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THINK FIRST: EXAMINING IMPULSIVITY AMONG UNIVERSITY STUDENTS

By

Antonette Scavone, M.A.

A Dissertation
Submitted to the Faculty of Graduate Studies
through the Department of Psychology
in Partial Fulfillment of the Requirements for
the Degree of Doctor of Philosophy
at the University of Windsor

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Think First: Examining Impulsivity among University Students
By
Antonette Scavone

APPROVED BY:

A. Howard, External Examiner
Carleton University

D. Andrews
Department of Kinesiology

L. Buchanan
Department of Psychology

J. Singleton-Jackson
Department of Psychology

C.J. Miller, Advisor
Department of Psychology

November 30, 2020

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ABSTRACT

Researchers have noted the impact of various factors on academic success among university students but have yet to investigate how these factors influence academic engagement. Academic engagement is an important area, as it is associated with academic achievement, and is a concern in many post-secondary settings (Alrashidi et al., 2016). The focus of the present dissertation is the intersection of impulsivity, procrastination, and substance use with academic engagement. The first study examines the association between impulsivity and academic engagement, and considers the impacts of conscientiousness, neuroticism, self-efficacy, and life stress. The second study examines the association between procrastination and academic engagement, while testing the moderator roles of impulsivity, self-efficacy, and motivation. The third study examines whether the motivation to use alcohol and marijuana are associated with academic engagement, while considering impulsivity and stress as moderators. Results suggest that self-efficacy and conscientiousness impacts the association between impulsivity and academic engagement. Greater academic engagement also results in greater academic achievement regardless of impulsivity level. Intrinsic motivation and self-efficacy account for the relationship between passive procrastination and academic engagement. Overall, greater enhancement and expansion motive are associated with greater academic engagement, particularly among less impulsive individuals. The present studies identify areas that can be fostered to improve academic engagement, with implications for educators discussed.

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GLOSSARY OF TERMS

Term	Definition
Academic Engagement	Students' patterns in motivations, cognitions, and behaviours in the learning environment (Alrashidi et al., 2016).
Active Procrastination	Those who intentionally procrastinate, using their motivation under time pressure, and are typically able to complete tasks before deadlines with satisfactory outcomes (Choi & Moran, 2009; Kim & Seo, 2013).
Agreeableness	Prosocial and communal orientation towards others (John & Srivastava, 1999).
Autonomous Motivation	Comprises intrinsic motivation and types of extrinsic motivation wherein people have identified with an activity's value and will have integrated it into their sense of self (Deci & Ryan, 2008).
Behavioural Approach System (BAS)	Activates approach behaviour to stimuli signaling reward and non-punishment (Pickering & Gray, 1999; Zisserson & Palfaia, 2007).
Behavioural Inhibition System (BIS):	Activated by stimuli signaling non-reward and punishment, and is often associated with anxiety and avoidance (Pickering & Gray, 1999; Zisserson & Palfaia, 2007).
Conformity Motive	Drinking because others do, to fit in.
Conscientiousness	Socially prescribed impulse control that facilitates task- and goal-directed behaviour (John & Srivastava, 1999).
Coping Motive	Drinking because it makes you forget about problems.
Dysfunctional Impulsivity	Tendency to respond quickly and inaccurately in situations where this is not optimal (Dickman, 1990).
Enhancement Motive	Drinking to feel better or to be able to do things otherwise impossible.
Expansion Motive	Desired experiences resulting in a new awareness of the self, as well as one's relationships with others and nature (Simons et al., 1998).
Extraversion	Energetic approach toward the social and material world (John & Srivastava, 1999).
Functional Impulsivity	Tendency to respond quickly and inaccurately in situations where this is optimal (Dickman, 1990).
Impulsivity	Rapid, unplanned reactions to stimuli with inadequate consideration of negative consequences for self or others that may result (Moeller et al., 2001; Patton & Stanford, 2012).
Lack of Perseverance	An inability to maintain focus on a task, particularly when the task is long and/or boring (Jones et al., 2014).
Negative Urgency	The tendency to act maladaptively in response to negative mood states (Cyders et al., 2007; Whiteside et al., 2001).
Neuroticism	Negative emotionality, such as feeling anxious (John & Srivastava, 1999).

Openness to Experience	Breadth and complexity of one's mental and experiential life) (John & Srivastava, 1999).
Passive Procrastination	Individuals who postpone their tasks until the last minute due to an inability to make the decision to act in a timely manner (Choi & Moran, 2009; Kim & Seo, 2013).
Positive Urgency	The tendency to act maladaptively in response to positive mood states (Cyders et al., 2007; Whiteside et al. 2001).
Premeditation	The tendency to engage in behaviour without being able to anticipate the consequences (Jones et al., 2014).
Self-Efficacy	Judgment of one's task-specific capabilities based on actual accomplishments (Linnenbrink & Pintrich, 2002).
Sensation-Seeking	Tendency to seek excitement and adventure (Whiteside et al. 2001).
Social Motive	Drinking to be sociable, to celebrate parties.
Stress	A state of psychological and physiological arousal that results when external demands exceed an individual's adaptive abilities. The general response of the body to a task or situation, whereas arousal is the physiological and psychological response that occur to an individual during the task or situation (Lazarus, 1966; Lazarus & Folkman, 1984; Zajacova et al., 2005).

GLOSSARY OF ACRONYMS

Acronym	Meaning
ACC	Anterior cingulate cortex
AMS-C 28	Academic Motivation Scale College Version
ADHD	Attention-Deficit/Hyperactivity Disorder
BAS	Behavioural Approach System
BFI	Big Five Inventory
BIS	Behavioural Inhibition System
BIS-11	Barratt Impulsiveness Scale
CSEI	The College Self-Efficacy Inventory
DFAQ-CU	Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory
DLPFC	Dorsolateral prefrontal cortex
DMPFC	Dorsomedial prefrontal cortex
DMQ-R	Drinking Motives Questionnaire, Revised
DTI	Diffusion tensor imaging
GPA	Grade point average
MAR	Missing at random
MCAR	Missing completely at random
MNAR	Missing not at random
MMM	The Marijuana Motives Measure
MRI	Magnetic Resonance Imaging
OFC	Orbitofrontal Cortex
PSS	The Perceived Stress Scale
SAT	Scholastic Assessment Test
SPSS	Statistical Package for the Social Sciences
THC	Tetrahydrocannabinol
VTA	Ventral tegmental area
UES	Undergraduate Engagement Scale

CHAPTER 1: LITERATURE REVIEW OF IMPULSIVITY

Defining Impulsivity

Impulsivity is a topic that has received significant research attention, resulting in a vast literature covering multiple domains focusing on neurotypical and clinical populations across the lifespan. It is a complex construct and individuals fall on a continuum from very minor/non-noticeable to significant impairment. Although usually characterized as a less desirable trait, the presence of impulsivity does not always indicate psychopathology, as degrees of impulsivity are present in all people and differ by context. Yet, impulsivity is a factor in multiple forms of psychopathology, including Attention-Deficit/Hyperactivity Disorder (ADHD), Conduct Disorder, substance use disorders, and personality disorders. The definition of impulsivity has evolved over time, with researchers augmenting their definition based on new research with notable cross-researcher differences. Generally, impulsivity is referred to as rapid, unplanned reactions to stimuli with inadequate consideration of negative consequences for self or others that may result (Moeller et al., 2001; Patton & Stanford, 2012).

Theories of Impulsivity

Although the literature on impulsivity has tended to focus on behaviours related to acting without thinking or consideration of consequences, the conceptualization of the components of impulsivity has varied across researchers. Eysenck and Eysenck (1977) subdivided impulsivity into four specific dimensions: narrow impulsiveness, risk-taking, non-planning, and liveliness. Eysenck and Eysenck (1975) proposed a model of impulsivity that included a three-factor theory of personality, consisting of neuroticism,

extraversion, and psychoticism. They also included impulsivity as a subscale of the personality traits psychoticism and extraversion. Ainslie (1975) suggested that impulsive individuals prefer less worthy immediate rewards to delayed more worthy ones when faced with various consequences. Barratt (1985b) distinguished three dimensions of impulsivity: motor (acting without thinking), cognitive (quick decision-making), and non-planning (decrease in orientation towards future). Similarly, Patton and colleagues (1995) identified three factors involved in impulsivity, including motor activation (acting on the spur of moment), inattentiveness (not focusing on the task at hand), and non-planning (not planning and thinking carefully). Barratt was also responsible for creating the first impulsivity measure, the Barratt Impulsiveness Scale (1959). He found that poor performance on laboratory tasks of impulsivity was often associated with task complexity and that subjects higher in impulsivity exhibited more problems than those lower in impulsivity with regards to planning (Barratt, 1967), response set, and accuracy of fine perceptual-motor performance (Barratt et al., 1981). As time progressed, Barratt became more convinced that, in addition to failure to plan ahead, impulsive individuals tend to have a fast cognitive tempo and rapid thoughts (Barratt, 1985a; Patton & Stanford, 2012).

Dickman (1990) and Eysenck (1993) differentiated impulsivity into *functional impulsivity* and *dysfunctional impulsivity*. Some of this work postulated that the general tendency to respond quickly and inaccurately may be a source of difficulty or an asset, depending upon circumstances (Dickman, 1990). Specifically, Dickman (1990) noted that this represented two separate traits: functional impulsivity results in rapid but inaccurate performance in situations where this is optimal, whereas dysfunctional impulsivity results in rapid, inaccurate performance in situations where this is non-optimal. Examples of

non-optimal situations include academic achievement and drug abuse (Eysenck, 1993). Functional and dysfunctional trait impulsivity and its examined correlates will be further discussed in the following section.

Eysenck (1993) suggested that brain damage, specifically damage to right frontal and orbitofrontal areas, in addition to alcohol use increased impulsivity. In particular, he postulated this was due to diminished cortical arousal by acting on the reticular activating system, thus decreasing anxiety and, in turn, behavioural inhibition (Eysenck, 1993a). Moeller et al. (2001) took a bio-psycho-social perspective when developing a model of impulsivity, including decreased sensitivity to negative consequences of behaviours, immediate and unplanned reactions before thoroughly processing the information, and not considering the long-term consequences of a behaviour for themselves or others. In contrast, Nigg and colleagues (2005) defined impulsivity in more simplistic terms, as a rash response in situations where a considered response would be more appropriate.

In general, the theories tend to focus on acting on the spur of the moment without thinking of the consequences with more dysfunctional outcomes. The present studies will focus more on the construct of dysfunctional impulsivity (i.e., acting on the spur of the moment without considering outcomes), as it is most associated with negative consequences.

The construct of impulsivity is also often included in models focused on clinical problems, including the literature on alcohol use. For example, LaBrie and colleagues (2014) highlighted four dimensions as important to understanding impulsivity: positive and negative urgency (the tendency to act maladaptively in response to positive mood states or negative mood states, respectively; Cyders et al., 2007; Whiteside et al. 2001),

premeditation (the tendency to engage in behaviour without being able to anticipate the consequences; Jones et al., 2014), sensation-seeking (tendency to seek excitement and adventure; Whiteside et al. 2001), and lack of perseverance (an inability to maintain focus on a task, particularly when the task is long and/or boring; Jones et al., 2014).

Impulsivity as a Trait

Although impulsivity is often referred to as a broad construct, some researchers have separated impulsivity into two, distinct domains: functional and dysfunctional impulsivity, as discussed above. Functional impulsivity is relevant to instances in which speed is more important than accuracy (Brunas-Wagstaff et al., 1995). Dickman's research suggested that functional and dysfunctional impulsivity were not highly correlated. Brunas-Wagstaff and colleagues (1995) followed the work of Dickman (1990) by examining the association of functional and dysfunctional impulsivity with personality traits. Disparities between the two types of impulsivities were also found; functional impulsivity was negatively associated with neuroticism, but dysfunctional impulsivity was unrelated to neuroticism (Brunas-Wagstaff et al., 1995). However, these researchers found both functional and dysfunctional impulsivity to be positively associated with extraversion, further indicating that the constructs are distinct, yet also have some overlap. More recently, Zdravec and colleagues (2005) examined the association of functional and dysfunctional impulsivity with general impulsivity scales and other related variables (e.g., Big Five personality traits, Eysenck's personality questionnaire). Functional impulsivity, as measured by the Dickman Impulsivity Inventory (1990), was found to be more associated with extraversion than general impulsiveness (Barratt impulsiveness scale; Patton et al., 1995) or sensation-seeking scores (Zuckerman

sensation-seeking scale; Zuckerman et al., 1978). Dysfunctional impulsivity was most associated with the general impulsivity measures. These results further indicate that functional and dysfunctional impulsivity are different constructs, with dysfunctional impulsivity most consistent with what impulsivity is typically considered (i.e., acting without thinking which results in negative consequences). Eysenck (1993) suggested that *spontaneity* may be a more appropriate term, as the label of functional impulsivity was somewhat misleading given the low correlation of the construct with narrow impulsivity (e.g., doing things spur of the moment). Although impulsivity is often subdivided into more narrow traits, empirical data suggest that a more global measure of impulsivity obtained by a total impulsivity score on a measure (rather than narrow trait score) better predicts dysfunction and psychopathology (Patton & Stanford, 2012). It is important to also consider that impulsivity can differ within individuals, as impulsivity is both a trait and state behaviour. Some individuals tend to engage in impulsive behaviours in general (i.e., trait), with some individuals acting more impulsive in certain situations than other situations (i.e., state). Spontaneity may therefore explain why some individuals who are not generally impulsive (i.e., low trait impulsivity) have situations in which they may engage in more impulsive behaviours. For instance, an individual who is generally careful and thoughtful in their decision making (i.e., low impulsivity) may be spontaneous on occasion and purchase an expensive item at the store without putting much thought into the decision based on the context (e.g., they were in a hurry, they were tired and wanted to return home).

Impulsivity is included among the diagnostic criteria for many psychiatric disorders, including borderline personality disorder, antisocial personality disorder,

ADHD, mania, and substance use disorders (Whiteside & Lynam, 2001). However, as previously mentioned, impulsivity does not indicate psychopathology, as high levels of impulsivity are present even among those without psychopathology and may play a functional role in the behaviour in certain contexts.

Impulsivity as an Aspect of Personality

Impulsivity is an important construct of personality. Eysenck and Eysenck (1985) included impulsiveness (e.g., I usually think carefully before doing anything) as a component of psychoticism and venturesomeness, and sensation-seeking as a component of extraversion. In many models, impulsivity is a facet under the personality trait of neuroticism, which is a measure of emotional stability versus instability. Emotional stability may be manifested in students' responses to stress and time deadlines, and in their adaptability to new situations or conditions (Goldberg, 2001; Trapmann et al., 2007). Costa and McCrae (1992) proposed that low self-control is measured by the impulsiveness facet within the neuroticism domain and by the self-discipline facet within the conscientiousness domain of their Big Five model of personality. In this model, impulsivity is also found in the excitement-seeking facet within extraversion, which is similar to the dimension of sensation-seeking described by Zuckerman (1994). Buss and Plomin (1975) included impulsivity, as well as emotionality, activity, and sociability in their four-factor model of temperament. They postulated that impulsivity is a multi-dimensional temperament with inhibitory control as a core factor. They also theorized that impulsivity involves: a lack of considering alternatives and consequences before decision-making, a lack of ability to remain with a task despite competing options, and

the tendency to become bored and need to seek novel stimuli (Buss & Plomin, 1975; Whiteside & Lynam, 2001).

Developmental Perspective on Impulsivity

Impulsivity is studied across the lifespan. In a longitudinal study, self-regulation and maternal sensitivity at 10 months of age was found to predict impulsivity at 36 months (Frick et al., 2018). Between three and six years of age, youth make a considerable gain in developing self-control, although self-control continues to develop into childhood and adolescence (Diamond & Taylor, 1996; Lewis & Todd, 2007; Tarullo et al., 2009). Even in young children, the majority of the literature on impulsivity is focused on children with ADHD or whom are at risk for ADHD diagnoses in the future, as impulsivity is a core feature of ADHD, a relatively common psychiatric disorder in children.

Concerns about impulsivity continue into the school-age years. Impulsive children are at higher risk of poor academic achievement and difficulties with peers (Gresham et al., 2005; Ruf et al., 2008; Spira & Fischel, 2005). In general, impulsivity has been negatively associated with academic achievement among children and adolescents (Fink & McCown, 1993; Vigil-Colet & Morales-Vives, 2005).

Individuals with poorer academic performance tend to show an impulsive and poor problem-solving style and give the first answer that comes to mind (Fink & McCown, 1993; Vigil-Colet & Morales-Vives, 2005). Flynn (1985) found that improvements in delay of gratification were significantly positively correlated with improvements in school achievement among young boys.

Impulsivity typically continues to develop into adolescence, with risk-taking often an area of concern. Specifically, impulsivity among adolescents has been associated with substance use and problem gambling (Vitaro et al., 1998). Impulsivity is also prevalent among adults, despite the maturation of the associated brain regions (e.g., prefrontal cortex). Although ADHD is more prevalent in childhood and adolescence, it is important to consider that it continues into adulthood in some individuals. However, increased impulsivity in adulthood is not always due to ADHD. Spinella (2004) found that behavioral measures associated with prefrontal functioning (e.g., go/no-go task) were related to self-ratings of impulsivity, indicating that the prefrontal cortex is involved in impulsive behaviours among adults.

Much of the literature surrounding impulsivity and academic achievement tends to focus on ADHD in children (e.g., Merrell & Tymms, 2001). Socioeconomic status (SES) has been found to predict both childhood (Miech et al., 2001) and adult impulsivity (Flory et al., 2006; Ruf et al., 2008). Self-control and self-regulation are also contributing factors to academic achievement. The childhood impulsivity literature is important in understanding the trait in university students, as childhood traits often influence and continue into emerging adulthood.

Self-regulation, although not synonymous with impulsivity is somewhat overlapping, involving the ability to control or direct one's attention, thoughts, actions, and emotions (McClelland & Cameron, 2012). Self-regulation has been found predict academic achievement before kindergarten (McClelland et al., 2007), throughout schooling (Blair & Razza, 2007), and into adulthood (McClelland & Cameron, 2012).

Indeed, self-regulation as a general construct has been found to be a predictor of academic success among children.

Impulsivity and Academic Achievement in Higher Education Settings

The role of impulsivity in academic achievement has been widely studied across the age range (Rodriguez-Fornells & Maydeu-Olivares, 2000; Shoda et al., 1990; Tangney et al., 2004). Findings from studies with children may not be generalizable to young adults. However, impulsivity is a life-long trait, and increased impulsivity in childhood has been found to influence academic achievement in university years (Mischel et al., 1988; Shoda et al., 1990). Therefore, although the findings may not necessarily generalize, they can be used to inform hypotheses of the role of impulsivity in academic performance. Indeed, studies have examined the association between academic achievement and engagement in academics in this age range, although this literature has a narrow focus. Specifically, academic engagement is often conceptualized as time spent doing homework and class attendance (e.g., Fraser & Killen, 2003), with research needed on more specific academic activities.

Academic achievement in university is a large area of study given the numerous factors that influence success. Intelligence test scores have been theorized and found to predict academic success across many studies of university students (Busato et al., 2000; Farsides & Woodfield, 2003; Neisser et al., 1996). Although there has been much debate, many have noted that standardized tests, such as the Scholastic Assessment Test (SAT), have not been found to predict grades in first year university (Geiser & Santelices, 2007). Rather, high school grades have been found to be more associated with academic performance in university and university graduation (Geiser & Santelices, 2007). Time

devoted to studying and completing academic work has also been associated with academic success, and with competing activities, such as working a part-time job (Van Den Berg & Hofman, 2005). One study in particular found that working less than 12 hours a week did not influence academic success, but working more than 12 hours per week was associated with decreased success (Van Den Berg & Hofman, 2005).

Self-efficacy, defined as a self-evaluation of one's competence to successfully execute a course of action necessary to reach desired outcomes (Bandura, 1977, 1982, 1986; Zajacova et al., 2005), has been associated with academic achievement. High self-efficacy has been associated with greater family support during university education (Torres & Solberg, 2001). Moreover, university students with high perceived availability of family support are more likely to develop relationships with faculty and other students, which also impacts success (Torres & Solberg, 2001). Self-esteem and internalized locus of control have also been associated with academic success (Byrne, 1984; Finn & Rock, 1997). Pascarella and colleagues (1996) found that increased locus of control with regards to academic success was impacted by credit hours taken, hours worked per week, and participation in athletics. Participating in extracurricular activities can improve one's locus of control for academic success, but can also hinder academic success due to hours taken away from studying.

Personality traits have also been found to have implications in academic achievement. In a meta-analysis conducted by Trapmann and colleagues (2007), conscientiousness was found to be most associated with academic success as compared to the other Big Five personality traits. De Barbenza and Montoya (1974) found a negative correlation between neuroticism, which includes impulsivity, and academic achievement

among university students, whereas significant associations were not observed with other undergraduate samples (Busato et al., 2000; Halamandaris & Power, 1999). Impulsivity and self-control are also important factors that have been found to impact academic success.

The role of impulsivity in the academic achievement of university students has been investigated from a number of perspectives. In a Spanish sample of college students, impulsive and careless problem solving was found to be associated with poorer academic achievement (Rodriguez-Fornells & Maydeu-Olivares, 2000). In a study of college students with ADHD and without ADHD, those with ADHD reported lower grades than those without ADHD, as well as an increased likelihood of being on academic probation (Heiligenstein et al., 1999). Delay-discounting was used as a measure of impulsivity among college students to determine its association with academic achievement. Originally developed for use in gambling studies, delay-discounting assesses the value of rewards to an individual in relation to the time the reward is earned. Higher rates of delay-discounting are assumed to indicate an impulsive decision-making style. Research suggests that greater delay-discounting has been associated with lower grades in university students and associated with non-planning impulsivity among middle-aged adults (deWit et al., 2007; Kirby et al., 2005).

Impulsivity is also associated with academic performance, particularly in the context of procrastination. Procrastination is considered a failure in self-regulation, as procrastinators may have a reduced ability to resist social temptations, pleasurable activities, and immediate rewards when the benefits of academic behaviours are distant, as compared to non-procrastinators (Ariely & Wertenbroch, 2002; Chu & Choi, 2005;

Rabin et al., 2010). For many years, researchers have noted that the further away an event is in time, the less impact it has on one's decisions (Lewin, 1935; Steel, 2007). Therefore, those who are less likely to consider future consequence (i.e., those high in impulsivity) are more likely to procrastinate. Impulsivity and procrastination are thought to be linked from a cognitive perspective, as both constructs seem to share a common underlying cognitive ability of goal-management ability, which is the ability to use one's short-term and long-term goals to guide behaviours (Gustavson et al., 2014). Indeed, procrastination involves irrationally delaying actions that help accomplish one's goals, whereas impulsivity is about giving in to urges, often at the expense of long-term goals (Gustavson et al., 2014). Procrastinators have also been found to be more sensitive to the pleasantness of tasks, thus procrastinators are more likely to be impulsive (Steel, 2007). Procrastinators often exhibit deficits in inhibition (Gustavson et al., 2015; Rebetz et al., 2016) and error processing on behavioural impulsivity measures (Michałowski et al., 2017; Wypych et al., 2017; Wypych et al., 2018). Procrastination can also vary by situation, as some individuals more inclined to procrastinate in certain situations but less so in other situations. Procrastination decreases with age from young adulthood through older adulthood as individuals gain life experiences (Wypych et al., 2018). Moreover, maturation of the prefrontal cortex is not yet complete during university, with this area responsible for inhibition, thus potentially impacting procrastination and impulsivity (Sowell et al., 1999; Wypych et al., 2018). Indeed, lack of maturation of the prefrontal cortex results in increased impulsive and potentially dangerous behaviours among university students, such as alcohol and drug use (Wypych et al., 2018).

Impulsivity's Intersection with Alcohol and Marijuana Use

Impulsivity is frequently associated with increased alcohol and marijuana use among university students (Gruber et al., 2011; Jones et al., 2014; LaBrie et al., 2014; Magid et al., 2007). The association between impulsivity and substance use (i.e., alcohol and marijuana use) during emerging adulthood is particularly important given the effects of substance use on many areas of functioning, as well as the effects on neural development. Specifically, marijuana can slow brain development in numerous areas, including those areas involved in socio-emotional functioning (e.g., amygdala, ventral striatum, orbitofrontal cortex, medial prefrontal cortex, and superior temporal sulcus) and cognitive control (i.e., lateral prefrontal, lateral parietal, and anterior cingulate cortices; Chassin et al., 2010; Crews et al., 2007; Gruber et al., 2014; VanderVeen et al., 2016). This slowing of brain development may also lead to more pronounced difficulties in adulthood in these domains (Hall, 2009; Hall & Degenhardt, 2009; Meier et al., 2012). Inhibition is largely controlled by the frontal areas of the brain; thus, it would be understandable that those who use substances are more impulsive in nature. However, it is also important to consider that substance use alone does not lead to impulsivity. Rather, impulsive individuals tend to be more prone to using substances, which in turn, further increase their impulsivity. Based on findings from a number of studies, Perry and Carroll (2008) suggest that increased impulsivity leads to drug abuse, drug use increases impulsivity, and impulsivity and drug use are associated with other factors, such as non-drug rewards and early environmental factors. Therefore, the neural mechanisms through which alcohol and marijuana use are associated with impulsivity must be considered to better understand how the constructs are related.

Neuro-Biological Mechanisms Behind Alcohol and Marijuana Use

Although there are multiple theories about factors underlying substance abuse, Gray's Reinforcement Sensitivity Theory directly addresses the relationship between substance abuse and impulsivity. Gray's (1987a, 1987b) theory proposes that two independent neurologically-based motivational systems are involved in behaviour regulation: The Behavioural Approach System (BAS) and the Behavioural Inhibition System (BIS). The BAS activates approach behaviour to stimuli signaling reward and non-punishment. It is typically associated with positive affect, but it responds equally well to aversive stimuli that require goal-directed behavior (Dawe et al., 2004; Pickering & Gray, 1999). The BIS is activated by stimuli signaling non-reward and punishment, and is often associated with anxiety and avoidance (Pickering & Gray, 1999; Zisseron & Palfaia, 2007).

Increased alcohol consumption has been found among individuals with increased BAS sensitivity as a result of stronger subjective, physiological, and behavioral responses to positive incentive cues (Fowles, 1993; Franken, 2002; Zisseron & Palfaia, 2007). Indeed, those with greater BAS sensitivity exhibit greater levels of positive affect following reward cues (Carver & White, 1994) and positive mood induction (Zelenski & Larsen, 1999). Moreover, those with higher BAS sensitivity are more likely to engage in approach and active avoidance behaviours in situations that have cues for the reward (Dawe et al., 2004). Fowles (1987) postulated that an underactive BIS, which also results in low anxiety, could also predispose individuals to risky and disinhibited behaviours (Pardo et al., 2007). In general, impulsivity is often seen as more strongly active with the BAS (Pickering, 1997; Steel, 2007). The BAS has been shown to relate to the

dopaminergic reward circuitry, an area also involved in reinforcing alcohol and drug use (Barros-Loscertales et al., 2010). This circuitry involves the substantia nigra, the ventral tegmental area (VTA) to the dorsal and ventral striatum, and the prefrontal cortex (Depue & Collins, 1999; Knutson & Cooper, 2005; Pickering & Gray, 2001).

Activation of the frontal cortex has been found following illicit drug intake, which indicates that regions in the frontal cortex are affected by drug use (Goldstein & Volkow, 2002; Tekin & Cummings, 2002). Findings across studies therefore suggest that individuals with less frontal activity are more prone to trait impulsivity, with this impulsivity further potentiated with increased substance use (Jentsch & Taylor, 1999; Rolls, 1986). As such, individuals with higher levels of impulsivity are also more prone to using substances.

Association of Impulsivity with Alcohol and Marijuana Use

Higher rates of impulsivity have been found among polysubstance dependents than single substance dependents, and among individuals who abuse alcohol compared with healthy individuals (Adams et al., 2012; Evren & Dalbudak, 2009; Hamdan-Mansour et al., 2018). Among adolescents, self-control was found to be an important predictor of substance use (Tangney et al., 2004; Wills et al., 1995).

As previously described, there has been a substantial emphasis on impulsivity and impulsivity-related factors in the literature on alcohol use and abuse. These factors include positive and negative urgency, premeditation (or lack of planning ahead), sensation-seeking, and lack of perseverance. Cyders and colleagues (2009) postulated that sensation-seeking is likely driven by a need for stimulation, whereas positive and negative urgency appear to be influenced by emotional dysregulation. Specifically,

individuals act in ways that are inconsistent with their long-term interests because they are either extremely distressed or excited and therefore do not employ the more typical cognitive controls (Cyders et al., 2009). Negative and positive urgency have also been implicated in several risky behaviors, including problematic alcohol consumption (Cyders et al., 2009; Cyders & Smith, 2007; Whiteside & Lynam, 2003). Furthermore, negative and positive urgency have been found to relate to risky behaviours that are engaged in during extremely negative and positive moods, respectively (Cyders et al., 2009; Cyders & Smith, 2007). Individuals who report regrettable actions when in very positive or negative moods are more likely to report negative consequences from drinking (positive and negative urgency, respectively; LaBrie et al., 2014). Negative urgency appears to be the strongest predictor of the severity of alcohol problems of all the impulsivity dimension (Adams et al., 2012; Curcio & George, 2011; Verdejo-García et al., 2007). Urgency appears to be more closely associated with problem drinking than with alcohol use more generally (Curcio & George, 2011; LaBrie et al., 2014). The effect of urgency (LaBrie et al., 2014) may result from those higher in urgency focus on improving immediate mood, rather than the potential negative longer-term consequences of their actions (Cyders et al., 2009). Additionally, extreme emotions can reduce cognitive resources and may lead to poorer decision making (Dick et al., 2010). With regards to sensation-seeking, the literature is inconsistent in identifying gender differences, with some finding female students to have higher levels of sensation-seeking (Chambers et al., 2003), whereas others have found male students to have higher levels of sensation-seeking (de Wit, 2009; Hamdan-Mansour et al., 2018). Sensation-seeking has been associated with the frequency of engaging in risky behaviors due to alcohol use

(Cyders et al., 2009; Cyders & Smith, 2007; Whiteside & Lynam, 2003). Moreover, higher sensation-seeking levels have been associated with higher frequencies of substance use across a number of studies (Cyders et al., 2009; Cyders & Smith, 2007; de Wit, 2009; Hamdan-Mansour et al., 2018). Therefore, it appears that sensation-seeking impacts the frequency of drinking, whereas positive and negative urgency impact the engagement of risky and impulsive decisions.

From a genetic standpoint, single nucleotide polymorphisms (SNPs) in cannabinoid receptor 1 (CNR1) has been found to moderate the association of trait impulsivity with marijuana-related consequences (e.g., impulsive decisions, risky decision; Bidwell et al., 2013). Indeed, those with the CNR1 variant who are also high in impulsivity are at greater risk of experiencing problems due to marijuana use (Bidwell et al., 2013). Individuals with a parental history of substance use disorders have been found to report greater levels of impulsivity, favouring immediate rather than delayed rewards, suggesting biological mechanisms (Bidwell et al., 2013).

From a fMRI neuroimaging standpoint, binge drinking among college students has been significantly associated with decreased activation of the dorsolateral prefrontal cortex (DLPFC), dorsomedial prefrontal cortex (DMPFC), and anterior cingulate cortex (ACC) during negative emotion relative to neutral inhibitory task trials (Cohen-Gilbert et al., 2017). These brain regions are strongly involved in executive functioning, with frontal areas responsible for inhibitory control and implicated in impulsivity, as previously described. The findings by Cohen-Gilbert and colleagues (2017) suggest that drinking alcohol results in greater impulsivity, particularly in situations that are more emotionally laden. Jacobus and colleagues (2014) have found changes in cortical

thickness among heavy alcohol and marijuana users, resulting in cognitive functioning deficits.

Greater impulsivity has also been associated with marijuana use in a variety of studies. In a study utilizing functional neuroimaging and measures of impulsivity (diffusion tensor imaging; DTI), chronic marijuana users who reported more impulsivity also exhibited alterations in frontal white matter (Gruber et al., 2011). Therefore, impulsivity among marijuana users is evidenced not only via self-report measures, but also through brain imaging. The relation between impulsivity and marijuana may be cyclical, with those who use marijuana are more impulsive and marijuana exposure increases overall level of impulsivity. Research has also shown that marijuana alters time perception (Chait and Pierri, 1992; Schulze et al, 1988), causing the overestimation and under-reproduction of time intervals, suggesting a speeding of the internal clock. A factor of impulsivity is the tendency to perceive time as progressing more slowly than actual time (McDonald et al., 2003; Meck, 1996). This can be particularly consequential for university students with regards to academic deadlines, as it may feel that they have more time to complete their work than they actually do.

Research from the nicotine literature can be influential in guiding hypotheses given the nature of cigarette smoking and similar dependence as alcohol and marijuana use. It has been suggested that the novelty of smoking and the positive reinforcement individuals receive from smoking may attract those higher in sensation-seeking to become regular smokers (Clayton et al., 2007; Spillane et al., 2010). The novelty of the smoking experience wears off as individuals continue to smoke, thus the individual seeks out other novel and/or thrilling experiences to engage in (Spillane et al., 2010). Alcohol

and marijuana among university students may similarly be novel and exciting at first for them, particularly given that university is a time of new-found independence for some. However, over time the substance use is no longer as novel, as is the case with smoking. Smoking is reinforced during intense mood states, such as celebration of positive events or as a means of reducing negative affect. This is similar to the influence of positive and negative urgency on increased alcohol and marijuana use, as well as increased negative consequences due to the use.

Future Directions

The extant literature has already described the impact of impulsivity on academic success among university students, as detailed previously. However, studies have yet to examine how impulsivity is directly associated with academic engagement, which is particularly important given that academic engagement is associated with achievement and is an area of intervention in many post-secondary settings (Alrashidi et al., 2016). Studies have documented the procrastination prevalence among university students, as well as the role of impulsivity in procrastination (Panek, 2014). Research has identified the impact of procrastination on academic achievement (Jackson et al., 2003), but has yet to examine if procrastination may be associated with academic engagement. Determining whether impulsivity affects the association between procrastination and academic engagement will help with further understanding how impulsivity impacts academic performance. Another topic receiving significant interest in university students is alcohol and marijuana use, particularly given that university is a time of new-found independence and novel experiences for many. This is particularly timely given that marijuana has just been legalized in Canada for use by adults at the time of development of this study.

Given the negative consequence of alcohol and marijuana use on academic achievement, it is important to identify reasons why students tend to use substances, and in turn, how these reasons influence academic engagement.

The following chapters will outline the three independent studies that make up the dissertation document. In chapter two, a common methods section will describe the overall study plan. Each of the three following chapters will describe a study and are intended for submission as a manuscript for publication with limited revisions. Thus, it is likely that the chapters will be somewhat repetitive for a reader of the full dissertation.

The first study sought to examine the association between impulsivity and academic engagement and measured some of the factors that moderate the association, including conscientiousness, neuroticism, self-efficacy, and life stress. The second study sought to determine an association between procrastination and academic engagement, while testing the moderator role of impulsivity, self-efficacy, and motivation in the association. The third study built upon the extant literature and measured whether motivation to use alcohol and marijuana was associated with academic engagement, while considering impulsivity and stress as moderators. For all of the studies, each of the moderator variables were chosen after extensive review of the applicable literature. Indeed, the moderator variables were chosen due to the association the variables have been shown to have with academic achievement in the literature, as well as their association with impulsivity and/or procrastination.

CHAPTER 2: METHODS

The current project is comprised of three independent yet related studies examining the role of impulsivity in academic performance among university students. The data for the project were collected in one overall data collection process but the analyses were separated by the hypotheses for each independent study. This chapter provides details regarding the common methods and procedures that were used for the three studies, with the study-specific details concerning aims, hypotheses, and data analyses to follow in subsequent chapters.

Participants

Of the 198 participants in the total sample, 152 were female, 45 were male, and one identified as “other”. With regards to ethnicity, 8.1% (N=16) were Asian or Asian descent, 5.6% (N=11) were Southeast Asian, 2.0% (N=4) were Hispanic/Latino, 11.1% (N=22) were non-Hispanic Black or African descent, 55.1% (N=109) were non-Hispanic White, Caucasian, or European descent, 13.6% (N=27) were Arab or Middle Eastern descent, and 4.5% (N=9) were an Other/Mixed descent. With regards to year of study, 17.2% were in their first year, 32.8% in their second year, 27.8% in their third year, 17.2% in their fourth year, and 5.1% in their fifth year or above. Subsets of the total sample were used for the present studies, with the relevant demographics noted in the associated sections below. Although the sample consists primarily of females, which is consistent with other undergraduate samples, the pool of participants in the present study is rather ethnically diverse compared to other undergraduate pools.

