DISSERTATION

SENSATION SEEKING AND IMPULSIVITY IN RELATION TO YOUTH DECISION MAKING

ABOUT RISK BEHAVIOR: MINDFULNESS TRAINING TO IMPROVE SELF-REGULATORY

SKILLS

Submitted by

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ABSTRACT

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The goal of this study is to examine the effects of a mindfulness intervention on at-risk

adolescents' decision-making about risk behavior. Significant research shows that during adolescence

individuals are at higher risk for morbidities and co-morbidities resulting from risk-taking behavior than

at other points in the lifespan. Further, research shows that although adolescents are cognitively similar to

adults in appraising risk in hypothetical situations, they are still over-represented in health-compromising

risk-taking behavior, suggesting that there are other factors contributing to their decision-making about

risk. Sensation seeking and impulsivity have been shown to lead to a proclivity for risk behavior and

decisions that involve reward-seeking, susceptibility to peer pressure and increased risk-taking.

Furthermore, developmental research demonstrates that youth are still developing self-regulatory skills

that can down regulate impulsive or sensation-seeking behavior. Interestingly, there is also beginning

evidence that self-regulation can be practiced and fostered during adolescence, suggesting that self-

regulation is an important intervention target. Thus, this study tests the hypothesis that a mindfulness

intervention will improve self-regulation as a way reducing the link between impulsivity, sensation-

seeking and decision-making that leads to risk-taking behavior.

The sample for this study includes 178 diverse (63% Male; 50% White, 33% Hispanic, 6%

Native American, 4% Black), at-risk, youth between the ages of 10-18 (mean age = 13.6) who are

participating in a university-based therapeutic mentorship program, Campus Corps. Youth were referred

to the mentoring program by the juvenile court magistrate, the district attorney's office, probation

officers, and school counselors. Campus Corps pairs at-risk youth with university students and takes place

once per week for four hours over a 12-week period. Youth engage in tutoring and prosocial activities

with their mentors. This program is led by marriage and family therapy graduate students. Youth were randomly assigned to a control (Campus Corps as usual) or an intervention (Campus Corps with mindfulness) condition. The mindfulness intervention (Learning to Breathe; Broderick, 2009) is implemented for one hour during the Campus Corps evening over a six week period. The intervention includes specific lessons in mindfulness surrounding decision making, self-awareness, and regulation.

Results indicate that mindfulness does not significantly moderate the process of self-regulation as a moderating factor with respect to impulsivity and various decision making bases, as well as with respect to sensation seeking and various decision making bases. However, secondary data analyses reveal that the mindfulness intervention did have a significant moderating effect on self-regulation as a moderating variable between impulsivity and risk behavior count (number of risks taken during the past three weeks) over time, as well as between sensation seeking and risk behavior count over time. Speculations regarding the results of this study include the notion that the interaction between self-regulation and mindfulness more strongly affects the "in the moment," gratification-seeking, and/or emotional drive to engage in a particular *behavior* than the reflective cognitive process measured by decision making bases.

ACKNOWLEDGMENTS

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Chapter 1

Growing interest in the area of youth engagement in risk-taking behavior has generally been spurred by population trends highlighting the prevalence of risk-related casualties that peak during adolescence (Boyer, 2006). There exists a growing body of work that seeks to understand the decision-making precursors of risk behavior. In large part, this decision-making work has been carried out in the area of social psychology. Research posits that two major findings are salient: (a) despite expectations to the contrary, adolescents and adults are very similar in appraising risk and show few significant differences in making decisions about *hypothetical* risk; (b) yet, despite cognitive similarity in risk appraisal skills, it is still the case that adolescents are overrepresented in health-compromising risk-taking behavior (e.g. Millstein & Halpern-Felsher, 2002; Steinberg, Graham, O'Brien, Woolard, Cauffman, & Banich, 2009). This seeming anomaly has spurred examinations of socio-emotional processes that may affect adolescents' "cold logic" about risk appraisal. The following review will address three related areas. First, I will discuss research about decision-making in adolescence, toward the argument that a helpful addition to the literature is understanding adolescents' own motivations for engaging in or refraining from actual risk situations. Second, I will review literature that links self-regulation to risk behavior. Third, I will review research about impulsivity and sensation seeking as they relate to risk-taking behavior. I will conclude with a suggestion for mindfulness intervention as a means to improve self-regulation among adolescents. A conceptual model is presented in Figure 1 that guides the review.

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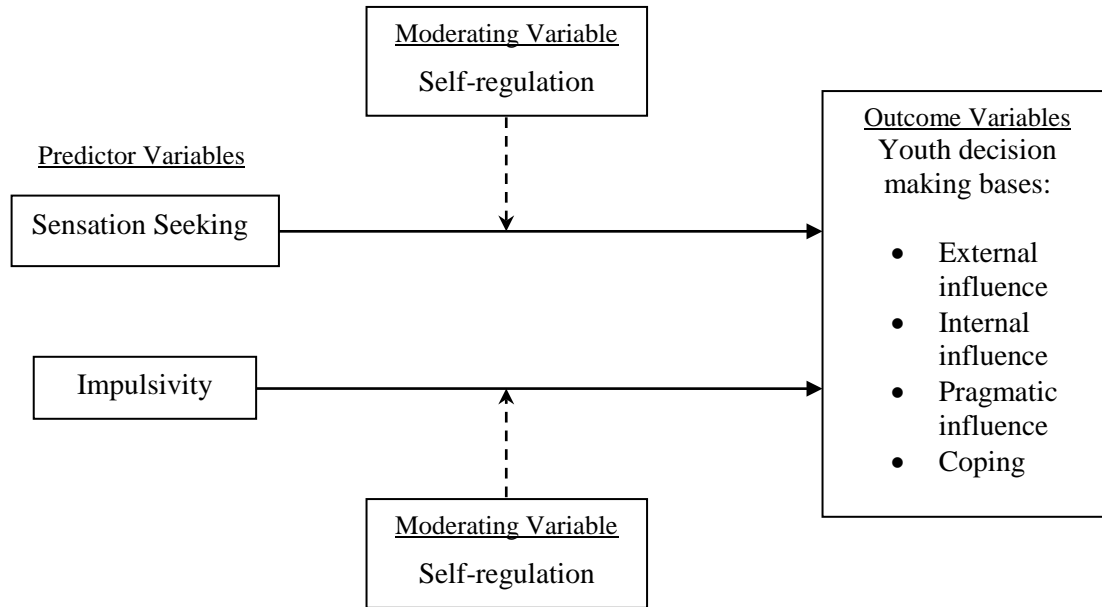
Figure 1. Conceptual model depicting self-regulation as moderating the relationship between sensation seeking and impulsivity and youth decision making bases

Decision Making

Several models of decision-making highlight the importance of contextual factors, as well as developmental factors, related to the decision-making process of risk-taking behavior among adolescents (Albert & Steinberg, 2011). Dual-processing models of decision making have gained increasing popularity in the literature on adolescent decision making. Dual-processing models generally uphold the notion that there are two processes that individuals engage in simultaneously when engaging in decision making. Namely, dual-processing models of decision making describe a calculated process as well as a reactive process of decision making (Albert & Steinberg, 2011). As such, dual-processing models of decision making lend some insight into the discrepancies in risk-related casualties between adolescents and adults. It is noted in the literature that the intuitive (reactive) process of decision making has not reached its full potential during adolescence (Casey et al., 2008; Harden & Tucker-Drob, 2011). Therefore, the salience of

rewards may simply overpower a more abstract and calculatory ability. The following section will provide a brief summary of brain development during adolescence in order to provide some background information regarding the biological processes that the various decision making theories refer to. Following this summary, I will provide an overview of some of the prominent decision-making theories that are rooted in the dual-processing framework of decision making.

Brain Development. Adolescents' brains are rapidly growing and developing. For example, increases in the levels of dopamine produced in the adolescent brain contribute to an increased propensity for adolescents to be driven by rewards in their environment (Luciana & Collins, 2012). Further evidence from research in neuroscience suggests that adolescents have an enhanced nucleus accumbens. As a part of the limbic system (the emotion center of the brain), the nucleus accumbens drives an individual to seek out rewards in his or her environment. As well, adolescents' prefrontal cortex is immature. The prefrontal cortex is important with respect to the control of cognitive functions and in self-regulation (Casey et al., 2008). As such, planning and regulation of emotion seem to be relatively immature compared to adults (Casey et al., 2008; Harden & Tucker-Drob, 2011). Thus, in a *hypothetical* situation, adolescents may be equally competent as adults in risk appraisal but, in a situation involving social or emotional arousal, as with peers, adolescents may be more likely to select outcomes that satisfy reward-seeking motivations. Understanding basic brain development during the adolescent years thus provides context for the various decision-making theories that will be discussed in more detail.

Cognitive-Experiential Self-Theory. The first theory that will be discussed is the cognitive-experiential self-theory (CEST; Epstein, 1990). CEST maintains the notion that "rational" defines the *process* of making decisions but does not define whether the behavior that one engages in after a rational thought process is right or wrong per se (Epstein, 1990). CEST

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does, however, contribute to our understanding of the role of the subconscious mind with respect to decision making. Unlike other dual-processing models that consider the experiential construct of decision making as a series of heuristic or cognitive "shortcuts," CEST considers the notion that the experiential process develops out of a subconscious organization of previous experiences that one has had with one's environment (Epstein, 1990). Unlike other dual-process models, CEST assumes that the subconscious process is a *direct function* of adaptation to one's environment (Epstein, 1990). Thus, the analytic approach is a generally conscious process, whereas the experiential process generally operates outside an individual's awareness of the process of thought (Gerrard, Gibbons, Houlihan, Stock, Pomery, 2008).

Marks, Hine, Blore, and Phillips (2008) developed and assessed the validity of the rational-experiential inventory for adolescents (REI-A), a measure used to provide some evidence for the decision-making processes as explained by CEST. Using this measure, Fletcher, Marks, and Hine (2012) examined the difference between adults and adolescents regarding varying profiles of "more rational" versus "more experiential" thinkers. Among a group of 269 Australian adults (mean age = 35.9 years) and a group of 308 Australian adolescents (mean age = 15.4 years) Fletcher et al. (2012) found four profiles describing the types of decision makers. The profiles were determined based on their levels of rational and experiential decision-making processes. The "rational system" is described as a logical and calculated process. The "experiential system" on the other hand is the reactive process. As such, Fletcher and colleagues (2012) derived four profiles of decision makers: (a) the rational decision makers who scored proportionately higher in rational processes; (b) the experiential decision makers who scored proportionately higher in experiential processes; (c) the disengaged decision makers who scored low on both rational and experiential processes; (d) the dual-preference decision makers who

scored high on both rational and experiential processes. Although all four profiles (Disengaged, Experiential, Dual-preference, and Rational) were represented among both adolescents and adults, adolescents were overrepresented in the disengaged and dual-preference profiles. Adults were likely to have developed, and gravitated, to being either experiential or rational thinkers (Fletcher et al., 2012). This may highlight the active development of decision making among adolescents, providing some evidence for the notion that adolescents are "practicing" with respect to decision making, while adults have, generally, developed into being predominantly experientially driven or predominantly rationally driven decision makers.

Fuzzy Trace Theory. Another theory of decision making that takes into account both the calculated, as well as the socioemotional, aspects of decision making, is fuzzy trace theory. The developers of fuzzy trace theory argue that mature decision making is not emotionless. Instead, they explain that mature decision making is laden with emotion as much as immature decision making is. The difference between mature (or typically adult) decision making and immature (or typically adolescent) decision making is the notion that as individuals mature, individuals become more experienced and aware of emotions and possible consequences of decisions (Rivers, Reyna, & Mills, 2008). In other words, Rivers et al. (2008) argued that one's heuristic (also described as intuitive) repertoire expands with increased gains in experience with one's emotions. For example, anecdotal reports of adolescents believing that they will be free of worry if they were to leave home at 18 provides some evidence of how experience and heuristics play a role in decision making. Often adolescents will explain that they will move out, get a job, and "be free." An adult might ask the adolescent to describe how they plan to pay rent, to pay their cell phone bills, and to pay for groceries on a monthly basis. Adolescents often have an unrealistic expectation of the cost of living before they *have to* take on the responsibility

themselves. Rivers et al. (2008) highlighted the idea that, faced with a decision between confession of skipping school and skipping school but keeping quiet and potentially being found out (dishonesty), a mature or experienced decision maker would opt to not skip school at all, whereas the immature decision maker would choose the option that would make the outcome "worth the risk" (p. 118). According to Rivers et al. (2008), the mature decision maker thus makes a decision based on experience and intuition, whereas the immature decision maker makes a decision based on literal pro's and con's – a more traditionally analytic approach.

Empirical research regarding fuzzy trace theory is limited to date. However, it is thought that through *practice* of risk avoidance (making positive choices surrounding risk behavior), maladaptive risk avoidance (the practice of avoiding health-compromising risk behavior), rather than maladaptive risk behavior, becomes the intuitive approach for adolescents. For example, as fuzzy trace theorists argue that the decision-making process becomes more intuitive with development, practice of risk avoidance may "lock in" risk-avoidant behavior. According to Reyna and Farley (2006), interventionists using fuzzy trace theory as their basis are encouraged to implement the practice of positive choice surrounding maladaptive risk taking behavior and to gain greater understanding of risk behavior as a means to "lock" positive choices into the adolescents long term memory – available for retrieval when risky situations present themselves. Anecdotally, many adolescents will engage in health compromising risk behavior when they are bored. I speculate that this engages the reward seeking neural pathway. However, the Fuzzy Trace theory suggests that as adolescents practice implementing prosocial activities at times of boredom or negative emotional states (or general risk behavior triggers) adolescents would "default" to prosocial activities rather than defaulting to engagement in risk taking behavior in order to satisfy the adolescent reward system.

