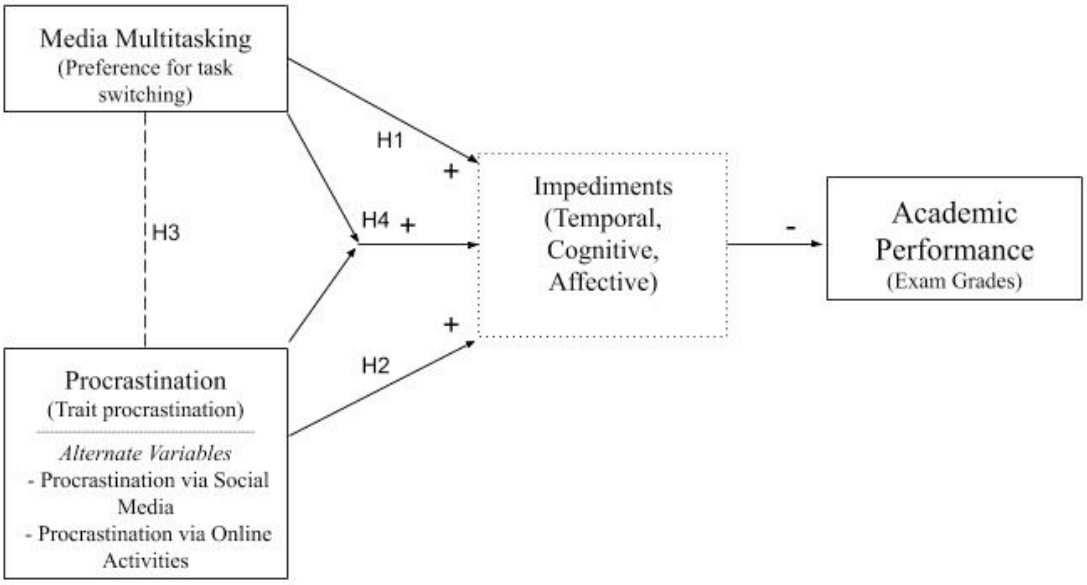

FIGURE 1 Conceptual model of relationships between media multitasking and procrastination on academic performance via the theorized temporal, cognitive, and affective impediments.

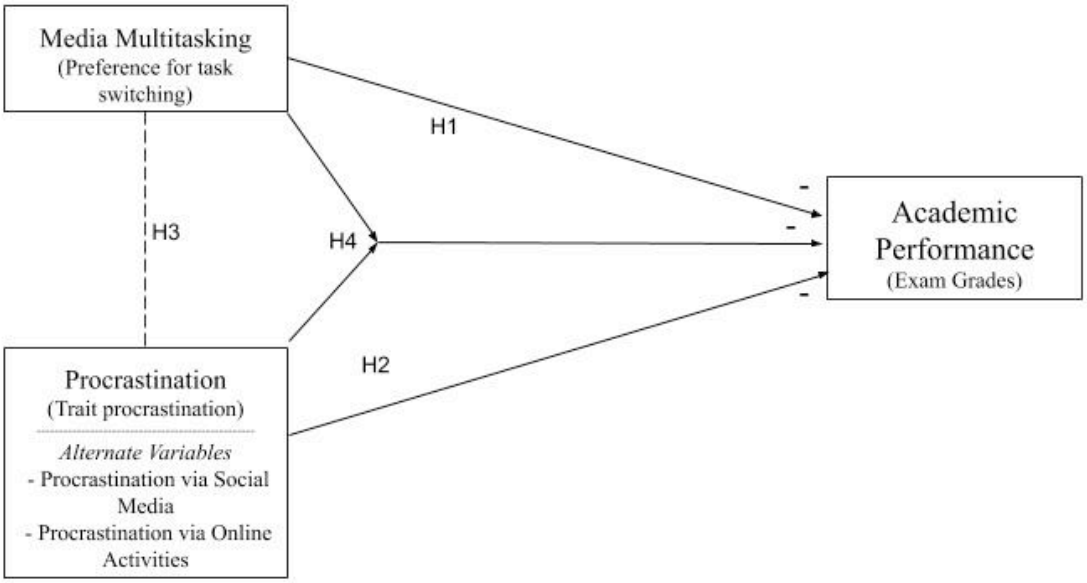

FIGURE 2 Hypothesized model of direct relationships between media multitasking and procrastination on academic performance.