Participants were recruited from the research pool within the Psychology Department at the University of Windsor. This is an electronic system that allows full-

and part-time undergraduate students enrolled in psychology and business courses to receive extra credit for their courses in exchange for research participation. The study was submitted to and approved by the Research Ethics Board of the University of Windsor. Inclusion criteria required participants to be able to read, write, and speak English. No other exclusionary criteria were used. A preliminary analysis using a small-to-medium minimum detectable effect size of 0.10 that was informed by previous research with comparable constructs, and four to six tested predictors yielded a sample size of 143. In order to yield on the side of caution, an additional 10% of the sample size was planned to be collected to compensate for spoiled data (i.e., incomplete responses, invalid responding), thus requiring a total sample size of 157. It is important to note that the three studies fell within a single data collection procedure. The power analyses to estimate necessary sample size resulted in each study having different proposed sample sizes, which is reported within each sample. Because the data collection was accomplished for all three studies at the same time, the model with the largest required sample size (study 3; 143 participants) was used as the target sample size. Due to the rate of alcohol use among participants (approximately 80% reported alcohol use), the sample size was increased to 200 participants part-way through data collection in order to allow for an adequate sample size for the analysis of data.

Procedures

Participants signed up for a one-hour session of the study via the research pool website, where the screening criteria queried participants' ability to speak, read, and write English, as previously mentioned. Participants were made aware that they would be asked to access the student information services website to view their transcript with the

primary investigator on the day of the study, with the investigator taking note of their GPA. The details of each of the measures will be further discussed in the respective chapters.

The data collection was completed in-person in groups of 5-8 participants in university space allocated for research. Prior to participating, the primary investigator took all participants through the informed consent process, including description of the study and information about risks and benefits of participating, confidentiality, and the right to withdraw. They were provided with the opportunity to ask questions regarding their participation. They were also informed that they may withdraw at any point during the study without experiencing any negative consequences. Had participants withdrawn, they would receive credit proportional to their participation in the study (i.e., for each 30 minutes of participation they would receive 0.5 bonus points). Time would be rounded to the closest 30-minute interval (e.g., 45 minutes of participation would be rounded to 60 minutes, and the participant would have received 1.0 bonus points). In the event participants chose to withdraw, they would have been asked to indicate whether they wished for their data to be destroyed confidentially. After consent was obtained from all participants, the measures listed below were administered with the order of the measures randomly assigned, and the participant privately viewed their transcript with the primary investigator at some point during their scheduled session. The randomization of measures was completed using a Latin square (Williams, 1949); each measure was assigned a number, and the Latin square provided randomized number sequences to order the questionnaires.

Measures

The following measures were used in the present studies. Detailed information about each measure is provided in subsequent chapters.

- Demographics.
- Barratt Impulsiveness Scale.
- Dickman Impulsivity Inventory.
- Undergraduate Engagement Scale.
- Tuckman Procrastination Scale.
- The Active Procrastination Scale.
- Academic Motivation Scale (AMS-C 28) College Version.
- College Self-Efficacy Inventory.
- The Perceived Stress Scale (PSS).
- Big Five Inventory.
- Alcohol Frequency Index.
- Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU).
- Drinking Motives Questionnaire, Revised (DMQ-R).
- The Marijuana Motives Measure (MMM).

Data Storage, Entry, and Preparation

Paper copies of participant data are stored in a locked room in Dr. Carlin Miller's research lab, with electronic versions of the data stored in encrypted form and analyzed on the personal computers of the researchers. To maintain privacy, all participant responses were coded using a research ID number and were stored using password-

protected files on a USB. Following the defense of the dissertation, the paper copies of participant data will be confidentially destroyed. Electronic copies of the dataset will be kept by the dissertation author and her adviser, Dr. Carlin Miller. The electronic dataset will be fully de-identified and will remain password-protected.

Data were double-entered by trained research assistants into a database created by the primary investigator, using the Statistical Package for the Social Sciences (SPSS) Version 22 software. The data were screened for incomplete responses or response patterns that suggest data invalidity, such as the same response for all questions. In order to address issues around missing data, all data were screened in order to determine the pattern by which the data were missing. The Missing Completely at Random (MCAR) test was conducted to determine if the data were missing completely at random. This test examines the pattern of the missing data to determine if the pattern does not depend on the data values. A visual examination of the data allowed for a determination if the data was missing at random (MAR) or missing not at random (MNAR). Visual inspection of missing data points allows one to determine potential patterns as to why the data are missing by examining potential trends in the participants' responses. The expectation-maximization algorithm was used to replace missing data, which estimates the parameters of the missing data directly by maximizing the complete data log likelihood function (Dong & Peng, 2013). All predictor variables were mean-centered by subtracting the mean score across all participants from each participant's score on that measure. Mean centering reduces the correlation between interaction terms and allows for better interpretation (Cohen et al. 2003). The statistical analyses for each study are discussed in the appropriate following chapter.

Assumptions of Regression Analyses

The assumptions of a linear regression analysis were checked prior to completing the analysis. Specifically, adequate sample size, normality, linearity, absence of multicollinearity, absence of outliers, homoscedasticity of errors, and independence of errors.

Sample size is the assumption that the sample is large enough in order to be able to identify a statistically significant difference if a difference does indeed exist. Generally, at least 15 observations per predictor are needed to meet the assumption (Pituch & Stevens, 2015). The present sample size, thus, meets the assumption.

Normality was assessed by examining skewness ($< |2|$) and kurtosis ($< |3|$) values of all variables included in the regression analyses, as well as visually inspecting histograms. Values of skewness and kurtosis were within the adequate range for all variables. Histograms of the variables and q-q plots also indicated a normal distribution for all variables. Scatterplots were created to identify the pattern of association between the predictor variables and outcome variables, in order to assess the assumption of linearity. Visual inspection of the scatterplots indicated that the associations were linear.

Multicollinearity was assessed by examining the correlations between the predictor variables included in the regression analyses. Intercorrelations between the predictor variables ranged from -0.68 to 0.67 for study 1, -0.42 to 0.48 for study 2, and 0.24 to 0.87 for study 3. These intercorrelations did not indicate multicollinearity for study 1 or 2, but multicollinearity was violated in study 3 (Cohen et al., 2003; Pituch & Stevens, 2015). As such, each of the alcohol motives were examined in individual regression analyses. Collinearity diagnostic tests yielded tolerance values > 0.1 and

Variance Inflation Factor (VIF) values <10 (Pituch & Stevens, 2015). Thus, the variables demonstrated an absence of multicollinearity.

Linear regression assumes the absence of outliers and influential observations. For study 1, no cases were found to be outliers on Y , with standardized residuals of $<|3.17|$, with a cut-off of 3.29 (Tabachnick & Fidell, 2013). Mahalanobis distance scores did not indicate any multivariate outliers. For study 2, one case was found to be an outlier on Y and was removed, with standardized residuals of $|3.29|$ as a cut-off (Tabachnick & Fidell, 2013). Mahalanobis distance scores indicated one multivariate outlier, which was removed. For study 3, One case was found to be an outlier on Y for the alcohol analyses and removed, with standardized residuals cut-off of $|3.29|$ (Tabachnick & Fidell, 2013). Mahalanobis distance scores did not indicate any multivariate outliers for the alcohol analyses, but two outliers were identified and removed for the marijuana analysis. No influential observations were found across all studies, with Cook's d values less than 1.0 (Cohen et al., 2003).

Homoscedasticity of errors refers to the assumption that error variances are equal across predicted values of the independent variables (Cohen et al., 2003). This assumption was tested by plotting the residuals against the predicted values for each of the predictor variables. Visual inspection of the plots did not indicate violations of the assumption. The Durbin Watson statistic was calculated to identify the independence of errors, with a value of 2.1 for study 1, value of 2.0 for study 2, and values between 1.5 and 2.5 for study 3. Another assumption is measurement of variables without error. Cronbach's alpha was calculated to determine internal consistency of items of the study measures. All values of internal consistency were adequate (0.72 to 0.92).

Linear regression also assumes independence of observations. As the variables measured are rather static personality traits, it would be expected that values provided by participants are influenced by their personality and beliefs. Therefore, values would not be expected to be influenced by the potential interaction of participants in courses.

CHAPTER 3: IMPULSIVITY AND ACADEMIC ENGAGEMENT AMONG UNIVERSITY STUDENTS

Impulsive problem solving has been found to have various negative consequences for university students, with a notable consequence being poor academic achievement (Rodriguez-Fornells & Maydeu-Olivares, 2000). The association between impulsivity and poorer academic success is evident in children (Tangney et al., 2004) and adolescents (Duckworth & Seligman, 2005), but very few studies have been conducted with university students.

Academic achievement is also influenced by academic engagement, which in turn is influenced by a number of factors. How these factors affect academic engagement determines the types of policies and interventions that are implemented to allow for optimal performance. One individual factor influencing academic achievement is impulsivity, which refers to the tendency to deliberate less than most people before taking action (Dickman, 1990). Impulsivity is a construct that spans several domains, with individuals falling along a continuum. Impulsivity is also a factor in multiple forms of psychopathology, including Attention-Deficit/Hyperactivity Disorder (ADHD), Conduct Disorder, substance use disorders, and personality disorders. But, the presence of elevated impulsivity does not always indicate psychopathology. Certain individuals are prone to impulsive behaviours for a variety of reasons, including genetic and environmental factors.

Impulsivity

Impulsivity is a vast area of literature from studies across the lifespan. With regards to the association of impulsivity and academics, studies often examine

performance of children with ADHD, yet this is not necessarily generalizable to university students. Furthermore, although impulsivity is often viewed in a negative light, there are instances in which impulsivity can be beneficial in academic settings. The research literature often calls this *functional impulsivity*. Dickman (1990) differentiated impulsivity into *functional impulsivity* and *dysfunctional impulsivity*. This work postulated that there could be a general tendency to respond quickly and inaccurately that may be a source of difficulty or an asset, depending upon circumstances. Specifically, Dickman (1990) noted that this represented two separate traits: one that results in rapid inaccurate performance in situations where this is optimal (functional impulsivity) and the other that results in rapid, inaccurate performance in situations where this is non-optimal (dysfunctional impulsivity). Examples of non-optimal situations include academic achievement and drug abuse (Eysenck, 1993). Indeed, functional impulsivity is relevant to instances in which speed outweighs the importance of accuracy (Brunas-Wagstaff et al., 1995). Dickman's research suggested that functional and dysfunctional impulsivity were not highly correlated. Thus, they are likely distinct constructs that are differentially associated with personality variables (Dickman, 1990).

Following from the foundation delineated by Dickman's work, Brunas-Wagstaff and colleagues (1995) examined the association of functional and dysfunctional impulsivity with personality traits. Disparities between the two types of impulsivities were also found; functional impulsivity was negatively associated with neuroticism, but dysfunctional impulsivity was unrelated to neuroticism (Brunas-Wagstaff et al., 1995). However, they found both functional and dysfunctional impulsivity to be positively associated with extraversion, thus further indicating that the constructs are distinct, yet

also have some overlap. These findings further suggest that functional and dysfunctional impulsivity are different constructs, with dysfunctional impulsivity most consistent with what impulsivity is typically considered (i.e., acting without thinking which results in negative consequences). Indeed, Eysenck (1993) suggested that the label of functional impulsivity was somewhat misleading given the low correlation of the construct with narrow impulsivity (e.g., doing things spur of the moment), thus *spontaneity* was suggested as a more appropriate term.

Impulsivity and Academic Achievement

Several studies assessed children's capacity to delay gratification at age 4 years and followed up with the participants as they completed high school and entered college (Mischel et al., 1988; Shoda et al., 1990; Tangney et al., 2004). Results from these studies showed that children who were better at delaying gratification earlier achieved higher SAT scores later (Mischel et al., 1988; Shoda et al., 1990; Tangney et al., 2004;). Among adolescents, impulsivity has been found to moderate the association between intelligence and academic success, as those with high intelligence and high impulsivity performed more poorly than those with high intelligence and low impulsivity (Vigil-Colet & Morales-Vives, 2005).

Among university students, impulsive and careless problem solving was found to result in lower academic functioning (Rodriguez-Fornells & Maydeu-Olivares, 2000). Moreover, college students with ADHD reported lower grades than those without ADHD, as well as an increased likelihood of being on academic probation (Heiligenstein et al., 1999). Among adolescents, self-discipline accounted for twice as much variance as intelligence when it came to grades, hours spent doing homework, and hours spent

watching television (Duckworth & Seligman, 2005). Researchers have examined the association between academic achievement and engagement in academics, although this literature has a narrow focus.

Academic Engagement

Academic engagement generally refers to students' patterns in motivations, cognitions, and behaviours in the learning environment (Alrashidi et al., 2016). The term is quite complex, with researchers referring to it in different ways and with different labels, such as valuing school-related outcomes and participates in school activities (Willms, 2003); effort, action, and persistence in school work (Skinner et al., 1990); and a study-related state of mind characterized by absorption, vigor, and dedication (Schaufeli et al., 2002). Although there are varying definitions of academic engagement across researchers, some uniformity has been made in terms of the dimensions of academic engagement. Some researchers have adopted a two-dimensional model (e.g., Audas & Willms, 2002; Finn, 1989; Willms, 2003), which includes behavioural (e.g., participation in academic and non-academic activities) and psychological (e.g., identification with school, valuing learning outcomes, and belonging) subtypes (Appleton et al., 2008). Others have proposed a tripartite model (e.g., Fredricks et al., 2004; Jimerson et al., 2003) that includes a cognitive dimension (e.g., thoughtfulness and willingness to master difficult tasks), as well as the psychological and behavioural subtypes. Schaufeli et al. (2002) also adopted three dimensions, however, labelled these components as dedication, vigor, and absorption (Alrashidi et al., 2016; Appleton et al., 2008). Academic engagement is important to study and foster for a multitude of reasons, particularly given that it is associated with increased academic achievement. Moreover,

as students dropping out of school is usually considered a gradual process rather than an instantaneous one, researchers view academic engagement as a main way of intervening to improve academic performance and decrease dropouts (Alrashidi et al., 2016; Appleton et al., 2008; Appleton et al., 2006).

University students are expected to be largely independent learners, which relates to Mischel's (1973) "self-regulatory systems and plans." They must therefore be able to balance their needs for affiliation with their needs for achievement, they must have a strong feeling of self-efficacy, and they must be able to appreciate the complexity of the situations they encounter (Fraser & Killen, 2003). A study by Fraser and Killen (2003) examined a sample of South African university students, asking lecturers, first-year students, and senior students to rank different influential factors on academic success. The researchers found that many students do not have the type of effective self-regulatory system indicated by Mischel (Fraser & Killen, 2003). Specifically, they found that students tend to see themselves operating in an environment that is regulated largely by others (Fraser & Killen, 2003). It was suggested that this may be attributable to their prior educational experience, since there is little evidence that the school system had placed much importance on self-efficacy, independent decision-making and self-regulation (De Villiers & Rwigena, 1998; Fraser & Killen, 2003; Jackson & Young, 1987). Self-discipline was highly rated across groups as an influential factor for success (Fraser & Killen, 2003). Regular lecture attendance was rated highly by first-year students, whereas senior students placed little importance on this factor (Fraser & Killen, 2003). The first step towards academic engagement would be lecture attendance, thus a difference between students may indicate a decrease in academic engagement over time. Inefficient

time management was rated much lower by first-year and senior students as compared to lecturers, which may indicate the lack of awareness of the importance of time management on academic success. This may also contribute to lack of awareness that time spent on other tasks may impede academic success. Although identifying the perceived importance of various factors on success does not indicate academic engagement, it does shed some light on what students find important, which influences their academic engagement. Impulsivity often results in negative academic consequences, as students engage in other activities rather than schoolwork. The association between organization and dysfunctional impulsivity would also be applicable to university students, as it would be expected that students who are less organized are also more likely to be less engaged in their schoolwork, thus also more likely to make impulsive decisions.

Factors influencing the Intersection of Impulsivity and Academic Engagement

The literature on impulsivity is vast, thus particular areas intersecting with academic engagement must be identified to further understand the association between the two constructs. In reviewing the literature, specific bridging constructs have been identified, including personality, self-efficacy, and life stresses. Personality refers to terms that could be used to “distinguish the behavior of one human being from that of another” (Allport & Odbert, 1936, p. 24; John & Srivastava, 1999). Self-efficacy is defined as a self-evaluation of one's competence to successfully execute a course of action necessary to reach desired outcomes (Bandura, 1977, 1982, 1986; Zajacova et al., 2005). Stress refers to a state of psychological and physiological arousal that results when external demands exceed an individual's adaptive abilities (Lazarus, 1966; Lazarus &

Folkman, 1984; Zajacova et al., 2005). Stress is the general response of the body to a task or situation, whereas arousal is the physiological and psychological response that occur to an individual during the task or situation. At all levels, stress causes physiological arousal and does not happen all at once. Stress might become problematic when external demands exceed one's adaptive abilities. This definition of stress is one of many that exist. Each of these factors will be discussed in turn.

Personality

Personality and facets of personality have significant implications for success in academic settings. The Big Five personality traits (John & Srivastava, 1999) include: agreeableness (i.e., prosocial and communal orientation towards others), conscientiousness (i.e., socially prescribed impulse control that facilitates task- and goal-directed behaviour), extraversion (i.e., energetic approach toward the social and material world), neuroticism (i.e., negative emotionality, such as feeling anxious), and openness to experience (i.e., breadth and complexity of one's mental and experiential life). Some researchers have recommended using personality assessment for university admissions, as incremental validities of personality over and above academic ability tests (e.g., the SAT) have been found (Conard, 2006; Trapmann et al., 2007). A meta-analysis conducted by Trapmann and colleagues (2007) reported that conscientiousness showed the strongest association with academic success as compared to the other Big Five personality traits. Barchard (2003) similarly found conscientiousness to have a positive association with academic success, as well as predicting academic success. The literature indicates positive correlations between conscientiousness and academic success at the

school level (Heaven et al., 2002), at the college level (Wolfe & Johnson, 1995), and at the university level (Busato et al., 2000; Farsides & Woodfield, 2003).

With regards to neuroticism, which typically often includes aspects of emotional impulsivity, De Barbenza and Montoya (1974) found a negative correlation between neuroticism and academic achievement among university students, whereas other studies did not find any associations among university students (Busato et al., 2000; Halamandaris & Power, 1999) nor among school children (Farsides & Woodfield, 2003; Heaven et al., 2002). A meta-analysis found that neuroticism did not predict college grades (Trapmann et al., 2007). However, specific facets of neuroticism, including depression, self-consciousness, impulsiveness, and vulnerability showed small negative effects on academic success (Trapmann et al., 2007).

Openness to experience is positively associated with academic success, although consistent with the meta-analysis by Trapmann and colleagues (2007), it does not improve prediction of academic success (Barchard, 2003). A study by Farsides and Woodfield (2003) also examined the associations between the Big Five personality traits and academic success. Openness to experience was associated with final grades even when controlling for intelligence and application (Farsides & Woodfield, 2003). This is consistent with the literature, which notes positive correlations between openness to experience and academic success among school children (Farsides & Woodfield, 2003; Schuerger & Kuna, 1987) and first year undergraduates (De Fruyt & Mervielde, 1996). Mixed findings have been reported for agreeableness and academic success, with a positive association found for school children (Farsides & Woodfield, 2003; Heaven et al., 2002), with no association found for university students (Busato et al., 2000; De Fruyt

and Mervielde, 1996; Farsides & Woodfield, 2003). Farsides and Woodfield (2003) found that application to academics, specifically seminar attendance, was the best predictor of academic success, with agreeableness contributing to success due to application. Attendance is not synonymous with engagement; rather, attendance is a way in which a student can engage with their academics. Although academic engagement includes class attendance, it also includes a variety of other factors (e.g., completing assignments, studying for tests) that can influence the individual's academic success.

Mixed findings have been documented with regards to extraversion and academic success, with De Barbenza and Montoya (1974) finding extraverted university students slightly outperforming introverted ones, whereas other studies found no correlation between extraversion and undergraduate academic success (Farsides & Woodfield, 2003; Halamandaris & Power, 1999; Trapmann et al., 2007). However, another study found a negative correlation of extraversion with both high school and undergraduate GPA (Farsides & Woodfield, 2003; Goff & Ackerman, 1992). Indeed, mixed findings have been documented for associations between the Big Five personality traits and academic success. Personality traits are one set of individual differences widely studied with regards to contributing to academic success, with self-efficacy another area of focus.

Self-Efficacy

Self-efficacy is a construct widely studied for its association with academic adjustment and success (Zajacova et al., 2005). It is important to note that self-efficacy is distinct from self-esteem, as self-efficacy refers to judgment of one's task-specific capabilities based on actual accomplishments, whereas self-esteem is a more general evaluation of the self (Linnenbrink & Pintrich, 2002). A large meta-analysis of self-

efficacy studies in academic environments found that specific academic self-efficacy indices had the strongest effect on academic outcomes, whereas the generalized measures of self-efficacy were less associated (Multon et al., 1991; Zajacova et al., 2005). Therefore, measures of academic self-efficacy are best utilized when examining the construct in an academic setting. It has been noted that students who have more positive self-efficacy beliefs are more likely to work harder, persist, and succeed at higher levels of education, with studies reporting a positive association between self-efficacy and higher levels of achievement and learning (Linnenbrink & Pintrich, 2002). Specifically, self-efficacy has been associated with various adaptive academic outcomes in experimental and correlational studies, including higher levels of effort and increased persistence on difficult tasks (Bandura, 1997; Linnenbrink & Pintrich, 2002; Pintrich & Schunk, 2002). Self-efficacy has also been associated with greater levels of self-regulation, indicating that those with higher self-efficacy will likely use adaptive and appropriate study skills (Linnenbrink & Pintrich, 2002). It therefore appears that students that report self-efficacy are more likely to be academically engaged, with greater self-regulation potentially resulting in them choosing to focus on academics rather than giving in to distractors. In a study of children with ADHD, a disorder of impulsivity, those with ADHD had lower levels of self-efficacy compared to those without (Gambin & Świącicka, 2015). These findings may be due to students with increased levels of impulsivity finding it difficult to concentrate on material, which results in more negative feedback from teachers and parents (Gambin & Świącicka, 2015). It has been suggested that higher levels of self-efficacy do not necessarily indicate positive outcomes; rather, it is more adaptive to have self-efficacy levels that are consistent with one's

accomplishments (Bandura, 1997; Linnenbrink & Pintrich, 2002). Therefore, students should not underestimate or overestimate their academic abilities (Linnenbrink & Pintrich, 2002). Instead, fairly accurate yet optimistic beliefs in academic abilities are optimal for academic success (Linnenbrink & Pintrich, 2002).

Stress and Self-Efficacy

Stress is one factor that can also greatly influence academic success, particularly given the nature of academics for students. The association between stress and academic success is rather mixed (Zajacova et al., 2005). Some studies have found stress to be associated with decreased academic success among university students (Gall et al., 2000), particularly among first-year students (Struthers et al., 2000). However, Petrie and Stoeber (1997) and Sandler (2000) did not identify an association between stress and academic outcomes.

Stress is also affected by self-efficacy, as the extent to which a person feels confident about their competence to handle a situation affects whether a task is perceived as stressful rather than as a challenge (Zajacova et al., 2005). Moreover, when a task is perceived to be a challenge, one is more likely to select an effective coping strategy and to persist at managing the task (Zajacova et al., 2005). Numerous studies of university students have identified a negative association between self-efficacy and stress (Gigliotti and Huff, 1995; Hackett et al., 1992; Zajacova et al., 2005). Along this line, Hackett and colleagues (1992) indicated that stress and anxiety may decrease the self-efficacy judgments of students. Zajacova and colleagues (2005) examined the association between self-efficacy and stress with academic success, including first-year GPA, number of credits earned, and enrollment at second year. Self-efficacy was found to be associated

with first-year GPA and number of credits earned, but not associated with persistence into second year (Zajacova et al., 2005). On the contrary, stress was not associated with GPA or number of credits earned but was marginally positively associated with persistence into second year (Zajacova et al., 2005). These results also highlight that different coping strategies are used due to threat appraisal, such as procrastinating, which can influence academic outcomes (Zajacova et al., 2005).

Filling the Gaps in the Literature

Although a considerable amount of research has been conducted on academic success as it relates to personality, self-efficacy, and life stress, little is known about the association of these constructs with academic engagement in university students. Given the effects of academic engagement, particularly increased academic achievement and increased retention, it is important to further understand constructs that are associated with academic engagement to help foster students' engagement. It is important to clarify that academic engagement and academic achievement are not synonymous and are distinct. Academic engagement refers to the ways in which a student engages with their academics (e.g., attending class, taking notes, completing assignments), whereas academic achievement is the grades they receive. Across the literature, self-efficacy has been studied as a predictor of academic success rather than academic success as a predictor of self-efficacy (Multon et al., 1991; Zajacova et al., 2005). Indeed, a large meta-analysis found that self-efficacy had an effect on academic outcomes (Multon et al., 1991; Zajacova et al., 2005). Therefore, the present study used previous studies to guide hypotheses regarding self-efficacy as a predictor of academic engagement. Although the impulsivity literature is extensive, with information regarding associations with the

bridging constructs, it is unknown how impulsivity may be associated with these constructs when it comes to academic engagement. Moreover, given that impulsivity is likely to affect academic engagement, it is important to determine how it does influence engagement.

Study Aims and Hypotheses

The current study aims to investigate whether self-reported impulsivity predicts academic engagement and success with moderation by personality (specifically, conscientiousness and neuroticism), self-efficacy, and life stresses. The following hypotheses were proposed:

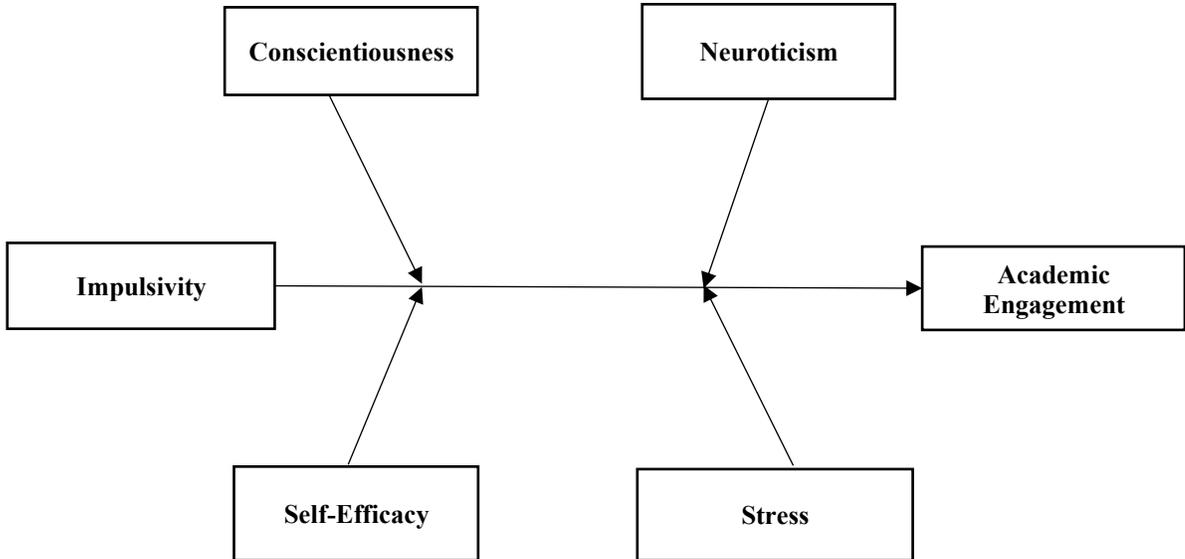
Hypothesis 1a. Higher self-reported impulsivity would be correlated with lower academic engagement in university students.

Hypothesis 1b. Self-reported dysfunctional impulsivity would be negatively correlated with academic engagement.

Hypothesis 2. Conscientiousness, neuroticism, life stresses, and self-efficacy would moderate the association between self-reported impulsivity and academic engagement. Specifically, high impulsivity, in combination with low conscientiousness, high neuroticism, high life stresses, and low self-efficacy would be associated with lower academic engagement.

Figure 1

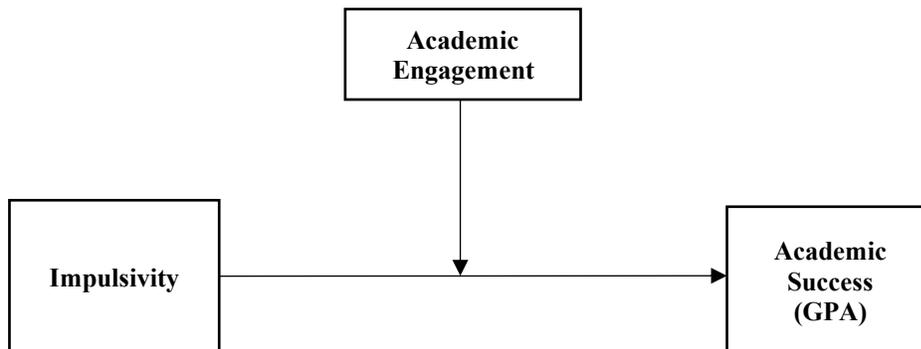
Hypothesized Linear Regression Model of Impulsivity Predicting Academic Engagement with Potential Moderator Variables.



Hypothesis 3. Academic engagement would moderate the association between self-reported impulsivity and academic success.

Figure 2

Hypothesized Linear Regression Model of Impulsivity Predicting Academic Success with Academic Engagement Moderation.



Methods

Participants

Participants {N=198; mean age = 20.06 (SD = 1.67); 77% female} were recruited from the research pool within the Psychology Department at the University of Windsor. This is an electronic system that allows full- and part-time undergraduate students enrolled in psychology and business courses to receive extra credit for their courses in exchange for research participation. The study was submitted to and approved by the Research Ethics Board of the University of Windsor. Inclusion criteria required participants to be able to read, write, and speak English. No other exclusionary criteria were used. Of the 198 participants in the total sample, 152 were female, 45 were male, and one identified as “other”. With regards to ethnicity, 8.1% (N=16) were Asian or Asian descent, 5.6% (N=11) were Southeast Asian, 2.0% (N=4) were Hispanic/Latino, 11.1% (N=22) were non-Hispanic Black or African descent, 55.1% (N=109) were non-Hispanic White, Caucasian, or European descent, 13.6% (N=27) were Arab or Middle Eastern descent, and 4.5% (N=9) were an Other/Mixed descent. With regards to year of study, 17.2% were in their first year, 32.8% in their second year, 27.8% in their third year, 17.2% in their fourth year, and 5.1% in their fifth year or above. With regards to year of study, 17.2% were in their first year, 32.8% in their second year, 27.8% in their third year, 17.2% in their fourth year, and 5.1% in their fifth year or above.

Power Analysis

A power analysis was conducted using G*power, v3.1 (Faul et al., 2009) to determine the sample size for a multiple regression with four tested predictors and nine predictor variables. Cohen’s F, calculated by taking the square root of eta-squared, or the

proportion of explained variance to unexplained variance, was used as the index of effect size for the current study (Faul et al., 2009). A minimum detectable effect size of 0.10 was chosen. Under the assumptions, a total sample size of approximately 125 was required to achieve a power level greater than 0.80.

Measures

See Appendices C, D, and G for each of the measures of the present study.

Demographics. A questionnaire was filled out by the participants to collect demographic information. Information was collected regarding participants' age, gender, ethnicity, marital status, education level, and GPA. This demographic information was used to describe the sample, with GPA a proxy for academic success. Major GPA was used for students above first year, with students in first year omitted from the academic success regression analysis.

Barratt Impulsiveness Scale. The Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995) was completed by participants. The scale is a 30-item measure of trait impulsivity, with participants responding on a Likert scale ranging from 1 (never/rarely) to 4 (almost always/always). It includes items that are considered dysfunctional as well as some items that are more neutral. It is the most widely used measure of impulsivity in the literature. Three impulsivity factors have been created in the scale: attentional (e.g., "I am restless at the theater or lectures."), motor (e.g., "I do things without thinking"), and non-planning (e.g., "I am a careful thinker"). The scale has demonstrated good internal consistency, with a reported Cronbach's alpha coefficient of 0.83, as well as good test-retest reliability, with a Spearman's rho of 0.83 (Stanford et al., 2009). Good internal consistency was found for the present study, with a Cronbach's alpha of 0.84.

Dickman Impulsivity Inventory. The Dickman Impulsivity Inventory (1990) is a self-report measure consisting of 23 true/false questions. The measure is commonly used and has been translated to various languages for international use. The measure consists of 11 questions for dysfunctional impulsivity (e.g., “I will often say whatever comes into my head without thinking first”) and 12 questions for functional impulsivity (e.g., “I like sports and games in which you have to choose your next move very quickly”). The author of the measure reported adequate internal consistency reliability of the Functional Impulsivity scale with a Cronbach's alpha of 0.74 and of the Dysfunctional Impulsivity scale with a Cronbach's alpha of 0.85) in the normative sample (Dickman, 1990). Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.83.

Undergraduate Engagement Scale. The undergraduate engagement scale is a 16-item measure of academic engagement currently being developed by Dr. Carlin Miller and her research group. Participants responded on Likert scale ranging from 0 (never) to 4 (always). Examples of items include: “When I am having trouble with a course or an assignment, I work with other students,” “I come to class having completed readings or assignments,” and “I study with other students.” There are no comparable measures with language that is contextually appropriate that have been published. Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.85.

College Self-Efficacy Inventory. The College Self-Efficacy Inventory (CSEI; Solberg et al., 1993) is a 19-item self-report measure of self-efficacy for college students, with participants responding on a Likert scale ranging from 0 (not at all confident) to 10 (extremely confident). The questionnaire measures domains of course/academic efficacy (e.g., “research a term paper”), social efficacy (e.g., “make new friends at college”), and

roommate efficacy (e.g., “divide chores with your roommate”). For the purposes of the current study, the roommate efficacy questions were not included, as not all students will be living in dormitories/residence halls. A total score was created by averaging the total number of items. The authors of the measure report good convergent and discriminant validity of the measure (0.68 to 0.84; Solberg et al., 1997). The authors also report good reliability, including internal consistencies, with Cronbach’s alpha of 0.88 for each subscale and 0.93 for the total score in the normative sample (Solberg et al., 1993). Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.88.

The Perceived Stress Scale (PSS). The Perceived Stress Scale (Cohen et al., 1983) is a 10-item self-report measure of stress and is the most widely used measure of perceived stress. Participants responded on a Likert-type scale ranging from 0 (never) to 4 (very often). Examples of items include “In the last month, how often have you found that you could not cope with all the things that you had to do?” and “In the last month, how often have you been upset because of something that happened unexpectedly?” A number of studies have reported good internal consistency and validity for the measure (Cohen & Williamson, 1988; Roberti et al., 2006; Lee, 2012). Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.86.

Big Five Inventory. The Big Five Inventory (BFI) is a 44-item self-report measure of personality, specifically extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (John & Srivastava, 1999). Based on previous findings, the constructs conscientiousness and neuroticism are of particular interest. Conscientiousness refers to dependability, organization, persistence, and achievement-orientation (Trapmann et al., 2007). Neuroticism is a measure of emotional stability vs.

instability, with emotional stability potentially manifested in students' responding appropriately to stress and tight time deadlines, and in their adaptability to new situations or conditions (Goldberg, 2001; Trapmann et al., 2007). Participants respond on a Likert scale ranging from 1 (strongly disagree) to 5 (agree strongly). The measure shows good reliability and validity across numerous studies (Arterberry et al., 2014; Soto & John, 2009). Adequate internal consistency was found for the present study for conscientiousness (Cronbach's $\alpha=.75$) and neuroticism (Cronbach's $\alpha=0.84$).

Procedures

The data collection was completed in-person in groups of 5-8 participants in university space allocated for research. Measures took approximately one hour to complete. Prior to participating, the primary investigator took participants through the informed consent process, including description of the study and information about risks and benefits of participating, confidentiality, and the right to withdraw, and answered any remaining questions. After consent was obtained from all participants, the aforementioned measures were administered with the order of the measures randomly assigned. Data were double-entered by trained research assistants and cleaned by the primary investigator.