Prototype Willingness Theory. The last theory that will be discussed in order to gain an understanding of the current decision-making theories that take into account the dual-processing model is prototype willingness theory. The prototype willingness theory was specifically designed to better understand unintentional adolescent decision making with respect to engagement in risk-taking behavior (Gerrard et al., 2008). The prototype willingness theory considers adolescents' reactions to prototypes within their social environment, for example the reputation of peers that engage in particular behaviors (e.g., image or character of a "smoker"), and the adolescent's willingness to engage in the behavior associated with the particular prototype (Gerrard et al., 2008). This particular process is described as the socioemotional, or reactive, aspect of adolescent decision making.

The prototype willingness theory further indicates an understanding that adolescent intention, based on a more calculated process, does not predict adolescent engagement in risk-taking behavior. Understanding that both intention and willingness processes described by the prototype willingness theory often occur simultaneously, proponents of the prototype willingness theory uphold the notion that *willingness* to engage in risk-taking behavior is based on social status, and is often more rewarding for adolescents when acting in the moment (Gerrard et al., 2008). Furthermore, based on the prototype willingness theory, one might assume that adolescents, regardless of previous knowledge or intent, do not often regulate the in-the-moment impulses that are generally driven by social image and by social desirability of the greater peer culture.

In a study of 189 adolescents between the ages of 13 and 15, recruited through high schools, a sports team, and a church, Litt and Stock (2011) examined attitudes and decisions surrounding alcohol use within the prototype willingness framework. The authors were interested

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in the role of social media (Facebook) and how social media provided prototypes of adolescents who use alcohol. They examined the willingness of participants to use alcohol based on the prototypes. The authors found that adolescents who spent a lot of time on social media viewed profiles of older adolescents who showed alcohol as normative, were more likely to view alcohol use as favorable and be more likely to make decisions to use alcohol themselves than those who were not as frequently exposed to these social media profiles (Litt & Stock, 2011).

Summary. The various decision-making theories discussed in this section highlight the notion that adolescents tend to make more reactive, unintentional decisions based on some lack in experience with the environment as well as the desire for reward gratification. Some differences between the theories exist. Namely, the fuzzy trace theory maintains the notion that with development, certain patterns are locked into long-term memory. Thus the more youth engage in making choices to engage in maladaptive behavior, the more likely this pattern will continue. CEST similarly highlights the subconscious organization of past patterns of behavior. However, CEST maintains that youth are not systematic in their decision making and thus are neither experiential nor logical – whereas adults seem to have locked into being dominant with respect to being either experiential or logical in their thought processes. Finally, the prototype willingness theory differs from both the fuzzy trace theory and CEST in that it proposes that youth decision making is a more conscious process. Namely, youth base their conscious decision making on the social desirability of the "model" for their potential action.

It is important to note, however, that the theories also highlight the notion that adolescents, like adults, have the *ability* to make more calculated and intentional decisions. The theories furthermore put forth the idea that adolescents are gaining practice and experience with their environment and developing repertoire that may lead to more intentioned decisions.

Nevertheless, it seems that the reactive and unintentional processes tend to be more overpowering during adolescence than during adulthood more generally.

Although, the literature on brain development indicates that the development of the prefrontal cortex will lead adolescents to a more calculated decision-making process with maturation, the theories bring to light the interesting notion that there may be interplay between cognitive development and experience with respect to more purposeful and less reactive decision making. To further support this notion, it has been recognized in the EF literature that during the first frontal lobe growth-spurt (during the childhood years), if self-control (self-regulation and delayed gratification) is encouraged and modeled, children are more likely to be able to regulate their reactions to frustrations and their ability to delay gratification (Mischel, Shoda, & Rodriguez, 1989). This reasoning leads to the speculation that self-regulation may play a key role in other types of high-arousal circumstances, as may be the case surrounding decision making with regard to risk-taking behavior.

Though the aforementioned theories acknowledge a developmental property to more calculated decision-making processes, some of the theories allude to practice and experience as important factors with respect to establishing a "decision-making repertoire." Considering the various decision-making theories, as well as the notion that self-control can be encouraged and practiced, the fuzzy trace theory lays the foundation for recognizing the malleability of self-regulation as it relates to decision-making regarding risk taking behavior.

Self-Regulation and Decision Making about Risk-Taking Behavior

Some of the literature concerning youth decision making considers the notion that adolescents are immature in their ability to self-regulate both their emotion and their behavior (Luciana & Collins, 2012). Self-regulation is described in the literature to encompass the ability

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to regulate emotion and cognitive processes (Magar, Phillips, & Hosie, 2008). In a study of 153 students (mean age = 20.87 years), Magar and colleagues (2008) found that decreased self-regulation, and particularly decreased cognitive regulation (also described as executive function), was related to an increased propensity to take part in health-compromising risk-taking behavior. Based on previously mentioned evidence suggesting a link between brain development, specifically development in the prefrontal cortex, and the role of self-regulation in decision making (Casey et al., 2008), a discussion surrounding executive function (EF) with respect to adolescent decision making is warranted. Executive functioning (EF) is a concept that encompasses the necessary skills with respect to impulse control, problem-solving ability, ability to shift attention, as well as overall goal-directed activity (Riggs, Jahromi, Razza, Dillworth-Bart, Mueller, 2006). It is well noted in the EF literature that higher levels of EF activate connections in the prefrontal cortex. Several scholars examining EF components, as they relate to adolescents' engagement in risk-taking behavior, focus their efforts on measures of working memory and cognitive control as they relate to simulated as well as self-reported risk taking. Cognitive control, described as having the ability to control or regulate, one's own behavior, is of particular interest because it is a specific form of self-regulation.

As previously discussed, varying decision-making theories posit that adolescents are more ambivalent in their methods of making decisions or are less skilled in choosing "heuristic shortcuts" (CEST; Epstein, 1990); are less likely to have an intuitive repertoire that steers them away from maladaptive risk taking (fuzzy trace theory; Reyna & Farley, 2006); and are more likely to favor "prototypes" that benefit them with respect to potential rewards (prototype willingness theory; Gerrard et al., 2008). Competence in self-regulation assumes that the

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individual is able to resist temptations driven by impulses and reward gratification that puts the individual at risk for maladaptive outcomes (Baumeister and Heatherton, 1996).

As Lerner, Lerner, Bowers, Lewin-Bizan, Gestsdottir, and Urban (2011) illustrate, adolescence is a developmental stage during which the individual explores and establishes personal adaptation to his/her particular context given his/her particular characteristics. During this time, adolescents are also adapting to the demands of their environment. One task for adolescents is to develop the bases and skills that allow them to grow and succeed within their context.

Self-regulation as it relates to decision making during adolescence can be described as "contextualized actions" focused on navigating one's context in an attempt to reach goals and to promote positive development (Gestsdottir & Lerner, 2008). Understanding self-regulation as it relates to decision making during adolescence further warrants the discussion of motivations that drive the need to regulate impulse and reward gratification. The motivations have been referred to as decision-making bases (Curry, 2004).

Curry (2004) carried out a qualitative, exploratory study in order to create a decision making bases inventory. Intuitively, it is clear that decisions are made by people for various reasons. The previously discussed decision-making theories highlight some of the avenues (dual processes) that are engaged when making decisions. Curry interviewed 30 adolescents about their reasons for engaging or not engaging in a list of specific risk behaviors (e.g., smoking, taking drugs, drinking). From these interviews, 12 items representing reasons for engaging in risk behavior and 12 items representing reasons for not engaging in risk were culled. These decision-making bases were utilized in a study of 286 adolescents, which showed that decision making mediated the relations between affect (positive, anger, depression) and actual

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engagement in risk behavior. In a subsequent study by Johansen and Youngblade (2013), further study of the measure using factor analysis revealed that Curry's (2004) measure yielded three "motivations" for deciding to take part in or not to take part in risk-taking behavior: internalized value factors, external or environmental factors, and affect-driven factors. Internalized value factors include items such as "it's a part of who I am." External or environmental factors include items such as "my friends wanted me to do it," or "it's not available to me." Finally, affect-driven factors include items such as "it makes me feel good." Taken at face value, this reveals that some decisions are made more impulsively, or because they "seem cool" (sensation seeking), whereas others are more "thought out." Thought-out decisions indicate greater self-regulation efforts and often include more internalized value systems for taking part in or for not taking part in risk behavior.

The aforementioned notion that competence in self-regulation indicates the individual's ability to resist temptations driven by impulses and reward gratification, gives way to the idea that self-regulation may potentially moderate the relationship between impulsivity and sensation-seeking and risk-taking behavior during adolescence.

Based on the prior discussion evidencing that adolescents' brains are not fully developed, and particularly that the area of the brain related to executive function is still developing, then, it is reasonable to hypothesize that self-regulation (i.e. self-control or cognitive control), a key executive function, is an important, and potentially malleable, mechanism in understanding risk-taking behavior among teens. While research has documented a significant relationship between self-regulatory behavior and risk-taking behavior (Luciana & Collins, 2012), the direct link between self-regulation and decision making about risk has not been tested. For this reason, the

present study will focus efforts on decision making bases with respect to risk taking behavior, but will examine the outcome of engagement in risk taking behavior as well.

Impulsivity and Sensation Seeking

Two additional and related constructs have been linked to risk-taking behavior: impulsivity and sensation seeking. Before reviewing research that links sensation seeking and impulsivity to decision making regarding risk behavior, it is important to distinguish concepts. Sensation seeking has been defined as the motivation to partake in activities and behaviors that are driven by seeking out rewards and novelty (Maursich, Darna, Charnigo, Dwoskin, & Bardo, 2011). Sensation seeking is also thought to be a part of an "independent personality" construct (Whiteside & Lynam, 2001). Impulsivity, on the other hand, has been defined as having poor foresight, and as acting without thinking (Maursich et al., 2011). Impulsivity increases in early adolescence and slowly decreases as the prefrontal cortex matures with age (Harden & Tucker-Drob, 2011; Steinberg et al., 2008).

In a study of 30 college-age participants, Zermatten and van der Linden (2005) found that lower levels of premeditation (higher impulsivity) were related to greater risk taking in a laboratory setting. The research by Luciana and Collins (2012) furthermore proposes that adolescents who have high levels of impulsivity and sensation seeking put themselves at greater risk for the negative consequences of risk-taking behavior than adolescents who have relatively normative levels of impulsivity and sensation seeking (Luciana & Collins, 2012).

Additionally, in a study of 935 individuals between the ages of 10 and 30 years, Steinberg and colleagues (2008) found a curvilinear relationship between sensation seeking and age. Youth between the ages of 14-15 years indicated higher levels of sensation seeking than preadolescent youth, older adolescents, and adults.

To further support the neurobiological roots, as well as distinctions, of impulsivity and sensation seeking, Harden and Tucker-Drob (2011) proposed a link between sensation seeking and an increase in activity in the subcortical, or emotion center, of the brain. Also highlighted is the link between impulsivity and cortical development. Specifically, Harden and Tucker-Drob (2011) argued that in both the neurobiological research as well as the research on socioemotional development during adolescence, the age trends of the constructs of interest coincide. Namely, sensation seeking and the development of the subcortical region of the brain alike have been noted to peak during midadolescence. Meanwhile, impulsivity decreases as activity in the prefrontal cortex increases steadily across adolescence (Harden & Tucker-Drob, 2011).

The difference between the aforementioned definitions of sensation seeking and impulsivity, as well as the proposed link between these two particular constructs and neurological developmental timing, provide some evidence for a likely distinction between sensation seeking and impulsivity. It should be noted, however, that the notion of sensation seeking and impulsivity as separate constructs is relatively recent in its conception, and early literature conflated the two. Regardless, research indicates that sensation seeking and impulsivity peak in adolescence (Harden & Tucker-Drob, 2011; Steinberg et al., 2008). Not only are there systematically observed peaks during adolescence, there are also individual difference parameters as well as research that show that those higher in sensation-seeking characteristics as well as those who are more impulsive engage in greater levels of risk-taking behavior (Luciana & Collins, 2012). However, again, there is limited research that ties these constructs to decision-making behavior, and to my knowledge, none that examines the mediating role of executive function, specifically self-regulation, in this process. Further, owing to relatively recent debate

(Harden and Tucker-Drob, 2011) about the independence of the two constructs, I will examine sensation seeking and impulsivity separately in this study.

As previously discussed, sensation seeking (or the responsiveness to reward and novelty) and impulsivity (unintentional reactivity) increases during adolescence due to normative neurocognitive development (Romer et al., 2009); and within that normative spike, there are degrees of individual differences. In order to find out whether there is or isn't a developmental element to sensation seeking and impulsivity, Romer and colleagues (2011) studied adolescents over a 3-year period. They found that though stronger working memory (a potential marker of self-regulation; Zermatten & van der Linden, 2005) at time one was significantly related to increased sensation seeking at time two, stronger working memory was significantly related to decreases in risk taking behavior at time three. It is also important to note that levels of sensation seeking stayed the same between time two and time three. These results suggest that although sensation seeking (and particularly the item "I like new and exciting experiences") generally increases over time, stronger working memory might in fact buffer the likelihood of impulsivity with respect to engagement in risk-taking behavior over time.