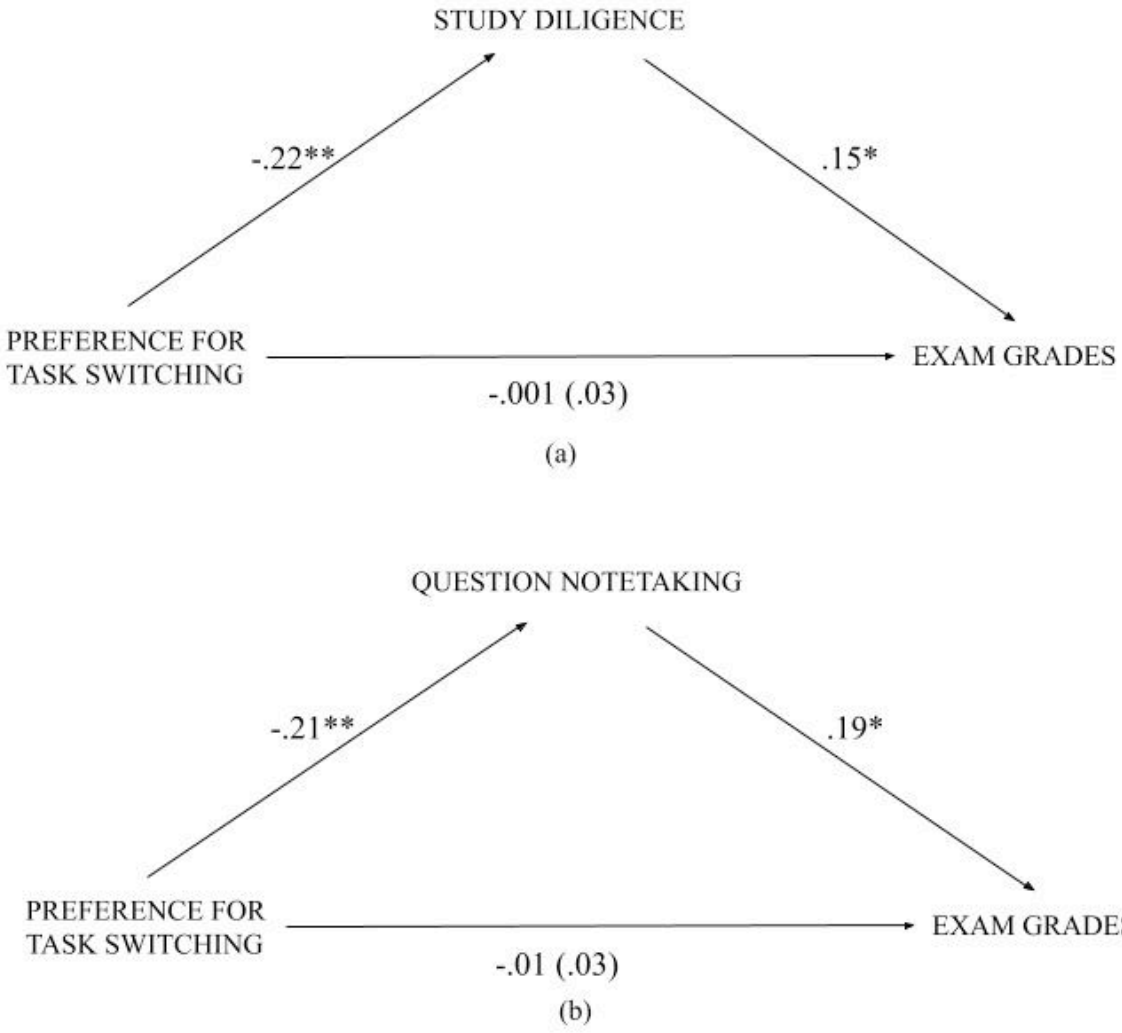

FIGURE 3 Indirect mediation supported for identified study habits: (a) study diligence and (b) question notetaking are both supported as indirect mediators between preference for task switching and exam grades.

$^{+}p < .10$. $*p < .05$. $**p < .01$. $***p < .001$.

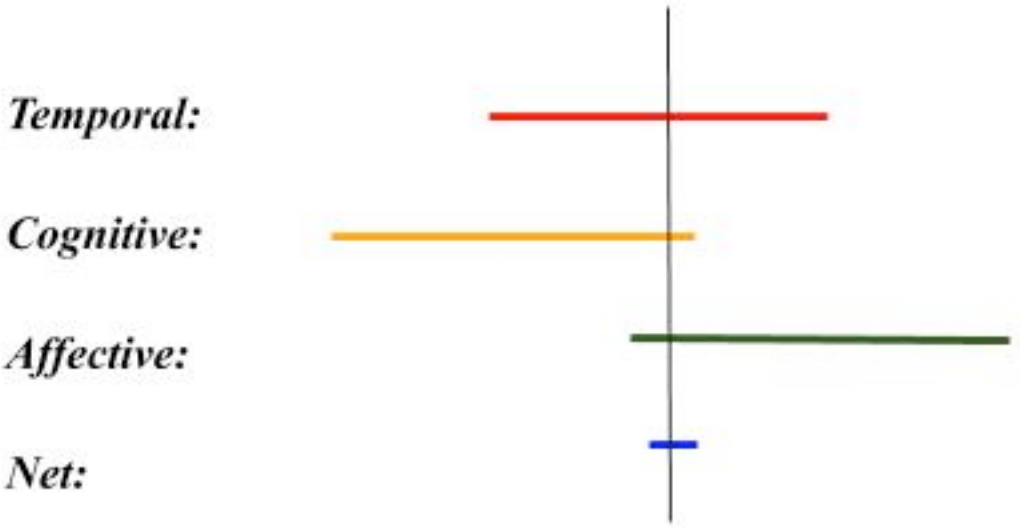

FIGURE 4 Example of possible "net" effect of dimensions on overall academic performance. In this example, the temporal dimension has minimal effect, the cognitive dimension has a largely negative effect, and the affective has a largely positive effect. The net effect leads to minimal net difference on academic performance.