Data Analysis

Missing Data

In order to address issues around missing data, all data were screened in order to determine the pattern by which the data were missing. The Missing Completely at Random (MCAR) test was conducted to determine if the data were missing completely at random. All data except for the undergraduate engagement scale (UES) were found to be

MCAR, with visual inspection of the data revealing the UES data to be missing at random. Missing data were replaced via the expectation-maximization algorithm of SPSS for all variables (Dong & Peng, 2013), except for the BIS, for which the series mean for each variable was used, as per the guidelines of the measure's author.

Assumptions

The assumptions of a linear regression analysis were checked prior to completing the analysis. Specifically, adequate sample size, normality, linearity, absence of multicollinearity, absence of outliers, homoscedasticity of errors, and independence of errors. All assumptions were met.

Model of Analysis

A linear regression was utilized to determine the ability of current self-reported impulsivity (Barratt Impulsiveness Scale) to predict academic engagement, as measured by the Undergraduate Engagement Scale. Two Big Five personality domains (specifically, conscientiousness and neuroticism), self-efficacy, and stress were included as moderator variables. A second linear regression was conducted to determine if academic engagement moderates the association between self-reported impulsivity and academic success. The moderation effects were determined by creating interaction terms with impulsivity and each of the moderator variables. For the second analysis, only students in their second year of study or above were included in the model (i.e., first year students will be excluded). GPA in first year of studies is not comprised of many courses and is often a misrepresentation of students' abilities, as they are still transitioning to university and the expectations of university-level courses.

Results

Two separate linear regression analyses were conducted; one predicting academic engagement and the other predicting academic success. The first model tested the ability to predict academic engagement from impulsivity, with conscientiousness, neuroticism, self-efficacy, and stress as moderator variables. The second model tested the ability to predict academic success from impulsivity, with academic engagement as a moderator variable. All predictor variables were mean-centered to allow for better interpretation (Cohen et al. 2003).

Academic Engagement

As was predicted, self-reported impulsivity on the BIS was significantly, negatively correlated with academic engagement ($r = -.25; p < 0.001$). Contrary to predictions, dysfunctional impulsivity was not significantly correlated with academic engagement ($r = -.07; p = .30$).

The regression model of BIS impulsivity predicting academic engagement was statistically significant, $F(9,188) = 12.95, p < 0.001$. R^2 for the overall model was 38% with an adjusted R^2 of 35%. This data relation is considered a medium effect size according to Cohen (1988). Impulsivity ($B = -.23, SE = .06, t = -3.67, p < .001$) was a significant predictor of academic engagement in the first step (i.e., when entered into the model alone), but was not significant in the final step (i.e., when entered with the moderator variables and interaction terms; $B = .05, SE = .07, t = .65, p = .52$). Conscientiousness ($B = .36, SE = .15, t = 2.47, p = .015$) and self-efficacy ($B = 3.36, SE = .40, t = 8.31, p < 0.001$) were significant predictors of academic engagement, whereas

neuroticism ($B = -.002$, $SE = .11$, $t = -.02$, $p = .98$) and stress ($B = .18$, $SE = .11$, $t = 1.71$, $p = .09$) were not significant predictors of academic engagement.

As expected, conscientiousness and self-efficacy contributed to the association between impulsivity and academic engagement, although neuroticism and stress did not, and the predictors did not significantly increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = .03$; $F_{change}(4,188) = 2.16$; $p = .07$). Conscientiousness ($B = -.02$, $SE = .01$, $t = -2.03$, $p = .04$) and self-efficacy ($B = .11$, $SE = .04$, $t = 2.73$, $p = .007$) were significant moderators of impulsivity and academic engagement, whereas neuroticism ($B = <0.01$, $SE = .01$, $t = -.007$, $p = .99$) and stress ($B = .001$, $SE = .01$, $t = .11$, $p = .91$) were not significant moderators of impulsivity and academic engagement.

Post Hoc Analyses

Given that impulsivity was no longer a significant predictor of academic engagement once self-efficacy and conscientiousness were entered into the model, the PROCESS macro via SPSS was used to determine if self-efficacy and conscientiousness mediate the association between impulsivity and academic engagement. Self-efficacy (Indirect effect (B)= $-.18$, $CI = -.27 - -.11$) was found to mediate the association, but conscientiousness was not a significant mediator (Indirect effect (B)= $-.08$, $CI = -.18 - .01$).

Following the progress meeting, a committee suggestion was to investigate if high school GPA is a moderator in the association between impulsivity and academic engagement. A linear regression was conducted with the same variables as in the original model, with the addition of high school GPA as a potential moderator variable. Results indicated that high school GPA was not a predictor of academic engagement ($B = -.09$,

SE = .07, $t = -1.27$, $p = .21$), nor a moderator between impulsivity and academic engagement ($B = .00$, SE = .007, $t = -.06$, $p = .95$).

Academic Success

As first year students did not have a GPA from university when completing the study, only students above first year were used for this regression analysis (N=163; mean age = 20.37(1.62); 75% female). The regression model was statistically significant, $F(3,162) = 8.39$, $p < .001$. R^2 for the overall model was 14% with an adjusted R^2 of 12%. This finding is considered a small size effect according to Cohen (1988). Impulsivity ($B = -.14$, SE = .07, $t = -1.97$, $p = .05$) was a significant predictor of academic success. Academic engagement was also found to be a significant predictor of academic success ($B = .29$, SE = .08, $t = 3.50$, $p = .001$).

Contrary to expectations, academic engagement did not act as a moderator ($B = .007$, SE = .007, $t = 1.03$, $p = .30$), as it did not increase the amount of variance in academic success accounted for by the model when entered as a moderator ($\Delta R^2 = .006$; $F_{change}(1,159) = 1.07$; $p = .30$).

Post Hoc Analyses

Given that impulsivity and academic engagement were significant predictors of academic success but there was no interaction, the PROCESS macro via SPSS was used to determine if academic engagement mediates the association between impulsivity and academic success. Academic engagement was found to be a significant mediator (Indirect effect (B)=-.07, CI= -.16 - -.02).

Following the progress meeting, a committee suggestion was to investigate if high school GPA moderates the association between impulsivity and academic success. A

linear regression was conducted with the same variables as in the original model, with the addition of high school GPA as a potential moderator variable. Results indicated that high school GPA was a predictor of academic success ($B = .58$, $SE = .08$, $t = 7.24$, $p < 0.001$), but was not a moderator between impulsivity and academic success ($B = .008$, $SE = .008$, $t = 1.04$, $p = .32$). However, high school GPA was found to be a mediator between impulsivity and academic success (Indirect effect (B) = $-.07$, $CI = -.16 - -.003$).

Table 1

Descriptive Statistics

	Mean (SD)	Range	Cronbach's Alpha
BIS Impulsivity	61.63 (10.70)	40.69-95	.84
Dysfunctional Impulsivity	2.73 (2.94)	0-12	.83
Conscientiousness	32.68 (5.42)	15-44	.75
Neuroticism	25.48 (6.63)	9-40	.84
Self-Efficacy	6.45 (1.51)	2.33-9.47	.88
Stress	20.16 (7.05)	0-39	.86
Academic Engagement	35.51 (9.52)	9-64	.85
Major GPA	77.80 (10.29)	48.2-100	-

Note. SD = standard deviation. BIS=Barratt Impulsiveness Scale

Table 2*Intercorrelations of Variables*

	1	2	3	4	5	6	7	8
1. BIS Impulsivity	-	.67***	-.68***	.26***	-.37***	.28***	-.25**	-.19*
2. Dysfunctional Impulsivity	.67***	-	-.43***	.16*	-.20**	.26***	-.07	-.14
3. Conscientiousness	-.68***	-.43***	-	-.23***	.37***	-.34***	.31***	.19**
4. Neuroticism	.26***	.16*	-.23***	-	-.21**	.63***	-.06	.06
5. Self-Efficacy	-.37***	-.20**	.37***	-.21**	-	-.24***	.58***	.31
6. Stress	.28***	.26***	-.34***	.63***	-.24***	-	-.06	-.11
7. Academic Engagement	-.25**	-.07	.31***	-.06	.58***	-.06	-	.21**
8. Major GPA	-.29**	-.21**	.21**	.04	.40***	-.10	.34***	-

Note. * $p \leq 0.05$, ** $p \leq 0.01$; *** $p \leq 0.001$

Table 3*Linear Regression of Impulsivity Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Impulsivity	-.23***	.06	-3.67	<.001	-.35 - -.10
2	Impulsivity	.02	.07	.35	.72	-.12-.17
	BFI Conscientiousness	.28*	.14	1.98	.05	.001-.56
	BFI Neuroticism	.03	.11	.30	.76	-.18-.25
	Self-Efficacy	3.50***	.40	8.65	<.001	2.70-4.25
	Stress	.13	.10	1.25	.21	-.07-.34
3	Impulsivity	.05	.07	.65	.52	-.09-.19
	BFI Conscientiousness	.36**	.15	2.47	.01	.07-.65
	BFI Neuroticism	-.002	.11	-.02	.98	-.22-.21
	Self-Efficacy	3.36***	.40	8.31	<.001	2.57-4.16
	Stress	.18	.11	1.71	.09	-.02-.39
	BFI Conscientiousness X Impulsivity	-.02*	.01	-2.03	.04	-.04- -.001
	BFI Neuroticism X Impulsivity	-.000	.01	-.007	.99	-.02-.02
	Self-Efficacy X Impulsivity	.11**	.04	2.73	.007	.03-.19
	Stress X Impulsivity	.001	.01	.11	.91	-.02-.02

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Note. BFI=Big Five Inventory.

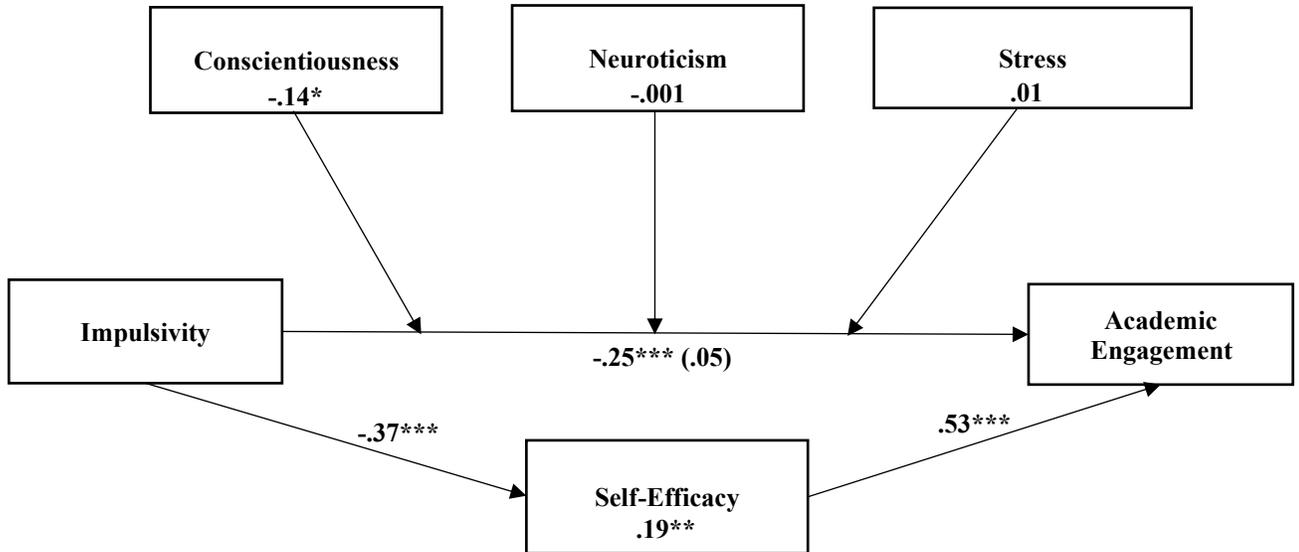
Table 4*Linear Regression of Impulsivity Predicting Academic Success*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Impulsivity	-.22**	.07	-3.01	.003	-.37- -.08
2	Impulsivity	-.15*	.07	-1.99	.05	-.29- -.01
	Academic Engagement	.30***	.08	3.78	<.001	.14-.46
3	Impulsivity	-.14*	.07	-1.97	.05	-.29-.00
	Academic Engagement	.29***	.08	3.50	.001	.12-.45
	Impulsivity X Academic Engagement	.007	.007	1.03	.30	-.01-.02

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Figure 3

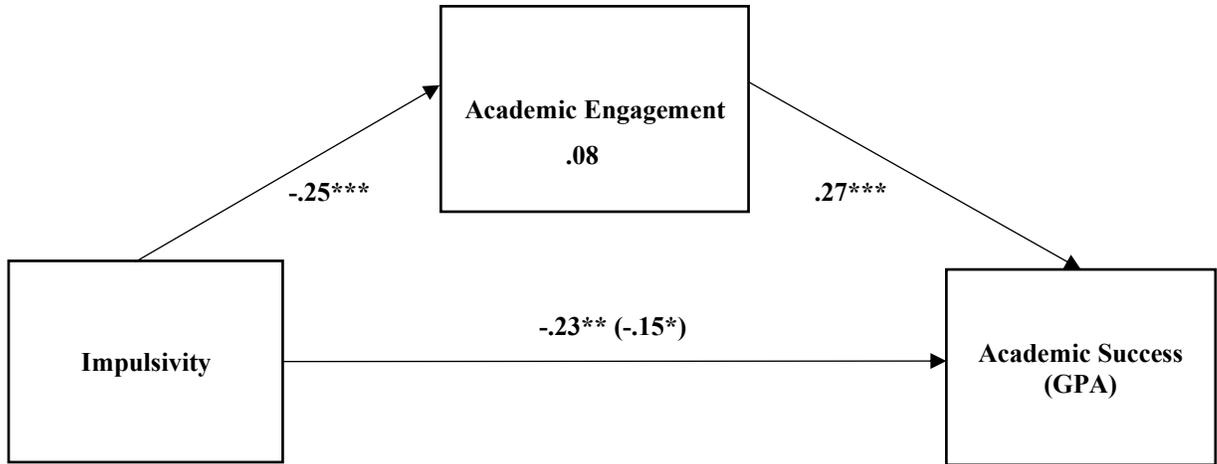
Linear Regression Model of Impulsivity Predicting Academic Engagement with Potential Moderator Variables.



Note. $*p \leq 0.05$; $**p \leq 0.01$; $***p \leq 0.001$. Values are standardized beta-coefficients. For the association between impulsivity and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator/mediator variables is the beta-coefficient of the interaction of that variable with impulsivity. Moderator variables are the variables with a single line pointing to the association between impulsivity and academic engagement, whereas the mediator variable (self-efficacy) is the variable with lines from impulsivity and to academic engagement.

Figure 4

Linear Regression Model of Impulsivity Predicting Academic Success with Academic Engagement Tested as a Mediator Variable



Note. $*p \leq 0.05$; $**p \leq 0.01$; $***p \leq 0.001$. Values are standardized beta-coefficients. For the association between impulsivity and academic success, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the academic engagement is the beta-coefficient of the interaction of academic engagement with impulsivity.

Discussion

Considerable research has been conducted on academic success as it relates to personality, self-efficacy, and life stress. The present study is the first to examine the association of these constructs with academic engagement in university students. Given the effects of academic engagement, including increased academic achievement and increased retention, it is important to increasing understanding of constructs that are associated with academic engagement to foster students' engagement. The present study has identified how impulsivity and other traits and characteristics are associated with academic engagement, which can aid with specifying the characteristics for educators and students to focus on to optimize academic engagement and success.

Across the lifespan, impulsivity has been found to be negatively associated with academic performance (Mischel et al., 1988; Rodriguez-Fornells & Maydeu-Olivares, 2000). The extant literature has focused on examining the relationship between impulsivity and academic success, with little known about how impulsivity may impact academic engagement. Given that academic engagement is associated with academic success (Closson & Boutilier, 2017), one may hypothesize that factors contributing to academic success also contribute to academic engagement.

Consistent with the related literature (Rodriguez-Fornells & Maydeu-Olivares, 2000; Shoda et al., 1990; Tangney et al., 2004), greater impulsivity was associated with lower academic engagement. This is understandable given that individuals who are less likely to consider the consequences of their actions are also less likely to engage in their academics. Diminished consideration of consequences may result in students not realizing that certain academic tasks should be completed to allow for optimal performance. For instance, not realizing that they should begin working on an assignment well before the due date rather than the day before may have a negative impact on the grade on the assignment. Conversely, a lack of considering consequences may also impact students in that they choose to engage in non-academic activities rather than academic tasks without considering what consequences that may have on their academics. Therefore, students may find it difficult to inhibit an urge to engage in other activities (e.g., going out with friends) rather than attending to their academics. Disinhibition has been associated with poorer academic success from kindergarten into adulthood (McClelland & Cameron, 2012; McClelland, Cameron, Connor, et al., 2007); thus, one can postulate that inhibition is also a factor involved in academic engagement.

Inconsistent with the academic achievement literature, dysfunctional impulsivity was not associated with academic engagement. As dysfunctional impulsivity involves rapid, inaccurate performance (Dickman, 1990), it would be expected that individuals who tend to make spur of the moment decisions without considering consequences will also be less likely to engage in their academics. Moreover, university students high in dysfunctional impulsivity are expected to be more likely to spend their time on non-academic tasks, thus reducing the time available for academic tasks. One may therefore postulate that those higher in dysfunctional impulsivity may not always purposefully avoid academic engagement, but may be less likely to engage in their academics because they impulsively chose to engage in other time-consuming activities. For example, they may choose to attend a party rather than working on their assignment that is due the following day. However, the present study did not find that individuals who reported higher dysfunctional impulsivity engaged less with their academics. This further highlights the differentiation of dysfunctional impulsivity and overall impulsivity as separate constructs, despite being correlated in the literature (Dickman, 1990). Although both types of impulsivity were significantly correlated with each other in the present study, they are not similarly associated with academic engagement, thus suggesting that it is components of general impulsivity rather than dysfunctional impulsivity that result in poorer academic engagement. Indeed, general impulsivity measures attention, motor, and planning, whereas dysfunctional impulsivity involves acting without thinking that results in negative consequences, which would be similar to the motor component of general impulsivity. The present results suggest that academic engagement is due to a broad

range of impulsive behaviours, rather than solely failure to plan ahead and consider the consequences.

Conscientiousness has been found to be the personality trait most often associated with academic success (Trapmann et al., 2007), with an association with academic engagement also found in the present study. This is understandable given that students that are more conscientious (i.e., focused, planful, task-oriented, etc.) are also more likely to complete academic tasks. Moreover, as conscientiousness involves self-discipline, it is understandable that students higher in self-reported conscientiousness are more likely to engage in academic activities in striving for academic success. Consistent with the literature, higher levels of conscientiousness were associated with lower levels of impulsivity in the present study (Zadavec et al., 2005).

The present findings are consistent with previous work suggesting that students who have more positive self-efficacy beliefs are more likely to work harder, persist, and succeed at higher levels of education (Linnenbrink & Pintrich, 2002). Therefore, those with lower self-efficacy are less likely to engage in academics. Given that those with greater self-efficacy show higher levels of effort and increased persistence on difficult tasks (Bandura, 1997; Linnenbrink & Pintrich, 2002; Pintrich & Schunk, 2002), it would be expected that they would engage in academics even when tasks may be difficult or time-consuming. The present findings are also consistent with previous work suggesting that greater self-efficacy is associated with greater self-regulation (Linnenbrink & Pintrich, 2002). Therefore, students with lower impulsivity are more likely to engage in academics when they have higher levels of self-efficacy.

Conscientiousness and self-efficacy were found to not only predict academic engagement, but also serve as a moderator and mediator, respectively, in the association between impulsivity and academic engagement. This suggests that impulsivity does not directly impact academic engagement, and that impulsivity is associated with academic engagement due to conscientiousness and self-efficacy. Indeed, regardless of their level of impulsivity, individuals with higher levels of self-efficacy engage more with their academics. However, among those with low self-efficacy, impulsivity appears to have a negative effect on academic engagement, with higher impulsivity resulting in lower academic engagement than lower impulsivity. Higher levels of conscientiousness, in combination with low levels of impulsivity result in the greatest academic engagement, whereas at higher levels of impulsivity, conscientiousness does not have the same “protective” effect.

Previous research has found mixed results with regards to the association between neuroticism and academic success (Busato et al., 2000; De Barbenza & Montoya, 1974). The present findings are consistent with the work of Busato and colleagues (2000) and Halamandaris and Power (1999), who did not find any associations between neuroticism and academic achievement. The mixed findings are understandable when considering that neuroticism involves emotional instability, including the tendency to experience negative emotions, such as anxiety or depression (Eysenck, 1967). Anxious thoughts and worrying can drive individuals to engage in their academics to allow for greater success. On the contrary, anxiety can also be overwhelming and impede one’s ability to engage in academics. Furthermore, the results of the present study do not suggest that neuroticism impacts the effect of impulsivity on academic engagement. Neuroticism not being a

significant moderator is consistent with the literature that has not found an association between neuroticism and academic achievement. The moderation of neuroticism between impulsivity and academic engagement has yet to be examined. As such, the present results must be compared to the literature that has studied the relationship between neuroticism and academic achievement. Previous research has found high school GPA to be a predictor of academic success (Cyrenne & Chan, 2012), which is inconsistent with the present finding that high school GPA does not predict academic engagement. This may suggest that one's level of achievement during high school may not translate to the degree to which they engage with their academic in university. This disparity may be due to university being a new learning environment, therefore students may not continue to use the same academic strategies used in high school.

Mixed findings have been reported in the literature examining stress and academic success (Gall et al., 2000). The present findings are consistent with the related work of Petrie and Stoeber (1997) and Sandler (2000) who did not identify an association between stress and academic outcomes. Stress did not predict academic engagement, nor was it significantly associated with academic engagement, suggesting that stress levels may not strongly impact the level at which university students engage with their schoolwork.

Contrary to predictions, academic engagement was not found to moderate the association between impulsivity and academic success. Instead, academic engagement was found to mediate the association between impulsivity and academic success. A mediator is a variable that explains a causal relationship between two variables. A moderator influences the strength of the relationship between two variables, with the

relationship between those two variables differing at various levels of the moderator variable. Impulsivity was significantly and negatively correlated with academic success, whereas academic engagement was significantly and positively correlated with academic success. These results are consistent with previous research that has found higher impulsivity to be associated with lower academic success in university students (Rodriguez-Fornells & Maydeu-Olivares, 2000), as well as the literature finding academic engagement to be associated with academic success (Closson & Boutilier, 2017). As academic engagement is a mediator, students with high levels of academic engagement report higher academic success regardless of their impulsivity. The findings suggest that low academic engagement is indeed a factor that influences individuals high in impulsivity to achieve poorer grades. Moreover, the findings are substantial contributions to the literature, as they suggest that high academic engagement leads to greater academic success regardless of one's level of impulsivity. The finding that high school GPA is a mediator between impulsivity and academic success is consistent with the literature noting that high school GPA is a rather strong predictor of undergraduate GPA (Cyrenne & Chan, 2012). Moreover, the results suggest that regardless of level of impulsivity, students with higher GPAs in high school will also have higher GPAs in university. As a whole, the results suggest that academic engagement and high school GPA are both important factors to allow for greater success in university.

Limitations

A limitation of the present study was the use of a research pool to gather data. All of the participants in this study are currently enrolled in Psychology or Business courses in university, thus reflecting a specific subgroup in the larger population. Furthermore,

this sample included a large proportion of female participants, which is consistent with samples collected in university populations. However, results from other studies suggest that males tend to report higher levels of impulsivity (Silverman, 2003); thus, the present findings may, in fact, be an underrepresentation of the associations between impulsivity and academic engagement. Additionally, women have been found to report higher levels of neuroticism than men (Costa et al., 2001); thus, our sampling may have also impacted the role that neuroticism plays in the association between impulsivity and academic engagement in these data. Replication of the study with a larger number of male participants may identify potential greater associations between impulsivity and academic engagement. Another limitation of the present study is the use of self-report measures of impulsivity, rather than behavioural measures. The literature reports mixed findings in the association between self-report measures of impulsivity and behavioural measures of impulsivity (Rodriguez-Fornells et al., 2002; Spinella, 2004). However, the self-report measures of impulsivity used in the present study are widely used and have been found to be valid and reliable measures. Future studies may want to use behavioural measures of impulsivity in conjunction with self-report measures to better determine how impulsivity is associated with academic engagement. An example of a behavioural measure of impulsivity is a go/no-go task. This type of task requires an individual to either respond or withhold a response depending on the instructions. Spinella (2004) used a task in which the participant was to imitate the tapping sequence of the examiner (one or two taps), perform the opposite of the examiner (one tap for two taps and vice versa), or tapping once when the examiner tapped once but not tapping when the examiner tapped twice. Go/no-go tasks often require the use of a computer or tablet, as the reaction time

must be precisely measured to determine the accuracy of the response. Requiring technology for a task can be expensive (i.e., in purchasing a computer or tablet), can succumb to technological glitches that may affect data (e.g., a task not running correctly; internet connection lost resulting in data not being recorded), often limits the number of individuals that can participate at once, and can be more time-consuming for the investigator (e.g., setting up the task, fewer participants at once means more data collection sessions needed). Given that self-report measures have been found to be valid and reliable, it is often a better alternative to behavioural measures for the aforementioned reasons.

Implications

The current findings provide a greater understanding of how impulsivity impacts academic success in university students. Indeed, increasing academic engagement among university students may be an area for intervention to allow for improved success, regardless of their impulsivity. Therefore, efforts to increase success among students may be limited if individuals are low in academic engagement, particularly if they are also high in impulsivity. Moreover, efforts to increase academic engagement may be limited if students are more impulsive and are less confident in their ability to enact behaviours associated with academic success. As such, interventions that lower impulsivity may allow for improved academic engagement, in turn improving academic success. Mindfulness interventions may be one area of intervention that could be promising to decrease impulsivity among university students. Mindfulness interventions have been found to be useful in reducing ADHD-related behaviours (e.g., impulsivity) among children and adolescents with ADHD (Haydicki et al., 2013; Van de Weijer-Bergsma et al., 2012; Van

der Oord et al., 2012). A meta-analysis has found mindfulness-based therapies to be efficacious in decreasing impulsivity among children and adults with ADHD (Cairncross & Miller, 2016). Moreover, the literature has found that mindfulness meditation and behavioural intervention are beneficial in decreasing impulsivity among young adults with problem gambling, with impulsivity a key factor of internet gaming disorder (Yao et al., 2017). The benefits of brief mindfulness training in reducing impulsivity that has been found in youth may also translate to university students. When students seek help from their professors on an individual basis, educators may be able to aid students with decreasing their impulsivity by suggesting they try a mindfulness meditation activity, which they can find online, or suggest the use of a mindfulness application on one's cell phone. Alternatively, educators could guide the student through a mindful breathing meditation if they are meeting with the student or can be done in a lecture setting.

Self-efficacy can be viewed as a protective factor of academic engagement, as even those with higher levels of impulsivity engage in their academics due to higher levels of self-efficacy. As a result, it is important to improve self-efficacy among students to allow for greater academic engagement and achievement. Following the work of Kennett and Reed (2009), a success course may be beneficial for increasing self-efficacy. The course offered by Kennett and Reed (2009) included lectures, such as library research, critical evaluation of literature, citing, and essay planning; and discussions, such as study skills and test-taking skills (Kennett & Reed, 2009). Educators may also choose to find and compile some of these resources (i.e., study skills, test-taking skills etc.) and provide them to students, or refer students to a writing support centre at the university.

Conscientiousness can also be viewed as a protective factor at lower levels of impulsivity. As self-efficacy is a facet (e.g., subdomain) of conscientiousness, it may be possible that the types of interventions suggested for self-efficacy may also be beneficial for improving conscientiousness. Orderliness is another facet of conscientiousness that may be targeted by educators, such as suggesting students make lists of their upcoming academic tasks (e.g., assignments, tests), as well as using a planner to schedule times that they will work on those activities. Suggestions around organization can be made during individual meetings or in a classroom setting. Overall, interventions that foster self-efficacy and conscientiousness, and decrease impulsivity may be beneficial to improve academic engagement.

CHAPTER 4: IMPULSIVITY, PROCRASTINATION, AND ACADEMIC ENGAGEMENT AMONG UNIVERSITY STUDENTS

Impulsivity is a broad area of research, particularly in examining academic performance. Impulsivity as it relates to academic achievement has been studied across ages of learners, with many studies focusing on individuals with Attention-Deficit/Hyperactivity Disorder (ADHD). It is important to note that elevated levels of impulsivity are not solely present in psychopathology with a range of impulsive-type behaviours exhibited in individuals across a broad continuum of individual differences. Impulsive individuals tend to prefer smaller immediate rewards to delayed, more valuable ones when faced with various consequences (Ainslie, 1975). Indeed, impulsive individuals are often less likely to consider the distant rewards of activities, such as the rewards of studying for tests. Such rewards are also involved with goal-management ability, which is the ability to use one's short-term and long-term goals to effectively guide behaviours (Gustavson et al., 2014).

Barratt found that poor performance on laboratory tasks of impulsivity was often associated with task complexity and that subjects with greater impulsivity exhibited more problems with planning (Barratt, 1967), response set, and accuracy of fine perceptual-motor performance (Barratt et al., 1981). Barratt suggested that in addition to failure to plan ahead, impulsive individuals tend to have a fast cognitive tempo and rapid thoughts (Barratt, 1985a; Patton & Stanford, 2012). Brunner and Hen (1997) distinguish impulsive action (behaviour) from impulsivity (basic psychological processes). In this model, impulsive actions are more likely when an individual has two reward choices: one of

which is smaller but immediate, and another which is bigger but delayed (Bakhshani, 2014). Impulsive behaviour is often defined by those instances where they choose the small immediate reward because they struggle with delaying satisfaction (Brunner & Hen, 1997). Specifically, if individuals choose the small immediate reward due to their inability to evaluate and compare the rewards, it is because of their inability to distinguish between the two choices (Brunner & Hen, 1997). Although their choice is impulsive, it is not due to their inability to delay satisfaction. Thus, impulsive behaviour is defined as those instances when individuals choose a smaller, immediate reward over a bigger, delayed reward, due to an inability to delay their satisfaction.

Self-control and self-regulation are also contributing factors to academic achievement and have been examined as sub-dimensions of impulsivity (Kochanska et al., 1996; Olson et al., 1999; Ruf et al., 2008). Self-regulation is related to impulsivity in that it involves inhibitory control (McClelland & Cameron, 2012). Self-regulation has been found to have lifelong effects, with components of self-regulation predicting academic achievement before kindergarten (McClelland et al., 2007), throughout schooling (Blair & Razza, 2007), and into adulthood (McClelland & Cameron, 2012). Among adolescents, those with high intelligence and high impulsivity were found to perform more poorly than those with high intelligence and low impulsivity (Helmers et al., 1995; Vigil-Colet & Morales-Vives, 2005; Zeidner, 1995). Researchers have postulated that impulsivity may contribute to poorer academic achievement due to those with poorer academic performance tending to show a more impulsive and poorer problem-solving style, and giving the first answer that comes to mind (Fink & McCown, 1993; Vigil-Colet & Morales-Vives, 2005).

A construct that has been frequently considered in impulsivity research is procrastination, a well-known phenomenon that refers to the voluntary delay of activities which are intended, despite the delay potentially having negative consequences (Eckert et al., 2016; Klingsieck, 2013). Procrastination is common among college students, with up to 50% of college students procrastinating consistently and problematically (Day et al., 2000). Additionally, procrastinators earn lower grades than non-procrastinators (Steel, 2007). Procrastinators may avoid work due to anxiety, particularly with initiating tasks, and may also underestimate the amount of time it will take to complete the task, thus not investing the effort and time required to perform well (Jackson et al., 2003; McCowan, 1986; Schouwenberg, 1995). In a study of college students, Jackson and colleagues (2003) found that those with lower levels of procrastination reported higher grades. Moreover, those who spent less time engaged in social and recreational activities also reported higher grades (Jackson et al., 2003). Indeed, various studies have indicated the association between procrastination and lower academic performance (Eckert et al., 2016; Steel, 2007; Tice & Baumeitser, 1997).

Although procrastination has often been viewed in a negative light, it has been proposed that procrastination can be adaptive in some situations. Delaying work may serve as a self-motivating strategy or an effective study strategy (Brinthaupt & Shin, 2001; Ferrari et al., 1995), as students at times postpone work because they believe that they work better under pressure (Kim & Seo, 2013; Schraw et al., 2007; Simpson & Pychyl, 2009). Procrastination has, thus, been divided into active procrastination and passive procrastination. Active procrastination refers to those who intentionally procrastinate, using their motivation under time pressure, and are typically able to

complete tasks before deadlines with satisfactory outcomes (Choi & Moran, 2009; Kim & Seo, 2013). Active procrastinators are able to estimate the amount of time required to complete a task and use more task-oriented coping strategies under the stress (Kim & Seo, 2013). It should also be noted that although some procrastinators may indicate that they work better under pressure, the stress that results from meeting a soon-approaching deadline can impede performance (Jackson et al., 2003; Tice & Baumeitser, 1997). Passive procrastinators are what would be considered traditional procrastinators who postpone their tasks until the last minute due to an inability to make the decision to act in a timely manner (Choi & Moran, 2009; Kim & Seo, 2013).

Academic Engagement

One critical variable in academic achievement at all levels is academic engagement. A review of the literature reveals a variety of definitions for the term *academic engagement*. Despite the variation in conceptualization of the term, it generally refers to students' patterns in motivations, cognitions, and behaviours (Alrashidi et al., 2016). Some researchers focus on valuing school-related outcomes and participating in school activities (Willms, 2003). Others have focused on effort, action, and persistence in schoolwork (Skinner et al., 1990) or a study-related state of mind characterized by absorption, vigor, and dedication (Schaufeli et al., 2002). Moreover, researchers have proposed different dimension of academic engagement, with some uniformity across conceptualizations. For instance, Schaufeli et al. (2002) described three dimensions: dedication, vigor, and absorption (Alrashidi et al., 2016; Appleton et al., 2008). Dedication was defined as being strongly involved in one's work and experiencing a sense of significance, enthusiasm, inspiration, pride, and challenge (Schaufeli et al.,

2006). Vigor involved high levels of energy and mental resilience while working, the willingness to invest effort in one's work, and persistence even when experiencing difficulties (Schaufeli et al., 2006). Absorption included being fully concentrated and happily engrossed in one's work, with time passing quickly and having difficulties detaching oneself from work (Schaufeli et al., 2006). Academic engagement is an important research area due to its influence on academic success, particularly among university students, where less structure and more autonomy than high school places more ownership on students to complete their schoolwork and study. Academic engagement results in greater academic success, thus is an area of importance for intervention. There are various factors that contribute to academic engagement, both external (e.g., working part-time) and internal (e.g., trait impulsivity and procrastination).

Intersection of Impulsivity, Procrastination, and Academic Engagement

Procrastination and impulsivity are key factors that can influence academic engagement. Specifically, procrastination involves irrationally delaying actions that help accomplish one's goals, whereas impulsivity is about giving in to urges, often at the expense of long-term goals (Gustavson et al., 2014). As such, individuals who are more prone to delaying their actions and more likely to act without thinking, would most likely engage less with academics. Engaging in an intended, but aversive task requires an individual to exert self-control, which is necessary when prioritizing long-term goals over short-term desires (Hofmann et al., 2009; Meier et al., 2016; Sirois & Pychyl, 2013). Procrastination is often considered a failure in self-regulation, as procrastinators may have a reduced ability to resist social temptations, pleasurable activities, and immediate rewards when the benefits of academic behaviours are distant, as compared to non-

procrastinators (Ariely & Wertenbroch, 2002; Chu & Choi, 2005; Rabin et al., 2010). Procrastination may be considered a result of impulsivity, as individuals who are more impulsive are more likely to be disorganized, engage in impulsive problem solving, and less likely to think about consequences of actions, thus pushing off completion of work. However, although related, the constructs of procrastination and impulsivity are distinct. A study by Panek (2014) found that low trait self-control was associated with increased time spent on leisure media use and decreased time on self-directed learning, with social media use strongly associated with low trait self-control. It was thus concluded that students often give in to media use that provide short-term rewards compared to important, but aversive academic tasks. Moreover, the findings highlight the frequent uncontrolled and possibly procrastinatory use of social media (Meier et al., 2016; Panek, 2014).