Malleability of Self-Regulation

The relationship of self-regulation to sensation seeking and impulsivity is an important concept to examine with regards to prevention of health-compromising risk behavior. As described in the literature on neurocognitive development, self-regulation is immature during adolescence (Casey et al., 2008). Adolescents become more adept at self-regulation as they mature (Harden & Tucker-Drob, 2011). Like other developmentally normative processes (i.e., language development during childhood), scaffolding and practice can foster greater competency (Zimmerman, Gilkerson, Richards, Christakis, Xu, Gray, & Yapanel, 2009). Furthermore,

Baumeister, Gailliot, DeWall and Oaten (2006) discussed the muscle-like characteristic of self-regulation. Namely, they discussed the notion that self-regulation can be exercised and that regular exercise of self-regulation may lead to decreases in ego depletion, which has been linked to self-destructive behavior (Baumeister et al., 2006). Therefore, Baumeister et al. (2006) asserted that increased practice and strength in self-regulation lead to decreased likelihood for ego depletion which in turn is thought to decrease the likelihood that the individual engages in risk behavior. The empirical evidence of the malleability of self-regulation is limited to date. Thus, the assertion by Baumeister et al. (2006) calls for further empirical evidence for the notion that self-regulation can be strengthened – leading to the discussion of the role of self-regulation in the process of decision making regarding risk behavior.

Rivers et al. (2008) argued that one's heuristic (experiential) repertoire expands with increased gains in *experience* with one's emotions. For example, language development is immature during the early childhood years (this immaturity is deemed cognitively normative). However, the child exposed to greater volume and variety in vocabulary (as through adult-child conversation in addition to other mediums of language exposure) will also become a more verbally expressive child, whereas the child deprived of linguistic richness through adult-child conversation will also express less linguistic richness (Zimmerman, et al., 2009). Guided by the aforementioned Fuzzy Trace theory, a similar process of expanding the heuristic repertoire is expected with the development of self-regulation. Furthermore, several of the decision making theories discussed propose that *experience* steers the socioemotional aspect of decision making.

Whereas sensation seeking and impulsivity have been described as being trait-like, there is literature suggesting that self-regulation can be increased with practice (Muraven, Baumeister, & Tice, 1999). Muraven et al. (1999) suggested that self-regulation can be exercised as a means

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to strengthen it. Based on the importance of *experience* set forth by the various decision-making theories, and the postulate that self-regulation is malleable, one might suggest that the more self-regulation is practiced, the stronger the self-regulation repertoire becomes. In other words, one might argue that the more self-regulation is practiced, the better youth become at regulating impulses and need for reward gratification (sensation-seeking).

The Current Study

Given current gaps in the literature, this study evaluated certain predisposing characteristics involved in decisions to engage in, or refrain from, actual risk situations. Impulsivity and sensation seeking have been linked directly to adolescent risk-taking behavior and for this reason risk behavior over the course of the semester was further considered as an important study variable. The literature further suggests that self-regulation may be a moderating factor in the relationship between impulsivity and sensation seeking and risk behavior among adolescents, and thus is a reasonable target for intervention. Furthermore, in considering Muraven et al.'s (1999) suggestion that self-regulation can be exercised as a means to strengthen one's ability to regulate cognitive and emotional functions, future research may move into examining the practice of strengthening self-regulation among adolescents to promote more purposeful decision making as a way to curb rates of adolescent health-compromising risk-taking behavior. Similarly, the previously discussed decision-making theories allude to the notion that adolescents are gaining practice and experience with their environment and that they are thereby developing a repertoire that may lead to more intentioned decisions.

As previously stated, Reyna and Farley (2006) encouraged the implementation of practice of positive choice surrounding maladaptive risk taking behavior as a means to provide adolescents with a heuristic available to them when risky situations present themselves. One

way that this practice can be encouraged is through the use of "mindfulness." Mindfulness is defined as a way of paying attention, or being mindful, of the present moment. It is being focused on the moment and maintaining a nonjudgmental attitude (Kabat-Zinn, 1994). Mindfulness practice is therefore a way to increase awareness of mental and emotional processes in an attempt to self-regulate and become balanced when strong emotions arise (Broderick & Metz, 2009). With a focus on self-regulation, therefore, mindfulness practice may be one avenue for intervention that may benefit the field of youth decision making surrounding risk behavior.

Thus, as previously stated, this review highlights various factors of youth decision making with respect to risk-taking behavior. Various decision-making theories suggest that there is, in fact, a difference between adults and adolescents in the way that they make decisions. Namely, as previously noted, dual-processing models of decision making lend some insight into the discrepancies in risk-related casualties between adolescents and adults. Research suggests that during adolescence, the salience of the reward system of the brain may overpower the more abstract and calculatory process of decision making (Casey et al., 2008; Harden & Tucker-Drob, 2011).This review further introduced a potential intervention that may promote increased self-regulation among adolescents. Namely, it is suggested that the practice of mindfulness may increase self-regulation, which in turn may function as a moderating variable between sensation seeking/impulsivity and decision-making basis in regard to negative risk. Figure 2 depicts this set of relationships. The current review furthermore introduces the notion that self-regulation is malleable and that through mindfulness intervention, self-regulation can be practiced in order to curb health-compromising risk taking behavior during adolescence. Further work in this area may increase the understanding of the mechanisms of youth decision making and may set a

foundation in changing the population trends that highlight the prevalence of risk-related

casualties that peak during adolescence (Boyer, 2006).

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                                 ┆                  │ Outcome Variables │
 Predictor Variables             ┆                  │  Youth decision   │
                                 ┆                  │  making bases:    │
 ┌─────────────────┐             ┆                  │                   │
 │ Sensation Seeking│────────────▼─────────────────▶│  • External       │
 └─────────────────┘                               │    influence      │
                                                    │  • Coping         │
                                                    │  • Personal       │
 ┌─────────────────┐                               │  • Moral (not to) │
 │   Impulsivity   │──────────────────────────────▶│  • External (not  │
 └─────────────────┘             ▲                  │    to)            │
                                 ┆                  └──────────────────┘
                        ┌─────────────────┐
                        │Moderating Variable│
                        │ Self-regulation │
                        └─────────────────┘
                                 ▲
                                 ┆
                        ┌─────────────────┐
                        │  Mindfulness    │
                        │  Intervention   │
                        └─────────────────┘
```
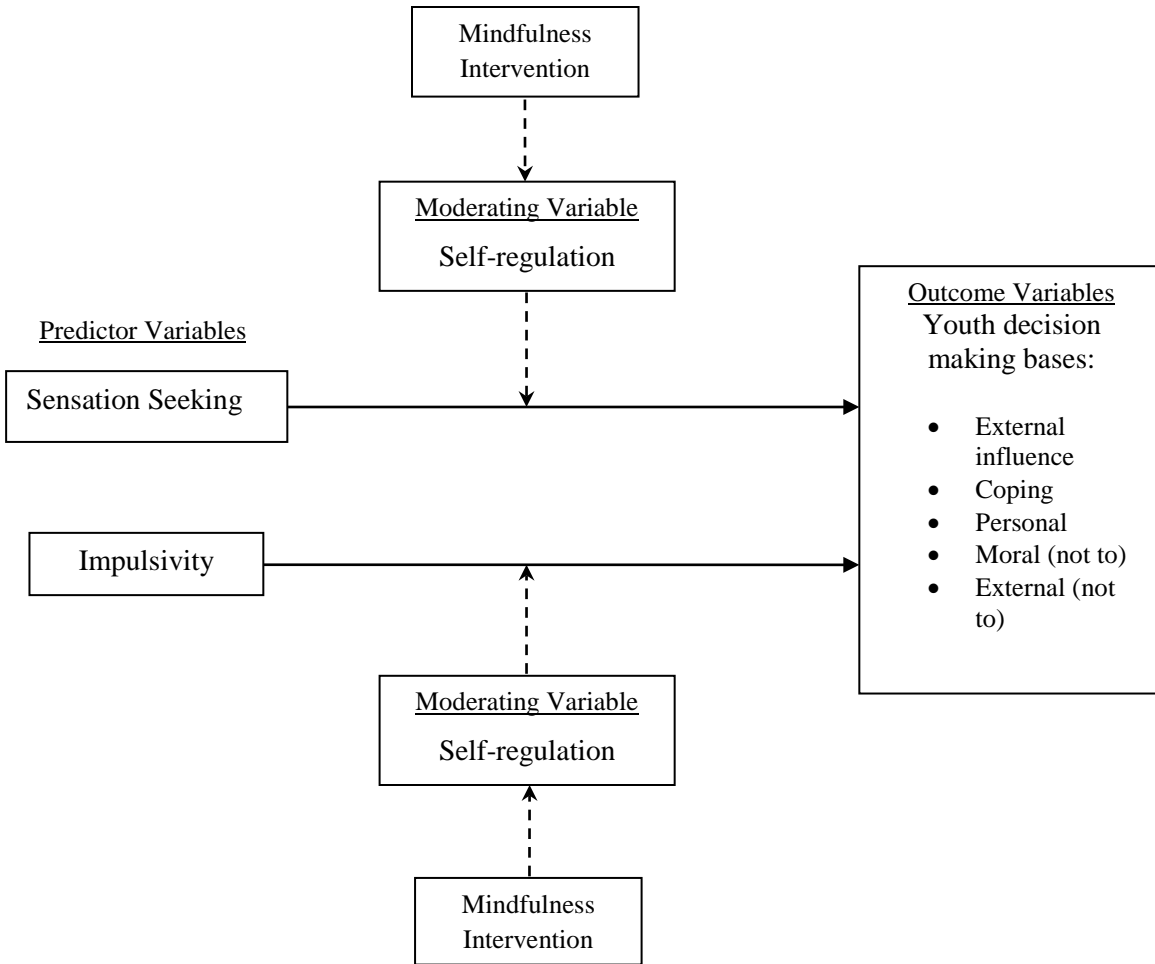
Figure 2. Conceptual model depicting self-regulation as moderating the relationship between sensation seeking and impulsivity and youth decision making bases

Mindfulness as an intervention. For the purpose of this study, mindfulness is defined as

a way of paying attention, or being mindful, of the present moment. It is being focused on the

moment and maintaining a nonjudgmental attitude (Kabat-Zinn, 1994). Mindfulness practice can

be thought of as a way to encourage insight with respect to one's thoughts, emotions, actions,

and behaviors. Mindfulness practice is therefore a way to increase awareness of mental and

emotional processes in an attempt to self-regulate and become balanced when strong emotions arise (Broderick, 2009). Based on this definition, one might suppose that mindfulness practice is not only a way to become aware of thoughts and emotions in the moment, but a way to restrain impulses as they arise.

Not many studies of mindfulness practice have been conducted with children and adolescents. However, although relatively limited, studies of mindfulness practice with children and adolescents have revealed promising results. In particular, studies that used mindfulness-based stress reduction models (MBSR) with child and adolescent samples have illustrated the usefulness of the MBSR with respect to increased calmness and relaxation, and decreases in symptoms of anxiety and ADHD (Napoli, Krech, & Holley, 2005; Semple, Reid, & Miller, 2005; Wall, 2005). MBSR was developed by Kabat-Zinn to aid participants in their healing of chronic illness and a variety of health problems (www.mindfullivingprograms.com). It incorporates mindful meditation and yoga on a weekly basis for eight weeks. Its purpose is to engage participants in awareness and unity of the mind and the body, as well as the subconscious thoughts and feelings that drive behavior.

Based on the foundations set forth by MBSR, namely bringing awareness to subconscious thoughts, feelings, and emotions that influence behavior, Broderick (2009) created a mindfulness program specifically for adolescents: Learning to Breathe. The program takes into account the particular developmental challenges that adolescents face. In particular, adolescents in U.S. society are intensely involved in gaining greater autonomy from adults in an attempt to establish a sense of self. During this developmental period, sorting out the numerous emotions involved in developing an autonomous identity can be very confusing (Broderick, 2009). Learning to Breathe considers the need for understanding and being able to feel in control of

one's seemingly unfamiliar emotions during adolescence. Learning to Breathe has been developed to unfold over an 18-week span, a 12-week span, or a six-week span. This particular study will utilize the six-week curriculum. Each lesson is developed with a particular theme in mind. The first lesson considers awareness of one's body. The next lesson is focused on reflection of self and one's surrounding. The third lesson incorporates awareness of emotion, followed by a lesson focusing on attention to stressors in one's life. The fifth lesson asks the adolescent to be tender with judgment of self. The final lesson incorporates instruction regarding practice of a "healthy mind." Across the lessons, the program reminds adolescents of the strength of the mind, thus fostering empowerment (Broderick, personal communication December 21st 2012).

In summary, Learning to Breathe aims to foster awareness and identification of emotion experience and intensity, and to further foster skills that aid adolescents' emotion regulation and tolerance of distressful circumstances (Broderick, 2009). The program is focused on empowering youth. In a pilot study of 120 adolescents, Broderick (2009) found significant reductions in negative affect, and significant increases in emotion regulation, among adolescents who participated in the program as compared to a small comparison group ($n = 30$). Although research in this area is limited to date, the pilot study provides some promising results regarding the teaching of mindfulness among adolescents as a possible way to increase adolescent self-regulation. This in turn may cultivate more purposeful thought processes among adolescents. Furthermore, a study conducted by Metz, Frank, Reibel, Cantrell, Sanders, and Broderick (2013) highlighted self-regulation as a construct for intervention. Two hundred and sixteen public high school students took part in the study and received the 18-session Learning to Breathe curriculum over a 16-week period. Findings reveal that Learning to Breathe had a positive effect

on self-regulation efficacy as well as on emotion regulation, perceived stress levels, and psychosomatic complaints (Metz et al., 2013). For the purpose of this study, the finding highlighting the effectiveness of the mindfulness program with respect to having an impact on self-regulatory efficacy is of particular interest – further supporting the proposal that a mindfulness intervention has the ability to foster self-regulation.

Research Questions and Hypotheses

Based on an analysis of theory and empirical findings detailed in the literature review, this study sought to further an understanding of adolescents' own motivations for engaging in or refraining from actual risk situations as well as understanding changes in risk behavior. The following research questions were addressed.

Research question 1: How are impulsivity and sensation seeking related to change in risk behavior, various decision-making outcomes with respect to engagement in risk-taking behavior, as well as with respect to refusal to partake in risk-taking behaviors?

Hypothesis1a: I hypothesize that there is a positive relation between impulsivity and engagement in risk behavior. I further hypothesize that there is a significant relation between impulsivity and the decision-making bases. Although it is reasonable to predict that a positive relationship exists between impulsivity and decisions around risk-behavior engagement, and a negative relationship exists between impulsivity and decisions to refrain from risk, these postulates are exploratory.

Hypothesis1b: I hypothesize that there is a positive relation between sensation seeking and engagement in risk behavior. I further hypothesize that there is a significant relation between sensation seeking and the decision-making bases. Although it is reasonable to expect that a positive relation will emerge between sensation seeking and decisions around risk behavior

engagement, and a negative relationship exists between sensation seeking and decisions to refrain from risk, these postulates are exploratory.

Research question 2: Does self-regulation moderate the relation between impulsivity and decision-making bases as well as between sensation seeking and decision-making bases? Further, does self-regulation moderate the relationship between impulsivity and risk behavior as well as between sensation seeking and risk behavior?

Hypothesis 2a: Self-regulation moderates the relation between impulsivity and decision-making bases. Self-regulation also moderates the relation between impulsivity and risk behavior. Namely, for those higher in impulsivity, higher levels of self-regulation will yield lower scores on decision making to engage in risk, higher scores on decision making to refuse risk engagement, and lower risk behavior scores.

Hypothesis 2b: Self-regulation will moderate the relationship between sensation seeking and decision making bases. Self-regulation will further moderate the relationship between sensation seeking and risk behavior. Namely, for those higher in sensation seeking, higher levels of self-regulation will yield lower scores on decision making to engage in risk, higher scores on decision making to refuse risk engagement, and lower risk behavior scores.

Research question 3: Does a mindfulness intervention enhance self-regulation, in turn altering adolescents' decision-making bases to engage or refuse to engage in risk behavior? Further does mindfulness result in increased self-regulation which in turn mitigates risk behavior?

Hypothesis 3: I hypothesize that a mindfulness intervention increases self-regulation, in turn increasing reasons to refuse to engage in risk as well as decreasing adolescents' reasons to engage in risk and decreasing risk behavior reports.

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Hypothesis 4: I hypothesize that a mindfulness intervention alters self-regulation, in turn moderating the relation between impulsivity and report of risk behavior as well as between sensation seeking and report of risk behavior.

Chapter 2

Methods

Participants

The sample for this study included 178 youth between the ages of 11 and 18 (M = 13.85, SD = 1.80) who participated in the Campus Corps program at Colorado State University between spring 2013 and fall 2013. Campus Corps is a youth mentoring program and also serves as a service learning course for university students. Most youth who are enrolled in Campus Corps are referred by the juvenile court magistrate, the district attorney's office, probation officers, school counselors, and The Center for Family Outreach. Youth who take part in Campus Corps are deemed "at risk" and have been identified as youth who would benefit from a positive relationship with a mentor. Mentors are students at Colorado State University (CSU) and work closely with the referred youth, building positive relationships and helping the youth in areas such as school success and engagement in prosocial activities. All of the youth participating in Campus Corps during the study time frame were eligible to participate in the study. About seventy percent (69.9%) of participants were male. About forty-nine percent (48.6%) of participants identified as White; 18.8% identified as Hispanic; 15.9% identified as bi/multi-ethnic; 5.8% identified as Black or African-American; 4.3% identified as Native American. 72.3% of youth qualify for the free and reduced lunch program.

Participants were randomized by semester into the mindfulness intervention (52.7% of participants took part in the mindfulness intervention) or the control condition (Campus Corps as usual) as described in the following sections. Participants were not aware of whether they were selecting a mindfulness intervention session or not. Participants selected their Campus Corps session based on their schedule availability (as usual). The mindfulness intervention took place

during the fall semester 2013. Three out of the four Campus Corps sessions during the fall semester 2013 received the mindfulness intervention. One session during the spring semester 2013, one session during the summer semester 2013, and one session during the fall semester 2013 served as the control conditions.

Control Condition

Campus Corps is a one-on-one mentoring program. Youth are matched with a CSU student who serves as their mentor for one evening (four hours) per week over the course of 12 weeks. Campus Corps takes place on the CSU campus. Mentor-mentee pairs are organized into "mentor families" – groups that include approximately three or four mentees of similar ages and their mentors. Each mentor family is supervised by a "mentor coach" (an experienced mentor) who offers high levels of support and guidance to mentors and youth. Mentors go through extensive training (20 hours) prior to working with their mentee, and are closely supervised by a therapist in the program of marriage and family therapy in the department of Human Development and Family Studies at CSU throughout their participation in Campus Corps. Having trained therapists oversee the Campus Corps program is essential for effective and timely interventions. Therapists are further supervised by therapist faculty in the department of Human Development and Family Studies at CSU. Mentor training includes information, guidance, and practice through role play about how to motivate and support youth regarding academics, as well as to recognize issues that arise related to truancy, mental health, substance abuse, and other contextual problems. A typical evening of Campus Corps (Campus Corps as usual) is as follows:

3:00-4:00pm: Mentors attend a class session in which announcements about the evening are made. Additionally, mentors discuss the readings assigned about mentoring adolescents and potential challenges are discussed.

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4:00-4:30pm: The youth from the community (the mentees) arrive at Campus Corps. During the first half hour, the mentees and their mentors group together into their mentor family groups and take a walk to pre-determined locations on campus where the mentors highlight facts about the university campus. During this time, mentees get a glimpse of university life while having the freedom to discuss daily events with their mentors.

4:30-5:30pm: Supporting School Success. During the Supporting School Success hour, mentees work on their homework (or GED preparations) with the guidance of their mentors. Mentors also monitor their mentee's grades and school attendance and discuss this with the mentees. The purpose of this hour is to aid youth with academic success.

5:30-6:00pm: Dinner. The local food bank delivers a hot meal to Campus Corps for mentor families to have a family-style dinner.