When considering academic engagement and procrastination, it is important to note that they are distinct constructs, despite their seemingly overlapping definitions. Although academic engagement refers to completing schoolwork, it also entails a variety of other factors, such as attending lectures and making notes/paying attention to lectures. Procrastination focuses on putting off the completion of a task (e.g., an assignment) for various reasons, such as anxiety or impulsive tendencies. Therefore, procrastination of a task does not necessarily implicate a lack of academic engagement, although the current study hypothesizes that the constructs are indeed associated.

Spending more time on homework and less time engaged in other activities should result in greater academic achievement in most cases. Students often engage in activities like sleeping, reading, or watching TV instead of learning (Eckert et al., 2016;

Pychyl et al., 2000). Various factors influence level of academic engagement, as certain students may be more prone to engage in other activities. For instance, in a university sample, conscientious students reported spending more time-on-task, which contributed to higher grades (Biderman et al., 2008; Lubbers et al., 2010). Given the increasing presence of social media in society, particularly among university students, social media is a main area in which students spend their time, rather than devoting that time to their academic work. For example, multiple studies have shown that students procrastinate with important academic tasks in favor of Facebook use, which has been suggested to contribute greatly to the negative association between Facebook use and academic performance (Junco, 2012; Kirschner & Karpinski, 2010; Meier et al., 2016; Panek, 2014; Rosen et al., 2013; Thompson, 2013). The preference of social media use as opposed to completing academic tasks has been explained by short-term and long-term rewards. Procrastinated tasks often provide only distant rewards (e.g., good grades or a higher salary) and are less appealing than activities that are more immediately at hand (e.g., checking Facebook or watching a video clip on YouTube). The procrastinatory activity (i.e., checking Facebook) provides the individual with immediate gratifications, such as the satisfaction of relatedness needs (Reinecke et al., 2014; Sheldon et al., 2011). The procrastinated task (i.e., writing a term paper), however, is often perceived as stressful, frustrating, or boring, thus increasing short-term negative affect during task engagement (Meier et al., 2016; Pychyl et al., 2000). It may therefore be that students who are more impulsive are more likely to procrastinate, thus less likely to engage in their academic activities.

Other factors associated with procrastination and academic success may also influence academic engagement, including self-efficacy and motivation. Self-efficacy is defined as a self-evaluation of one's competence to successfully execute a course of action necessary to reach desired outcomes (Bandura, 1977, 1982, 1986; Zajacova et al., 2005). Motivation has been studied from a variety of standpoints, thus referring to varying constructs. For the present study, the area of motivation that will be discussed pertains to self-determination theory (SDT), which includes *autonomous motivation* and *controlled motivation*. Autonomous motivation comprises intrinsic motivation and types of extrinsic motivation wherein people have identified with an activity's value and will have integrated it into their sense of self (Deci & Ryan, 2008). Controlled motivation consists of external regulation, in which one's behavior is a function of external contingencies of reward or punishment, and introjected regulation, in which the regulation of action has been partially internalized and is energized by factors such as an approval motive, avoidance of shame, contingent self-esteem, and ego-involvements (Deci & Ryan, 2008).

Self-Efficacy

According to Zimmerman (1989, 1990), self-regulated learners (i.e., students who perceive themselves as capable of regulating and structuring their own learning) display a higher sense of self-efficacy in their capabilities, which influences the goals they set for themselves and their commitment to fulfill these challenges. In contrast, non-self-regulated learners might display lower task persistence, effort and interest, which resemble procrastination (Tan et al., 2008). Studies utilizing university samples have found that procrastination is strongly and negatively related to self-efficacy, with self-

regulated learning correlated with students' grade goals (Tan et al., 2008; Wolters, 2003; Zimmerman et al., 1992). The association between procrastination and self-efficacy is consistent with the finding that increased anxiety around a subject area was shown to result in greater procrastination (Dunn, 2004), as increased anxiety may suggest decreased self-efficacy. The literature highlights empirical evidence consistent across studies that suggests a negative correlation between self-efficacy for self-regulated learning and procrastination (Tan et al., 2008). Wolters (2003) has given some potential reasons as to why students who have greater self-efficacy for self-regulated learning would be better able to manage their learning. First, those with higher self-efficacy are more knowledgeable of cognitive strategies and utilize these strategies to enhance learning (Tan et al., 2008; Wolters, 2003). Second, these individuals are less impulsive, as they possess metacognitive skills and can effectively monitor and control important aspects of their learning behavior (Tan et al., 2008; Wolters, 2003). Impulsivity may therefore not only influence procrastination, due to the tendency to engage in more pleasurable activities, but may also influence procrastination via self-efficacy, due to difficulties with controlling their behaviour. Third, these individuals have adaptive motivational beliefs and attitudes, and an orientation toward mastery goals, thus may be more intrinsically motivated (Tan et al., 2008; Wolters, 2003).

Motivation

Autonomous and controlled motivation influence students' tendency to procrastinate because of their drive to engage with academic activities. When people are autonomously motivated, they experience volition or a self-endorsement of their actions (Deci & Ryan, 2008). However, when people's motivation is more controlled, they

experience pressure to think, feel, or behave in particular ways (Deci & Ryan, 2008). It is important to consider that, although controlled motivation may result in enhanced academic engagement, the reason to complete academic tasks and activities may influence academic success and well-being. For example, if a student attends lectures to avoid shame (i.e., controlled motivation wherein they are concerned their professor will notice and comment on their absence), they will most likely gain less from the lecture than a student who is attending due to enjoyment of the material (autonomous motivation). Intrinsic motivation (engaging in tasks because it is a reward in itself), which is similar to autonomous motivation, was found to be associated with decreased procrastination among university students (Dunn, 2014). Among children, autonomous motivation was found to both mediate and moderate the association between self-efficacy and procrastination, suggesting that both self-efficacy and an autonomous motivation style are necessary to aid with decreasing procrastination (Katz et al., 2014). The literature thus highlights the importance of investigating both motivation and self-efficacy when examining procrastination.

Filling the Literature Gaps

Various studies have concluded that procrastination is positively associated with impulsivity and difficulties with self-regulation. Given that procrastination often hinders academic success, it is important to further examine how it affects success in academic settings, specifically academic engagement in university students. Indeed, academic engagement has been associated with academic success in higher education settings where little is known about how procrastination is associated with engagement. Self-efficacy and motivation, in terms of education, have been associated with variables of

interest for the present study. Specifically, self-efficacy has been associated with decreased procrastination and better self-regulation (i.e., less impulsivity). With regards to motivation, those who are more autonomously motivated (i.e., completing coursework out of enjoyment for learning) would be expected to engage in academics more than those who experience controlled motivation (e.g., completing homework to avoid shame). The current study seeks to examine if procrastination can predict academic engagement, and if impulsivity, self-efficacy, and motivation may contribute to the association.

Study Aims and Hypotheses

The current study investigated whether self-reported procrastination predicted academic engagement with moderation by impulsivity, self-efficacy, and intrinsic motivation. The following hypotheses were proposed:

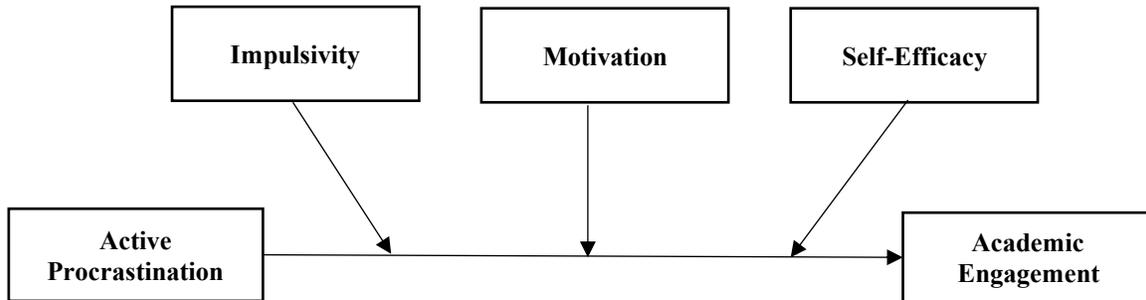
Hypothesis 1a. Self-reported active procrastination would be positively correlated with academic engagement in university students.

Hypothesis 1b. Self-reported passive procrastination would be negatively correlated with academic engagement in university students.

Hypothesis 2a. Lower impulsivity, higher self-efficacy, and higher intrinsic motivation would moderate the association between self-reported active procrastination and academic engagement.

Figure 5

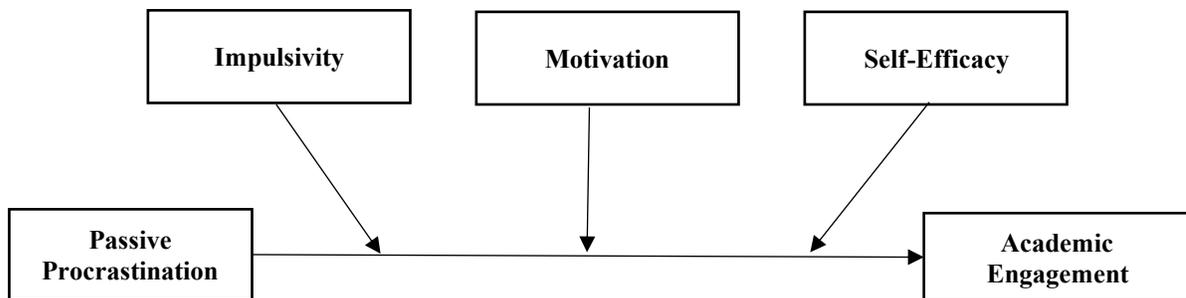
Hypothesized Linear Regression Model of Active Procrastination Predicting Academic Engagement with Potential Moderator Variables



Hypothesis 2b. Higher impulsivity, lower self-efficacy, and lower intrinsic motivation would moderate the association between self-reported passive procrastination and academic engagement.

Figure 6

Hypothesized Linear Regression Model of Passive Procrastination Predicting Academic Engagement with Potential Moderator Variables



Methods

Participants

Demographic information of the sample is displayed in Appendix A. Participants {N=196; mean age = 20.06 (SD = 1.68); 77% female} were recruited from the research

pool within the psychology department at the University of Windsor. This is an electronic system that allows full- and part-time undergraduate students enrolled in psychology and business courses to receive extra credit for their courses in exchange for research participation. The study was submitted to and approved by the Research Ethics Board of the University of Windsor. Inclusion criteria required participants to be able to read, write, and speak English. No other exclusionary criteria were used. Of the 196 participants, 151 were female, 44 were male, and one identified as other. With regards to ethnicity, 8.2% (N=16) were Asian or Asian descent, 5.6% (N=11) were Southeast Asian, 2.0% (N=4) were Hispanic/Latino, 10.2% (N=20) were non-Hispanic Black or African descent, 55.6% (N=109) were non-Hispanic White, Caucasian, or European descent, 13.8% (N=27) were Arab or Middle Eastern descent, and 4.6% (N=9) were an Other/Mixed descent. With regards to year of study, 16.8% were in their first year, 33.2% in their second year, 27.6% in their third year, 17.3% in their fourth year, and 5.1% in their fifth year or above.

Power Analysis

A power analysis was conducted using G*Power, v3.1 (Faul et al., 2009) to determine the sample size for a multiple regression with three tested predictors and seven predictor variables. Cohen's F, calculated by taking the square root of eta-squared, or the proportion of explained variance to unexplained variance, was used as the index of effect size for the current study (Faul et al., 2009). A minimum detectable effect size of 0.10 was chosen. Under these assumptions, a total sample size of approximately 114 was required to achieve a power level greater than 0.80.

Measures

The measures for this study appear in Appendices C, E, and G.

Demographics. A questionnaire was filled out by the participants to collect demographic information. Information was collected regarding participants' age, gender, ethnicity, marital status, education level, and GPA. This demographic information was used to describe the sample, with GPA a proxy for academic success. Major GPA was used for students above first year.

Tuckman Procrastination Scale (Tuckman, 1991). The Tuckman Procrastination Scale is a 16-item measure of passive procrastination. Participants responded on a 4-point scale ranging from 1 ("that's not me, for sure") to 4 ("that's me, for sure"). Examples of items include: "I needlessly delay finishing jobs, even when they are important", "When I have a deadline, I wait till the last minute," and "I am an incurable time waster." The author of the measure reported good reliability and validity in the normative sample (Cronbach's alpha of 0.86; Tuckman, 1991). Good internal consistency was found for the present study, with a Cronbach's alpha of 0.92.

The Active Procrastination Scale. The Active Procrastination Scale, developed by Choi and Moran (2009), is a 16-item self-report measure of active procrastination. The measure is divided into four subscales: outcome satisfaction (e.g., "I don't do well if I have to rush through a task" [reverse coded]), preference for pressure (e.g., "It's really a pain for me to work under upcoming deadlines" [reverse coded]), intentional decision to procrastinate (e.g., "I intentionally put off work to maximize my motivation"), and ability to meet deadlines (e.g., "I'm often running late when getting things done" [reverse coded]). Participants respond on a 5-point Likert-type scale ranging from 1 (not at all true

of me) to 5 (very true of me). The measure has been found to have adequate validity ($\alpha = 0.66$ to 0.82) and reliability ($\alpha = 0.77$) in the normative sample (Kim & Seo, 2013). Adequate internal consistency was found for the present study, with a Cronbach's alpha of 0.78 .

Barratt Impulsiveness Scale. The Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995) was completed by participants. The scale is a 30-item measure of trait impulsivity, with participants responding on a Likert scale ranging from 1 (never/rarely) to 4 (almost always/always). It is the most widely used measure of impulsivity in the literature. Three impulsivity factors have been created in the scale: attentional (e.g., "I am restless at the theater or lectures"), motor (e.g., "I do things without thinking"), and non-planning (e.g., "I am a careful thinker"). The scale has demonstrated good internal consistency, with a reported Cronbach's alpha coefficient of 0.83 , as well as good test-retest reliability, with a Spearman's rho of 0.83 in a recent sample (Stanford et al., 2009). Good internal consistency was found for the present study, with a Cronbach's alpha of 0.84 .

Undergraduate Engagement Scale. The undergraduate engagement scale is a 16-item measure of academic engagement currently being developed by Dr. Carlin Miller and her research group. Participants responded on a Likert scale ranging from 0 (never) to 4 (always). Examples of items include: "When I am having trouble with a course or an assignment, I work with other students," "I come to class having completed readings or assignments," and "I study with other students." This measure is currently undergoing validity trials but early evidence from unpublished data suggests it is both reliable and valid. There are no comparable measures with language that is contextually appropriate

that have been published. Good internal consistency was found for the present study, with a Cronbach's alpha of 0.85.

College Self-Efficacy Inventory. The College Self-Efficacy Inventory (CSEI; Solberg et al., 1993) is a 19-item self-report measure of self-efficacy for college students, with participants responding on a Likert scale ranging from 0 (not at all confident) to 10 (extremely confident). The questionnaire measures domains of course/academic efficacy (e.g., “research a term paper”), social efficacy (e.g., “make new friends at college”), and roommate efficacy (e.g., “divide chores with your roommate”). For the purposes of the current study, the roommate efficacy questions were not included, as not all students were not living in dormitories/residence halls. A total score was created by averaging the total number of items. The authors of the measure report good convergent and discriminant validity of the measure (0.68 to 0.84; Solberg et al., 1997). The authors also report good reliability, including internal consistencies, with Cronbach's alpha of 0.88 for each subscale and 0.93 for the total score in the normative sample (Solberg et al., 1993). Good internal consistency was found for the present study, with a Cronbach's alpha of 0.88.

Academic Motivation Scale (AMS-C 28; Vallerand et al., 1993) College Version. The AMS is a 28-item measure of academic intrinsic motivation rooted in self-determination theory. The items are separated into seven subscales of motivation: intrinsic motivation – to know, intrinsic motivation – toward accomplishment, intrinsic motivation – towards stimulation, extrinsic motivation – identified, extrinsic motivation – introjected, extrinsic motivation – external regulation, and amotivation (i.e., lacking in motivation). Students are asked the question “why do you go to college?”, with each item

a reason which they rate on a Likert scale ranging from 1 (does not correspond at all) to 10 (corresponds exactly). Examples of items include “Because I experience pleasure and satisfaction while learning new things,” “In order to obtain a more prestigious job later on,” and “I once had good reasons for going to college; however, now I wonder whether I should continue.” For the present study, *intrinsic motivation – to know* was used as the intrinsic motivation variable, as it is the most consistent with what would be defined as academic intrinsic motivation. The measure was translated from a French version of the questionnaire, with the creators reporting a good internal consistency ($\alpha = 0.81$) and test-retest reliability ($r = 0.79$) for this English version (Cokley et al., 2001). Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.88.

Procedures

The data collection was completed in person in groups of 5-8 participants in university space allocated for research. The paper-and-pencil measures took approximately one hour to complete. Prior to participating, the primary investigator took participants through the informed consent process, including description of the study and information about risks and benefits of participating, confidentiality, and the right to withdraw, and answered any remaining questions. After consent was obtained from all participants, the aforementioned measures were administered with the order of the measures randomly assigned. Data were double-entered by trained research assistants and cleaned by the primary investigator.

Data Analysis

Missing Data

In order to address issues around missing data, all data were screened in order to determine the pattern by which the data were missing. The Missing Completely at Random (MCAR) test was conducted to determine if the data were missing completely at random. All data except the undergraduate engagement scale (UES) were found to be MCAR, with visual inspection of the data revealing the UES data to be missing at random. Missing data were replaced via the expectation-maximization algorithm of SPSS for all variables (Dong & Peng, 2013), except for the BIS, for which the series mean for each variable was used, as per the guidelines of the measure's author.

Assumptions

The assumptions of a linear regression analysis were checked prior to completing the analysis. Specifically, assumptions of adequate sample size, normality, linearity, absence of multicollinearity, absence of outliers, homoscedasticity of errors, and independence of errors were checked. All assumptions were met.

Model of Analysis

Two linear regressions were utilized to determine the ability of current self-reported procrastination to predict academic engagement, as measured by the Undergraduate Engagement Scale. One regression analysis included the Tuckman Procrastination Scale as the independent variable, and the second regression analysis included the Active Procrastination Scale as the independent variable. Impulsivity, self-efficacy, and motivation were included as moderator variables.

Results

Two separate linear regression analyses were conducted to predict academic engagement. The first model tested the ability to predict academic engagement from active procrastination with impulsivity, self-efficacy, and motivation as moderator variables. The second model tested the ability to predict academic engagement from passive procrastination with impulsivity, self-efficacy, and motivation as moderator variables. All predictor variables were mean-centered to allow for better interpretation (Cohen et al. 2003).

Active Procrastination

Contrary to predictions, active procrastination was not significantly correlated with academic engagement ($r = .07$; $p = .25$).

The regression model of active procrastination was statistically significant, $F(7,188) = 18.15$, $p < 0.001$. R^2 for the overall model was 40% with an adjusted R^2 of 38%. This finding is considered a medium size effect, according to Cohen (1988). Active procrastination ($B = -.72$, $SE = .73$, $t = -.98$, $p = .33$) was not a significant predictor of academic engagement. Impulsivity ($B = -.01$, $SE = .06$, $t = -.11$, $p = .91$) also was not a significant predictor of academic engagement; whereas, self-efficacy ($B = 3.22$, $SE = .42$, $t = 7.70$, $p < 0.001$), and intrinsic motivation ($B = .38$, $SE = .11$, $t = 3.46$, $p = .001$) were significant predictors of academic engagement.

Contrary to hypotheses, impulsivity, self-efficacy, and intrinsic motivation did not act as moderators, as these predictors did not increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = .01$; $F_{change}(3, 188) = 1.14$; $p = .33$). Impulsivity ($B = .02$, $SE = .07$, $t = .33$, $p = .74$), self-efficacy ($B =$

-.33, SE = .53, $t = -.62$, $p = .54$), and intrinsic motivation ($B = -.16$, SE = .13, $t = -1.23$, $p = .22$) were not significant moderators of active procrastination and academic engagement.

Post Hoc Analysis

Following the suggestions of dissertation committee members at a progress meeting, the active procrastination regression was re-analyzed with the same variables and high school GPA added as a potential moderator variable. High school GPA was not found to be a significant predictor of academic engagement ($B = -.08$, SE = .07, $t = -1.19$, $p = .23$) or moderator ($B = -.05$, SE = .08, $t = -.62$, $p = .53$) of active procrastination and academic engagement.

Passive Procrastination

As was predicted, passive procrastination was significantly, negatively correlated with academic engagement ($r = -.40$; $p < 0.001$).

The regression model was statistically significant, $F(7,188) = 19.48$, $p < 0.001$. R^2 for the overall model was 42% with an adjusted R^2 of 40%. This finding is considered a large size effect according to Cohen (1988). Passive procrastination ($B = -.19$, SE = .07, $t = -2.71$, $p = .007$) was a significant predictor of academic engagement. Impulsivity ($B = .07$, SE = .06, $t = 1.14$, $p = .26$) was not a significant predictor of academic engagement, whereas self-efficacy ($B = 2.93$, SE = .42, $t = 6.96$, $p < 0.001$), and intrinsic motivation ($B = .34$, SE = .11, $t = 3.06$, $p = .003$) were significant predictors of academic engagement.

Contrary to predictions, impulsivity, self-efficacy, and intrinsic motivation did not act as moderators, as these predictors did not increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = .01$; $Fchange$

(3,188) = 1.28; $p = .28$). Impulsivity ($B = -.003$, $SE = .006$, $t = -.60$, $p = .55$), self-efficacy ($B = -.03$, $SE = .04$, $t = -.72$, $p = .47$), and intrinsic motivation ($B = .02$, $SE = .01$, $t = 1.70$, $p = .09$) were not significant moderators of passive procrastination and academic engagement.

Post Hoc Analyses

Given that self-efficacy and motivation were significant predictors but not moderators of academic engagement, the PROCESS macro via SPSS was utilized to determine if self-efficacy and motivation mediate the association between passive procrastination and academic engagement. Results were statistically significant, with self-efficacy (Indirect effect (B)=-.23, $CI = -.33 - -.15$) and motivation (Indirect effect (B)=-.10, $CI = -.17 - -.04$) found to mediate the association between passive procrastination and academic engagement.

As per the suggestion of the committee at the progress meeting, the passive procrastination regression model was reanalyzed with the same variables and high school GPA added as a potential moderator variable. High school GPA was not found to be a significant predictor of academic engagement ($B = -.06$, $SE = .07$, $t = -.94$, $p = .35$) or moderator ($B = .01$, $SE = .006$, $t = 1.64$, $p = .10$) between passive procrastination and academic engagement.

Table 5*Descriptive Statistics*

	Mean (SD)	Range	Cronbach's Alpha
Active Procrastination	3.95 (.81)	2.19-6.69	.78
Passive Procrastination	37.64 (9.03)	18-63	.92
Impulsivity	61.49 (10.66)	40.69-95	.84
Self-Efficacy	6.43 (1.50)	2.33-9.47	.88
Motivation	20.66 (5.35)	4-28	.88
Academic Engagement	35.54 (9.56)	9-64	.85

Note. SD = standard deviation.

Table 6*Intercorrelations of variables*

	1	2	3	4	5	6
1. Active Procrastination	-	-.17*	-.27***	.24***	.03	.07
2. Passive Procrastination	-.17*	-	.48***	-.44***	-.29***	-.40***
3. Impulsivity	-.27***	.48***	-	-.40***	-.23**	-.25***
4. Self-Efficacy	.25***	-.43***	-.40***	-	.37***	.58***
5. Motivation	.03	-.29***	-.23**	.37***	-	.42***
6. Academic Engagement	.07	-.40***	-.25***	.58***	.42***	-

Note. * $p \leq 0.05$, ** $p \leq 0.01$; *** $p \leq 0.001$

Table 7*Linear Regression of Active Procrastination Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Active Procrastination	.87	.84	1.03	.30	-.79-2.54
2	Active Procrastination	-.72	.70	-1.03	.30	-2.11-.66
	Impulsivity	-.01	.06	-.20	.84	-.12-.10
	Self-Efficacy	3.26***	.42	7.79	<.001	2.44-4.09
	Motivation	.40***	.11	3.70	<.001	.19-.62
3	Active Procrastination	-.71	.73	-.98	.33	-2.16-.73
	Impulsivity	-.006	.06	-.11	.91	-.12-.11
	Self-Efficacy	3.22***	.42	7.70	<.001	2.40-4.05
	Motivation	.38***	.11	3.46	.001	.16-.60
	Impulsivity X Active Procrastination	.02	.07	.33	.74	-.12-.16
	Self-Efficacy X Active Procrastination	-.33	.53	-.62	.54	-1.37-.72
	Motivation X Active Procrastination	-.16	.13	-1.23	.22	-.42-.10

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

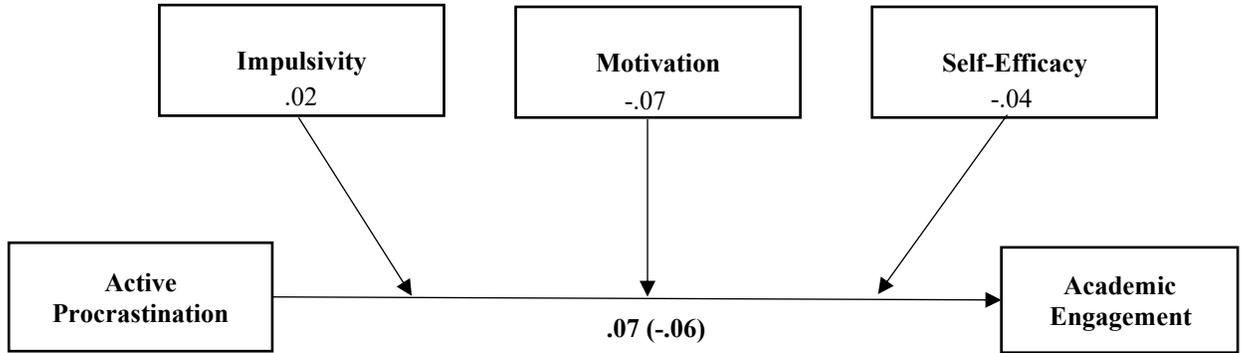
Table 8*Linear Regression of Passive Procrastination Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Passive Procrastination	-.42***	.07	-6.10	<.001	-.56- -.28
2	Passive Procrastination	-.18**	.07	-2.51	.01	-.32- -.04
	Impulsivity	.05	.06	.93	.36	-.06-.17
	Self-Efficacy	2.91***	.42	6.92	<.001	2.08-3.74
	Motivation	.38***	.11	3.51	.001	.17-.59
3	Passive Procrastination	-.19**	.07	-2.71	.007	-.34- -.05
	Impulsivity	.07	.06	1.14	.26	-.05-.19
	Self-Efficacy	2.93***	.42	6.96	<.001	2.10-3.76
	Motivation	.34**	.11	3.06	.003	.12-.56
	Impulsivity X Passive Procrastination	-.003	.01	-.60	.55	-.01-.01
	Self-Efficacy X Passive Procrastination	-.03	.04	-.72	.47	-.11-.05
	Motivation X Passive Procrastination	.02	.01	1.70	.09	-.003-.04

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Figure 7

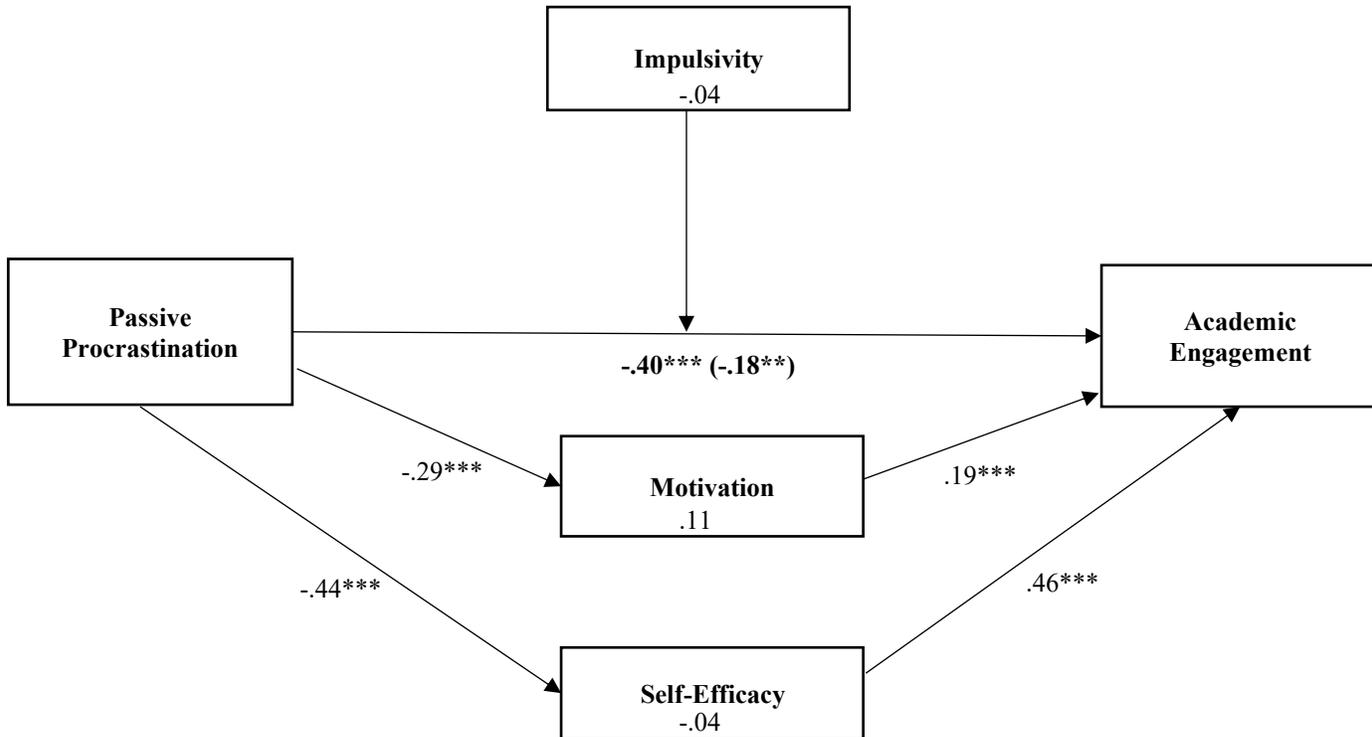
Linear Regression Model of Active Procrastination Predicting Academic Engagement with Potential Moderator Variables



Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$. Values are standardized beta-coefficients. For the association between active procrastination and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator variables is the beta-coefficient of the interaction of that variable with active procrastination.

Figure 8

Linear Regression Model of Passive Procrastination Predicting Academic Engagement with Potential Moderator Variables



Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$. Values are standardized beta-coefficients. For the association between passive procrastination and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator/mediator variables is the beta-coefficient of the interaction of that variable with passive procrastination. The moderator variable (impulsivity) is the variables with a single line pointing to the association between passive procrastination and academic engagement, whereas the mediator variables are the variables with lines from passive procrastination and to academic engagement.

Discussion

The present study is the first to examine the association of active procrastination and passive procrastination with academic engagement, as well as the first to identify how traits impact the relation between passive procrastination and academic engagement.

Various studies have concluded that procrastination is positively associated with impulsivity and difficulties with self-regulation. Given that procrastination often hinders academic success, it is important to further examine how it affects success in academic settings, specifically academic engagement in university students. Moreover, the literature has highlighted the importance of separating the study of procrastination into active and passive procrastination (Choi & Moran, 2009; Kim & Seo, 2013), with the present study shedding more light on how each are associated with academic engagement and performance.

Contrary to predictions, self-reported active procrastination was not significantly correlated with academic engagement. Given that active procrastination involves intentional delay in working on tasks, and active procrastinators are able to estimate their time to complete a task and are goal-oriented (Kim & Seo, 2013), it would be expected that these individuals would also be more likely to engage in their academics. Moreover, those who intentionally delay tasks often do so due to a preference to work under pressure and are able to complete tasks on time (Choi & Moran, 2009; Kim & Seo, 2013), rather than delaying tasks to engage in alternative, more preferred tasks. The findings are consistent with the suggestion that other factors, such as self-efficacy, are better predictors of academic achievement than active procrastination (Kim & Seo, 2013).

Self-reported passive procrastination was found to be negatively correlated with academic engagement. Passive procrastinators are what would be considered traditional procrastinators who postpone their tasks due to an inability to make the decision to act in a timely manner (Choi & Moran, 2009; Kim & Seo, 2013). As such, it would be

understandable that passive procrastinators are less likely to engage in academics, for a variety of reasons. Passive procrastinators may avoid work due to anxiety, particularly with initiating tasks, or may avoid academic work due to more favourable activities (e.g., spending time with friends, going on social media). Passive procrastinators may also underestimate the amount of time it will take to complete the task, thus not investing the effort and time required to perform well (McCowan, 1986; Schouwenberg, 1995). The association between passive procrastination and academic engagement is also consistent with the academic achievement literature, which has found that procrastinators tend to have lower grades (Jackson et al., 2003). Passive and active procrastination are indeed separate constructs given that the former is associated with academic engagement, whereas the latter is not. Researchers have documented that passive and active procrastination should be viewed as separate constructs (Choi & Moran, 2009; Kim & Seo, 2013), with this distinction also applicable to the academic engagement research.

Consistent with hypotheses, passive procrastination was found to predict academic engagement. Contrary to the hypotheses, active procrastination was not found to predict academic engagement. For both active and passive procrastination models, it was found that self-efficacy and motivation predict academic engagement, whereas impulsivity does not. Results indicate that self-efficacy and motivation mediate the association between passive procrastination and academic engagement, which suggests that regardless of the level of passive procrastination, higher levels of self-efficacy and motivation result in greater academic engagement.

The present findings are consistent with the related body of literature, as impulsive individuals tend to choose more immediate rewards, which is also common in

passive procrastination, resulting in poorer performance in school from a young age into adulthood (Blair & Razza, 2007; McClelland & Cameron, 2012). As such, passive procrastinators would be more likely to choose tasks that lead to immediate rewards (e.g., going on social media) over less favourable tasks that lead to long term rewards (e.g., studying for a test). Passive procrastinators may have a reduced ability to resist social temptations, pleasurable activities, and immediate rewards when the benefits of academic behaviours are distant (Ariely & Wertenbroch, 2002; Chu & Choi, 2005; Rabin et al., 2010). This tendency would make individuals less likely to engage in their academics. The results suggest that increased or decreased academic engagement does not play a role in active procrastination.

Studies of university students have found that procrastination is strongly and negatively associated with self-efficacy, with self-regulated learning correlated with students' grade goals (Tan et al., 2008; Wolters, 2003; Zimmerman et al., 1992). This is consistent with the current findings, as passive procrastinators have lower levels of self-efficacy, which in turn impacts their engagement with academics. Increased anxiety around a subject area has been shown to result in greater procrastination (Dunn, 2004), thus increased anxiety may suggest decreased self-efficacy. Passive procrastinators may therefore be less likely to engage in their academics due to the anxiety they experience with working on a task (e.g., if the material is challenging), with their anxiety likely also impacting their self-efficacy. Self-efficacy is relevant to procrastination as individuals with higher self-efficacy are less impulsive, as they possess metacognitive skills and can effectively monitor and control important aspects of their learning behavior (Tan et al., 2008; Wolters, 2003). Therefore, individuals with higher self-efficacy would be less

likely to procrastinate and more likely to engage with their academics. The literature has also noted that poor self-regulated learning, which includes self-efficacy and low impulsivity, is associated with passive procrastination (Kim & Seo, 2013). These findings are consistent with the present study, as higher self-efficacy and intrinsic motivation were found to be associated with less procrastination and associated with greater academic engagement. Individuals higher in self-efficacy have adaptive motivational beliefs and attitudes, and an orientation toward mastery goals, whereas procrastinators are less likely to be goal-oriented (Tan et al., 2008; Wolters, 2003). Among university students, intrinsic motivation has been associated with lower levels of procrastination (Steel, 2007), which is understandable, as the more intrinsically motivated the individual is to succeed, the less likely they are to delay academic tasks. Given that passive procrastinators report poor academic performance, the current findings shed light on how passive procrastination impacts predictors of academic achievement (i.e., academic engagement). The present findings are inconsistent with the literature finding high school GPA to be a strong predictor of university GPA (Cyrenne & Chan, 2012), as high school GPA was not a predictor of academic engagement. This lack of association may infer that high school GPA does not strongly influence the ways in which students engage with academics in university, particularly since university has a different learning environment than high school. Moreover, high school GPA does not contribute to the observed relationship between passive procrastination and academic engagement, nor does it explain a relationship for active procrastination, which was not found to be a predictor of academic engagement.