6:00-8:00pm: Mentor-mentee pairs take part in two prosocial activities that include but are not limited to sports, arts and crafts, music, cooking, and games. These activities allow youth to learn how to positively interact with others. Furthermore, Public Achievement Club (PA) is another option during this time, which allows youth to contribute to their community. Activities carried out by PA include but are not limited to writing letters to soldiers, firefighters, and other first responders; making dog biscuits for the local animal shelter; collecting canned goods for the local homeless shelter; and so forth.

8:00-9:00pm: Mentors attend a class-style-session in which they note the time spent with their mentees. Furthermore, this hour serves as a debriefing session in which mentors are supported, guided and coached regarding specific situations that may have posed difficult during the time spent with the youth. This is also a time where positive aspects of the night are often highlighted as a means to motivate the mentors for the following week.

Mindfulness Intervention

The mindfulness intervention took place during three Campus Corps sessions during the fall semester in 2013. Based on the foundations set forth by MBSR, namely bringing awareness to subconscious thoughts, feelings, and emotions that influence behavior, Broderick created a mindfulness program specifically for adolescents: Learning to Breathe. In collaboration with the Campus Corps program, the six-week (abbreviated) version of Learning to Breathe was implemented. A 12-week and an 18-week version of the program exist. The brief version was chosen for practical reasons surrounding implementation within an existing youth mentoring program. The six-week version of Learning to Breathe unfolds across six lessons. Each lesson was developed with a particular theme in mind.

Lesson 1: Consider awareness of one's body.

Lesson 2: Focus on reflection of self and one's surrounding.

Lesson 3: Incorporates awareness of emotion.

Lesson 4: Focus on attention to stressors in one's life.

Lesson 5: Asks the adolescent to be tender with judgment of self.

Lesson 6: Incorporates instruction regarding practice of a "healthy mind."

Across the lessons, the program reminds adolescents of the strength of the mind, thus fostering empowerment.

Adolescents participated in each lesson for 45 minutes, once every week, for six weeks. The lessons took place during the six o'clock activity hour. During this time, adolescents were split into two similar age groups. By dividing the groups, the youth were ensured a more intimate space in which to practice mindfulness techniques, without the possible intimidation of large numbers of people. Using age to dictate the groups was also a way for youth to practice

mindfulness in groups consisting of adolescents in similar stages of social, emotional, and cognitive development.

Each lesson was facilitated by trained and registered therapists in Marriage and Family Therapy master's program at Colorado State University. The registered therapists were further trained in the Learning to Breathe curriculum during a training that took place at Colorado State University in September 2013. The learning to breathe facilitators followed the six session curriculum using a facilitators' handbook. The youth and their mentors followed the lessons and were provided worksheets from the learning to breathe curriculum. The materials for the program can be obtained by visiting the Learning to Breathe website: http://learning2breathe.org/.

Procedure

Data collection began during the spring semester, 2013. One Campus Corps session served as the control condition during the spring semester 2013. Full-length surveys, including all of the measures, were administered at the first and the twelfth week. Shorter surveys, excluding the impulsivity and sensation seeking measures, were administered at week three, six, and nine. Another two rounds of control condition surveys, following the previously described time sequence, were administered during one of the Campus Corps sessions during the summer semester 2013 and again during one of the Campus Corps sessions during the fall semester 2013.

During the spring semester 2013, a few adjustments were made to the surveys. The decision-making bases questionnaires were changed to include a choice for "other, please describe" with respect to what influenced adolescents to take part in risk behavior. This new choice was included after week three of data collection.

Measures

Table 1.
Description of Measures including Administration Timing, Number of Items, and Psychometric Properties

Construct	Instrument	Administration	Description	Psychometrics
Impulsivity	Impulsivity scale (Harden & Tucker-Drob, 2004)	Pretest and Posttest	3 items; 4-point Likert scale (1=*strongly disagree*, 4=*strongly agree*)	α = .51 at pretest; α = .71 at posttest
Sensation Seeking	Sensation seeking (Harden & Tucker-Drob, 2004)	Pretest and Posttest	3 items; 4-point Likert scale (1=*strongly disagree*, 4=*strongly agree*)	α = .52 at pretest; α = .72 at posttest.
Self-regulation	SOC (Freund & Baltes, 2002)	Pretest and Posttest; week 3, week 6, week 9 weekly	18 items (Lerner & Gestsdóttir, 2007); 4-point Likert scale (1=*strongly disagree*, 4=*strongly agree*)	α=.67 at pre-test; α=.80 at posttest
Decision-Making Bases	Reflecting engagement in negative risk (Curry, 2004)	Pretest and Posttest; week 3, week 6, week 9 weekly	25 items for reflection on negative risk. 4-point Likert scale (1=*did not influence my decision*, 2= *somewhat influenced my decision*, 4= *strongly influenced my decision*	α =.76- α=.95

Impulsivity. Impulsivity was measured using a self-report measure (Harden & Tucker-Drob, 2011). This measure includes three items measured on a 4-point Likert scale ranging from 1=*strongly disagree* to 4=*strongly agree*. The items on this scale are as follows: (a) "I often get in a jam because I do things without thinking;" (b) "I think that planning takes the fun out of things;" (c) "I have to use a lot of self-control to stay out of trouble."

Sensation seeking. Sensation seeking was measured using a self-report measure (Harden & Tucker-Drob, 2011). This measure includes three items measured on a 4-point Likert scale

ranging from 1=*strongly disagree* to 4=*strongly agree*. The items on this scale are as follows: (a) "I enjoy taking risks;" (b) "I enjoy new and exciting experiences;" (c) "Life with no danger in it would be too dull for me." The reliability coefficient was low at pretest, but adequate at posttest (see Table 1).

Self-Regulation. Self-regulation was measured using the Selection, Optimization, and Compensation Scale (SOC; Freund & Baltes, 2002). The SOC is a self-report measure consisting of 18 items. Participants were asked to indicate the option that is "most like them" for each item. Items form three subscales: Selection (S); Optimization (O); and Compensation (C). Items included in the selection subscale measure the development of goal preference and commitment to goals. Items included in the optimization subscale measure the ability to find means to achieve goals. Finally, items included in the compensation subscale measure ability to adapt alternative means to continue goal achievement. The SOC measure revealed adequate reliability yielding Cronbach's alphas of .75, .70, and .67 for the three subscales respectively. Gestsdóttir and Lerner (2007) constructed a shorter, 9-item SOC self-report measure based on the 18-item measure created by Freund and Baltes (2002). This scale was created by excluding items that yielded low reliability among a normed adolescent population, and was found to have adequate psychometric properties. For the purpose of this study, the format of the 9-item SOC measure was modified. Although it is based on the 9-items, the items were taken out of their dichotomous format and put onto a Likert scale in order to simplify the measure for the youth and as a way to increase reliability. The 9-item measure became an 18-item measure measured on a Likert scale where 1=strongly disagree and 4=strongly agree.

Decision-making bases. Youth were also asked to report on decisions for taking risk using the Decision-making Bases Inventory (Curry, 2004). In this measure, youth were first

asked to indicate if they engaged in a particular risk behavior. Adolescents were asked to circle the risk(s) that they partook in. Furthermore, there is an option for youth to write in any other risk that was not listed in which they partook. Following the indication of risk-taking behavior, the youth were given a list of possible motivational factors that led to the decision to partake in the particular risk behavior. This was measured using a 4-point Likert scale where 1=*did not influence at all* and 4=*strongly influenced my decision*. A similar procedure was followed with respect to <u>not</u> engaging in risk. Namely, youth were asked to indicate a risk from the list of risks presented that they could have taken part in but did not, and reflected on what led to the decision to refuse to engage in the particular risk behavior. This was measured using a 4-point Likert scale where 1=*did not influence my decision at all* and 4=*strongly influenced my decision*. These measures are not intended to measure the frequency of engagement in risk. Rather, this measure allows two outcomes to be measured: (a) engagement in risk-taking behavior or not; (b) motivation to take part in or not to take part in risk-taking behavior. In an attempt to reduce the number of outcome variables while maintaining as much variance as possible (Conway & Huffcutt, 2003), exploratory factor analysis was carried out with the 12 reasons to engage in risk. Another exploratory factor analysis was carried out to reduce the number or outcome variables for the 13 reasons to not engage in risk.

Twelve items make up the various motivations to take part in risk. The items include: "Everyone does it;" "It is a part of who I am;" "It seemed like fun;" "Others would think I was cool;" "It helps me relax;" "It makes me feel better;" "I wanted to see what it was like;" "It just happened;" "Someone else wanted me to;" "I was angry;" "I think it's cool;" "I was bored." Exploratory factor analysis with principle axis factoring was carried out to determine how the items loaded onto different factors. The initial solution demonstrated the matrix was factorable

(Kaiser-Meyer-Olkin measure of sampling adequacy =.806, Bartlett's Test of Sphericity $X^2(66, N = 102) = 686.55, p < .001$).

Decisions about the number of factors retained for the final rotation were informed by an evaluation of the items that had eigenvalues approximating one, the scree plot, percent of variance accounted for by the factors, and the theoretical interpretability of the factors. Because multiple items were significantly correlated with one another (see Appendix A), oblique rotation was chosen for this factor analysis. Items that loaded .4 or greater were included in the factor, as recommended by Netemeyer, Bearden, and Sharma (2003). Items that loaded on more than one factor with .2 or less were excluded from the factor, as recommended by Netemeyer et al. (2003). As such, the item "I was bored" was excluded from the summary score. Further, parallel analysis as suggested by Hayton, Allen, and Scarpello (2004) and Velicer's (1976, 2000) minimum average partial (MAP) was used to determine the appropriate number of factors to retain. In a parallel analysis using common factor analysis and raw data permutation iterated 1000 times (Hayton, Allen & Scarpello, 2004), a total of three factors with eigenvalues greater than one were maintained. Further, Velicer's MAP determined three distinct factors (Velicer, 2000). Using these criteria, three factors were retained for the final analysis (see Table 2).

External motivation to engage in risk. Factor one (see Table 2) can be described as the decision-making outcome that encompasses external motivations to engage in risk-taking behavior. Based on the factor analysis and the conceptual value, the following four items make up this particular outcome measure: "everyone does it;" "others think I'm cool;" "someone else wanted me to do it;" and "I think it's cool." The reliability coefficient for this scale for the study's sample at pretest (week 1) suggests good reliability (α = .811).

Coping reasons to engage in risk. Factor two (see Table 2) can be described as the decision-making outcome that encompasses the youths' motivations to engage in risk-taking behavior as a means to cope with distressing feelings. Based on the factor analysis and the conceptual value, the following two items make up this particular outcome measure: "it helps me relax;" and "it makes me feel better." The reliability coefficient for this scale for the study's sample at pretest suggests high reliability ($\alpha = .925$).

Personality driven motivation to engage in risk. Factor three (see Table 2) can be described as the decision-making outcome that encompasses the youths' motivations to engage in risk-taking behavior as motivated by internal – or personal and identity seeking – reasons to engage in risk-taking behavior. Examining the items in this factor, conceptually they resemble characteristics of sensation seeking. Thus the items that make up this particular outcome measure include: "it's just a part of who I am;" "it seemed fun;" "I wanted to see what it was like;" "it just happened." The reliability coefficient for this scale for the study's sample at pretest suggests moderate reliability ($\alpha = .764$).

Table 2.
Factor Solution for Decision-Making Bases to Partake in Risk

Pattern Matrix[a]

	Factor		
	1	2	3
Everyone Does It	**.498**		
Part of Who I Am	-.153	.240	**.556**
Seemed Fun	.291	.189	**.450**
Others Think I'm Cool	**.691**		
Helps Me Relax		**.938**	
Makes Me Feel Better		**.869**	
See What It Was Like	.398		**.581**
Just Happened			**.647**
Someone Wanted Me To	**1.004**		-.129
I Was Angry	**.406**	.193	
I Think It's Cool	**.826**		

Note: Factor loadings above .40 appear in bold

If the adolescent stated that he or she did not engage in the risk behavior, he or she was prompted to continue to the list of possible motivational factors that lead to the decision *not* to partake in risk-taking behavior. The items include: "It's just not me;" "It's against my beliefs and values;" "I don't want to disappoint my parents;" "It's dangerous;" "It's bad for your health;" "I'd get into trouble;" "My parents would get angry;" "It could ruin my future;" "My friends aren't into doing that;" "It's not available to me;" "It's too expensive;" "It's wrong;" and "It's gross." Again, exploratory factor analysis with principle axis factoring was carried out to determine how the items load on to different factors. The initial solution demonstrated the matrix was factorable (Kaiser-Meyer-Olkin measure of sampling adequacy =.906, Bartlett's Test of Sphericity $X^2(78, N = 112) = 1358.68, p < .001$). Decisions about the number of factors retained using the same procedure and guidelines for retention as were used with the items for decision making to engage in risk behavior. As such, the item "it's dangerous" was excluded from the analysis. Further, parallel analysis as suggested by Hayton, Allen, and Scarpello (2004) and Velicer's (1976, 2000) Minimum Average Partial was used to determine the appropriate number of factors to retain; two factors with eigenvalues greater than one were maintained. Further, Velicer's MAP determined two distinct factors (Velicer, 2000). Using these criteria, two factors were retained for the final analysis (see Table 3).

Moral and value-driven motivations to not engage in risk. The first factor (see Table 3) can be described as the moral and value-driven reasons to not engage in risk. The items include: it's just not me;" "it's against my beliefs;" "I don't want to disappoint my parents;" "I would get in trouble;" "my parents would get mad;" "it could ruin my future;" and "it's wrong." The reliability coefficient for this scale for the study's sample at pretest suggests high reliability (α=.946).

Externally driven motivations. The second factor (see Table 3) can be described as the decision making outcome that encompasses youths' externally driven motivations to not engage in risk. As such, the five items that make up this particular outcome variable include: "it's bad for your health;" "my friends are not into it;" "it's not available to me;" "it's too expensive;" and "it's gross." The reliability coefficient for this scale for the study's sample at pretest suggests high reliability ($\alpha = .916$).

Table 3.
Factor Solutions for Decision Making Bases to Refuse to Partake in Risk

Pattern Matrix[a]

	Factor	
	1	2
Just Not Me	**.683**	.136
Against Beliefs	**.551**	.329
Don't Want To Disappoint Parents	**.899**	
Bad For Health	.206	**.609**
I'll Get In Trouble	**.896**	
Parents Would Get Mad	**.991**	
Could Ruin Future	**.856**	
Friends Not Into It	.226	**.638**
Not Available To Me		**.831**
Too Expensive	-.121	**.954**
It's Wrong	**.633**	.295
It's Gross		**.921**

Note: Factor loadings above .40 appear in bold

Risk behavior. Youth were asked to indicate if they engaged in a particular risk behavior. Adolescents were asked to circle the risk(s) that they partook in over the course of the previous three weeks. Youth reported all risks that they partook in. These risks were then counted at each time point to create the risk-behavior outcome variable.

Plan of Analysis

First correlations between the study variables were carried out. Next multiple regression analyses of the predictor variables with each outcome variable was performed. Multilevel

modeling (MLM), also known as hierarchical linear modeling (HLM), was used to test the

hypotheses proposed in this study. This method was chosen for several reasons, including its

ability to explain individual variance among adolescents over time (Hoffman & Rovine, 2007).

Further, MLM is a form of growth curve modeling that allows the examination of patterns across

time. From a structural modeling perspective, MLM assumes a hierarchical system of

interrelated regression equations (Hoffman & Rovine, 2007; Hox, 2002). Multilevel modeling is

often used to explain individual, as well as intergroup, variance at different levels of analysis

(Hoffman & Rovine, 2007). This is particularly useful when considering the clusters, or nested

groups, that may exist within the studied population. For this reason, multilevel modeling

considers the variance, or the deviation from the mean, for each individual, while considering

patterns that emerge among individuals. Multilevel modeling has further been deemed useful

when individuals are measured at multiple time points (repeated measures) due to the multiple

levels of data points (Hox, 2002). Furthermore, multilevel modeling is able to take into

consideration mediation and moderation at various levels of data analysis (Bauer, Preacher, &

Gil, 2006). Additionally, multilevel modeling has been explained as a useful statistical method

that is not greatly affected by missing data (Raudenbush & Bryk, 2002).

Chapter 3

Results

The purpose of this study was to explore the relation between sensation seeking and impulsivity as they relate to decision-making outcomes. I proposed that self-regulation would be a moderating variable whereby higher levels of self-regulation would moderate the relation between impulsivity and decision-making bases as well as between sensation seeking and decision-making bases. Finally, with this study I tested a mindfulness intervention as a plausible intervention effort in increasing self-regulation with the intent to engage a more "purposeful" decision-making process about risk behavior.

Table 4 illustrates descriptive statistics for the various outcome variables included in the study. Results are presented in three main sections. The first section provides information about the relations among the study variables at week one for predictor variables and at the average across the time points for the main effects and outcome variables. The next section provides a series of multiple regressions that describe the relation between sensation seeking and impulsivity with the various outcome variables. Finally the results of the multilevel modeling are presented. These models test the moderating role of self-regulation on the relations between impulsivity and the outcome variables, as well as of self-regulation on the relationship between sensation seeking and the outcome variables. The models also test whether a mindfulness intervention positively affects self-regulation and in turn the various decision-making bases and risk behavior.

Table 4.
Descriptive Statistics for Variables included in the study

	Mindfulness (N=90)		Control (N=88)	
	M	SD	M	SD
Impulsivity Centered	-0.073	0.600	0.087	0.694
Sensation Seeking Centered	-0.026	0.618	0.032	0.661
Self-regulation Average Centered	0.880	0.009	-0.023	0.339
DM_external week 3	1.682	0.863	1.686	0.860
DM_external week 6	1.770	0.966	1.651	0.934
DM_external week 9	1.640	0.914	1.671	0.926
DM_external week 12	1.370	0.682	1.258	0.443
DM_coping week3	1.954	1.117	2.076	1.197
DM_coping week6	2.118	1.149	2.244	1.225
DM_coping week9	1.985	1.190	2.207	1.177
DM_coping week12	1.586	0.935	1.917	1.067
DM_personal week3	1.872	0.778	2.032	0.862
DM_personal week6	2.021	1.058	1.981	0.921
DM_personal week9	1.843	0.936	2.078	1.009
DM_personal week12	1.700	0.813	1.617	0.629
DM_moralno week3	2.745	1.112	2.429	1.053
DM_moralno week6	2.683	1.071	2.657	1.129
DM_moralno week9	2.391	1.157	2.600	1.158
DM_moralno week12	2.605	1.131	2.378	1.133
DM_externalno week3	2.231	1.020	2.095	1.152
DM_externalno week6	2.465	1.605	2.006	1.138
DM_externalno week9	1.876	1.048	2.223	1.276
DM_externalno week12	2.098	1.115	1.865	0.999
Risk week1	2.089	3.683	1.614	2.756
Risk week3	1.389	2.507	1.386	2.718
Risk week6	1.144	2.835	0.966	1.927
Risk week9	1.022	2.327	0.534	1.241
Risk week12	1.144	2.770	0.671	1.396

Bivariate Correlations

First, I describe some of the relationships between the variables of interest. Table 5

presents bivariate correlations between the various predictor variables and outcome variables.

There are several correlations worth noting. For example, this table highlights the notion that

more impulsive youth are more likely to be high in sensation seeking. Consistent with previous literature (e.g., Zermatten & van der Linden, 2005) there was a positive correlation between impulsivity and risk engagement, and between sensation seeking and risk engagement. Related to the different decision-making bases, youth who were higher in impulsivity were more likely to engage in risk based on personal (or character-based) reasons (e.g., "it's a part of who I am;" "I wanted to see what it was like").

There was a negative association between self-regulation and risk engagement. It is interesting to note that self-regulation across the time points is significantly negatively correlated with external reasons to engage in risk, such that higher scores on self-regulation were associated with lower scores on basing decisions on external reasons (e.g., "everyone does it;" "others think I'm cool"). Self-regulation was also significantly negatively correlated with personal (or character based) reasons to engage in risk behavior. Finally, self-regulation was positively correlated with moral reasons to refuse to engage in risk and positively correlated with external reasons to refuse to engage in risk behavior. The correlation results thus suggest that youth who had greater self-regulation were more likely to make decisions to not engage in risk behavior for both moral (e.g., "it's wrong;" "it's not good for my future") and external reasons (e.g., "it's not available to me;" "too expensive.")

<div align="center">

Test of Research Questions

</div>

Preliminary Test of Difference between Groups

Before examining the research questions presented in this study, I performed independent samples *t*-tests to examine whether there were significant group differences at baseline between youth who were a part of the mindfulness intervention and the control (Campus Corps as usual) group. Results indicated that there were no statistically significant differences between the two

groups with respect to impulsivity, $t(139)=-1.47$, $p=.144$, sensation seeking, $t(139)=-.538$, $p=.592$, self-regulation at week one, $t(123)=1.41$, $p=.160$ and risk behavior at week one, $t(176)=.973$, $p=.332$. This indicates that youth taking part in the mindfulness intervention were similar at baseline to the youth taking part in Campus Corps without the mindfulness intervention on the key variables of interest to this study. Further, Table 4 illustrates descriptive statistics for the various outcome variables included in the study.

Research Question One

How are sensation seeking and impulsivity related to various decision making outcomes with respect to engagement in risk taking behavior, as well as with respect to refusal to partake in risk taking behaviors?

To address the first research question, I performed multiple regressions. Separate regression analyses were computed for each outcome variable (i.e., external reasons to partake in risk; coping reasons to partake in risk; personal reasons to partake in risk; moral reasons to refuse risk engagement; external reasons to refuse risk engagement) with impulsivity and sensation seeking at week one included as predictors.

Table 5.
Correlations between key study variables

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	1.00												
2. Mindfulness	.046	1.00											
3. Impulsivity (week1)	.001	-.124	1.00										
4. Sensation Seeking (week1)	.023	-.046	.350**	1.00									
5. Self-regulation (week 1)	-.167	.126	-.424**	-.007	1.00								
6. Self-regulation (average)	-.093	.047	-.384**	.074	.684**	1.00							
7. Risk behavior (week 1)	.099	.073	.277**	.213*	-.183*	-.205**	1.00						
8. Risk behavior (average)	.105	.085	.282**	.175*	-.160†	-.164*	.540**	1.00					
9. External reason	-.043	.063	.186	-.026	-.324**	-.253**	.209*	.357**	1.00				
10. Coping reason	.259**	-.058	.151	.121	-.190	-.086	.337**	.378**	.494**	1.00			
11. Personal reason	.040	-.070	.295**	.065	-.412**	-.304**	.253**	.429**	.766**	.617**	1.00		
12. Moral refuse	-.214*	.097	-.167	.081	.224*	.331**	-.100	-.188*	.022	-.063	-.040	1.00	
13. External refuse	-.306**	.129	-.056	.020	.182†	.239**	-.028	-.165	.169†	-.060	-.053	.721**	1.00

† $p<.10$, * $p < .05$, ** $p<.001$

The outcome variable was constructed by taking an average score for the variable across time two through time five, in order to examine overall impact of the predictor variables on the decision-making bases. Age was entered into the model (not centered) as a control variable in instances where age was significantly correlated with the outcome: namely, with coping reasons to engage in risk, and with both decision-making bases to refuse to engage in risk behavior.

I also examined how the predictor variables related to actual risk behavior. A multiple regression was carried out to examine the relation between the predictor variables (impulsivity and sensation seeking) and engagement in risk from time two through five.

External reason to partake in risk. The model to predict the average external reasons to engage in risk behavior was not statistically significant, $F(2,101)=2.44$, $p=.092$. The parameter estimates are reported in Table 6. Note, however, that impulsivity at week one significantly predicted external reasons to partake in risk.

Table 6.
Multiple Regression predicting External Reasons to Engage in Risk from Impulsivity and Sensation Seeking

	b	SE b	β
(Constant)	1.579	.075	
Impulsivity	.279	.127	.231[*]
Sensation Seeking	-.141	.128	-.116

[*]$p<.05$

Coping reason to partake in risk. Collectively, impulsivity and sensation seeking did not significantly predict the average coping reasons to engage in risk behavior, $F(3,99)=2.899$, $p=.39$. Age was included as a control variable because the correlation between age and coping reasons to partake in risk were statistically significant (see Table 4). The parameter estimates are reported in Table 7.

Table 7.
Multiple Regression predicting Coping Reasons to Engage in Risk from Impulsivity and Sensation Seeking

	b	SE b	β
(Constant)	.103	.763	
Age	.130	.054	.232[*]
Impulsivity	.225	.162	.123
Sensation Seeking	.072	.164	.046

[*]*p<.05*

Personal reasons to partake in risk. Impulsivity and sensation seeking significantly predicted the average personal reasons to engage in risk, $F(2,101)=4.98$, $p<.05$. To examine the unique contribution of each variable, the parameter estimates are reported in Table 8. A higher score in impulsivity significantly predicted a higher score in personally driven decision making bases to engage in risk.

Table 8.
Multiple Regression predicting Personal Reasons to Engage in Risk from Impulsivity and Sensation Seeking

	b	SE b	β
(Constant)	1.860	.074	
Impulsivity	.389	.126	.318[*]
Sensation Seeking	-.072	.127	-.059

[*]*p<.05*

Moral reason to refuse to partake in risk. Collectively, age, impulsivity and sensation seeking significantly predicted average moral reasons to refuse to engage in risk behavior, $F(3,110)=3.324$, $p=.022$. Age was included as a control variable because the correlation between age and moral reasons to partake in risk were statistically significant (see Table 4). The parameter estimates are reported in Table 9. A higher score in impulsivity significantly predicted a lower score in morally driven decision making bases to engage in risk. Sensation seeking indicated a potential increase in morally driven reasons for engagement in risk behavior as opposed to decreased likelihood. However, this was marginal after controlling for impulsivity.