The results suggest that active procrastination is not influenced by other traits or characteristics that are associated with academic performance. More specifically, active procrastination was found to be correlated with self-efficacy and motivation, which were also found to be predictors of academic engagement, yet active procrastination itself was not associated with academic engagement. This finding is inconsistent with part of the academic achievement literature, as active procrastination has been found to be associated with academic success, suggesting that academic engagement differs from academic success (Kim & Seo, 2013). However, the achievement literature has found that self-regulated learning (which involves self-efficacy) is a greater predictor of academic achievement than active procrastination (Kim & Seo, 2013), which is consistent with the strong association between self-efficacy and academic engagement in the current study. Indeed, a number of studies have found active procrastinators to report higher levels of self-efficacy and greater academic performance than passive procrastinators (Choi & Moran, 2009; Chu & Choi, 2005; Corkin et al., 2011).

Limitations

Although informative, the present study is not without its limitations. First, the procrastination measures are self-reports. Although the measures have been found to be valid and reliable, and research has shown that self-reports are a relevant method to assess behavior, future research should assess procrastination on a behavioral basis (Podsakoff et al., 2003). An example of a behavioural measure of procrastination that is most applicable to passive procrastination is documenting the submission times of assignments (Howell et al., 2006). The researchers obtained consent to collect their submission times for online assignments for their introductory psychology class (Howell

et al., 2006). Students who submitted closer to the deadline also had higher self-report scores of procrastination (Howell et al., 2006). Second, the results may be influenced by the type of measure used to assess active procrastination. Although the Active Procrastination Scale (APS) has been found to be a valid measure (Choi & Moran, 2009; Chu & Choi, 2005), some concerns have been raised. The majority of the questions of the measure are reversed coded, and it has been noted that reverse-coded items can make it difficult to interpret a construct (Chowdhury, 2016; DeVellis, 2003), and that reverse-coded items can load on unexpected factors (Chowdhury, 2016; Weijters et al., 2013). Hensley (2015) conducted an exploratory factor analysis of active procrastination and found a three-factor model rather than Choi and Moran's (2009) four-factor model, suggesting that the APS may not be as valid of a measure as originally thought by the creators. As a result, the current findings surrounding active procrastination may be influenced by the measure. Third, although the measures of the present study are valid and widely used, it is possible that some individuals respond in an effort to *fake good* on measures of procrastination or academic engagement so as to appear more favourably. Given that the data were de-identified and self-reports were completed with the investigator a distance away (i.e., unable to see what the participant was reporting), *faking good* is unlikely to be common.

Implications

The present findings can inform academic planning by suggesting that reducing passive procrastination tendencies among university students will allow for increased academic engagement, which in turn may result in better academic performance. The findings are of great importance, given that they not only allow for a better understanding

of factors that are associated with academic engagement, but also suggest ways in which educators can aid students with their academic engagement. Indeed, the results give a better understanding as to which factors educators should focus on to allow for greater academic engagement, with implementation of these interventions rather feasible. Each of the factors of importance, including procrastination, self-efficacy, and motivation, can be addressed by educators at the individual level (e.g., one-on-one meetings with students) or at the group level (e.g., during a large lecture).

Schouwenburg and colleagues (2004) suggest that time-management is a popular focus for interventions targeting procrastination. Solomon and Rothblum (1984) indicated that teaching time management alone is insufficient for reducing procrastination. This is of particular importance given that time management is often a key skill that educators suggest students focus on and improve in order to increase their academic success. The fact that time management alone does not allow for greater academic success further identifies the importance of an approach to reducing procrastination, Scent and Boes (2014) examined the use of acceptance and commitment therapy (ACT) to decrease procrastination among college students, as ACT posits that psychological problems stem from experiential avoidance (Strosahl, & Wilson, 2011), and procrastination involves avoidance. ACT covers three areas: acceptance and defusion, which is the willingness to simply have thoughts and to detach from the content of those thoughts; mindfulness and self-as-context, which is the ability to maintain a nonjudgmental stance with the present-moment experiences and have a sense of self that is flexible and recognizes the changing nature of experience; and values and committed action, which is the ability to identify closely held values and take actions that incorporate those values without needing to

change one's thoughts or feelings (Harris, 2009). Scent and Boes (2014) found that students were engaged and responsive to the two ACT workshops, also suggesting that a virtual version of the workshop may be a good option for educators. This type of workshop can be offered by departments of universities virtually, which may allow for greater ease of access. Alternatively, educators who have students reporting difficulties with procrastination and beginning tasks can suggest components of ACT during individual meetings or with the class as a whole.

Fostering self-efficacy and intrinsic motivation will also allow for academic engagement, and in turn potentially improve academic achievement. Indeed, self-efficacy and motivation can be viewed as protective factors for academic engagement, as individuals with higher levels of self-efficacy and motivation will engage more in their academics even if they also have higher levels of passive procrastination. Instilling and fostering a sense of intrinsic motivation (i.e., an interest in academics due to the enjoyment or interest of the subject area) may allow for increased academic engagement. Some tips to improve intrinsic motivation are: inquiring what students want out of their lecture sessions and structure the format of the instruction around those needs; structuring lessons around students' interests; encouraging participation; and providing positive feedback (Kusurkar et al., 2011).

As self-efficacy is associated with procrastination, components of ACT may also be beneficial for improving self-efficacy. Indeed, self-efficacy involves cognitive fusion, which occurs when individuals overidentify with thoughts that in turn dominate their behaviour (Harris, 2009). Therefore, ACT may be beneficial in increasing self-efficacy by promoting acceptance of thoughts and promoting mindfulness (i.e., nonjudgmental

focus on the present moment). Moreover, self-efficacy is mentioned as being similar to competence (intrinsic motivation) in the literature (Ryan & Deci, 2000). As such, the aforementioned tips that foster competence may also be beneficial in increasing self-efficacy. Additionally, educators may choose to implement a success course, following the work of Kennett and Reed (2009). The course offered by Kennett and Reed (2009) included lectures (e.g., library research, critical evaluation of literature, citing, essay planning), and demonstrations and discussions (e.g., hands-on library skills workshops, study skills, and collaboratively editing their own essays (Kennett & Reed, 2009). A variety of interventions that address procrastination, self-efficacy, and intrinsic motivation are available for educators to implement. A number of these interventions are rather feasible and amenable for educators who have limited resources or are concerned with aiding students on an individual basis.

CHAPTER 5: MOTIVATION TO USE ALCOHOL AND MARIJUANA, IMPULSIVITY, AND ACADEMIC ENGAGEMENT AMONG UNIVERSITY STUDENTS

Impulsivity is a widely studied construct across the lifespan, with a vast literature of the consequences of impulsivity in university students. Young adults who are more impulsive are more likely to use alcohol and marijuana, with these substances in turn also increasing impulsivity. This increased impulsivity often results in poorer academic achievement, with a likely contributing factor being academic engagement. The motives for which students use alcohol and marijuana have also been studied, with these motives associated with impulsivity. However, the literature has yet to examine how alcohol and marijuana use motives are associated with academic engagement, while also considering the role of impulsivity in this association. For the present study, the term *substance use* will be used to indicate alcohol and/or marijuana use.

Impulsivity

Trait impulsivity has been associated with increased alcohol and marijuana use among university students (Gruber et al., 2011; Jones et al., 2014; LaBrie et al., 2014; Magid et al., 2007). Generally, impulsivity has been separated into different dimensions. These dimensions are often separated into facets, including motor (acting without thinking), cognitive (quick decision-making), and non-planning (decrease in orientation towards future; Barratt, 1995). The substance use literature identifies other impulsivity-related dimensions in some cases, with impulsivity separated into four dimensions: positive and negative urgency, premeditation, sensation-seeking, and lack of perseverance (LaBrie et al., 2014). Positive and negative urgency involve the tendency to

act maladaptively in response to positive mood states or negative mood states, respectively (Cyders et al., 2007; Whiteside et al. 2001). Premeditation is the tendency to engage in behaviour without being able to anticipate the consequences (Jones et al., 2014). Sensation-seeking involves the tendency to seek excitement and adventure (Whiteside et al. 2001). Lack of perseverance is an inability to maintain focus on a task, particularly when the task is long and/or boring (Jones et al., 2014). All of the dimensions, except lack of perseverance, have been associated with problematic alcohol use (Jones et al., 2014).

Regardless of the theoretical model, specific neuroanatomical systems have been linked with impulsivity. As initially described by Gray in his biopsychological theory of personality (1970), the Behavioural Approach System (BAS) and Behavioural Inhibition System (BIS) are key systems in impulsivity. The BAS is activated by stimuli signaling reward and non-punishment, and is associated with positive affect, whereas the BIS is activated by stimuli signaling non-reward and punishment, and is associated with anxiety and avoidance (Pickering & Gray, 1999). Increased alcohol consumption has been found among those with increased BAS sensitivity due to stronger subjective, physiological, and behavioral responses to positive incentive cues (Fowles, 1993; Franken, 2002; Zisseron & Palfaia, 2007). Moreover, those with greater BAS sensitivity have been found to experience greater levels of positive affect following reward cues (Carver & White, 1994) and positive mood induction (Zelenski & Larsen, 1999). This increase in positive affect would likely reinforce substance use.

Intersection of Impulsivity with Alcohol and Marijuana Use

Individuals who report regrettable actions when in very positive or negative moods are more likely to report negative consequences from drinking (positive and negative urgency, respectively; LaBrie et al., 2014). Of all the impulsivity dimensions, negative urgency appears to be the strongest predictor of the severity of problematic use of alcohol (Adams et al., 2012; Curcio & George, 2011; Verdejo-García et al., 2007). Indeed, urgency appears to be more closely associated with drinking problems than alcohol use more generally (Curcio & George, 2011; LaBrie et al., 2014). The effect of urgency (LaBrie et al., 2014) may result from those higher in urgency focus on improving immediate mood, rather than the potentially negative longer-term consequences of their actions (Cyders et al., 2009). Additionally, extreme emotions can reduce cognitive resources and may lead to poorer decision making (Dick et al., 2010).

Greater impulsivity has also been associated with marijuana use in a variety of studies. In a study utilizing functional measures of impulsivity (diffusion tensor imaging; DTI), chronic marijuana users who reported higher levels of impulsivity also exhibited alterations in frontal white matter (Gruber et al., 2011). The frontal brain areas are responsible for higher order executive functioning, which includes inhibition. Therefore, impulsivity among marijuana users is evidenced not only via self-report measures but also through functional brain imaging. The relation between impulsivity and marijuana use may be cyclical in that those who use marijuana are more impulsive, and marijuana exposure increases overall level of impulsivity. Research has also found that marijuana alters time perception (Chait & Pierri, 1992; Schulze et al, 1988), causing the overestimation and under-reproduction of time intervals, suggesting a speeding of the

internal clock. This can be particularly consequential for university students with regards to academic deadlines, as it may feel that they have more time to complete their work than they actually do. However, it is important to also consider that use of marijuana may cause time misperception and procrastination, yet not all individuals who use marijuana procrastinate due to its use. Some individuals may be more purposeful and planned in their marijuana use, such as by using marijuana at times when they do not need to complete school work (e.g., after their assignments are completed), rather than using marijuana when it will impede their ability to complete school work (e.g., the night before an assignment is due rather than completing the assignment).

Rates of Alcohol and Marijuana Use

Rates of alcohol consumption among emerging adults (i.e., those between 18 and 24 years of age) are higher than alcohol consumption among the rest of the population in Canada. Specifically, risky and hazardous consumption among young adults is higher compared to the rest of the population. In a 2004 major national survey, 20.6% of university males and 12.5% of university females reported five or more drinks on one occasion weekly, compared to 6% of males age 25 years and above and 1.5% of females age 25 years and above (Adlaf, Begin & Sawka, 2005; Adlaf, Demers & Gliksman, 2005; CCSA, 2012). Hazardous consumption, as obtained via a screening tool regarding alcohol consumption, drinking behaviour and dependence, and consequence of drinking was reported by 37.5% of male and 27.5% of female university students, compared to 16.5% of males and 4% of females age 25 years and above (Adlaf, Begin & Sawka, 2005; Adlaf, Demers & Gliksman, 2005). The Canadian Community Health Survey (Statistics Canada, 2011) reported that among female young adults ages 18 to 24 years, 39% reported either

no alcohol consumption or fewer than five drinks on one occasion in the past year, whereas 53% reported five or more drinks on one occasion three times or less a month in the past year, and 8% reported five or more drinks on one occasion weekly or more often in the past year. Among males in this age group, 25% reported either no alcohol consumption or fewer than five drinks on one occasion in the past year, whereas 55% reported five or more drinks on one occasion three times or less a month in the past year, and 19% reported five or more drinks on one occasion weekly or more often in the past year (CCSA, 2012; Statistics Canada, 2011).

According to the 2012 Canadian Community Health Survey - Mental Health, one third of respondents between 18 and 24 years of age reported using marijuana in the past year, which exceeded the amount reported by those in other age groups (Rotermann & Langlois, 2015). Although most emerging adults who report marijuana use do not use chronically or become dependent, they remain at higher risk for marijuana-related negative consequences, such as accidents and injuries, decreased cognitive functioning, and poor school performance (Bachman et al., 1997; Gledhill-Hoyt et al., 2000; Lee et al., 2007). With the recent legalization of marijuana in Canada, there is a general concern that use of the drug among students may increase. The adolescent literature had yielded rather consistent findings that legalization of marijuana had little to no impact on use in those of age, with high rates among certain states post-legalization in states that already had high rates pre-legalization (Choo et al., 2004; Hasin et al., 2015). A study of adolescents in Oregon found that legalization of recreational marijuana did not increase marijuana use for youth who did not use marijuana but did increase use in youth who were already using (Rusby et al., 2018). Thus, it is likely that marijuana use among

emerging adults may increase after recent legalization among those already using prior to legalization. Given that emerging adults are still experiencing neurodevelopment through myelination, and marijuana use makes developing brains vulnerable to consequences on cognition and executive functioning, this is an important area of research given its consequences (Crane et al., 2013).

Motivation to Use Alcohol and Marijuana

The reasons for which people drink alcohol vary. For young adults, university is a new experience in their life in which they often obtain more independence and are faced with a variety of new opportunities with classmates. With this new-found independence, young adults have more opportunities to partake in certain activities, such as attending parties, drinking alcohol, and smoking marijuana. Prospective studies of college students have found that as they moved out of their parents' homes into dormitories or off-campus living situations, students' heavy drinking and marijuana use increased (Baer et al., 1995; Crowley, 1991; Harford & Muthén, 2001; White et al., 2006). Moreover, it is a time when they reach the legal age to drink (in Canada), or are surrounded by those who are of age to purchase alcohol. Drinking alcohol is such a common practice among university students that LaBrie and colleagues (2014) indicate that alcohol misuse is an ongoing public health problem among American students. The reasons for drinking alcohol among university students has been an area of great research. Cooper (1994) proposed four specific motives for drinking: enhancement (internal, positive reinforcement), social (external, positive reinforcement), coping (internal, negative reinforcement), and conformity (external, negative reinforcement). LaBrie et al. (2007) found that social motivation was the most frequently reported motive for drinking. This is understandable

given that drinking in university is typically done in social settings. Coping motives, which decrease negative internal states, have been found to predict heavy drinking, social and occupational problems, and greater tolerance and withdrawal symptoms (Cooper et al., 1992; LaBrie et al., 2007). The enhancement of internal affective states has been found to predict drinking rates and alcohol-related problems (LaBrie et al., 2007). Urgency was associated with drinking for coping motives, enhancement, and conformity (Jones et al., 2014). Premeditation and sensation-seeking were associated with enhancement motives (Jones et al., 2014).

Simons and colleagues (1998) expanded upon the four-dimensional motivational model for drinking to determine a model for marijuana use, which involves the four motives for drinking proposed by Cooper (1994), including enhancement, social, coping, and conformity. However, Simons and colleagues (1998) proposed a fifth motive for smoking marijuana: expansion. Marijuana leads to the enhancement of perceptual and cognitive experience, thus *expansion* refers to these desired experiences resulting in a new awareness of the self, as well as one's relationships with others and nature (Simons et al., 1998). A study by Simons and colleagues (2000) examined the endorsement of motive for alcohol and marijuana, and compared the endorsement of the motives between the two substances. Alcohol use was associated with enhancement and social motives, whereas marijuana use was associated with expansion motives (Simons et al., 2000). Furthermore, social motives were greater for alcohol use compared to marijuana use, and expansion motives were greater for marijuana use compared to alcohol use (Simons et al., 2000). Moreover, women reported using marijuana more than alcohol for the enhancement of positive affect (Simons et al., 2000). With regards to negative

consequences, marijuana motives may be stronger predictors of marijuana use-related problems than alcohol motives are of alcohol use-related problems (Simons et al., 1998). Of particular interest for the present study is the influence of motivation to use marijuana and alcohol on academic engagement.

Negative Academic Consequences of Substance Use

Alcohol and marijuana misuse among university students has been associated with decreased academic success across the literature (Arria et al., 2013; Philips et al., 2015; Presley & Pimentel, 2006; Singleton, 2007). Indeed, alcohol consumption was associated with poorer grades even when controlling for SAT scores and class rank (Singleton, 2007). In a large survey of 28,774 undergraduate students, alcohol consumption was associated with lower test grades (Presley & Pimentel, 2006; Singleton, 2007), with various other national alcohol studies finding lower GPA due to alcohol consumption (Core Institute, 2006; Engs et al., 1996; Singleton, 2007). Marijuana misuse has also been associated with decreased academic achievement in a number of studies (Arria et al., 2015; Fergusson et al., 2003; Horwood, 2010). Moreover, occasional marijuana users were also more likely to delay enrollment in or drop out of post-secondary education, with frequent users significantly less likely to enroll (Homel et al., 2014). Furthermore, the use of drugs influences one's cognitive functioning, including psychomotor speed and accuracy, attention, memory (e.g., encoding, working memory, retrieval), time estimation, and self-regulation (Phillips et al., 2015). It is therefore understandable that alcohol and marijuana misuse can result in lowered academic performance, as these cognitive effects would hinder the ability to concentrate in class, as well as test-taking abilities, such as concentrating on the questions and retrieving

pertinent information from memory. The effects of alcohol and marijuana misuse on academic success tends to focus on GPA, number of classes missed, and falling behind in schoolwork as operationalizations of academic achievement. The negative impact alcohol and marijuana use has been found to have on academic achievement may be associated with academic engagement, as academic engagement plays a key role in academic success (Alrashidi et al., 2016; Appleton et al., 2008; Carter et al., 2012).

Consequences of Alcohol and Marijuana Use on Academic Engagement

Academic Engagement in University Students

The term *academic engagement* has varying definitions in the literature. However, despite the variation in conceptualization of the term, it generally refers to students' patterns in motivation, cognitions, and behaviours (Alrashidi et al., 2016). Researchers have proposed different dimensions of academic engagement, with some uniformity across conceptualizations. For example, Schaufeli et al. (2002) used three dimensions: dedication, vigor, and absorption (Alrashidi et al., 2016; Appleton et al., 2008).

Dedication involves being strongly invested in one's work and experiencing a sense of significance, enthusiasm, inspiration, pride, and challenge (Schaufeli et al., 2006). Vigor involves high levels of energy and mental resilience while working, the willingness to invest effort in one's work, and persistence even when experiencing difficulties (Schaufeli et al., 2006). Absorption involves being fully concentrated and happily engrossed in one's work, with time passing quickly and having difficulties detaching oneself from work (Schaufeli et al., 2006). University has less structure and more autonomy than high school, placing more ownership on students to complete their schoolwork.

Academic Engagement and Alcohol Use

Alcohol and marijuana misuse have been associated with certain academic engagement activities (classes missed, studying time, and falling behind), and for many years, research has focused on these specific activities. Indeed, the Harvard School of Public Health College Alcohol Study surveyed a nationally representative sample of students in 1993 and 1997. They reported that alcohol misuse was associated with missing class and getting behind in schoolwork (Wechsler et al., 1997). Along this line, authors of past studies examining alcohol misuse and academic success suggested that decreased academic achievement was due to time taken away from studying due to alcohol drinking (Engs et al., 1996; NCASA, 1994; Pascarella et al., 2007; Presley et al., 1996; Rau & Durand, 2000). Wolver (2002) and Williams et al. (2003) also reported a direct effect of alcohol consumption on GPA, as well as an indirect effect on GPA via decreased study hours. Across a number of colleges, Porter and Pryor (2007) found decreased student-faculty interaction due to drinking alcohol, with other areas of engagement not significantly affected, except for heavy drinking among women at research universities, for whom all areas of engagement were affected (Porter & Pryor, 2007).

Academic Engagement and Marijuana Use

The influence of marijuana misuse on academic success has also been shown with regards to studying, as increased craving levels have been associated with decreased number of minutes spent studying and decreased academic motivation (Phillips et al., 2015). Indeed, alcohol and marijuana misuse have been associated with skipping class, particularly among those for whom the drug use has become problematic (Arria et al.,

2013). Researchers have noted a potential link between marijuana use and amotivation (Bloomfield et al., 2013; van Hell et al., 2010), which could contribute to a lack of engagement in college and difficulties in sustaining a focus on academics (Arria et al., 2015). The association between alcohol and marijuana misuse and academic engagement may be further exacerbated by impulsivity, as those who are more impulsive are even more likely to use alcohol or marijuana rather than completing academic-related tasks. Many of the cognitive deficits associated with alcohol and marijuana use (e.g., attention, processing speed, memory) could impact academic success, as a number of specific impairments (e.g., attention, inhibition, and executive functioning) are directly related to self-regulation in a learning environment (Phillips et al., 2015; Pintrich, 2004; Tangney et al., 2004). The mechanism through which marijuana misuse is associated with academic engagement may be similar to those found in alcohol consumption (Arria et al., 2015). Therefore, findings from alcohol studies may be applicable to marijuana as well, although further research is necessary, as little research has been conducted to determine associations between marijuana use and academic engagement.

Academic Engagement and Factors that Influence Motivation to Use Substances

Academic achievement is affected by a multitude of factors, with no single factor determining impact on achievement. Similarly, a multitude of factors influence academic engagement, particularly those specific to university students. Stress is one such factor, as university students are presented with new learning experiences, independence, and expectations. Stress refers to a state of psychological arousal that results when external demands exceed an individual's adaptive abilities (Lazarus, 1966; Lazarus and Folkman, 1984; Zajacova et al., 2005).

Stress

Arnett (2005) suggested that decreasing social control and increasing instability and stress contribute to increases in alcohol and drug use during emerging adulthood. The weakening of parental monitoring and increased importance of peer relationships that occurs during the transition to university can also lead to increased substance use (Borsari and Carey, 2001). Stress has been associated with decreased academic success among university students (Gall, Evans, and Bellerose, 2000), particularly among first-year students (Struthers, Perry, and Menec, 2000). However, Petrie and Stoeber (1997) and Sandler (2000) did not identify an association between stress and academic outcomes (Zajacova et al., 2005). Students who internalize the effect of stress (i.e., view themselves as responsible for their situation rather than society) have been found to receive higher grades (Dusellier et al., 2005), although students without the ability to use positive coping strategies with stress are less likely to receive high grades (Dusellier et al., 2005). The lack of positive coping strategies is where alcohol and marijuana use play a role. Specifically, alcohol reduces negative affective states associated with stress, which reinforces consumption and increases the probability of alcohol use when experiencing stress (Conger, 1956; Park et al., 2004). Stress has also been associated with increased marijuana use in adolescents and young adults (Siqueira et al., 2001; Vaccaro et al., 1998; Wills et al., 1996).

Filling the Literature Gaps

Previous studies have examined some forms of academic engagement in relation to alcohol and marijuana use (e.g., classes missed), but the focus has yet to extend to a variety of other academic engagement activities that may be affected by substance use.

Although these aspects of academic engagement are important in influencing overall academic success, it is important to extend the scope of research beyond these factors to identify other aspects of academic engagement that may be affected. Moreover, inconsistent findings across studies specify the need to further shed light on how alcohol and marijuana misuse are associated with academic engagement; that is, what other factors may contribute to the associations. This is of particular interest given that studies have identified differences in the effects of alcohol and marijuana use based on the types of universities attended, thus influencing generalizability (Porter & Pryor, 2007; Singleton, 2007). Moreover, this area of research is of interest given that the motivation to use alcohol and marijuana differs between individuals. Identifying which motives are most associated with academic engagement will aid in identifying specific areas of problem substance use to be targeted, in turn improving academic achievement. Coping, enhancement, and social alcohol motives have been chosen for the present study, as they have been predictors of various negative consequences among university students, with enhancement and social motives the most commonly reported (LaBrie et al., 2007; Simons et al., 2000). Given the recent legalization of marijuana in Canada, individuals may be more open to disclosing their use of the drug, allowing for more accurate examination of the variables of interest. The expansion motive of marijuana use was selected for the present study as it is the most commonly reported motive, and it is most applicable to marijuana use than alcohol use (Simons et al., 2000). The purpose of the present study is to determine if and how motivation to use alcohol and marijuana is associated with academic engagement, and to determine how impulsivity and other related factors (i.e., stress) may influence the associations.

Study Aims and Hypotheses

The current study aimed to determine if and how motivation to use alcohol and marijuana is associated with academic engagement, and to determine how impulsivity and other related factors (i.e., stress) may influence the associations.

Hypothesis 1a: Motivation to use alcohol, particularly coping, enhancement and social, would be associated with lower levels of self-reported academic engagement.

Hypothesis 1b: Motivation to use marijuana, particularly expansion, would be associated with lower levels of self-reported academic engagement.

Hypothesis 2a: Self-reported impulsivity and stress would moderate the association between motivation to use alcohol (coping, enhancement, and social) and academic engagement.

Figure 9

Hypothesized Linear Regression Model of Alcohol Coping Motive Predicting Academic Engagement with Potential Moderator Variables

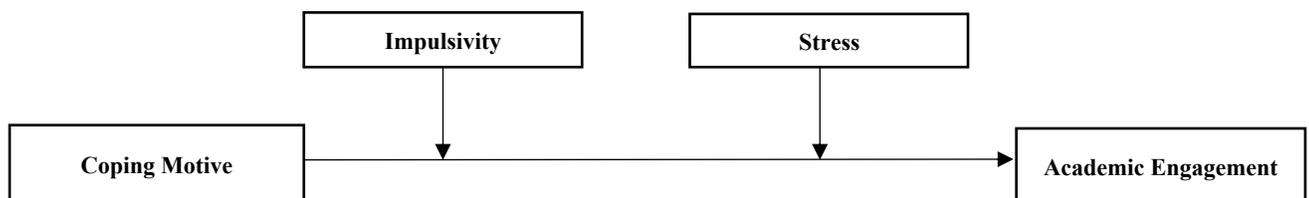


Figure 10

Hypothesized Linear Regression Model of Alcohol Enhancement Motive Predicting Academic Engagement with Potential Moderator Variables

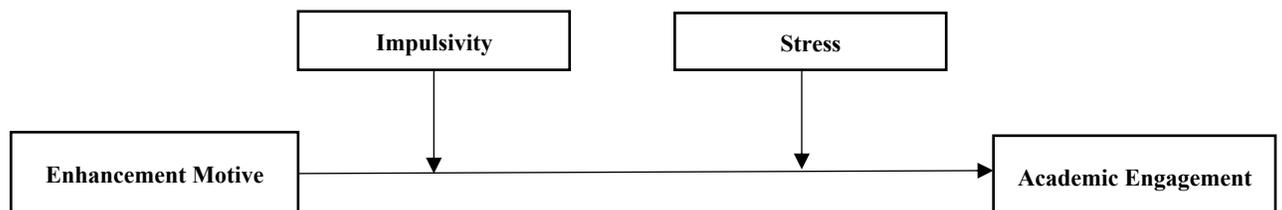
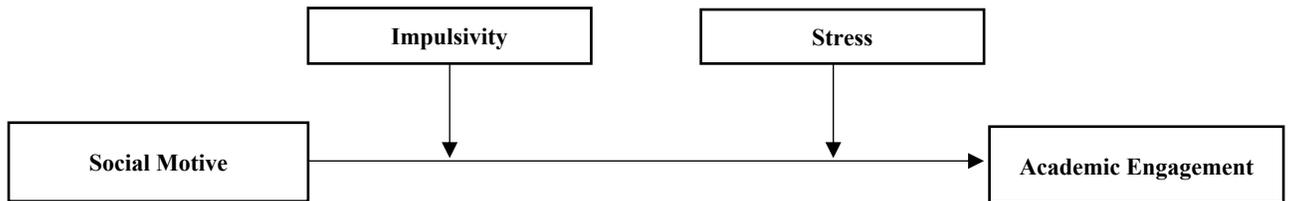


Figure 11

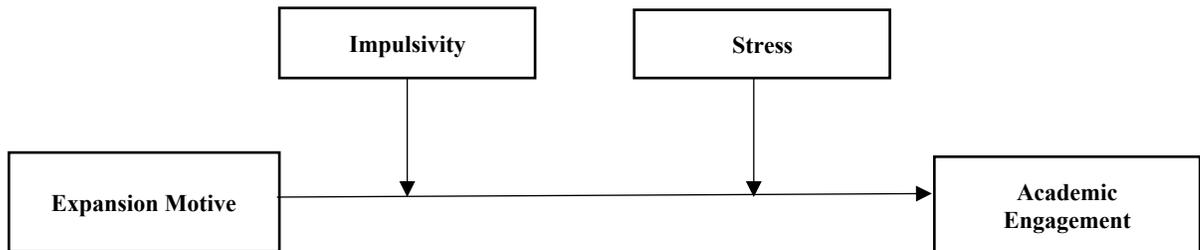
Hypothesized Linear Regression Model of Alcohol Social Motive Predicting Academic Engagement with Potential Moderator Variables



Hypothesis 2b: Self-reported impulsivity and stress would moderate the association between motivation to use marijuana (expansion) and academic engagement.

Figure 12

Hypothesized Linear Regression Model of Marijuana Expansion Motive Predicting Academic Engagement with Potential Moderator Variables



Methods

Participants

Participants {Alcohol use: N=151; mean age = 20.15 (SD = 1.67); 78.1% female; Marijuana use: N=92; mean age = 20.24 (SD = 1.73); 71% female} were recruited from the research pool within the Psychology Department at the University of Windsor. This is an electronic system that allows full- and part-time undergraduate students enrolled in psychology and business courses to receive extra credit for their courses in exchange for

research participation. The study was submitted to and approved by the Research Ethics Board of the University of Windsor. Inclusion criteria required participants to be able to read, write, and speak English. No other exclusionary criteria were used.

To assess current alcohol use, only participants who reported alcohol use within the past six months were included in the analyses. Of the 151 participants, 118 were female, 32 were male, and one identified as other. With regards to ethnicity, 7.3% (N=11) were Asian or Asian descent, 2.6% (N=4) were Southeast Asian, 2.6% (N=4) were Hispanic/Latino, 8.6% (N=13) were non-Hispanic Black or African descent, 66.9% (N=101) were non-Hispanic White, Caucasian, or European descent, 6.0% (N=9) were Arab or Middle Eastern descent, and 6.0% (N=9) were an Other/Mixed descent. With regards to year of study, 17.9% were in their first year, 31.8% in their second year, 28.5% in their third year, 17.2% in their fourth year, and 4.6% in their fifth year or above.

To assess current marijuana use, only participants who reported marijuana use within the past year were included in the analysis. Of the 92 participants, 65 were female, 26 were male, and one identified as other. With regards to ethnicity, 3.3% (N=3) were Asian or Asian descent, 3.3% (N=3) were Southeast Asian, 1.1% (N=1) was Hispanic/Latino, 12.0% (N=11) were non-Hispanic Black or African descent, 66.3% (N=61) were non-Hispanic White, Caucasian, or European descent, 8.7% (N=8) were Arab or Middle Eastern descent, and 5.4% (N=5) were an Other/Mixed descent. With regards to year of study, 17.4% were in their first year, 30.4% in their second year, 31.5% in their third year, 16.3% in their fourth year, and 4.3% in their fifth year or above.

Power Analysis

A power analysis was conducted using G*Power, v3.1 (Faul et al., 2009) to determine the sample size for a multiple regression with two tested predictors and five predictor variables. Cohen's F, calculated by taking the square root of eta-squared, or the proportion of explained variance to unexplained variance, was used as the index of effect size for the current study (Faul et al., 2009). A minimum detectable effect size of 0.11 was chosen. Under the assumptions, a total sample size of approximately 91 was required to achieve a power level greater than 0.80.

Measures

See Appendices C, F, and G for each of the measures of the present study.

Demographics. A questionnaire was filled out by the participants to collect demographic information. Information was collected regarding participants' age, gender, ethnicity, marital status, education level, and GPA. This demographic information was used to describe the sample, with GPA as a proxy for academic success. Major GPA was used for students above first year.

Barratt Impulsiveness Scale. The Barratt Impulsiveness Scale (BIS-11; Patton et al., 1995) was completed by participants. The scale is a 30-item measure of trait impulsivity, with participants responding on a Likert scale ranging from 1 (never/rarely) to 4 (almost always/always). It is the most widely used measure of impulsivity in the literature. Three impulsivity factors have been created in the scale: attentional (e.g., "I am restless at the theater or lectures."), motor (e.g., "I do things without thinking"), and non-planning (e.g., "I am a careful thinker"). The scale has demonstrated good internal consistency, with a reported Cronbach's alpha coefficient of 0.83, as well as good test-

retest reliability, with a Spearman's rho of 0.83 in a recent sample (Stanford et al., 2009). Good internal consistency was found for the present study, with a Cronbach's alpha of 0.84.

Alcohol Frequency Index. Following the work of Simons and colleagues (2000), anchored self-report ratings were used, as Hays and Huba (1988) reported anchored rating scales for 12-month use with good test-retest correlations of 0.83 or greater across different drugs in a college student sample. Past 6-month use were measured with 9-point anchored rating scales: (0) no use, (1) less than once a month but at least once in the last 6 months, (2) once a month, (3) 2–3 times/month, (4) once or twice/week, (5) 3–4 times/week, (6) nearly every day, (7) once a day, and (8) more than once a day. Participants also provided the number of alcoholic drinks they typically have when drinking. Lifetime experience using marijuana and alcohol were also assessed by 9-point anchored rating scales; (0) no use, (1) 1–5 times, (2) 6–9 times, (3) 10–19 times, (4) 20–39 times, (5) 40–59 times, (6) 60–79 times, (7) 80–99 times, and (8) 100 or more times. Simon and colleagues (2000) reported good internal consistency for this scale in the normative sample, with a Cronbach's alpha coefficient of 0.85. Adequate internal consistency was found for the present study, with a Cronbach's alpha of 0.70.

Daily Sessions, Frequency, Age of Onset, and Quantity of Cannabis Use Inventory (DFAQ-CU; Cuttler & Spradlin, 2017). A modified version of the DFAQ-CU was utilized to collect frequency of marijuana use. The 16-item section measuring frequency and method of use was administered rather than the entire measure, as it is rather lengthy, and frequency of use is the area of importance for the present study. Examples of questions include: “Which of the following best captures the average

frequency you currently use cannabis?,” “Which of the following best captures your pattern of cannabis use throughout the week?,” and “What is the primary method you use to ingest cannabis?” The measure has been reported to have good convergent, discriminant, and predictive validity as well as good reliability, with Cronbach’s alphas ranging from 0.69 to 0.95 in the normative sample (Cuttler & Spradlin, 2017).

Drinking Motives Questionnaire, Revised (DMQ-R). The Drinking Motives Questionnaire (Cooper, 1994) is a 20-item self-report measure to gauge motive for drinking alcohol. These four motives include: social (drinking to be sociable, to celebrate parties), coping (drinking because it makes you forget about problems), enhancement (drinking to feel better or to be able to do things otherwise impossible), and social pressure and conformity (drinking because others do, to fit in). The participant is asked to respond to each statement about motivation for drinking alcohol on a Likert-type scale ranging from 1 (almost never/never) to 5 (almost always/always). Examples of items include “To forget about your problems” and “To be sociable.” This factor structure of alcohol motivation has been replicated by Kuntsche et al. (2006), with the measure reported to have good validity (Cooper, 1994). Adequate internal consistency was found for the present study for the coping (Cronbach’s $\alpha=0.75$), enhancement (Cronbach’s $\alpha=0.72$), and social subscales (Cronbach’s $\alpha=0.80$) with a Cronbach’s alpha of 0.88.