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Table 9.
Multiple Regression predicting Moral Reasons to Refuse to Engage in Risk from Impulsivity and Sensation Seeking

	b	SE b	β
(Constant)	3.957	.691	
Age	-.096	.049	-.179
Impulsivity	-.372	.151	-.243*
Sensation Seeking	.269	.147	.180†

†*p*<.10; **p*<.05

External reason to refuse to partake in risk. Collectively, age, impulsivity and sensation seeking statistically significantly predicted average external reasons to refuse to engage in risk behavior, $F(3,110)=3.676$, $p=.014$. Age was included as a control variable because the correlation between age and coping reasons to partake in risk were statistically significant (see Table 5). The parameter estimates are reported in Table 10. The older the participant, the lower the score in external reasons to refuse to engage in risk behavior (e.g., "it's not available to me;" "it's too expensive").

Table 10.
Multiple Regression predicting Moral Reasons to Refuse to Engage in Risk from Impulsivity and Sensation Seeking

	b	SE b	β
(Constant)	4.489	.719	
Age	-.166	.051	-.295*
Impulsivity	-.157	.157	-.098
Sensation Seeking	.113	.154	.072

*p<.05

Risk behavior. Collectively, impulsivity, and sensation seeking significantly predicted average risk behavior, $F(2,138)=6.521$, $p<.05$. The parameter estimates are reported in Table 11. Namely a higher score in impulsivity statistically significantly predicted a higher score in report of engagement in risk behavior.

Table 11.
Multiple Regression predicting Risk Engagement from Impulsivity and Sensation Seeking

	b	SE b	β
(Constant)	1.011	.143	
Impulsivity	.689	.237	.252[*]
Sensation Seeking	.241	.241	.087

*p<.05

Summary of Findings

The regression models examining the impact of sensation seeking and impulsivity on reasons to refuse to engage in risk behavior were both statistically significant. Impulsivity in particular emerged as a significant predictor, predicting a decrease in moral and external reasoning to refuse to engage in risk behavior. Furthermore, the regression model depicting the relationship between impulsivity and sensation seeking with risk behavior was statistically significant. Impulsivity significantly predicted an increase in risk behavior.

Research Questions Two and Three

Does self-regulation moderate the relationship between impulsivity and decision making bases as well as sensation seeking and decision making bases? Further, does a mindfulness intervention positively impact self-regulation, in turn, impacting the decision making bases to engage or refuse to engage in risk behavior?

I hypothesized that a mindfulness intervention would increase self-regulation, in turn increasing moral reasoning to not engage in risk, as well as decreasing adolescents' reasons to engage in risk more generally. I further hypothesized that an increase in self-regulation would decrease the likelihood that adolescents would engage in risk for both external and personal reasons. I was furthermore interested in how increases in self-regulation would affect risk behavior, as previous research indicates self-regulation to be negatively associated with risk taking behavior (Magar, Phillips, & Hosie, 2008). Based on previously cited literature as well as

the previous regression analyses, I hypothesized that a mindfulness intervention would alter self-regulation, in turn moderating the relationship between impulsivity and report of risk behavior as well as between sensation seeking and report of risk behavior.

To test the hypotheses, I conducted multiple hierarchical linear model (HLM) analyses. I chose this method for several reasons, including its ability to explain individual variance among adolescents over time (Hoffman & Rovine, 2007). The following model depicts the relations tested. Because age was not significantly correlated with self-regulation or with risk outcomes, age was not included in the full HLM model. It is important to note that a total of five data points were obtained over the course of 12 weeks. Time was coded so that time five = 0; time four = -1; time three = -2; time two = -3 and that time one was used as a control variable. Time was coded in this manner in order to capture growth over time while using the final time point as the main reference point for appropriate interpretation of results.

Level-1 Model:

$DecisionMakingBase_{ti} = \pi_{0i} + \pi_{1i} \times (Time_{ti}) + e_{ti}$

Level-2 Model:

$\pi_{0i} = \beta_{00} + \beta_{01}*(Self\text{-}regulation\ Week1_i) + \beta_{02}*(Impulsivity_i) + \beta_{03}*(Sensation\ Seeking_i) + \beta_{04}*(Mindfulness\ Intervention_i) + \beta_{05}*(DecisionMakingBase\ at\ week\ 1_i) + \beta_{06}*(Self\text{-}regulation\ Average\ week\ 3\text{-}12_i) + \beta_{07}*(Self\text{-}regulation\ (average)\ x\ Mindfulness_i) + \beta_{08}*(Self\text{-}regulation\ (average)\ x\ Impulsivity_i) + \beta_{09}*(Self\text{-}regulation\ (average)\ x\ Sensation\ Seeking_i) + + r_{0i}$

$\pi_{1i} = \beta_{10} + \beta_{11}*(Self\text{-}regulation\ Week1_i) + \beta_{12}*(Impulsivity_i) + \beta_{13}*(Sensation\ Seeking_i) + \beta_{14}*(Mindfulness\ Intervention_i) + \beta_{15}*(DecisionMakingBase\ at\ week\ 1_i) + \beta_{16}*(Self\text{-}regulation\ Average\ week\ 3\text{-}12_i) + \beta_{17}*(Self\text{-}regulation\ (average)\ x\ Mindfulness_i) +$

β_{18}*(Self-regulation (average) x Impulsivity$_i$) + β_{19}*(Self-regulation (average) x

Sensation Seeking$_i$) + r_{1i}

Model 1.
Hierarchical Linear Model Depicting Relationship between Predictor and
Outcome Variables Moderated by Self-Regulation and Mindfulness

Decision making or Risk (T1) | Impulsivity | Sensation Seeking | Self-regulation (T1) | Mindfulness

Intercept

Ave. Self-regulation

β_{12} β_{02} β_{04}

β_{0} β_{11} β_{16}

β_{00} β_{05} β_{03} β_{13} β_{06} Mindful x SR

β_{14} β_{07}

β_{15} β_{17}

β_{08} Impulse x SR

π_{oi} β_{18}

β_{09} SS x SR

Time β_{10} π_{1i} β_{19}

Decision Making Base or Risk
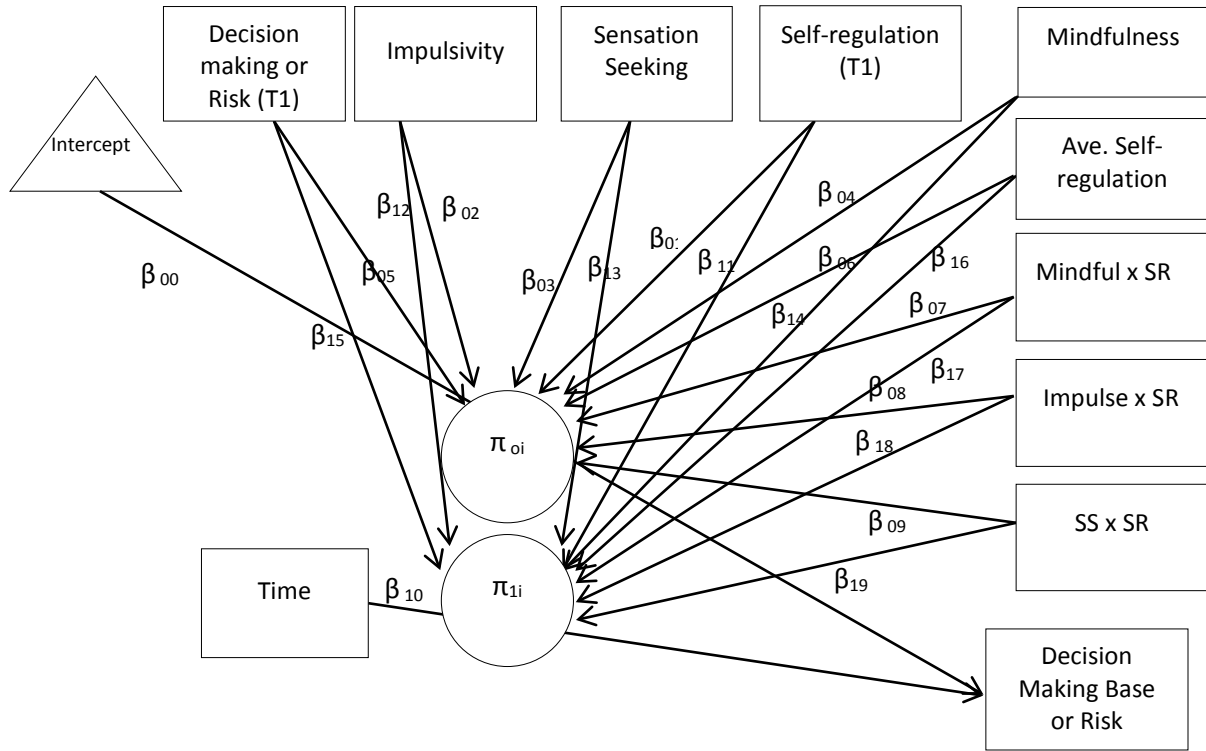
Model 1 illustrates the relationship between the various control variables, main effects, and interaction variables as they relate to the outcome variable across time. The variables explain variability at the intercept and at the slope describing both within-student and between-student variability in the outcome variable (decision making to engage or refuse to engage in risk, as well as in number of risks reported).

Decision-Making Base: Engagement in Risk for External Reasons

Hierarchical linear modeling was conducted to evaluate the growth of the students with respect to decision making to engage in risk due to external influences. Model 1 in Table 12 depicts the outcome variable (decision to engage in risk behavior due to external reasons) as predicted by time. 53.75% of the variance in decision making to engage in risk for external reasons at week 12 is between students. The between-student variance in the growth slope is statistically nonsignificant. On average, students ended with a score of 1.48 (on a 4-point Likert scale) in decision making to engage in risk for external reasons. Students decreased at a rate of .088 every three weeks across the course of the semester. When comparing Model 2 to the first model, the chi-square statistic indicates that Model 2 is indeed a better fit, $\chi^2(18) = 33.76$, $p < .05$. Controlling for all other variables, students who were in the control group and started one unit above average in using external reasons for making decisions to engage in risk had average decision making to engage in risk for external reasons at the end of the semester that was .57 units higher than at the start of the semester. The mindfulness intervention was not a significant predictor of change in decision making to engage in risk for external reasons. Thus, only decision making to engage in risk for external reasons at week one was predictive of decision making to engage in risk for external reasons at week 12 (time five).

Table 12.
Decision Making Base: Engagement in Risk for External Reasons

Fixed effects	Model 1			Model 2		
	Coefficient	(SE)	df	Coefficient	SE	df
Intercept, β_{00}	1.476**	(.1)	55	1.46**	(.12)	69
Self-regulation wk1, β_{01}				-.196	(.603)	69
Impulsivity, β_{02}				-.124	(.185)	69
Sensation seeking, β_{03}				.059	(.132)	69
Mindfulness, β_{04}				-.092	(.157)	69
Engagement in risk for external reason wk1, β_{05}				.566*	(.188)	69

Self-regulation average wk3-12, β_{06}				-.403	(.549)	69
Self-regulation average x Mindfulness, β_{07}				-.239	(.529)	69
Self-regulation ave x impulsivity, β_{08}				-.223	(.377)	69
Self-regulation ave x sensation seeking, β_{09}				-.009	(.265)	69
Slope, β_{10}	-.088[*]	(.038)	55	-.067	(.054)	69
Self-regulation wk1, β_{11}				.123	(.222)	69
Impulsivity, β_{12}				-.09	(.086)	69
Sensation seeking, β_{13}				.1	(.081)	69
Mindfulness, β_{14}				-.026	(.071)	69
Engagement in risk for external reason wk1, β_{15}				.003	(.059)	69
Self-regulation average wk3-12, β_{16}				-.102	(.151)	69
Self-regulation average x Mindfulness, β_{17}				-.144	(.212)	69
Self-regulation ave x impulsivity, β_{18}				.081	(.162)	69
Self-regulation ave x sensation seeking, β_{19}				.005	(.187)	69
Random Effects	Variance	χ^2	df	Variance	χ^2	df
Within-student e_{ti}	.29		55	0.29		
student intercept, r_{0i}	.337[**]	119.9	55	.132[*]	79.65	46
student slope, r_{1i}	.005	55.46	55	.009	53.54	46
Model Deviance (parameters)	430.47 (6)			396.71 (24)		

[†]$p<.10$; [*]$p<.05$; [**]$p<.001$

Decision Making Base: Engagement in Risk for Coping Reason

Hierarchical linear modeling was conducted to evaluate the growth of the students with respect to decision making to engage in risk due to coping influences. Model 1 in Table 13 depicts the outcome variable (decision to engage in risk behavior due to coping reasons) as predicted by time. 57.88% of the variance in decision making to engage in risk for coping reasons at week 12 was between students. The variance in the rate of growth between students

was statistically nonsignificant. On average, students ended with a score of 1.77 (on a 4-point Likert scale) in decision making to engage in risk for coping reasons. They, on average, decreased at a rate of .12 units every three weeks across the course of the semester. When comparing Model 2 to the first model, the chi-square statistic indicates that Model 2 is indeed a better fit $\chi^2(18) = 37.597$, $p<.01$. Controlling for all other variables, youth who were in the control group, who started one unit above the mean in their using coping reasons for making decisions to engage in risk had average decision making to engage in risk for coping reasons at the end of the semester that were .36 units higher than youth who start with an average score in coping reasons of decision making to engage in risk. The mindfulness intervention was not a significant predictor of change in decision making to engage in risk for coping reasons. Further, youth who started one unit above the mean in self-regulation increased by .67 units in decision making to engage in risk for coping reasons by the end of the semester. Thus, only decision making to engage in risk for coping reasons at week one, and self-regulation at week one, were predictive of decision making to engage in risk for coping reasons at week 12 (time five).

Table 13.
Decision Making Base: Engagement in Risk for Coping Reason

Fixed effects	Model 1			Model 2		
	Coefficient	(SE)	df	Coefficient	(SE)	df
Intercept, β_{00}	1.767**	(.128)	77	1.864**	(.201)	68
Self-regulation wk1, β_{01}				.833	(.807)	68
Impulsivity, β_{02}				.411	(.305)	68
Sensation Seeking, β_{03}				-.046	(.262)	68
Mindfulness, β_{04}				.02	(.259)	68
Engagement in risk for coping reason wk1, β_{05}				.368**	(.121)	68
Self-regulation average wk3-12, β_{06}				.459	(.869)	68
Self-regulation average x Mindfulness, β_{07}				-.095	(1)	68
Self-regulation average x Impulsivity, β_{08}				.964	(.697)	68

Self-regulation average x Sensation Seeking, β_{09}				.068	(.713)	68
Slope, β_{10}	-0.118*	(.047)	77	-.136†	(.079)	68
Self-regulation wk1, β_{11}				.669*	(.305)	68
Impulsivity, β_{12}				.025	(.114)	68
Sensation Seeking, β_{13}				.022	(.114)	68
Mindfulness, β_{14}				.052	(.106)	68
Engagement in risk for coping reason wk1, β_{15}				-.056	(.048)	68
Self-regulation average week3-12, β_{16}				-.337	(.328)	68
Self-regulation average x Mindfulness, β_{17}				.22	(.419)	68
Self-regulation average x Impulsivity, β_{18}				.082	(.259)	68
Self-regulation average x Sensation Seeking, β_{19}				.115	(.329)	68
Random Effects	Variance	χ^2	df	Variance	χ^2	df
Within-student e_{ti}	0.443			0.426		
student intercept, r_{0i}	.609**	137.14	56	0.377	106.84	47
student slope, r_{1i}	0.007	65.46	56	0.003	60.89	47
Model Deviance (parameters)	522.67 (6)			485.08 (24)		

†$p<.10$; *$p<.05$; **$p<.001$

Decision Making Base: Engagement in Risk for Personal Reason

Hierarchical linear modeling was conducted to evaluate the growth of the students with respect to decision making to engage in risk due to personal influences. Model 1 in Table 14 depicts the outcome variable (decision to engage in risk behavior due to personal reasons) as predicted by time. 59.35% of the variance in decision making to engage in risk for personal reasons at week 12 is between students. The variance in the rate of growth between students over time was statistically nonsignificant. On average, students ended with a score of 1.71 (on a 4-point Likert scale) in decision making to engage in risk for personal (character based) reasons. The youth decreased at a rate of .10 every three weeks across the course of the semester. When

comparing Model 2 to the first model, the chi-square statistic indicates that Model 2 is indeed a

better fit $\chi^2(18) =39.33$, $p<.01$. Controlling for all other variables, youth who were in the control

group and who started one unit above average in their using personal reasons for making

decisions to engage in risk had average decision making to engage in risk for personal reasons at

the end of the semester that were .44 units higher than youth who were at the mean in their using

personal reasons for making decisions to engage in risk. Thus, only decision making to engage in

risk for personal reasons at week one was predictive of decision making to engage in risk for

personal reasons at week 12 (time five).

Table 14.
Decision Making Base: Engagement in Risk for Personal Reason

Fixed effects	Model 1			Model 2		
	Coefficient	SE	df	Coefficient	SE	df
Intercept, β_{00}	1.712**	(.107)	78	1.783**	(.167)	69
Self-regulation wk1, β_{01}				-.134	(.671)	69
Impulsivity, β_{02}				.064	(.26)	69
Sensation Seeking, β_{03}				.02	(.217)	69
Mindfulness, β_{04}				-.128	(.212)	69
Engagement in risk for personal reason wk1, β_{05}				.436*	(.146)	69