The Marijuana Motives Measure (MMM). The Marijuana Motives Measure (Lee et al., 2009) consists of 25 questions about the participants’ reasons for using marijuana. These reasons fall into one of five categories for social, coping, enhancement, conformity, and expansion motives. The participant is asked to respond to each statement

about reasons for using marijuana on a Likert-type scale ranging from 1 (almost never/never) to 5 (almost always/always), with examples of measure items including “Because it makes social gatherings more fun,” “So I won’t feel left out,” and “To understand things differently.” The measure was reported to have good validity in a previous study (Lee et al., 2009). Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.89.

Undergraduate Engagement Scale. The undergraduate engagement scale is a 16-item measure of academic engagement currently being developed by Dr. Carlin Miller and her research group. Participants responded on Likert scale ranging from 0 (never) to 4 (always). Examples of items include: “When I am having trouble with a course or an assignment, I work with other students,” “I come to class having completed readings or assignments,” and “I study with other students.” This measure is currently undergoing validity trials, but early evidence from unpublished data suggests it is both reliable and valid. There are no comparable measures with language that is contextually appropriate that have been published. Good internal consistency was found for the present study, with a Cronbach’s alpha of 0.88.

The Perceived Stress Scale (PSS). The Perceived Stress Scale (Cohen et al., 1983) is a 10-item self-report measure of stress and is the most widely used measure of perceived stress. Participants responded on a Likert-type scale ranging from 0 (never) to 4 (very often). Examples of items include “In the last month, how often have you found that you could not cope with all the things that you had to do?” and “In the last month, how often have you been upset because of something that happened unexpectedly?” A number of studies have reported good internal consistency and validity for the measure

(Cohen & Williamson, 1988; Roberti et al., 2006; Lee, 2012). Good internal consistency was found for the present study, with a Cronbach's alpha of 0.86 to 0.88.

Procedures

The data collection was completed in-person in small groups (5-8 participants) in university space allocated for research. Measures took approximately one hour to complete. Prior to participating, the primary investigator took participants through the informed consent process, including description of the study and information about risks and benefits of participating, confidentiality, and the right to withdraw, and answered any remaining questions. After consent was obtained from all participants, the aforementioned measures were administered with the order of the measures randomly assigned. Data were double-entered by trained research assistants and cleaned by the primary investigator.

Data Analysis

Missing Data

To address issues around missing data, all data were screened in order to determine the pattern by which the data were missing. The Missing Completely at Random (MCAR) test was conducted to determine if the data were missing completely at random. All data except for the undergraduate engagement scale (UES) were MCAR, with visual inspection of the data revealing the UES data to be missing at random. Missing data were replaced via the expectation-maximization algorithm of SPSS for all variables (Dong & Peng, 2013), except for the BIS, for which the series mean for each variable was used, as per the guidelines of the measure's author.

Assumptions

The assumptions of a linear regression analysis were checked prior to completing the analysis. Specifically, adequate sample size, normality, linearity, absence of multicollinearity, absence of outliers, homoscedasticity of errors, and independence of errors. All assumptions were met, except for multicollinearity for the alcohol analysis. The alcohol motives were examined in separate regression analyses rather than one analysis, which resolved the multicollinearity violation.

Model of Analysis

Three linear regressions were utilized to determine the ability of current self-reported motivation to use alcohol (enhancement, social, and coping) to predict academic engagement. A fourth linear regression was used to determine the ability of current self-reported motivation to use marijuana (expansion) to predict academic engagement. Impulsivity and stress were included as moderator variables in both regression models. All predictor variables were mean-centered to allow for better interpretation (Cohen et al. 2003).

Results

Motivation to Use Alcohol

Contrary to predictions, the coping motive ($r = -.005$; $p = .95$), enhancement motive ($r = .01$; $p = .87$), and social motive ($r = .02$; $p = .82$) were not significantly correlated with academic engagement.

Coping

The regression model was statistically significant, $F(5,145) = 3.51, p = .005$. R^2 for the overall model was 10.8% with an adjusted R^2 of 7.7%. This finding is considered a small size effect according to Cohen (1988). Coping motive ($B = 1.72, SE = 1.01, t = 1.71, p = .09$) was not a significant predictor of academic engagement. Impulsivity ($B = -.31, SE = .08, t = -3.88, p < .001$) was a significant predictor of academic engagement, whereas stress ($B = -.05, SE = .11, t = -.45, p = .65$) was not a significant predictor of academic engagement.

Contrary to expectations, impulsivity ($B = .001, SE = .09, t = .02, p = .99$) and stress ($B = -.11, SE = .11, t = -1.02, p = .31$) did not act as moderators, as these predictors did not increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = .007; Fchange(2,145) = .55; p = .58$).

Enhancement

The regression model was statistically significant, $F(5,145) = 3.73, p = .003$. R^2 for the overall model was 11.4 % with an adjusted R^2 of 8.4%. This finding is considered a small size effect according to Cohen (1988). Enhancement motive ($B = 2.70, SE = 1.26, t = 2.15, p = .03$), was a significant predictor of academic engagement. Impulsivity ($B = -.32, SE = .08, t = -4.08, p < .001$) was a significant predictor of academic engagement, but stress ($B = -.08, SE = .11, t = -.73, p = .46$) was not a significant predictor of academic engagement.

Contrary to predictions, impulsivity ($B = .005, SE = .09, t = .05, p = .96$) and stress ($B = -.12, SE = .13, t = -.89, p = .37$) did not act as moderators, as these predictors did not

increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = .005$; $F_{change}(2,145) = .41$; $p = .67$).

Social

The regression model was statistically significant, $F(5,145) = 3.39$, $p = .006$. R^2 for the overall model was 10.5% with an adjusted R^2 of 7.4%. This finding is considered a small size effect according to Cohen (1988). Social motive ($B = 1.46$, $SE = .90$, $t = 1.63$, $p = .11$) was not a significant predictor of academic engagement. Impulsivity ($B = -.30$, $SE = .08$, $t = -3.90$, $p < .001$) was a significant predictor of academic engagement, whereas stress ($B = -.03$, $SE = .11$, $t = -.26$, $p = .80$) was not a significant predictor of academic engagement.

Contrary to expectations, impulsivity ($B = .006$, $SE = .08$, $t = .08$, $p = .94$) and stress ($B = -.08$, $SE = .11$, $t = -.73$, $p = .46$) did not act as moderators, as these predictors did not increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = .003$; $F_{change}(2,145) = .28$; $p = .76$).

Post Hoc Analyses

Given the results of the regression, it appeared as though enhancement was in fact a suppressor variable, thus a mediator in the association between impulsivity and academic engagement. The PROCESS macro via SPSS was used to determine if the enhancement motive mediates the association between impulsivity and academic engagement. Results were not statistically significant, with enhancement (Indirect effect (B)=0.06, CI= -0.006 – 0.14) not found to mediate the association between impulsivity and academic engagement. Although this was found, researchers have argued for a newer concept of mediation in which a significant indirect path between the predictor and

outcome variable is not needed for a variable to be a mediator (MacKinnon et al., 2002; Pek & Hoyle, 2016). Instead, a variable is a mediator if the predictor variable significantly predicts the mediator, and the mediator significantly predicts the outcome variable (Pek & Hoyle, 2016). With this approach, mediation is no longer about identifying an explanatory variable, as is the case with the traditional mediation approach, but about the effect carried by the intervening variable (i.e., mediator; Pek & Hoyle, 2016). Using this approach, impulsivity predicts enhancement ($F(1,149)=34.85, p<0.001$) and in turn enhancement significantly predicts academic engagement ($p=0.05$), thus enchantment can be viewed as a mediator.

Following the suggestions made by the committee at the progress meeting, the regression analyses for coping, enhancement, and social motives were reanalyzed with the same variables, with high school GPA added as a potential moderator variable. High school GPA was not found to be a significant predictor or moderator ($B = .02, SE = .10, t = .16, p = .87; B = .14, SE = .13, t = 1.11, p = .27$) for the coping motive, respectively; for the enhancement motive ($B = .03, SE = .11, t = .36, p = .72; B = .006, SE = .01, t = .69, p = .49$); and for the social motive ($B = .02, SE = .10, t = .19, p = .85; B = .05, SE = .11, t = .42, p = .68$). Another suggestion from the committee was to examine if there is an association between frequency of alcohol use and change in standardized GPA between high school and university. Difference between high school and university GPA was not significantly associated with frequency of alcohol use ($r = -.07, p = .43$).

Motivation to Use Marijuana

Contrary to predictions, the marijuana motive of expansion was not significantly correlated with academic engagement ($r = .16; p = .06$). Moreover, the relationship

between expansion and academic engagement, predicted to be a negative correlation, was a positive correlation.

The regression model was statistically significant, $F(5,86) = 2.88, p = .02$. R^2 for the overall model was 14% with an adjusted R^2 of 9%. This finding is considered a small size effect according to Cohen (1988). Expansion motive ($B = 2.48, SE = 1.08, t = 2.29, p = .02$) was a significant predictor of academic engagement. Impulsivity ($B = -.32, SE = .10, t = -3.17, p = .004$) was a significant predictor of academic engagement, whereas stress ($B = -.11, SE = .15, t = -.76, p = .45$) was not a significant predictor of academic engagement.

Contrary to hypotheses, impulsivity ($B = -.02, SE = .09, t = -.22, p = .82$) and stress ($B = -.01, SE = .14, t = -.60, p = .95$) did not act as moderators, as these predictors did not increase the amount of variance in academic engagement accounted for by the model when entered as moderators ($\Delta R^2 = ; Fchange(2, 86) = .03; p = .97$).

Post Hoc Analyses

Given the results of the regression, it appeared as though expansion was in fact a suppressor variable, thus a mediator in the association between impulsivity and academic engagement. The PROCESS macro via SPSS was used to determine if the expansion motive mediates the association between impulsivity and academic engagement. Results were not statistically significant, with expansion (Indirect effect (B)=0.04, CI= -0.009 – 0.13) not found to mediate the association between impulsivity and academic engagement. As previously mentioned, a variable is a mediator if the predictor variable significantly predicts the mediator, and the mediator significantly predicts the outcome variable (MacKinnon et al., 2002; Pek & Hoyle, 2016). Using this approach, impulsivity

predicts expansion ($F(1,90)=3.87, p=0.05$) and in turn expansion significantly predicts academic engagement ($p=0.02$), thus expansion can be considered a mediator.

Following the suggestions made by the committee at the progress meeting, the regression analysis for the expansion motive was reanalyzed with the same variables, with high school GPA added as a potential moderator variable. High school GPA was not found to be a significant predictor of academic engagement ($B = .09, SE = .14, t = .63, p = .53$) or moderator ($B = -.001, SE = .01, t = -.08, p = .94$). Another suggestion from the committee was to examine if there is an association between frequency of marijuana use and change in GPA between high school and university. Difference between standardized high school and university GPA was not significantly associated with frequency of marijuana use ($r = -.07, p = .56$). A third suggestion to better discriminate between types of marijuana users was to compare the academic engagement of non/nonfrequent users of marijuana to more frequent users of marijuana. Examination of the frequency distributions suggested that students who do not currently use marijuana (but have at some point in their life), use less than once a year, or use once a year could be grouped into the *non-user* group. Individuals who never used marijuana in their life were also added to the non-user group. Those who used once every three to six months or greater were grouped into the *frequent user* group. A T-test did not find a significant difference in academic engagement between the non-user group and the frequent user group ($t(192) = 1.46, p = .15$).

Table 9*Descriptive Statistics of Alcohol Analysis*

	Mean (SD)	Range	Cronbach's Alpha
Alcohol – Coping	2.63 (.85)	1-4.6	.75
Alcohol – Enhancement	1.75 (.77)	1-4.2	.72
Alcohol – Social	2.86 (.94)	1-5	.80
Impulsivity	62.13 (10.71)	42-95	.84
Stress	19.86 (7.27)	0-39	.88
Academic Engagement	35.62 (9.59)	9-64	.85

Note. SD = standard deviation.

Table 10*Descriptive Statistics of Marijuana Analysis*

	Mean (SD)	Range	Cronbach's Alpha
Marijuana - Expansion	1.91 (0.98)	1-4.6	.89
Impulsivity	63.50 (10.83)	45-95	.84
Stress	20.57 (7.07)	4-36	.86
Academic Engagement	34.64 (10.53)	9-64	.88

Note. SD = standard deviation.

Table 11*Intercorrelations of Variables with Alcohol Use Motives*

	1	2	3	4	5	6
1. Coping	-	.72***	.87***	.43***	.30***	-.005
2. Enhancement	.71***	-	.65***	.43***	.40***	.01
3. Social	.87***	.65***	-	.37***	.24**	.02
4. Impulsivity	.43***	.43***	.37***	-	.27***	-.29***
5. Stress	.30***	.40***	.23**	.27***	-	-.08
6. Academic Engagement	-.005	.01	.02	-.29***	-.08	-

Note. * $p \leq 0.05$, ** $p \leq 0.01$; *** $p \leq 0.001$

Table 12*Intercorrelations of Variables with Marijuana Use Motive*

	1	2	3	4
1. Marijuana - Expansion	-	.23*	.06	.16
2. Impulsivity	.23*	-	.21*	-.29**
3. Stress	.06	.21*	-	-.13
4. Academic Engagement	.16	-.29**	-.13	-

Note. * $p \leq 0.05$, ** $p \leq 0.01$; *** $p \leq 0.001$

Table 13*Linear Regression of Coping Motive Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Alcohol - Coping	-.06	.92	-.06	.95	-1.88-1.77
2	Alcohol - Coping	1.75	1.00	1.75	.08	-.22-3.73
	Impulsivity	-.31***	.08	-3.93	<.001	-.47- -.15
	Stress	-.05	.11	-.41	.68	-.26-.17
3	Alcohol - Coping	1.72	1.01	1.71	.09	-.26-3.71
	Impulsivity	-.31***	.08	-3.88	<.001	-.46- -.15
	Stress	-.05	.11	-.45	.65	-.27-.17
	Impulsivity X Coping	.001	.09	.02	.99	-.17-.17
	Stress X Coping	-.11	.11	-1.02	.31	-.33-.11

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 14*Linear Regression of Social Motive Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Alcohol - Social	.19	.84	.23	.82	-1.46-1.85
2	Alcohol - Social	1.53	.87	1.76	.08	-.19-3.25
	Impulsivity	-.30***	.08	-3.91	<.001	-.45- -.15
	Stress	-.03	.11	-.30	.76	-.25-.18
3	Alcohol - Social	1.46	.90	1.63	.11	-.31-3.24
	Impulsivity	-.30***	.08	-3.90	<.001	-.46- -.15
	Stress	-.03	.11	-.26	.80	-.24-.19
	Impulsivity X Social	.006	.08	.08	.94	-.15-.16
	Stress X Social	-.08	.11	-.73	.46	-.29-.13

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 15*Linear Regression of Enhancement Motive Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Alcohol - Enhancement	.16	1.02	.16	.87	-1.85-2.18
2	Alcohol - Enhancement	.238*	1.14	2.10	.04	.14-4.63
	Impulsivity	-.32***	.08	-4.07	<.001	-.47- -.16
	Stress	-.08	.11	-.71	.48	-.30-.14
3	Alcohol - Enhancement	2.70*	1.26	2.15	.03	.21-5.19
	Impulsivity	-.32***	.08	-4.08	<.001	-.48- -.17
	Stress	-.08	.11	-.73	.46	-.31-.14
	Impulsivity X Enhancement	.005	.09	.05	.96	-.17-.18
	Stress X Enhancement	-.12	.13	-.89	.37	-.38-.14

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 16*Mediation Analysis of Enhancement Motive Predicting Academic Engagement*

Outcome Variable	Predictor	β	SE	t	p	95% CI for β
Enhancement	Impulsivity	.03***	.00	5.90	<.001	.02-.04
Academic Engagement	Impulsivity	-.32***	.07	-4.19	<.001	-.48- -.17
	Enhancement	2.12*	1.07	1.98	.05	-.00-4.24
Direct effect of impulsivity on academic engagement		-.32***	.07	-4.19	<.001	-.47- -.17
Indirect effect of impulsivity on academic engagement (via enhancement)		.06	.04	-	-	-.006- .14

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Table 17*Linear Regression of Expansion Motive Predicting Academic Engagement*

Step	Predictor	Unstandardized B	SE	t	p	95% CI for B
1	Marijuana - Expansion	1.72	1.12	1.54	.13	-.5-3.94
2	Marijuana - Expansion	2.48*	1.08	2.29	.02	.33-4.64
	Impulsivity	-.32**	.10	-3.17	.002	-.52- -.12
	Stress	-.11	.15	-.76	.45	-.41-.18
3	Marijuana - Expansion	2.51*	1.11	2.26	.03	.31-4.71
	Impulsivity	-.31**	.10	-2.99	.004	-.52- -.10
	Stress	-.12	.15	-.76	.45	-.42-.19
	Impulsivity X Expansion	-.02	.09	-.22	.82	-.19-.15
	Stress X Expansion	-.008	.14	-.06	.95	-.28-.27

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

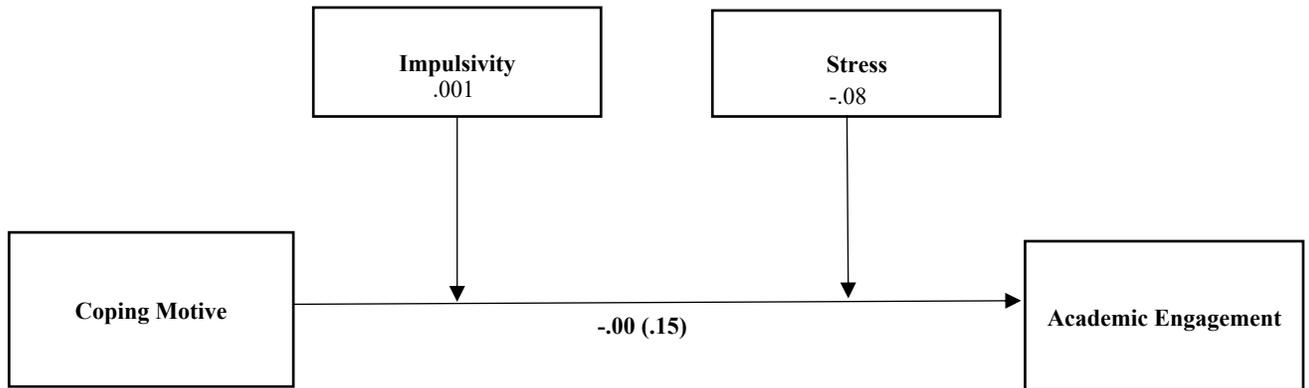
Table 18*Mediation Analysis of Expansion Motive Predicting Academic Engagement*

Outcome Variable	Predictor	β	<i>SE</i>	<i>t</i>	p	95% CI for β
Expansion	Impulsivity	.02*	.01	1.97	.05	-.00-.04
Academic Engagement	Impulsivity	-.33***	.10	-3.40	.001	-.53- -.14
	Expansion	2.47*	1.08	2.28	.03	.32-4.61
Direct effect of impulsivity on academic engagement		-.33***	.10	-3.40	.001	-.53- -.14
Indirect effect of impulsivity on academic engagement (via expansion)		.04	.04	-	-	-.009-.14

* $p \leq .05$; ** $p \leq .01$; *** $p \leq .001$

Figure 13

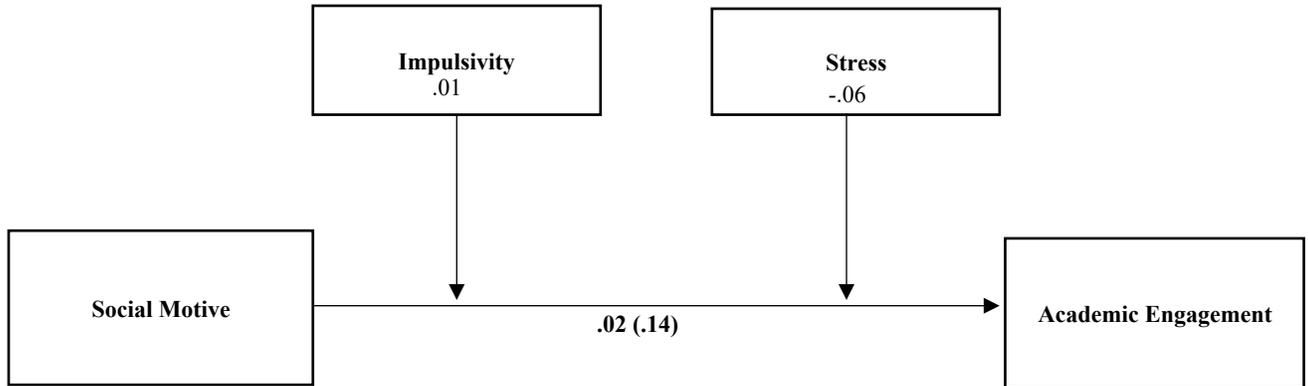
Linear Regression Model of Alcohol Coping Motive Predicting Academic Engagement with Potential Moderator Variables



Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$. Values are standardized beta-coefficients. For the association between coping motive and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator variables is the beta-coefficient of the interaction of that variable with coping motive.

Figure 14

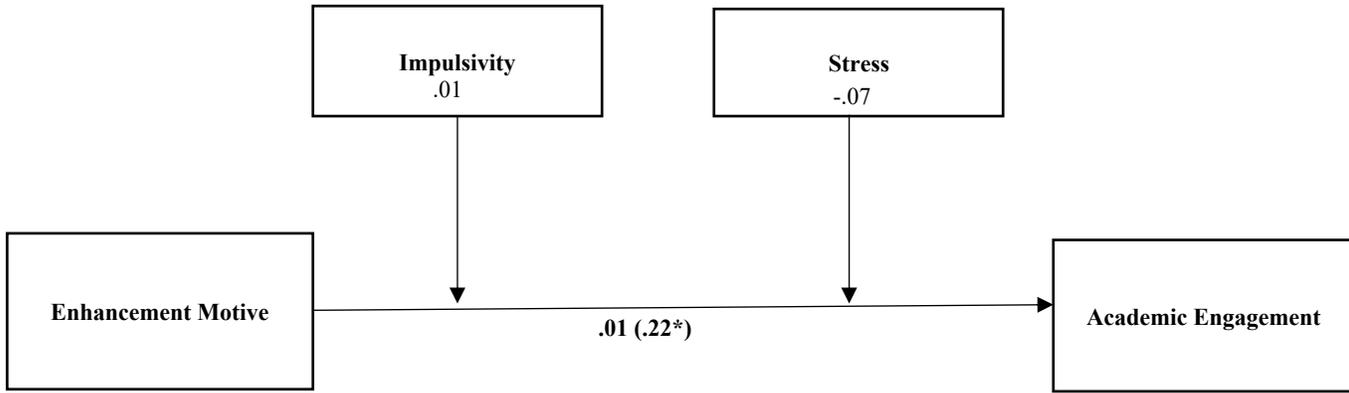
Linear Regression Model of Alcohol Social Motive Predicting Academic Engagement with Potential Moderator Variables



Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$. Values are standardized beta-coefficients. For the association between social motive and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator variables is the beta-coefficient of the interaction of that variable with social motive.

Figure 15

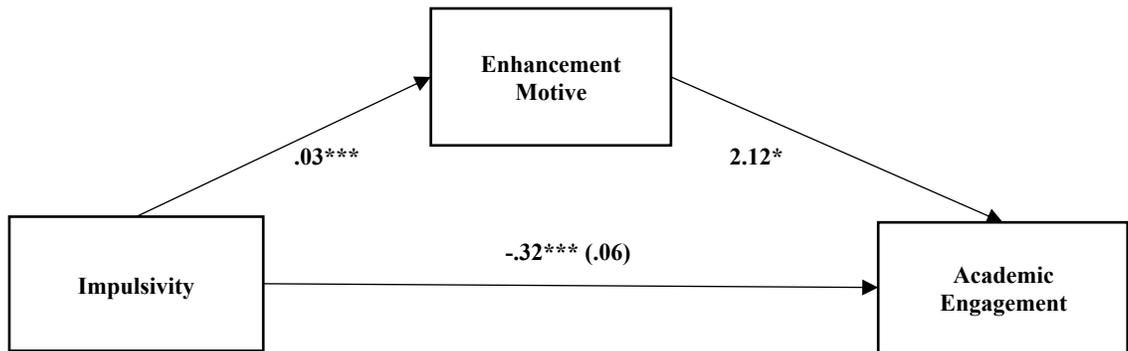
Linear Regression Model of Alcohol Enhancement Motive Predicting Academic Engagement with Potential Moderator Variables



Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$. Values are standardized beta-coefficients. For the association between enhancement motive and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator variables is the beta-coefficient of the interaction of that variable with enhancement motive.

Figure 16

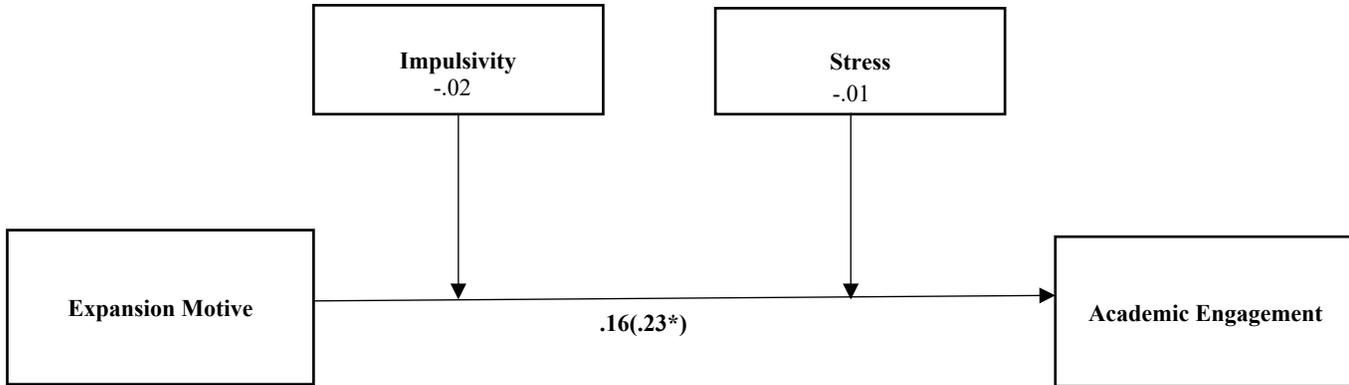
Linear Regression Model of Impulsivity Predicting Academic Engagement with Alcohol Enhancement Motive Mediating the Association



Note. * $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$. Values are B-coefficients. For the association between impulsivity and academic engagement, the value outside of parentheses is the B-coefficient of the direct effect, and the value inside parentheses is the B-coefficient of the indirect effect of enhancement.

Figure 17

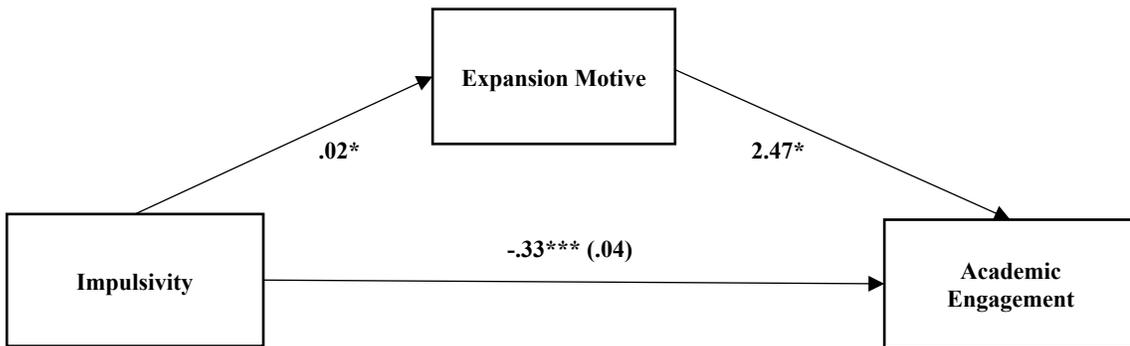
Linear Regression Model of Marijuana Expansion Motive Predicting Academic Engagement with Potential Moderator Variables



Note. $*p \leq 0.05$; $**p \leq 0.01$; $***p \leq 0.001$. Values are standardized beta-coefficients. For the association between expansion motive and academic engagement, the value outside of parentheses is the beta-weight of the association between the two variables, and the value inside parentheses is the beta-weight once all of the variables are included in the model. The value directly below the potential moderator variables is the beta-coefficient of the interaction of that variable with expansion motive.

Figure 18

Linear Regression Model of Impulsivity Predicting Academic Engagement with Marijuana Expansion Motive Mediating the Association



Note. $*p \leq 0.05$; $**p \leq 0.01$; $***p \leq 0.001$. Values are B-coefficients. For the association between impulsivity and academic engagement, the value outside of parentheses is the B-coefficient of the direct effect, and the value inside parentheses is the B-coefficient of the indirect effect of expansion.

Discussion

The present study enhances understanding of how motivation to use alcohol and marijuana is associated with academic engagement. The substance use literature, including alcohol and marijuana, has examined the association between substance use and academic success, as well as how impulsivity is associated with substance use. Moreover, the literature examines how motivation to use alcohol and marijuana can result in various negative consequences, such as engaging in risky behaviours (Cyders et al., 2009). The present findings suggest that an enhancement motive of alcohol use is a predictor of academic engagement, and that an expansion motive of marijuana use is a predictor of academic engagement. Contrary to predictions, a social motive and coping motive of alcohol use were not found to predict academic engagement.

Coping, enhancement, and social motives for alcohol use were not significantly correlated with academic engagement, which is inconsistent with hypotheses. Also inconsistent with predictions, an expansion motive of marijuana use was not correlated with academic engagement. Alcohol and marijuana use among university students has been associated with decreased academic success across the literature (Arria et al., 2013; Philips et al., 2015; Presley & Pimentel, 2006; Singleton, 2007). Alcohol consumption was associated with poorer grades even when controlling for SAT scores and class rank (Singleton, 2007). Marijuana misuse has also been associated with decreased academic achievement in a number of studies (Arria et al., 2015; Fergusson et al., 2003; Horwood, 2010), thus, highlighting the potential negative impact of marijuana and alcohol misuse on academic success. Given the literature, it would be expected that motives for alcohol and marijuana use are associated with academic engagement given the association with

poor academic achievement noted across studies. The findings suggest that academic engagement is distinct from academic achievement with regards to substance use.

The enhancement motive of alcohol use and impulsivity were found to be predictors of academic engagement. Contrary to predictions, stress was not found to be a predictor of academic engagement, nor were impulsivity or stress moderators in the association between enhancement and academic engagement. The enhancement of internal affective states has been found to predict drinking rates and alcohol-related problems (LaBrie et al., 2007). Mood enhancement, an internal motive of positive reinforcement to increase positive internal states, has been associated with patterns of frequent and heavy drinking (Colder & O’Conner, 2002; LaBrie et al., 2007; Stewart and Chambers, 2000). It would therefore be expected that individuals who are experiencing stress are more likely to misuse alcohol as a means of enhancing their mood, which is consistent with the present findings, as the enhancement motive was positively associated with stress. Impulsivity has also been associated with an enhancement motive for alcohol use (Jones et al., 2014), which is understandable given that individuals who are more impulsive are more likely to use alcohol as a means to improve their mood despite its negative consequences, rather than utilizing other mood enhancing outlets that are not problematic (e.g., exercise). It is important to consider that the enhancement motive predicted academic engagement, despite not being associated with academic engagement. However, the enhancement motive predicted academic engagement when impulsivity was also entered into the model, but enhancement was not a significant predictor when entered as the sole variable. Therefore, it is impulsivity that impacts enhancement in predicting academic engagement, and enhancement mediates the association between

impulsivity and academic engagement. The findings suggest that those with higher levels of enhancement report higher levels of academic engagement. Moreover, impulsivity predicts enhancement, which in turn predicts academic engagement. This suggests that higher levels of impulsivity lead to higher levels of enhancement, in turn resulting in higher levels of academic engagement. However, as higher impulsivity results in lower academic engagement, academic engagement does not seem to be impacted by enhancement among those high in impulsivity. At higher levels of impulsivity, academic engagement is rather similar across levels of enhancement (i.e., low and high), suggesting that enhancement does not have much impact on academic engagement at high levels of impulsivity. Generally, academic engagement levels decrease as impulsivity increases. The effect of enhancement is particularly noticeable at lower levels of impulsivity, where individuals high in enhancement and low in impulsivity report more academic engagement than those low in enhancement and low in impulsivity. This suggests that enhancement leads to greater academic engagement in general, with the effects most beneficial at lower levels of impulsivity, given that lower levels of impulsivity generally result in higher academic engagement. The causal nature of the association between enhancement and academic engagement cannot be determined from the current data, but a potential explanation is that students who use alcohol to improve their mood are more likely to engage in their academics due to their improved mood. A number of studies have identified positive mood as influencing academic performance (Bolte et al., 2003; Fredrickson & Branigan, 2005; Steele & Fullagar, 2008). As such, the positive mood that results from alcohol use (i.e., enhancement motive) may result in greater academic engagement.

Contrary to hypothesized, the social motive for alcohol use did not predict academic engagement, nor was stress a predictor of academic engagement or a moderator in the model. Impulsivity was a predictor of academic engagement in this model, although it was not a moderator. LaBrie et al. (2007) found that social motivation was the most frequently reported motive for drinking. It would therefore be expected that drinking for social reasons would be common among the present sample, and would result in decreased academic engagement due to choosing to attend social drinking events instead of working on school activities. However, the latter was not the case, as the social motive was not associated with or a predictor of academic engagement. Consistent with the literature, the social motive was the motive with the highest score (i.e., the most reported). Students experiencing stress may choose to drink alcohol in social settings with peers who are likely relatable and experiencing similar stress as them. Moreover, students who are more impulsive would also be expected to give into peer pressure or accept invitations to social gatherings to drink alcohol, even if such activities took away from their time to complete their schoolwork. This is consistent with the present findings, as the social motive was significantly associated with impulsivity and stress, suggesting that those who are more impulsive and experience more stress are more likely to drink for social reasons.

Inconsistent with predictions, the coping motive of alcohol use was not found to predict academic engagement. Stress was not found to predict academic engagement in this model, nor was it a moderator variable. However, impulsivity was found to predict academic engagement, although it did not serve as a moderator. Coping motives, which decrease negative internal states, have been found to predict heavy drinking, social and

occupational problems, and greater tolerance and withdrawal symptoms (Cooper et al., 1992; LaBrie et al., 2007). Moreover, impulsivity has been associated with coping motives (Jones et al., 2014), which is consistent with the present findings. It would be expected that individuals who are experiencing stress are more likely to turn to alcohol as a coping method, thus impacting their academic performance, including their academic engagement. As would be expected, coping was associated with greater stress, although coping was not associated with academic engagement. Alcohol reduces negative affective states associated with stress, which reinforces consumption and increases the probability of alcohol use when experiencing stress (Conger, 1956; Park et al., 2004).

Across the three models, stress was not found to be a predictor of academic engagement, nor was it associated with academic engagement. Those who endorsed the three motives were more likely to report higher levels of stress, which is consistent with the literature. The findings indicate that stress levels do not influence academic engagement. Similarly, the three motives were not associated with academic engagement. Together, the results suggest that social and coping drinking motives and stress do not impact students' engagement with their academics. Therefore, poor academic achievement among those who report higher levels of drinking and report social and coping motives, as evidenced in the literature, may not be due to a lack of academic engagement. However, those who report an enhancement motive are more likely to engage in their academics due to higher levels of impulsivity. Across all of the models, high school GPA was not found to predict academic engagement, nor moderate the association between the substance use motive and academic engagement. This finding suggests that high school GPA does not seem to impact how students engage with their

academic in university, nor does high school GPA contribute to an association between substance use motives and academic engagement. Moreover, a potential change in GPA from high school to university was not associated with frequency of alcohol or marijuana use. This finding suggests that students are not more likely to use more alcohol or marijuana if their university GPA decreases compared to their high school GPA. Indeed, this suggests that students are not using more alcohol or marijuana due to decreased grades in university, nor is greater alcohol or marijuana use resulting in decreased grades compared to high school.

As hypothesized, the expansion motive of marijuana use was found to predict academic engagement. However, contrary to hypotheses, higher levels of the expansion motive predicted higher levels of academic engagement. Impulsivity was also found to predict academic engagement in this model, although stress was not a predictor. Impulsivity and stress were not found to moderate the association between expansion motive and academic engagement. In previous research, marijuana use was mainly associated with expansion motives (Simons et al., 2000). Marijuana leads to the enhancement of perceptual and cognitive experience, therefore *expansion* refers to these desired experiences resulting in a new awareness of the self, as well as one's relationships with others and nature (Simons et al., 1998). The desire to expand one's awareness may be impacted by the individual's life circumstances in that those experiencing stress may want an escape from their thoughts and seek an alternative way to view things in their life. Indeed, greater stress has been associated with increased marijuana use among adolescents and young adults (Siqueira et al., 2001). The present findings are inconsistent with the literature, as the expansion motive was not associated

with stress. Moreover, the present findings suggest that students who report the expansion motive also report higher levels of impulsivity. Students who are more impulsive are more likely to use marijuana to achieve its desired effects (e.g., expanding one's awareness), even if doing so impacts their ability to engage in academics. A lack of commitment to academic work could potentially result in skipping classes, which could also be exacerbated by the neurocognitive effects of marijuana smoking or withdrawal symptoms associated with more regular use (Arria et al., 2015). Many of the cognitive deficits associated with marijuana misuse (e.g., attention, processing speed, memory) could impact academic success, as a number of these impairments (e.g., attention, inhibition, and executive functioning) are related to self-regulation in a learning environment (Phillips et al., 2015; Pintrich, 2004; Tangney et al., 2004).

Particularly noteworthy is the finding that the expansion motive was not a significant predictor of academic engagement when it was the sole variable in the model, but became a predictor when impulsivity was also entered. The results suggest that impulsivity predicts expansion, which in turn predicts academic engagement. Therefore, the expansion motive is the mediator variable rather than impulsivity. The findings suggest that those with higher levels of expansion report higher levels of academic engagement. Regardless of level of impulsivity, those with higher expansion report higher academic engagement. Moreover, impulsivity predicts expansion, which in turn predicts academic engagement. This suggests that higher levels of impulsivity lead to higher levels of expansion, in turn resulting in higher levels of academic engagement. However, this does not seem to be the case for those high in impulsivity, as higher impulsivity generally results in lower academic engagement, and academic engagement

does not seem to be impacted by expansion among individuals high in impulsivity. Lower levels of impulsivity predict lower levels of expansion, but, given that lower impulsivity results in higher academic engagement, academic engagement is still rather high despite low levels of expansion. Moreover, at low levels of impulsivity, high expansion results in greater academic engagement compared to low levels of expansion, indicating the benefit of increased expansion. Generally, academic engagement levels decrease as impulsivity increases. The effect of expansion is particularly noticeable at lower levels of impulsivity, as those with higher levels of expansion report more academic engagement compared to those with lower levels of expansion. It is possible that the desire to learn more about oneself and others also translates to academics and results in greater academic engagement. The present findings are inconsistent with previous work suggesting that marijuana use results in poorer academic performance and decreased class attendance (Arria et al., 2013). However, the results indicate that the motive to use marijuana impacts academics differently, and that academic engagement goes beyond class attendance. Indeed, although marijuana misuse is associated with poorer academic performance in the literature, marijuana use for its *expansion* may in fact result in better academic outcomes. As researchers have noted (Lee et al., 2007), it is important to understand marijuana use motives due to their unique consequences. Non-users or non-frequent users of marijuana were not found to significantly differ in their levels of academic engagement compared to more frequent users of marijuana. This suggests that there may not be a specific frequency at which marijuana use impacts academic engagement the greatest. Indeed, the expansion motive appears to influence academic

engagement rather than frequency of marijuana use, indicating the contribution of the motive to engagement.

Limitations

Although the present findings are informative, the study is not without its limitations. Firstly, the ability to generalize the findings is limited as the data were collected from one site. As such, future research may want to collect data from multiple post-secondary sites, including universities and colleges. Second, the present sample primarily consists of females (approximately 71% female for the marijuana analysis and 77% female for the alcohol analyses), which is rather consistent to other university sample studies. The alcohol literature has found that females and males use alcohol for different reasons and with different outcomes (Gleason, 1994; Labrie et al., 2007), thus a larger sample with more males would allow for better generalizability. Third, it is important to consider that some individuals may be reluctant to share their use of alcohol or marijuana, despite the recent legalization of marijuana. Therefore, the rate of alcohol and marijuana use may in fact be higher than reported. However, the rate of alcohol and marijuana use is rather consistent with rates reported nationally and in the literature (CCSA, 2012; Rotermann & Langlois, 2015). It has been noted that self-reports have been found to be valid in confidential research contexts when using measures that are reliable and valid (Lee et al., 2007).

Implications

The present findings suggest that interventions targeting mood may improve academic engagement, as the enhancement motive results in greater academic engagement. Improving mood may be particularly beneficial among students who are less impulsive. In

addition to improving mood, targeting impulsivity may also be beneficial, as impulsivity generally has negative outcomes. Therefore, aiming to decrease impulsivity while improving mood may have the optimal results in terms of increasing academic engagement. Vinci and colleagues (2016) compared the utility of a mindfulness intervention and a muscle relaxation intervention in reducing drinking among college students. It was found that for individuals reporting low levels of negative urgency (i.e., acting impulsively because of negative mood), a mindfulness intervention appears to have a positive effect on urge to drink (Vinci et al., 2016). However, individuals with high negative urgency benefitted most from the relaxation intervention (Vinci et al., 2016). As mindfulness interventions have been useful in decreasing impulsivity among adolescents and adults with ADHD (i.e., high impulsivity; Cairncross & Miller, 2016; Van de Weijer-Bergsma et al., 2012), and mindfulness interventions are increasingly used in the alcohol literature, mindfulness-based techniques may be beneficial for decreasing impulsivity among university students in order to foster academic engagement. Mindfulness techniques have found to also be beneficial for improving mood states. Mindful breathing exercises can be used by educators during individual meetings with students or during lectures. An educator could talk their students through this type of exercise in a lecture setting or during an individual meeting with a student who is reporting difficulty with stress or anxiety around their academics.

The expansion motive of marijuana use was found to predict academic engagement, suggesting that those who use marijuana to get a greater understanding of the self and others engage more in their academics. It may be that those who seek a greater understanding of things are also more determined to increase their academic

knowledge, thus resulting in academic engagement. As intrinsic motivation involves an interest in learning due to knowledge being a reward in itself, implementing techniques that allow for greater intrinsic motivation may also encourage students to seek a greater understanding of various topics. In turn, this interest in seeking knowledge may be similar to the interest in knowledge sought by marijuana users, and may allow for greater academic engagement. Educators may foster intrinsic motivation by asking students what they want out of their lecture sessions, allow for feedback about the format of the course, and allow for choices of assignment topics or modalities (Kusurkar et al., 2011).

Although the feasibility of providing choices may differ based on different factors, such as class size or time restraints, some form of choice should generally be achievable in most settings. The aforementioned tips may be beneficial in improving intrinsic motivation, which may translate to an increased interest in gaining knowledge without the use of marijuana to achieve a similar effect. Future research should examine if an interest in gaining a greater knowledge of academics by promoting intrinsic motivation also results in academic engagement, without the use of marijuana.

CHAPTER 6: GENERAL DISCUSSION

Impulsivity is usually characterized as a less desirable trait, particularly when it is present in multiple aspects of life or is severe. Nevertheless, all people have some degree of impulsivity across time and contexts. Although the literature on impulsivity has greatly focused on behaviours related to acting without thinking or consideration of consequences, various theories of impulsivity have been proposed by different researchers. Generally, impulsivity is referred to as rapid, unplanned reactions to stimuli with inadequate consideration of negative consequences for self or others that may result (Moeller et al., 2001; Patton & Stanford, 2012). Therefore, it would be understandable that individuals with greater impulsivity receive poorer grades, as they may engage in other activities rather than their academics. Indeed, impulsivity is a life-long trait, and greater impulsivity in childhood has been found to impact academic achievement in university years (Mischel et al., 1988; Shoda et al., 1990). Moreover, academic success has been associated with time devoted to studying and completing one's academic work (Van Den Berg & Hofman, 2005). Studies have examined the impact of impulsivity on academic success among university students; however, studies have yet to examine how impulsivity is directly associated with academic engagement. Investigating academic engagement is particularly important given that academic engagement is associated with achievement and is an area of intervention in many post-secondary settings (Alrashidi et al., 2016; Closson & Boutilier, 2017). The general aim of this dissertation was to examine whether impulsivity impacts academic engagement in university students, using the academic achievement literature to guide hypotheses.

Other constructs associated with impulsivity and academic achievement have also been considered in the present study. Higher levels of conscientiousness have been associated with lower levels of impulsivity and higher levels of academic achievement (Trapmann et al., 2007; Zadavec et al., 2005). Elevated neuroticism has been associated with greater impulsivity, although findings with regards to its association with academic achievement are mixed (e.g., Trapmann et al., 2007). Self-efficacy has been found to be associated with greater academic success, including higher first-year GPA and number of credits earned (Zajacova et al., 2005). Self-efficacy has also been associated with greater levels of self-regulation, such that those with greater self-efficacy will likely use adaptive and appropriate study skills (Linnenbrink & Pintrich, 2002). It, therefore, appears that students who report greater self-efficacy are more likely to be academically engaged, as greater self-regulation potentially results in them choosing to focus on academics rather than giving in to distractors. The present study sheds light on the impact of self-efficacy on academic engagement considering the associations found between self-efficacy, self-regulation (i.e., impulsivity), and adaptive study skills. Additionally, stress has been found to be associated with decreased academic success among university students (Gall et al., 2000). The relationship between academic achievement and impulsivity, self-efficacy, stress, and personality have been widely examined. However, little is known about how these constructs may relate to academic engagement. Moreover, although academic engagement and academic achievement have been positively associated, and one may hypothesize that the constructs (e.g., impulsivity, self-efficacy) correlate similarly with academic engagement as they do with achievement, academic engagement must be studied to determine if the similarity is indeed true.

Procrastination is also a key factor in understanding academic success and academic engagement, as it has been associated with lower academic achievement (Steel, 2007). Although procrastination has often been viewed in a negative light, it has been proposed that procrastination can be adaptive in some situations. Therefore, procrastination has been divided into active procrastination and passive procrastination. Research has identified the impact of procrastination on academic achievement (Jackson et al., 2003), but has yet to examine if procrastination may be associated with academic engagement. Determining whether impulsivity affects the association between procrastination and academic engagement will help with further understanding how impulsivity impacts academic performance. Both self-efficacy and an autonomous motivation style are necessary to aid with decreasing procrastination (Katz et al., 2014). Consequently, it would be beneficial to understand the role these constructs play in academic engagement.

Alcohol and marijuana use may also play a role in academic engagement, as alcohol and marijuana misuse among university students has been associated with decreased academic success across the literature (Arria et al., 2013; Philips et al., 2015; Presley & Pimentel, 2006; Singleton, 2007). Alcohol and marijuana misuse have also been associated with higher levels of impulsivity (LaBrie et al., 2014; McDonald et al., 2003). In a large sample of 28,774 undergraduate students, alcohol consumption was associated with lower test grades (Presley & Pimentel, 2006; Singleton, 2007), with a number of other national studies finding lower GPA due to alcohol consumption (Core Institute, 2006; Engs et al., 1996; Singleton, 2007). Marijuana use has also been associated with decreased academic achievement in a number of studies (Arria et al.,

2015; Fergusson et al., 2003; Horwood, 2010). Moreover, occasional marijuana users were also more likely to delay enrollment in or drop out of post-secondary education, with frequent users significantly less likely to enroll, suggesting a potential impact of marijuana use on academic engagement (Homel et al., 2014). The literature has widely examined the effects of alcohol and marijuana misuse on academic success, but little is known with regards to how substance use impacts academic engagement. Given that the different motives for alcohol and marijuana use have been associated with different consequences, it is important to study the motives separately, as reasons for using substances may impact academic differently (Lee et al., 2007). Motivation to use alcohol and marijuana may provide insight as to how substance use is associated with academic engagement.

The present dissertation is composed of three studies, each examining impulsivity and academic engagement to a degree, as well as their association with other variables. The first study sought to examine the association between impulsivity and academic engagement, measuring additional factors, including conscientiousness, neuroticism, self-efficacy, and life stress, that may have moderated the association. It also examined the association between impulsivity and academic achievement and identified if academic engagement played a role in the association. The second study sought to determine an association between procrastination and academic engagement, while testing the potential moderator role of impulsivity, self-efficacy, and motivation. The third study built upon the literature and measured whether motivation to use alcohol and marijuana were associated with academic engagement, while considering impulsivity and stress as moderators. In general, researchers have investigated the associations of these constructs

with regards to their impact on academic success. However, little is known about the relationship of these constructs with academic engagement, which is an area of importance given that poor academic engagement is associated with lower academic success.

Thematic Results

Role of Impulsivity in Predicting Academic Engagement and Academic Success

Consistent with the related literature (Rodriguez-Fornells & Maydeu-Olivares, 2000; Shoda et al., 1990; Tangney et al., 2004), greater impulsivity was associated with lower academic engagement in this dissertation. Inconsistent with the academic achievement literature, the results suggest dysfunctional impulsivity was not associated with academic engagement; it is components of general impulsivity rather than dysfunctional impulsivity that results in poorer academic engagement, and academic engagement is due to a broad range of impulsive behaviours, rather than solely failure to plan ahead and consider the consequences. Conscientiousness and self-efficacy were found to not only predict academic engagement, but also moderate and mediate, respectively, the association between impulsivity and academic engagement. This suggests that impulsivity does not directly impact academic engagement, and that impulsivity is associated with academic engagement through self-efficacy. Indeed, regardless of their level of impulsivity, individuals engage more with their academics due to higher levels of self-efficacy. Among those with lower self-efficacy, impulsivity impacts academic engagement, with students higher in impulsivity reporting lower academic engagement than those lower in impulsivity. High levels of conscientiousness are most beneficial for increased academic engagement for those with low levels of

impulsivity. However, the benefit of higher conscientiousness is not as impactful on academic engagement when individuals are also high in impulsivity.

The present findings are consistent with the work of Busato and colleagues (2000) and Halamandaris and Power (1999), who did not find any associations between neuroticism and academic achievement. Moreover, the results of the present study do not suggest that neuroticism impacts the effect of impulsivity on academic engagement. The present findings are also consistent with the related work of Petrie and Stoeberl (1997) and Sandler (2000) who did not identify an association between stress and academic outcomes. Stress did not predict academic engagement, nor was it significantly associated with academic engagement, suggesting that stress levels do not impact the level at which university students engage with their schoolwork. These findings are particularly noteworthy given that stress is often stereotypically considered an important factor that influences academic success. Academic engagement was found to mediate the association between impulsivity and academic success, and both academic engagement and impulsivity were significantly associated with academic success. This suggests that more impulsive individuals and those who engage less in their academics report poorer academic success. Moreover, the findings suggest that higher levels of academic engagement are associated with greater academic success regardless of impulsivity level, indicating the importance of increasing academic engagement.

Procrastination and Academic Engagement

The present findings suggest that active procrastination does not impact the likelihood for university students to engage with their academics, whereas passive procrastination is associated with less academic engagement. The association between

passive procrastination and academic engagement is also consistent with the academic achievement literature, which has found that procrastinators tend to have lower grades (Jackson et al., 2003). The present findings suggest that passive and active procrastination are separate constructs given that the former is associated with academic engagement, whereas the latter is not, which is consistent with the literature differentiating the two types of procrastination (Choi & Moran, 2009; Kim & Seo, 2013). The results also indicate that self-efficacy and motivation mediate the association between passive procrastination and academic engagement, which suggests that regardless of the level of passive procrastination, higher levels of self-efficacy and motivation result in greater academic engagement. Individuals higher in self-efficacy tend to have more adaptive motivational beliefs and attitudes, and an orientation toward mastery goals, whereas procrastinators tend to be less goal-oriented (Tan et al., 2008; Wolters, 2003). This is consistent with the present study, as higher self-efficacy and intrinsic motivation were found to be associated with lower procrastination, and associated with greater academic engagement. Impulsivity was not found to predict academic engagement, nor was it a moderator for the association between passive procrastination and academic engagement. It is important to consider that in the first study, self-efficacy was found to influence the relationship between impulsivity and academic engagement, thus explaining why impulsivity was not a significant predictor of academic engagement.

Motivation to Use Alcohol and Marijuana

Coping, enhancement, and social motives for alcohol use were not significantly associated with academic engagement, and expansion motive of marijuana use was not

associated with academic engagement. These findings are inconsistent with the academic achievement literature, as alcohol and marijuana use among university students have been associated with decreased academic success across the literature (Arria et al., 2013; Philips et al., 2015). The enhancement motive of alcohol use was found to be a predictor of academic engagement, as was impulsivity. The enhancement motive positively predicted academic engagement, despite not being associated with academic engagement, with enhancement mediating the association between impulsivity and academic engagement. The findings suggest that higher levels of impulsivity lead to higher levels of enhancement, in turn resulting in higher levels of academic engagement. However, enhancement does not have much of an impact on academic engagement at high levels of impulsivity. The effects of enhancement are most beneficial at lower levels of impulsivity, with lower levels of impulsivity also generally resulting in greater academic engagement. The causal nature of the association between enhancement and academic engagement cannot be determined from the current data, but a potential explanation is that students who use alcohol to improve their mood are more likely to engage in their academics due to their improved mood. A number of studies have identified positive mood as influencing academic performance (Bolte et al., 2003; Fredrickson & Branigan, 2005; Steele & Fullagar, 2008). As such, the positive mood that results from alcohol use (i.e., enhancement motive) may result in greater academic engagement. Although social and coping motives were not predictors of academic engagement, they were associated with impulsivity, suggesting that individuals who report higher levels of alcohol use due to social or coping reasons are also more impulsive.

Stress was not a predictor or moderator of academic engagement for any of the motives, again suggesting that stress does not impact academic engagement, even when it comes to substance use. It would be expected that individuals who are experiencing stress are more likely to use alcohol or marijuana, which would in turn result in less academic engagement. This was not found to be the case for the present study, although it is important to note that stress was significantly associated with each of the alcohol motives. These relationships suggest that individuals who are more stressed are also likely to use alcohol for social, coping, or enhancement reasons, but the alcohol use does not impact academic engagement. Therefore, poor academic achievement among those who report higher levels of drinking and report social and coping motives, as evidenced in the literature, may not be due to a lack of academic engagement.

The present findings suggest that students who report the expansion motive also report higher levels of impulsivity and higher levels of academic engagement. Both the expansion motive and impulsivity were significant predictors of academic engagement, with expansion altering the relationship between impulsivity and academic engagement. Students who are more impulsive are more likely to use marijuana to expand their awareness of themselves and others, which is consistent with the literature (Jones et al., 2014; LaBrie et al., 2014). The expansion motive's benefit with regards to being associated with greater academic engagement was most evident among those low in impulsivity. It is possible then that the desire to learn more about oneself and others also translates to academics and results in greater academic engagement. As researchers have noted (Lee et al., 2007), it is important to understand marijuana use motives due to their unique consequences.

Overall Limitations

A limitation of the present study was the use of a research pool of university undergraduates to gather data. Also, our participants were all enrolled in Psychology or Business courses in university, reflecting a specific subgroup in the larger population. Furthermore, our sample included a large proportion of female participants, which is consistent with samples collected in university populations. However, males tend to report higher levels of impulsivity (Silverman, 2003); thus, the present findings may in fact be an underrepresentation of the associations between impulsivity and academic engagement. However, the literature examining university students utilizes samples that are rather consistent with the present study. Replication of the study with a larger number of male participants may identify potential greater associations between impulsivity and academic engagement. Moreover, the alcohol literature has found that females and males use alcohol for different reasons and with different outcomes (Gleason, 1994; Labrie et al., 2007); thus, a larger sample with more males would allow for better generalizability.

Although not necessarily a limitation, it is important to note that, since the present findings were garnered from an undergraduate sample of primarily psychology students, the implications of the findings may not be generalizable to other students. Indeed, the findings may not be generalizable to all undergraduate majors (e.g., nursing), graduate students, or professional students (e.g., medical or dental students). However, the findings may be generally helpful at the undergraduate level regardless of major, given that undergraduate studies are often rather similar across most majors (e.g., students must adjust to demands of university, attend lectures, complete assignments etc.). Another limitation of the present study is the use of self-report measures of impulsivity, rather

than behavioural measures. The literature reports mixed findings in the association between self-report measures of impulsivity and behavioural measures of impulsivity (Rodriguez-Fornells et al., 2002; Spinella, 2004). However, the self-report measures of impulsivity used in the present study are widely used and have been found to be valid and reliable measures. Future studies may want to use behavioural measures of impulsivity (e.g., a go/no-go task) in conjunction with self-report measures to better determine how impulsivity is associated with academic engagement. A limitation of the present studies that examine self-efficacy is the directional relationship hypothesized and established based on extensive findings in the literature, which examines self-efficacy as a predictor of academic success (Multon et al., 1991; Zajacova et al., 2005). However, one may argue that the association is reversed; that greater academic success results in greater self-efficacy and lower academic success would result in lower self-efficacy due to greater or lower perceived competence resulting from success, respectively. Even though this is a limitation, the important factor of the results may not be the direction of the relationship but rather the implications of the findings. As the present findings identified self-efficacy as a predictor of academic engagement, and there are empirical methods to improving self-efficacy, fostering students' self-efficacy is important, even if engagement predicts self-efficacy. In other words, fostering one of the constructs (i.e., self-efficacy) may be beneficial to the other construct (i.e., academic engagement) even if there is a cyclical relationship between the two. It is important to note that academic engagement and success are different constructs, despite being correlated, and hypotheses surrounding success may not always apply to engagement. Although the measures of the present study have been shown to be valid and are widely used, it is possible that some individuals

respond in an effort to *fake good* on some measures. Individuals may *fake good* on measures of procrastination, academic engagement, and alcohol and marijuana use to appear more favourably or due to stigma surrounding substance use, despite recent legalization of marijuana. Given that the data are de-identified and self-reports are completed with the investigator a distance away (i.e., unable to see what the participant is reporting), *faking good* is unlikely to be common. Moreover, the rate of alcohol and marijuana use is rather consistent with rates reported nationally and in the literature (CCSA, 2012; Rotermann & Langlois, 2015).

Comments Following Defense Meeting

Limitations

The findings drawn from the stress measure were inconsistent with all regression analyses predictions. The measure was significantly correlated with a number of variables (e.g., impulsivity, alcohol use motives) and is a valid and reliable measure, thus the measure itself may not be the reason for the findings. It is plausible that some students may not have insight into their stress. Moreover, it is possible that the results are due to an inverse-U relationship with academic engagement, in which students with a mid-level of stress engage with their academics, whereas students with low or high levels of stress do not engage as much. Although low levels of stress would be favourable, some levels of anxiety or stress are beneficial in that it drives students to complete school work. On the contrary, high levels of stress may impede a student's ability to engage with their academics (e.g., ability to concentrate, memory) even if they would like to engage in their academics. This inverse-U relationship may cancel out the effects of stress in analyses, thus resulting in non-significant findings from the regression analyses.

It was pointed out by the committee that there is some overlap for various measures, such as impulsivity, conscientiousness, and procrastination. These overlapping variables are related in the literature, and the present findings have found some moderate correlations between certain variables. However, variables that are correlated were found to yield different results with regards to academic engagement, suggesting that they are distinct when it comes to academic engagement. Moreover, overlap between constructs may have resulted in some hypotheses not being confirmed, due to higher inter-correlations between variables. Overlap between constructs is well documented in the literature and is noted as a limitation when interpreting results. When considering the impulsivity measures, there is overlap in some items being similar to one another, thus likely resulted in a high correlation of the impulsivity measures with one another. This overlap of items can also be considered a limitation of the study. However, the overall impulsivity measure (BIS) was correlated with academic engagement, whereas the dysfunctional impulsivity measure (Dickman Impulsivity Inventory) was not correlated with academic engagement, suggesting that the two measures are distinct with regards to academic engagement

A limitation is the potential for type I error and potential false positives that may have resulted due to a large number of statistical analyses completed with one large data set. Another limitation includes not considering the need for more power for moderation analyses, as an interaction requires a greater number of participants compared to a predictor variable. The lack of significance for some moderations in the regression analyses may be due to a lack of power to be able to identify an interaction effect.

Multiple Imputation

It was suggested by the committee that single imputation for missing data (i.e., expectation-maximization) used for the present studies may not have been the best approach, and that multiple imputation is a better approach. As such, multiple imputation was used and all regression analyses were re-analyzed with the new data. Overall, all of the findings are the same when using multiple imputation with regards to significance. In other words, results that were significant with single imputation were still significant with multiple imputation, and nonsignificant findings were still nonsignificant. Results from the regression analyses using multiple imputation data will be discussed by study below.

For study 1, impulsivity ($B = -.22$, $SE = .07$, $t = -3.63$, $p < .001$) was a significant predictor of academic engagement in the first step (i.e., when entered into the model alone), but was not significant in the final step (i.e., when entered with the moderator variables and interaction terms; $B = .05$, $SE = .08$, $t = .69$, $p = .49$). Conscientiousness ($B = .36$, $SE = .15$, $t = 2.46$, $p = .01$) and self-efficacy ($B = 3.36$, $SE = .41$, $t = 8.30$, $p < 0.001$) were significant predictors of academic engagement, whereas neuroticism ($B = .01$, $SE = .11$, $t = .05$, $p = .96$) and stress ($B = .17$, $SE = .11$, $t = 1.64$, $p = .10$) were not significant predictors of academic engagement. Conscientiousness ($B = -.02$, $SE = .01$, $t = -2.00$, $p = .05$) and self-efficacy ($B = .11$, $SE = .04$, $t = 2.71$, $p = .007$) were significant moderators of impulsivity and academic engagement, whereas neuroticism ($B = <0.01$, $SE = .01$, $t = -.02$, $p = .99$) and stress ($B = .002$, $SE = .01$, $t = .20$, $p = .84$) were not significant moderators of impulsivity and academic engagement. For the academic success regression analysis, impulsivity ($B = -.18$, $SE = .08$, $t = -2.29$, $p = .02$) was a significant predictor of academic success. Academic engagement was also found to be a significant

predictor of academic success ($B = .33$, $SE = .09$, $t = 3.62$, $p < .001$), as well as a moderator ($B = .02$, $SE = .01$, $t = 2.36$, $p = .02$). This moderation was the only difference from the original analysis, but given that academic engagement was found to be a mediator in the original results, this finding does not change the implications.

For study 2, active procrastination ($B = -.73$, $SE = .74$, $t = -.99$, $p = .32$) was not a significant predictor of academic engagement. Impulsivity ($B = -.01$, $SE = .06$, $t = -.09$, $p = .93$) also was not a significant predictor of academic engagement; whereas, self-efficacy ($B = 3.22$, $SE = .42$, $t = 7.66$, $p < 0.001$), and intrinsic motivation ($B = .39$, $SE = .11$, $t = 3.48$, $p = .001$) were significant predictors of academic engagement. Impulsivity ($B = .02$, $SE = .07$, $t = .25$, $p = .80$), self-efficacy ($B = -.35$, $SE = .53$, $t = -.65$, $p = .51$), and intrinsic motivation ($B = -.13$, $SE = .13$, $t = -.97$, $p = .33$) were not significant moderators of active procrastination and academic engagement. Passive procrastination ($B = -.20$, $SE = .07$, $t = -2.78$, $p = .005$) was a significant predictor of academic engagement. Impulsivity ($B = .07$, $SE = .06$, $t = 1.17$, $p = .24$) was not a significant predictor of academic engagement, whereas self-efficacy ($B = 2.90$, $SE = .42$, $t = 6.84$, $p < 0.001$), and intrinsic motivation ($B = .35$, $SE = .11$, $t = 3.13$, $p = .002$) were significant predictors of academic engagement. Impulsivity ($B = -.003$, $SE = .01$, $t = -.56$, $p = .57$), self-efficacy ($B = -.02$, $SE = .04$, $t = -.57$, $p = .57$), and intrinsic motivation ($B = .02$, $SE = .01$, $t = 1.42$, $p = .15$) were not significant moderators of passive procrastination and academic engagement.

For study 3, coping motive ($B = 1.13$, $SE = .71$, $t = 1.57$, $p = .11$) was not a significant predictor of academic engagement. Impulsivity ($B = -.29$, $SE = .08$, $t = -3.84$,

$p < .001$) was a significant predictor of academic engagement, whereas stress ($B = -.04$, $SE = .11$, $t = -.38$, $p = .70$) was not a significant predictor of academic engagement. Impulsivity ($B = -.002$, $SE = .09$, $t = -.03$, $p = .98$) and stress ($B = -.14$, $SE = .11$, $t = -1.25$, $p = .21$) did not act as moderators. Enhancement motive ($B = 2.72$, $SE = 1.26$, $t = 2.16$, $p = .03$), was a significant predictor of academic engagement. Impulsivity ($B = -.32$, $SE = .08$, $t = -4.12$, $p < .001$) was a significant predictor of academic engagement, but stress ($B = -.08$, $SE = .11$, $t = -.71$, $p = .47$) was not a significant predictor of academic engagement. Impulsivity ($B = .01$, $SE = .10$, $t = .08$, $p = .93$) and stress ($B = -.12$, $SE = .13$, $t = -.90$, $p = .37$) did not act as moderators. Social motive ($B = 1.47$, $SE = .89$, $t = 1.65$, $p = .10$) was not a significant predictor of academic engagement. Impulsivity ($B = -.31$, $SE = .08$, $t = -3.94$, $p < .001$) was a significant predictor of academic engagement, whereas stress ($B = -.02$, $SE = .11$, $t = -.22$, $p = .83$) was not a significant predictor of academic engagement. Impulsivity ($B = .01$, $SE = .08$, $t = .17$, $p = .87$) and stress ($B = -.09$, $SE = .11$, $t = -.78$, $p = .43$) did not act as moderators. Expansion motive ($B = 2.50$, $SE = 1.10$, $t = 2.26$, $p = .02$) was a significant predictor of academic engagement. Impulsivity ($B = -.31$, $SE = .11$, $t = -3.00$, $p = .003$) was a significant predictor of academic engagement, whereas stress ($B = -.12$, $SE = .15$, $t = -.76$, $p = .45$) was not a significant predictor of academic engagement. Impulsivity ($B = -.02$, $SE = .09$, $t = -.21$, $p = .86$) and stress ($B = -.01$, $SE = .14$, $t = -.05$, $p = .94$) did not act as moderators.

Conclusions and Implications

Academic engagement was found to influence the relation between impulsivity and academic success, suggesting that academic engagement is associated with performance in university, and that greater engagement can result in greater success even among those with

greater impulsivity. Although this may be true, impulsivity and academic engagement are negatively associated; thus, reducing impulsivity is likely to be beneficial in improving academic engagement and success. Overall, impulsivity and self-efficacy have been found to be key constructs that influence academic engagement. Moreover, self-efficacy plays an important role in the association between impulsivity and academic engagement, suggesting that self-efficacy is a key area to focus on in intervention. For instance, Kennett and Reed (2009) identified the effect of an academic success-oriented course on first-year university students, with most of the course incorporating academic skills (e.g., time management, study skills, test-taking skills) and some social integration skills (e.g., available resources, student expectations, social support). It was found that students with the highest levels of impulsivity and lowest levels of academic self-efficacy showed the greatest improvement with respect to those constructs at the end of the course (Kennett & Reed, 2009). The course offered by Kennett and Reed (2009) included lectures, such as library research, critical evaluation of literature, citing, essay planning, university-level writing, learning and memory theory with applications to the university environment, reading and understanding research articles, stress and coping, and presentation skills. Demonstrations, activities, and discussions were also part of the course, and included hands-on library skills workshops, study skills, time management, test-taking skills, and collaboratively editing their own essays (Kennett & Reed, 2009). Departments at universities may choose to offer this type of course, or workshops that focus on these types of topics. On a course-based or individual level, educators may choose to refer students to a writing support centre at their university, if applicable, and seek a librarian's help with using library research tools. If classes are too large for personalized workshops, educators

may opt to invite a librarian or individual from the writing support centre (if applicable) to provide a lecture to the class regarding research tools or writing, respectively. If students are reporting difficulties with their academics, an educator can also suggest students find resources online about ways to improve study skills, test-taking skills, and time management. Suggesting that students find these types of resources can allow for greater autonomy and independence for the student in improving their academic performance. Educators may also choose to find and compile some of these resources (i.e., study skills, test-taking skills etc.) and provide them to students, either on an individual basis or to the class at large. The success course, and the resources either suggested by or provided by the educator, can be helpful for all students, as fostering self-efficacy can always be beneficial.

The findings by Kennett & Reed (2009) highlight the utility of interventions to improve academic performance among university students, as the intervention resulted in greater time management and social integration skills, which results in improved grades and greater retention. Solomon and Rothblum (1984) indicated that teaching time management alone is insufficient for reducing procrastination. Scent and Boes (2014) found the use of acceptance and commitment therapy (ACT) to be beneficial for procrastination among college students, as ACT posits that psychological problems stem from experiential avoidance (Strosahl & Wilson, 2011), and procrastination involves avoidance. Moreover, given that poor academic engagement may be due to avoidance, components of ACT may also be beneficial. Although ACT is a type of therapy, its components can be utilized in a non-clinical setting by non-clinicians. Delaying task initiation or completion is due to avoidance, often due to anxiety, being overwhelmed with where to begin, or uncertainty in one's abilities to produce good work. When the

student has identified that they must complete an assignment but instead want to push off working on it, they can be encouraged to observe the feelings they are having, engage in deep breathing while noticing their feelings, metaphorically make room for those feelings, and allowing oneself to have those feelings even if it is uncomfortable (Harris, 2009). This is the *acceptance* component of ACT. The *mindfulness* component of ACT can be addressed by guiding the student through a mindful breathing task, either guided by the educator, online video, or cell phone application. An important part of the mindfulness task is to encourage the student to focus on the present moment and be nonjudgmental of their thoughts. The *values and committed action* component of ACT can be addressed by encouraging the student to identify closely held values. Values are how you want to behave or act on an ongoing basis, with values potentially including being loving and caring, being a good friend, maintaining health and fitness, being a dedicated student, and being a high-achieving student (Harris, 2009). The student can then be asked to think of what is important about their education; how they would like others to view them in the context of education; and if they feel they are contributing enough time and effort to their education, and how they would like to improve that (Harris, 2009). Focusing on values would be particularly useful for students who identify academics as an important value. Educators can address the three components of ACT in individual meetings with students or with the class as a whole. As the components have a more personable feel to them, the educator may choose to run through the activities with the class during a lecture, However, providing a written document that outlines these activities could also be beneficial. It is important to note that, although there are three

components of ACT, not all three must be used depending on the situation, as each component is beneficial in its own way.

Interventions that improve self-efficacy, intrinsic motivation, and conscientiousness may aid with improving academic performance, even if individuals tend to engage in behaviours that result in lower academic engagement. Indeed, improving self-efficacy may be particularly important among individuals high in passive procrastination, as self-efficacy can influence academic engagement despite the level of procrastination. Intrinsic motivation is dependent on the fulfillment of autonomy, competence, and relatedness, which are components of self-determination theory (SDT; Kusurkar et al., 2011). The need for autonomy involves feeling that one is carrying out a task of their own choice and is not forced or coerced. The need for competence is feeling capable of learning the study or course material. The need for relatedness is feeling a connectedness or a sense of belonging with fellow peers and the teachers (Deci & Ryan 2000; Ryan & Deci 2000a, b). Kusurkar and colleagues (2011) compiled tips for increasing intrinsic motivation, with these tips rooted in SDT. Some of these tips that would be applicable for educators to utilize with their university students will be discussed briefly. Identifying and nurturing what students need and want allow for satisfaction of their autonomy, and can be accomplished by inquiring what students want out of their lecture sessions, and structure the format of the instruction around those needs (Kusurkar et al., 2011). For instance, the educator could ask students to complete a course evaluation in which they are able to choose which topics are most important to them, and the educator could take time to focus on those topics. Another tip is having students' internal states guide their behaviours, with structuring lessons around students'

interests, increasing their internal state of motivation. Allowing this state of interest is recommended, and educators are encouraged not to provide incentives, such as telling students certain topics will be on the exam (Kusurkar et al., 2011). Encouraging participation can also be helpful, as it makes learning more autonomous and fosters relatedness (Kusurkar et al., 2011). This can be implemented by dividing students into groups and asking each group to summarize a certain portion of a topic. Promoting communication between students, as well as between students and the educator allows for relatedness. Educators could also provide positive and constructive feedback that focuses more on the gap between the current and desired understanding. Although feedback should be positive, it can also be corrective, and can be phrased as ways of improvement rather than having a negative connotation (Kusurkar et al., 2011). Providing constructive feedback helps with one's need for competence, as it allows them to understand what they are doing correct and what needs improvement. Creating an environment of emotional support in the classroom is a way for educators to foster relatedness, by creating an environment in which students feel safe to share their feeling, doubts, and questions (Kusurkar et al., 2011).

As self-efficacy is a subdomain of conscientiousness, it may be possible that the types of aforementioned interventions for self-efficacy may also be beneficial for improving conscientiousness. Orderliness is another subdomain of conscientiousness that may be targeted by educators, such as suggesting students make lists of their upcoming academic tasks (e.g., assignments, tests), as well as using a planner to schedule times that they will work on those activities. For students that find it difficult to follow their schedule, which may be the case for those who are more impulsive, educators can suggest

that students reward themselves at the end of the day for following their schedule, such as by time playing video games, using social media, or watching an episode of a television show. Some individuals may also have the tendency to be unorganized. An educator may suggest that the student keep their workspace organized, which has been found to be beneficial for productivity in general. These types of suggestions would be applicable for educators to use both during individual meetings with students who are reporting difficulty with their academic success, as well as suggesting it to the class at large through online announcement posts or a brief discussion at the beginning of a class. It can be difficult to determine if these types of activities would increase one's level of conscientiousness, but nonetheless, using these types of techniques would ideally allow for greater organization and focus on one's academics.

Moreover, interventions reducing impulsivity may be beneficial, as evidenced by the finding that high levels of conscientiousness are no longer as beneficial when individuals have higher levels of impulsivity compared to those with lower levels of impulsivity. In general, impulsivity is strongly negatively associated with academic engagement; thus, it is a good area of focus in order to improve academic engagement. Mindfulness interventions have been found to be useful in reducing ADHD-related behaviours, including impulsivity, among children and adolescents with ADHD (Haydicki et al., 2013; Van de Weijer-Bergsma et al., 2012; Van der Oord et al., 2012). A meta-analysis also found mindfulness-based therapies to be efficacious in decreasing impulsivity among children and adults with ADHD (Cairncross & Miller, 2016), suggesting the utility of mindfulness interventions among university students to aid with impulsivity. When students seek help from their professors on an individual basis,

educators may be able to aid students with decreasing their impulsivity by suggesting they try a mindfulness meditation activity. Many of such activities are found online, particularly on YouTube, so it should not be difficult for students to find one. Searching for “guided mindfulness meditation” online results in various auditory videos that the student can choose from depending on what they feel is of most interest to them. Guided meditations can be particularly useful, as they talk the individual through a mindfulness activity, such as focusing on one’s breathe and being nonjudgmental of other thoughts they may have during the activity. Educators could also suggest the use of a mindfulness application on one’s cell phone, with many applications offering free versions with the opportunity to upgrade to a paid version (e.g., MyLife Meditation; Headspace: Meditation and Sleep). Alternatively, educators could talk the student through a mindful breathing meditation if they are meeting with the student. A mindful breathing exercise can often be three minutes, and asks the individual to place one hand on their chest and the other hand on their abdomen. They are to then take deep breathes and notice their breathing; how the air feels going through their nose and down their throat, and notice how their hands are moving. This type of mindful breathing exercise can also be done in a lecture setting, where the educator takes a few minutes at the beginning of the class to talk the students through the exercise. As impulsivity may be viewed as a stable trait, psychoeducation around impulsivity may be beneficial. When provided with information about impulsivity, particularly how it applies to an academic setting, students may realize that some of their behaviours are impulsive. In turn, they may be cognizant of their impulsive behaviours and try to decrease them.

The results of the present studies also suggest that interventions targeting mood may improve academic engagement, which was particularly evident among those who drink alcohol. In addition to improving mood, targeting impulsivity may also be beneficial, as impulsivity generally has negative outcomes. Therefore, aiming to decrease impulsivity while improving mood may have the optimal results in terms of increasing academic engagement. Vinci and colleagues (2016) found mindfulness intervention and muscle relaxation intervention beneficial in reducing drinking depending on the type of impulsivity students reported. Mindfulness interventions have been useful in decreasing impulsivity among adolescents and adults with ADHD (i.e., high impulsivity; Cairncross & Miller, 2016; Van de Weijer-Bergsma et al., 2012), and mindfulness interventions are increasingly used in the alcohol literature. Therefore, mindfulness-based techniques may be beneficial to decrease impulsivity among university students in order to foster academic engagement among those who drink alcohol. Those who use marijuana to get a greater understanding of the self and others (expansion motive) are more likely to engage in their academics. It may be that those who seek a greater understanding of themselves and the world are also more determined to increase their academic knowledge, in turn resulting in academic engagement. As intrinsic motivation involves an interest in learning due to knowledge being a reward in itself, implementing techniques that allow for greater intrinsic motivation may also encourage students to seek a greater understanding of various topics. In turn, this interest in seeking knowledge may be similar to the interest in knowledge sought by marijuana users (expansion motive), and may allow for greater academic engagement. The previously mentioned intervention tips for intrinsic motivation may also be applicable for promoting expansion. For instance, the educator

may ask students to complete a course evaluation in which they are able to choose which topics are most important to them, providing input on the sequence of topics presented, and choosing between different options for assignments (e.g., choosing from different topics or choosing to do a presentation instead of a written paper; Kusurkar et al., 2011). Although various factors may influence the feasibility of providing choices (e.g., class size or time restraints) some form of choice would most likely be achievable. These tips may be beneficial in improving intrinsic motivation, which may translate to an increased interest in gaining knowledge without the use of marijuana to achieve a similar effect.

Future research should aim to replicate the current findings across different samples, including different geographic regions, as well as students from a variety of majors, and a greater number of male participants. Future studies may want to also take a longitudinal approach to examine if academic engagement changes over the course of university, as well as to determine if constructs are associated similarly with academic engagement. As the literature reports mixed findings in the association between self-report measures of impulsivity and behavioural measures of impulsivity (Rodriguez-Fornells et al., 2002; Spinella, 2004), future studies should utilize both self-report and behavioural measures of impulsivity to further examine how impulsivity may be associated with academic engagement and other constructs examined in the present study. Other studies may also utilize different measures of active procrastination to determine if the present findings are consistent, or if the results are influenced by the measure used. Given the benefits of mindfulness-based interventions and acceptance and commitment therapy (ACT), a study that examines the utility of such an intervention compared to a control condition may be beneficial. Such a study could provide brief interventions over

time, and track impulsivity, academic engagement, self-efficacy, and procrastination to determine any impacts the intervention may have. Future research should examine if an interest in gaining a greater knowledge of the self and others without marijuana use also results in academic engagement. The present findings contribute to the growing literature of academic engagement, identifying the association between impulsivity and academic engagement, as well as the role that constructs related to academic achievement play in that association.

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APPENDICES
Appendix A: Demographics of Studies

Table 1

Participant Demographics, Study 1

Categorical Variables		<i>N</i>	%
Gender	Female	152	76.8
	Male	45	22.7
	Other	1	.5
Ethnic Background	Aboriginal	0	0
	Asian or Asian descent	16	8.1
	Southeast Asian	11	5.6
	Hispanic/Latino	4	2.0
	Non-Hispanic Black or African descent	22	11.1
	Non-Hispanic White, Caucasian, or European descent	109	55.1
	Arab or Middle Eastern descent	27	13.6
	Other/Mixed	9	4.5
	Prefer not to answer	0	0
	Year of Study	1	34
2		65	32.8
3		55	27.8
4		34	17.2
5+		10	5.1
No response		0	0
Relationship Status	Single	124	62.6
	In a romantic relationship (non-cohabiting)	69	34.8
	Married/Civil Union/Cohabiting	5	2.5
	Divorced/Separated and Single	0	0
	No response	0	0
	Employment	Full-time (including volunteer work)	16
Part-time (including volunteer work)		133	67.2

		<i>N</i>	%
	Not currently employed or volunteering	49	24.7
	No response	0	0
Overall GPA	Below 60	5	2.5
	60-69	30	15.2
	70-79	61	30.8
	80 or above	79	39.9
	No response	23	11.6
Major GPA	Below 60	8	4
	60-69	27	13.6
	70-79	63	31.8
	80 or above	76	38.4
	No response	24	12.1
High School GPA	Below 60	0	0
	60-69	6	3.0
	70-79	41	20.7
	80 or above	142	71.7
	No response	9	4.5
Continuous variable		<i>Mean (SD)</i>	<i>Range</i>
Age (years)		20.06 (1.67)	17-25

Table 2*Participant Demographics, Study 2*

Categorical Variables		<i>N</i>	%
Gender	Female	151	77.0
	Male	44	22.4
	Other	1	.5
Ethnic Background	Aboriginal	0	0
	Asian or Asian descent	16	8.2
	Southeast Asian	11	5.6
	Hispanic/Latino	4	2.0
	Non-Hispanic Black or African descent	20	10.2
	Non-Hispanic White, Caucasian, or European descent	109	55.6
	Arab or Middle Eastern descent	27	13.8
	Other/Mixed	9	4.6
	Prefer not to answer	0	0
	Year of Study	1	33
2		65	33.2
3		54	27.6
4		34	17.3
5+		10	5.1
No response		0	0
Relationship Status	Single	123	62.8
	In a romantic relationship (non-cohabiting)	68	34.7
	Married/Civil Union/Cohabiting	5	2.6
	Divorced/Separated and Single	0	0
	No response	0	0
	Employment	Full-time (including volunteer work)	16
Part-time (including volunteer work)		132	67.3
Not currently employed or volunteering		48	24.5
No response		0	0

		<i>N</i>	<i>%</i>
Overall GPA	Below 60	5	2.6
	60-69	30	15.3
	70-79	60	30.6
	80 or above	79	40.3
	No response	22	11.2
Major GPA	Below 60	8	4.1
	60-69	27	13.8
	70-79	62	31.6
	80 or above	76	38.8
	No response	23	11.7
High School GPA	Below 60	0	0
	60-69	6	3.1
	70-79	41	20.9
	80 or above	140	71.4
	No response	9	4.6
Continuous variable		<i>Mean (SD)</i>	<i>Range</i>
Age (years)		20.06 (1.68)	17-25

Table 3*Participant Demographics, Study 3 (Alcohol)*

Categorical Variables		<i>N</i>	%
Gender	Female	118	78.1
	Male	32	21.2
	Other	1	.7
Ethnic Background	Aboriginal	0	0
	Asian or Asian descent	11	7.3
	Southeast Asian	4	2.6
	Hispanic/Latino	4	2.6
	Non-Hispanic Black or African descent	13	8.6
	Non-Hispanic White, Caucasian, or European descent	101	66.9
	Arab or Middle Eastern descent	9	6.0
	Other/Mixed	9	6.0
	Prefer not to answer	0	0
	Year of Study	1	27
2		48	31.8
3		43	28.5
4		26	17.2
5+		7	4.6
No response		0	0
Relationship Status	Single	87	57.6
	In a romantic relationship (non-cohabiting)	61	40.4
	Married/Civil Union/Cohabiting	3	2.0
	Divorced/Separated and Single	0	0
	No response	0	0
	Employment	Full-time (including volunteer work)	11
Part-time (including volunteer work)		107	70.9
Not currently employed or volunteering		33	21.9
No response		0	0

		<i>N</i>	<i>%</i>
Overall GPA	Below 60	3	2.0
	60-69	26	17.2
	70-79	43	28.5
	80 or above	62	41.1
	No response	17	11.3
Major GPA	Below 60	6	4.0
	60-69	22	14.6
	70-79	48	31.8
	80 or above	57	37.7
	No response	18	11.9
High School GPA	Below 60	0	0
	60-69	4	2.6
	70-79	36	23.8
	80 or above	106	70.2
	No response	5	3.3
Continuous variable		<i>Mean (SD)</i>	<i>Range</i>
Age (years)		20.14 (1.67)	18-25

Table 4*Participant Demographics, Study 3 (Marijuana)*

Categorical Variables		<i>N</i>	%
Gender	Female	65	70.7
	Male	26	28.3
	Other	1	1.1
Ethnic Background	Aboriginal	0	0
	Asian or Asian descent	3	3.3
	Southeast Asian	3	3.3
	Hispanic/Latino	1	1.1
	Non-Hispanic Black or African descent	11	12.0
	Non-Hispanic White, Caucasian, or European descent	61	66.3
	Arab or Middle Eastern descent	8	8.7
	Other/Mixed	5	5.4
	Prefer not to answer	0	0
	Year of Study	1	16
2		28	30.4
3		29	31.5
4		15	16.3
5+		4	4.3
No response		0	0
Relationship Status	Single	50	54.3
	In a romantic relationship (non-cohabiting)	39	42.4
	Married/Civil Union/Cohabiting	3	3.3
	Divorced/Separated and Single	0	0
	No response	0	0
	Employment	Full-time (including volunteer work)	6
Part-time (including volunteer work)		63	68.5
Not currently employed or volunteering		23	25.0
No response		0	0

		<i>N</i>	<i>%</i>
Overall GPA	Below 60	3	3.3
	60-69	15	16.3
	70-79	32	34.8
	80 or above	33	35.9
	No response	9	9.8
Major GPA	Below 60	4	4.3
	60-69	12	13.0
	70-79	36	39.1
	80 or above	30	32.6
	No response	10	10.9
High School GPA	Below 60	0	0
	60-69	3	3.3
	70-79	23	25.0
	80 or above	62	67.4
	No response	4	4.3
Continuous variable		<i>Mean (SD)</i>	<i>Range</i>
Age (years)		20.24 (1.73)	18-25

Appendix B: Demographics Measure

DEMOGRAPHIC INFORMATION

Date of Birth (MM/YY): ___/___ Age (years): ____

GENDER: _____

Race/ethnic background:

- [1] ABORIGINAL
- [2] ASIAN OR ASIAN DESCENT (NON-ARAB)
- [3] SOUTHEAST ASIAN
- [4] HISPANIC/LATINO
- [5] NON-HISPANIC BLACK OR AFRICAN DESCENT
- [6] NON-HISPANIC WHITE, CAUCASIAN, OR EUROPEAN DESCENT
- [7] ARAB OR MIDDLE-EASTERN DESCENT
- [8] OTHER/MIXED (please describe) _____
- [9] PREFER NOT TO ANSWER

Marital Status:

- [1] SINGLE
- [2] IN A ROMANTIC RELATIONSHIP (NON-COHABITING)
- [3] MARRIED/CIVIL UNION/COHABITING
- [4] DIVORCED/SEPARATED AND SINGLE
- [5] DIVORCED/SEPARATED AND IN A ROMANTIC RELATIONSHIP (NON-COHABITING)
- [6] WIDOWED

Please describe your current level of employment, outside of being a student:

- [1] Full-time (including volunteer work)
- [2] Part-time (including volunteer work)
- [3] Not currently employed or volunteering

Number of hours worked per week: _____

ACADEMIC HISTORY

Please indicate your year at UWindsor:

- [1] 1st year
- [2] 2nd year
- [3] 3rd year
- [4] 4th year
- [5] 5th year or beyond

To which academic faculty do you belong?

- [1] Faculty of Arts, Humanities and Social Sciences
- [2] Faculty of Science
- [3] Faculty of Business Administration
- [4] Faculty of Education

- [5] Faculty of Engineering
 - [6] Faculty of Human Kinetics
 - [7] Faculty of Nursing
 - [8] Inter-Faculty Program, Please Specify:
-

Overall GPA: [1] below 60
 [2] 60-69
 [3] 70-79
 [4] 80 or above

Overall GPA (please specify GPA): _____

Major GPA: [1] below 60
 [2] 60-69
 [3] 70-79
 [4] 80 or above

Major GPA (please specify GPA): _____

High School GPA: _____

Number of courses dropped (after drop deadline): _____

Appendix C: Measures Used in All Studies

Barratt Impulsiveness Scale

People differ in the ways they act and think in different situations. This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate box on the right side of this page. Do not spend too much time on any statement. Answer quickly and honestly.

	Rarely/ Never	Occasionally	Often	Almost Always/ Always
1 I plan tasks carefully.				
2 I do things without thinking.				
3 I make -up my mind quickly.				
4 I am happy-go-lucky.				
5 I don't "pay attention."				
6 I have "racing" thoughts.				
7 I plan trips well ahead of time.				
8 I am self- controlled.				
9 I concentrate easily.				
10 I save regularly.				
11 I "squirm" at plays or lectures.				
12 I am a careful thinker.				
13 I plan for job security.				
14 I say things without thinking.				
15 I like to think about complex problems.				
16 I change jobs.				
17 I act "on impulse."				
18 I get easily bored when solving thought problems.				
19 I act on the spur of the moment.				
20 I am a steady thinker.				
21 I change residences.				
22 I buy things on impulse.				
23 I can only think about one thing at a time.				
24 I change hobbies.				
25 I spend or charge more than I earn.				
26 I often have extraneous thoughts when thinking.				
27 I am more interested in the present than the future.				
28 I am restless at the theater or lectures.				
29 I like puzzles.				
30 I am future oriented.				

Undergraduate Engagement Scale

When answering the following questions, keep in mind how you usually are with most of

	Never 0	Very Rarely 1	Occasionally 2	Quite Often 3	Always 4
1. I plan in advance how I will manage my academic workload					
2. When I am having trouble with a course or an assignment, I work with other students.					
3. I enjoy the intellectual challenge of the subjects I am studying.					
4. I study between classes.					
5. I talk about my courses with other students.					
6. I get a lot of satisfaction from studying for my courses.					
7. Working with other classmates is useful to me.					
8. I study with other students.					
9. The lectures often stimulate my interest in the subjects.					
10. Studying with other students is useful to me.					
11. I am finding my courses intellectually stimulating.					
12. I answer questions in class.					
13. I work with classmates outside of class on group assignments.					
14. I am motivated to study for my courses.					
15. I come to class having completed readings or assignments.					
16. I ask questions in class.					

your courses. Try not to answer as you wish you were or how you think you should be.

Appendix D: Study 1 Measures

Dickman Impulsivity Inventory

This is a test to measure some of the ways in which you act and think. Read each statement and put an X on the appropriate box, indicating if it is true or false in describing you.

	True	False
1. I don't like to make decisions quickly, even simple decisions, such as choosing what to wear, or what to have for dinner.		
2. I am good at taking advantage of unexpected opportunities, where you have to do something immediately or lose your chance.		
3. Most of the time, I can put my thoughts into words very rapidly.		
4. I am uncomfortable when I have to make up my mind rapidly.		
5. I like to take part in really fast-paced conversations, where you don't have much time to think before you speak.		
6. I don't like to do things quickly, even when I am doing something that is not very difficult.		
7. I would enjoy working at a job that required me to make a lot of split-second decisions.		
8. I like sports and games in which you have to choose your next move very quickly.		
9. I have often missed out on opportunities because I couldn't make up my mind fast enough.		
10. People have admired me because I can think quickly.		
11. I try to avoid activities where you have to act without much time to think first.		
12. I will often say whatever comes into my head without thinking first.		
13. I enjoy working out problems slowly and carefully.		
14. I frequently make appointments without thinking about whether I will be able to keep them.		
15. I frequently buy things without thinking about whether or not I can really afford them.		
16. I often make up my mind without taking the time to consider the situation from all angles.		
17. Often, I don't spend enough time thinking over a situation before I act.		
18. I often get into trouble because I don't think before I act.		
19. Many times the plans I make don't work out because I haven't gone over them carefully enough in advance.		
20. I rarely get involved in projects without first considering the potential problems.		
21. Before making any important decision, I carefully weigh the pros and cons.		
22. I am good at careful reasoning.		
23. I often say and do things without considering the consequences.		

Big Five Inventory

20. _____ Has an active imagination

21. _____ Tends to be quiet

22. _____ Is generally trusting

41. _____ Has few artistic interests

42. _____ Likes to cooperate with others

43. _____ Is easily distracted

44. _____ Is sophisticated in art, music,
or literature

1
Disagree
Strongly

2
Disagree
a little

3
Neither agree
nor disagree

4
Agree
a little

5
Agree
strongly

Appendix E: Study 2 Measures

Tuckman Procrastination Scale

Please read each statement and put an X on the appropriate box on the right side of this page.

	That's me for sure.	That's my tendency.	That's not my tendency.	That's not me for sure.
1. I needlessly delay finishing jobs, even when they're important.				
2. I postpone starting in on things I don't like to do.				
3. When I have a deadline, I wait till the last minute.				
4. I delay making tough decisions.				
5. I keep putting off improving my work habits.				
6. I manage to find an excuse for not doing something.				
7. I put the necessary time into even boring tasks, like studying.				
8. I am an incurable time waster.				
9. I'm a time waster now but I can't seem to do anything about it.				
10. When something's too tough to tackle, I believe in postponing it.				
11. I promise myself I'll do something and then drag my feet.				
12. Whenever I make a plan of action, I follow it.				
13. Even though I hate myself if I don't get started, it doesn't get me going.				
14. I always finish important jobs with time to spare.				
15. I get stuck in neutral even though I know how important it is to get started.				
16. Putting something off until tomorrow is not the way I do it.				

Active Procrastination

Using the scale below, please read each statement and circle the appropriate number on the right side of this page.

1 2 3 4 5 6 7

Not at
All True

Very True

1. My performance tends to suffer when I have to race against deadlines.	1	2	3	4	5	6	7
2. I don't do well if I have to rush through a task.	1	2	3	4	5	6	7
3. If I put things off until the last moment, I'm not satisfied with their outcomes.	1	2	3	4	5	6	7
4. I achieve better results if I complete a task at a slower pace, well ahead of a deadline.	1	2	3	4	5	6	7
5. It's really a pain for me to work under upcoming deadlines.	1	2	3	4	5	6	7
6. I'm upset and reluctant to act when I'm forced to work under pressure.	1	2	3	4	5	6	7
7. I feel tense and cannot concentrate when there's too much time pressure on me.	1	2	3	4	5	6	7
8. I'm frustrated when I have to rush to meet deadlines.	1	2	3	4	5	6	7
9. To use my time more efficiently, I deliberately postpone some tasks.	1	2	3	4	5	6	7
10. I intentionally put off work to maximize my motivation.	1	2	3	4	5	6	7
11. In order to make better use of my time, I intentionally put off some tasks.	1	2	3	4	5	6	7
12. I finish most of my assignments right before deadlines because I choose to do so.	1	2	3	4	5	6	7
13. I often start things at the last minute and find it difficult to complete them on time.	1	2	3	4	5	6	7
14. I often fail to accomplish goals that I set for myself.	1	2	3	4	5	6	7
15. I'm often running late when getting things done.	1	2	3	4	5	6	7
16. I have difficulty finishing activities once I start them.	1	2	3	4	5	6	7

Academic Motivation Scale (AMS-C 28)

Using the scale below, indicate to what extent each of the following items presently corresponds to one of the reasons why you go to college.

Does not correspond at all	Corresponds a little	Corresponds moderately	Corresponds a lot	Corresponds exactly		
1	2	3	4	5	6	7

WHY DO YOU GO TO COLLEGE ?

	1	2	3	4	5	6	7
1. Because with only a high-school degree I would not find a high-paying job later on.							
2. Because I experience pleasure and satisfaction while learning new things.							
3. Because I think that a college education will help me better prepare for the career I have chosen.							
4. For the intense feelings I experience when I am communicating my own ideas to others.							
5. Honestly, I don't know; I really feel that I am wasting my time in school.							
6. For the pleasure I experience while surpassing myself in my studies.							
7. To prove to myself that I am capable of completing my college degree.							
8. In order to obtain a more prestigious job later on.							
9. For the pleasure I experience when I discover new things never seen before.							
10. Because eventually it will enable me to enter the job market in a field that I like.							
11. For the pleasure that I experience when I read interesting authors.							
12. I once had good reasons for going to college; however, now I wonder whether I should continue.							
13. For the pleasure that I experience while I am surpassing myself in one of my personal accomplishments.							

	1	2	3	4	5	6	7
14. Because of the fact that when I succeed in college I feel important.							
15. Because I want to have "the good life" later on.							
16. For the pleasure that I experience in broadening my knowledge about subjects which appeal to me.							
17. Because this will help me make a better choice regarding my career orientation.							
18. For the pleasure that I experience when I feel completely absorbed by what certain authors have written.							
19. I can't see why I go to college and frankly, I couldn't care less.							
20. For the satisfaction I feel when I am in the process of accomplishing difficult academic activities.							
21. To show myself that I am an intelligent person.							
22. In order to have a better salary later on.							
23. Because my studies allow me to continue to learn about many things that interest me.							
24. Because I believe that a few additional years of education will improve my competence as a worker.							
25. For the "high" feeling that I experience while reading about various interesting subjects.							
26. I don't know; I can't understand what I am doing in school.							
27. Because college allows me to experience a personal satisfaction in my quest for excellence in my studies.							
28. Because I want to show myself that I can succeed in my studies.							

Appendix F: Study 3 Measures

Alcohol Frequency Index

In considering the past **six months**, indicate your typical use of alcohol (select one):

- (0) no use
- (1) less than once a month but at least once in the last 6 months
- (2) once a month
- (3) 2–3 times/month
- (4) once or twice/week
- (5) 3–4 times/week
- (6) nearly every day
- (7) once a day
- (8) more than once a day

How many drinks containing alcohol do you have on a typical day when you are drinking? (1 drink = approximately 1/2 a pint of beer, 1 measure of spirit, or 1 glass of wine)

- 1) 1 or 2
- 2) 3 or 4
- 3) 5 or 6
- 4) 7 to 9
- 5) 10 or more

In considering your **entire life**, indicate your **total** use of alcohol (select one):

- (0) no use
- (1) 1–5 times
- (2) 6–9 times
- (3) 10–19 times
- (4) 20–39 times
- (5) 40–59 times
- (6) 60–79 times
- (7) 80–99 times
- (8) 100 or more times

DFAQ-CU Inventory

Instructions: Please read each of the following questions and mark the response alternative that best describes your use of cannabis. *Note that the term cannabis is being used to refer to marijuana, cannabis concentrates, and cannabis-infused edibles.*

1. Have you ever used cannabis?

0 = No

1 = Yes

**If response = 0 then skip to end of questionnaire*

2. Which of the following best captures when you last used cannabis?

1 = over a year ago

7 = last week

2 = 9 – 12 months ago

8 = this week

3 = 6 – 9 months ago

9 = yesterday

4 = 3 – 6 months ago

10 = today*

5 = 1 – 3 months ago

11 = I am currently high*

6 = less than 1 month ago

**If response = 10 (today) or 11 (I am currently high) then answer 2b below*

2b. How high are you right now?

0 = I am not at all high

1 = I am a little bit high

2 = I am moderately high

3 = I am very high

4 = I am extremely high

3. Which of the following best captures the average frequency you currently use cannabis?

0 = I do not use cannabis

7 = once a week

1 = less than once a year

8 = twice a week

2 = once a year

9 = 3 – 4 times a week

3 = once every 3-6 months (2-4 times/yr)

10 = 5 – 6 times a week

4 = once every 2 months (6 times/yr)

11 = once a day

5 = once a month (12 times/yr)

12 = more than once a day

6 = 2 – 3 times a month

4. Which of the following best captures how long you have been using cannabis **at this frequency?**

1 = less than 1 month

7 = 2 – 3 years

2 = 1 – 3 months

8 = 3 – 5 years

3 = 3 – 6 months

9 = 5 – 10 years

4 = 6 – 9 months

10 = 10 – 15 years

5 = 9 – 12 months

11 = 15 – 20 years

6 = 1 – 2 years

12 = more than 20 years

5. Before the period of time you indicated above, how frequently did you use cannabis?

- | | |
|---|--------------------------|
| 0 = I did not use cannabis | 7 = once a week |
| 1 = less than once a year | 8 = twice a week |
| 2 = once a year | 9 = 3 – 4 times a week |
| 3 = once every 3-6 months (2-4 times/yr.) | 10 = 5 – 6 times a week |
| 4 = once every 2 months (6 times/yr.) | 11 = once a day |
| 5 = once a month | 12 = more than once a da |
| 6 = 2 – 3 times a month | |

6. How many days of the past week did you use cannabis?

- | | |
|------------|------------|
| 0 = 0 days | 4 = 4 days |
| 1 = 1 day | 5 = 5 days |
| 2 = 2 days | 6 = 6 days |
| 3 = 3 days | 7 = 7 days |

7. Approximately how many days of the past month did you use cannabis?

8. Which of the following best captures the number of times you have used cannabis in your entire life?

- | | |
|---------------------------------|--|
| 1 = 1 – 5 times in my life | 7 = 1001 – 2000 times in my life |
| 2 = 6 – 10 times in my life | 8 = 2001 – 5000 times in my life |
| 3 = 11 – 50 times in my life | 9 = 5001 – 10,000 times in my life |
| 4 = 51 – 100 times in my life | 10 = More than 10,000 times in my life |
| 5 = 101 – 500 times in my life | life |
| 6 = 501 – 1000 times in my life | |

9. Which of the following best captures your pattern of cannabis use throughout the week?

- 0 = I do not use cannabis at all
- 1 = I only use cannabis on weekends
- 2 = I only use cannabis on weekdays
- 3 = I use cannabis on weekends and weekdays

10. How many hours after waking up do you typically first use cannabis?

- | | |
|-----------------------------------|---------------------------------|
| 0 = I do not use cannabis at all | 4 = 3 – 6 hours after waking up |
| 1 = 12 – 18 hours after waking up | 5 = 1 – 3 hours after waking up |
| 2 = 9 – 12 hours after waking up | 6 = within 1 hour of waking up |
| 3 = 6 – 9 hours after waking up | 7 = within ½ hour of waking up |
| | 8 = immediately upon waking up |

11. How many times a day, on a typical weekday, do you use cannabis? _____

12. How many times a day, on a typical weekend, do you use cannabis? _____

13. What is the primary method you use to ingest cannabis?

0 = I do not use cannabis

1 = Joints

2 = Blunts (cigar sized joints)

3 = Hand pipe

4 = Bong (water pipe)

5 = Hookah

6 = Vaporizer (e.g., Volcano, Vape pen)

7 = Edibles

8 = Other

14. Which of the following other methods to ingest cannabis do you use **regularly** (at least 25% of the time use you cannabis)? [Mark all that apply]

0 = None

1 = Joints

2 = Blunts (cigar sized joints)

3 = Hand pipe

4 = Bong (water pipe)

5 = Hookah

6 = Vaporizer (e.g., Volcano, Vape pen)

7 = Edibles

8 = Other

15. What is the primary form of cannabis you use?

0 = None****

A = Marijuana***

B = Concentrates (e.g., Oil, Wax, Shatter, Butane Hash Oil, Dabs)**

C = Edibles*

D =

Other _____

16. What other forms of cannabis do you use **regularly** (at least 25% of the time you use cannabis)? [Mark all that apply]

0 = None****

A = Marijuana***

B = Concentrates (e.g., Oil, Wax, Shatter, Butane Hash Oil, Dabs)**

C = Edibles*

D = Other _____

Marijuana Motives Measure

Here is a list of reasons people give for using marijuana. Thinking of all the times you use marijuana, how often would you say that you use marijuana for each of the following reasons? There are no right or wrong answers to these questions. If you no longer use marijuana, please answer for when you previously used marijuana.

1. To forget my worries

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

2. Because my friends pressure me to use marijuana

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

3. Because it helps me enjoy a party

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

4. Because it helps me when I feel depressed or nervous

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

5. To be sociable

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

6. To cheer me up when I am in a bad mood

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

7. Because I like the feeling

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

8. So that others won't kid me about not using marijuana

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

9. Because it's exciting

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

10. To get high

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

11. Because it makes social gatherings more fun

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

12. To fit in with the group I like

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

13. Because it gives me a pleasant feeling

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

14. Because it improves parties and celebrations

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

15. Because I feel more self-confident and sure of myself

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

16. To celebrate a special occasion with friends

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

17. To forget about my problems

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

18. Because it's fun

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

19. To be liked

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

20. So I won't feel left out

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

21. To know myself better

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

22. Because it helps me be more creative and original

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

23. To understand things differently

- 1 almost never/never
- 2 some of the time
- 3 half of the time
- 4 most of the time
- 5 almost always/always

24. To expand my awareness

1 almost never/never

2 some of the time

3 half of the time

4 most of the time

5 almost always/always

25. To be more open to experiences

1 almost never/never

2 some of the time

3 half of the time

4 most of the time

5 almost always/always

Drinking Motives Questionnaire

Here is a list of reasons people give for drinking alcohol. Thinking of all the times you drinking alcohol, how often would you say that you drink alcohol for each of the following reasons?

There are no right or wrong answers to these questions.

	Almost never/never	Some of the time	Half of the time	Most of the time	Almost always/always
1. Because it helps you enjoy a party					
2. To be sociable					
3. Because it makes social gatherings more fun					
4. Because it improves parties and celebrations					
5. To celebrate a special occasion with friends					
6. To forget your worries					
7. Because it helps you when you feel depressed or nervous					
8. To cheer up when you are in a bad mood					
9. Because you feel more self-confident and sure of yourself					
10. To forget about your problems					
11. Because you like the feeling					
12. Because it's exciting					
13. To get high					
14. Because it gives you a pleasant feeling					
15. Because it's fun					
16. Because your friends pressure you to drink					
17. So that others won't kid you about not drinking					
18. To fit in with a group you like					
19. To be liked					
20. So you won't feel left out					

Appendix G: Measures Overlapping Studies

College Self-Efficacy Inventory (CSEI)

The following 15 items concern your confidence in various aspects of college. Using the scale below, please indicate how confident you are as student at the University of Windsor that you could successfully complete the following tasks. If you are extremely confident, mark a 10. If you are not at all confidence, mark a 1. If you are more or less confident, find the number between 10 and 1 that best describes you. Levels of confidence vary from person to person, and there are no right or wrong answers; just answer honestly.

1 2 3 4 5 6 7 8 9 10

Not at all Confident

Extremely Confident

1. Research a term paper.	1	2	3	4	5	6	7	8	9	10
2. Write course papers.	1	2	3	4	5	6	7	8	9	10
3. Do well on your exams.	1	2	3	4	5	6	7	8	9	10
4. Take good class notes.	1	2	3	4	5	6	7	8	9	10
5. Keep up to date with your schoolwork.	1	2	3	4	5	6	7	8	9	10
6. Manage time effectively.	1	2	3	4	5	6	7	8	9	10
7. Understand your textbooks.	1	2	3	4	5	6	7	8	9	10
8. Participate in class discussions.	1	2	3	4	5	6	7	8	9	10
9. Ask a question in class.	1	2	3	4	5	6	7	8	9	10
10. Get a date when you want one.	1	2	3	4	5	6	7	8	9	10
11. Talk to your professors.	1	2	3	4	5	6	7	8	9	10
12. Talk to university staff.	1	2	3	4	5	6	7	8	9	10
13. Ask a professor a question.	1	2	3	4	5	6	7	8	9	10
14. Make new friends at college.	1	2	3	4	5	6	7	8	9	10
15. Join a student organization.	1	2	3	4	5	6	7	8	9	10

Perceived Stress Scale

The questions in this scale ask you about your feelings and thoughts **during the last month**. In each case, you will be asked to indicate by circling *how often* you felt or thought a certain way.

0 = Never 1 = Almost Never 2 = Sometimes 3 = Fairly Often 4 = Very Often

1. In the last month, how often have you been upset because of something that happened unexpectedly?	0	1	2	3	4
2. In the last month, how often have you felt that you were unable to control the important things in your life?	0	1	2	3	4
3. In the last month, how often have you felt nervous and “stressed”?	0	1	2	3	4
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	0	1	2	3	4
5. In the last month, how often have you felt that things were going your way?	0	1	2	3	4
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	0	1	2	3	4
7. In the last month, how often have you been able to control irritations in your life?	0	1	2	3	4
8. In the last month, how often have you felt that you were on top of things?	0	1	2	3	4
9. In the last month, how often have you been angered because of things that were outside of your control?	0	1	2	3	4
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	0	1	2	3	4

VITA AUCTORIS

Antonette Scavone was born in 1990 in Toronto, Ontario. She graduated from Father Bressani Catholic High School in 2008. She then attended the University of Toronto Scarborough, from which she obtained an H.B.Sc. in Mental Health Studies in 2013. She obtained her M.A. in the Clinical Neuropsychology track at the University of Windsor in 2017, and she is a Ph.D. Candidate in the Clinical Psychology program, Clinical Neuropsychology track at the University of Windsor.