Self-regulation average wk3-12, β_{06}				-.223	(.685)	69
Self-regulation average x Mindfulness, β_{07}				-.367	(.821)	69
Self-regulation average x Impulsivity, β_{08}				.183	(.56)	69
Self-regulation average x Sensation Seeking, β_{09}				-.258	(.592)	69
Slope, β_{10}	-.104*	(.038)	78	-.091	(.065)	69
Self-regulation wk1, β_{11}				.313	(.251)	69
Impulsivity, β_{12}				-.017	(.097)	69
Sensation Seeking, β_{13}				.097	(.094)	69
Mindfulness, β_{14}				-.002	(.086)	69
Engagement in risk for personal reason wk1, β_{15}				-.010	(.058)	69
Self-regulation average wk3-12, β_{16}				-.140	(.259)	69
Self-regulation average x Mindfulness, β_{17}				-.127	(.342)	69
Self-regulation average x Impulsivity, β_{18}				.076	(.207)	69
Self-regulation average x Sensation Seeking, β_{19}				.055	(.271)	69

Random Effects	Variance	χ^2	df	Variance	χ^2	df
Within-student eti	0.3			0.291		
student intercept, r0i	.438*	134.9	58	.250**	103.87	49
student slope, r1i	.002	61.01	58	.001	59.25	49
Model Deviance (parameters)	447.58 (6)			408.26 (24)		

†$p<.10$; *$p<.05$; **$p<.001$

Decision Making Base: Refuse to Engage in Risk for Moral Reason

Hierarchical linear modeling was conducted to evaluate the growth of the students with respect to decision making to refuse to engage in risk due to moral influences. Model 1 in Table 15 depicts the outcome variable (decision to refuse to engage in risk for moral reasons) as predicted by time. 67.32% of the variance in decision making to refuse to engage in risk for moral reasons at week 12 is between students. The variance in the rate of growth between students over time is statistically nonsignificant. On average, students end with a score of 2.5 (on a 4-point Likert scale) in decision making to engage in risk for personal (character based) reasons. The growth slope, on the other hand was not statistically significant. When comparing Model 2 to the first model, the chi-square statistic indicates that Model 2 is indeed a better fit $\chi^2(18) = 41.215$, $p<.01$. Controlling for all other variables, youth who were in the control group and who started one standard deviation above the mean in their using moral reasons for making decisions to refuse to engage in risk had average decision making to refuse to engage in risk for moral reasons at the end of the semester that were .46 units higher than youth who were in the control group and who started at the mean level for using moral reasons to refuse risk. The mindfulness intervention did not have a significant impact on the outcome: using moral reasons to refuse risk. Thus, only decision making to refuse to engage in risk for moral reasons at week one was predictive of decision making to refuse to engage in risk for moral reasons at week 12 (time five).

Table 15.
Decision Making Base: Refuse to Engage in Risk for Moral Reason

Fixed effects	Model 1			Model 2		
	Coefficient	(SE)	df	Coefficient	SE	df
Intercept, β_{00}	2.53**	(.134)	90	2.572**	(.209)	81
Self-regulation wk1, β_{01}				0.024	(.741)	81
Impulsivity, β_{02}				-.229	(.297)	81
Sensation						81
Seeking, β_{03}				.207	(.218)	
Mindfulness, β_{04}				-.010	(.255)	81
Refuse risk for moral reason wk1, β_{05}				.464**	(.110)	81
Self-regulation average wk3-12, β_{06}				.425	(.844)	81
Self-regulation average x Mindfulness, β_{07}				-.271	(.893)	81
Self-regulation average x Impulsivity, β_{08}				-.523	(.713)	81
Self-regulation average x Sensation						81
Seeking, β_{09}				.986†	(.629)	
Slope, β_{10}	-0.033	(0.046)	90	.001	(.077)	81
Self-regulation wk1, β_{11}				.087	(.272)	81
Impulsivity, β_{12}				.025	(.108)	81
Sensation						81
Seeking, β_{13}				.014	(.083)	
Mindfulness, β_{14}				-.079	(.095)	81
Refuse risk for moral reason wk1, β_{15}				.021	(.041)	81
Self-regulation average wk3-12, β_{16}				-.103	(.309)	81
Self-regulation average x Mindfulness, β_{17}				-.123	(.348)	81
Self-regulation average x Impulsivity, β_{18}				.005	(.258)	81
Self-regulation average x Sensation						81
seeking, β_{19}				.145	(.257)	
Random Effects	Variance	χ^2	df	Variance	χ^2	
Within-student eti	0.444			0.444		
student intercept, r0i	.914**	225.75	72	0.583**	177.61	63
student slope, r1i	.026†	87.07	72	0.017*	84.69	63
Model Deviance (parameters)	642.6 (6)			601.39 (24)		

†$p<.10$; *$p<.05$; **$p<.001$

Decision Making Base: Refuse to Engage in Risk for External Reason

Hierarchical linear modeling was conducted to evaluate the growth of the students with respect to decision making to refuse to engage in risk due to external influences. Model 1 in Table 16 depicts the outcome variable (decision to refuse to engage in risk for external reasons) as predicted by time. 68.6% of the variance in decision making to refuse to engage in risk for external reasons at week 12 is between the students at the intercept. The variance between students in the rate of change over time was not statistically significant. On average, students

ended with a score of 2.1 (on a 4-point Likert scale) in decision making to engage in risk for

external reasons. When comparing Model 2 to the first model, the chi-square statistic indicates

that Model 2 is indeed a better fit $\chi^2(18) = 51.58$, $p<.001$. Controlling for all other variables,

youth who were in the control group and who started one standard deviation above the mean in

their using external reasons for making decisions to refuse to engage in risk had average decision

making to refuse to engage in risk for external reasons at the end of the semester that were .47

units higher than youth in the control group who had average levels of external reasons for

refusing risk. The mindfulness intervention did not statistically significantly affect the decision

making outcome. Thus, only decision making to refuse to engage in risk for external reasons at

week one was predictive of decision making to refuse to engage in risk for external reasons at

week 12 (time five).

Table 16.
Decision Making Base: Refuse to Engage in Risk for External Reason

Fixed effects	Model 1			Model 2		
	Coefficient	(SE)	df	Coefficient	(SE)	df
Intercept, β_{00}	2.077**	(.136)	90	2.18**	(.186)	81
Self-regulation wk1, β_{01}				-.204	(.841)	81
Impulsivity, β_{02}				.073	(.257)	81
Sensation Seeking, β_{03}				.05	(.233)	81
Mindfulness, β_{04}				-.226	(.225)	81
Refuse risk for external reason wk1, β_{05}				.472**	(.151)	81
Self-regulation average wk3-12, β_{06}				.708	(.728)	81
Self-regulation average x Mindfulness, β_{07}				-.246	(.741)	81
Self-regulation average x Impulsivity, β_{08}				-.726	(.532)	81
Self-regulation average x Sensation Seeking, β_{09}				.947	(.641)	81
Slope, β_{10}	-.021	(.047)	90	.017	(.067)	81
Self-regulation wk1, β_{11}				-.147	(.268)	81
Impulsivity, β_{12}				.027	(.092)	81
Sensation Seeking, β_{13}				-.020	(.081)	81
Mindfulness, β_{14}				-.072	(.08)	81

Refuse risk for external reason wk1, β_{15}				.146	(.241)	81
Self-regulation average wk3-12, β_{16}				.146	(.241)	81
Self-regulation average x Mindfulness, β_{17}				.017	(.277)	81
Self-regulation average x Impulsivity, β_{18}				.037	(.175)	81
Self-regulation average x Sensation Seeking, β_{19}				.219	(.207)	81
Random Effects	Variance	χ^2	df	Variance	χ^2	df
Within-student e_{ti}	.435			.417		
student intercept, r_{0i}	.951**	223.82	71	.620**	177.97	62
student slope, r_{1i}	.035†	88.91	71	.030*	88.67	62
Model Deviance (parameters)	644.64 (4)			586.065 (24)		

†$p<.10$; *$p<.05$; **$p<.001$

Risk Behavior

Last, I examined the conceptual model depicted by Model 1 with report of risk behavior as the outcome variable. I examined whether there was a significant interaction between self-regulation and mindfulness intervention with respect to risk behavior over time. Risk behavior was calculated as the sum of reported risk behaviors within the last three weeks for each time point of data collection (with the exception of the first week of data collection). The same two-level model was carried out:

Level-1 Model:

Risk Behavior$_{ti}$ = π_{0i} + π_{1i} x (Time$_{ti}$) + e_{ti}

Level-2 Model:

π_{0i} = β_{00} + β_{01}*(Self-regulation Week1$_i$) + β_{02}*(Impulsivity$_i$) + β_{03}*(Sensation Seeking$_i$) +

β_{04}*(Mindfulness Intervention$_i$) + β_{05}*(Number of Risks at week 1$_i$) + β_{06}*(Self-regulation Average week 3-12$_i$) + β_{07}*(Self-regulation (average) x Mindfulness$_i$) +

β_{08}*(Self-regulation (average) x Impulsivity$_i$) + β_{09}*(Self-regulation (average) x

Sensation Seeking$_i$) + + r_{0i}

π_{1i} = β_{10} + β_{11}*(Self-regulation Week1$_i$) + β_{12}*(Impulsivity$_i$) + β_{13}*(Sensation Seeking$_i$) +

β_{14}*(Mindfulness Intervention$_i$) + β_{15}*(Number of Risk at week 1$_i$)+ β_{16}*(Self-regulation Average week 3-12$_i$) + β_{17}*(Self-regulation (average) x Mindfulness$_i$) + β_{18}*(Self-regulation (average) x Impulsivity$_i$) + β_{19}*(Self-regulation (average) x Sensation Seeking$_i$) + r_{1i}

Hierarchical linear modeling was conducted to evaluate the growth of the students with respect to actual reported risk behavior. Model 1 in Table 16 depicts the outcome variable reported risk behavior as predicted by time. 66.3% of the variance in risk behavior at week 12 is between the students. Thus, 15.22% of the variance in the growth slope was between students and therefore 84.78% of the variance in the rate of change over time is within the student. On average, students ended with a report of .88 risks taken. Although this indicates a skewed distribution, the MLM analysis did detect significant changes over time. The growth slope is statistically significant and students on average decreased by .17 across time in Campus Corps. When comparing Model 2 to the first model, the chi-square statistic indicates that Model 2 is indeed a better fit $\chi^2(18) = 81.62$, $p<.001$. Controlling for all other variables, youth who were in the control group and were one unit above average in self-regulation over time had a risk score at the end of the semester that was 1.79 units higher than youth who were at average levels of self-regulation.

The coefficients presented below illustrate the significant interaction between self-regulation and the mindfulness intervention. This interaction is presented in Table 17. To help the reader conceptualize this interaction, I included predicted values for youth in the mindfulness intervention group and the control group who were at the mean of self-regulation as well as one standard deviation above the mean in self-regulation (see Figure 3). This figure illustrates that students who had higher levels of self-regulation were more likely to engage in risk at the start of

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the intervention if they were a part of the mindfulness intervention group. However, as highlighted by the *t*-test examining the differences between the means of the two groups (mindfulness intervention versus control group), this difference was not statistically significant, $t(176)=.973$, $p=.332$. Interestingly, youth in the control group who were one standard deviation above the mean in self-regulation across time increased in risk behavior over time. This is likely to be a spurious finding because self-regulation on average did not change significantly for students in the control group. On the other hand, youth who had higher self-regulation and who were a part of the mindfulness intervention decreased significantly in risk behavior across time. Namely, youth who started one standard deviation above the mean and received the mindfulness intervention decreased on average by three more risk taking units than their peers who did not receive the mindfulness intervention. This indicates a significant interaction between self-regulation and risk taking and the potential for intervention.

Table 17.
Risk Behavior outcome

Fixed effects	Model 1			Model 2		
	Coefficient	(SE)	*df*	Coefficient	(SE)	*df*
Intercept, β_{00}	0.884**	(.216)	111	.086	(.313)	102
Self-regulation wk 1, β_{01}				1.035	(.911)	102
Impulsivity, β_{02}				.632	(.412)	102
Sensation Seeking, β_{03}				-.016	(.351)	102
Mindfulness, β_{04}				.412	(.395)	102
Risk behavior wk1, β_{05}				.274	(.054)	102
Self-regulation average wk3-12, β_{06}				1.797†	(1.11)	102
Self-regulation average x Mindfulness, β_{07}				-3.005*	(1.23)	102
Self-regulation average x Impulsivity, β_{08}				.585	(1.021)	102
Self-regulation average x Sensation Seeking, β_{09}				.951	(1.006)	102
Slope, β_{10}	-.165*	(.082)	111	-.118	(.127)	102
Self-regulation wk1, β_{11}				.855*	(.37)	102
Impulsivity, β_{12}				.109	(.167)	102
Sensation				-.070	(.142)	102

	Variance	χ^2	df	Variance	χ^2	df
Seeking, β_{13}						
Mindfulness, β_{14}				.021	(.160)	102
Risk behavior wk1, β_{15}				-.005	(.022)	102
Self-regulation average wk3-12, β_{16}				.760†	(.45)	102
Self-regulation average x Mindfulness, β_{17}				-1.311*	(.50)	102
Self-regulation average x Impulsivity, β_{18}				.536	(.413)	102
Self-regulation average x Sensation Seeking, β_{19}				.474	(.407)	102
Random Effects	Variance	χ^2	df	Variance	χ^2	df
Within-student eti	1.96			1.960		
student intercept, r0i	3.86**	426.74	111	2.484**	314.75	102
student slope, r1i	.352**	212.66	111	.241**	180.49	102
Model Deviance (parameters)	1863.43 (6)			1781.81 (24)		

†$p<.10$; *$p<.05$; **$p<.001$
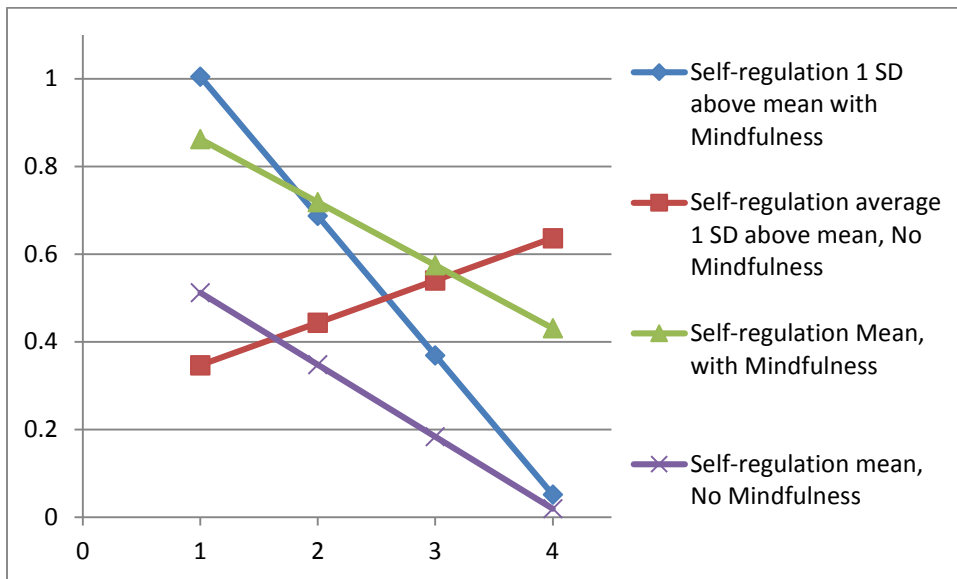
Figure 3. Interaction graph depicting predicted values for prototypical students

Summary of Results

There was a significant decrease in all of the decisions-making bases to engage in risk

over time. However, there were no significant effects of mindfulness intervention on decision-

making bases, either directly or by affecting adolescents' self-regulation. With risk behavior as

the outcome variable, however, a significant interaction between self-regulation and the

mindfulness intervention was observed. In this case, youth in the mindfulness intervention group,

who were one standard deviation above the mean on self-regulation, decreased in their risk

taking behavior, as compared to similar students in the control group.

Chapter 4

Discussion

The literature on adolescent decision making indicates that adolescents and adults are not that different in hypothetical decision making about risk, but that in "real world" risk situations, adolescents are more likely to engage in risk than adults (Millstein & Halpern-Felsher, 2002; Steinberg, Graham, O'Brien, Woolard, Cauffman, & Banich, 2009). Understanding this phenomenon is important when considering the higher propensity for youth to be involved in risk-related casualties (Boyer, 2006). Baumeister et al. (2006) argued that self-regulation may be a potential construct for intervention, given that self-regulation has been compared to a muscle that can be exercised. Furthermore, in a recent study, Metz et al. (2013) found that the Learning to Breathe mindfulness program had some positive impact with respect to self-regulation efficacy. In the current study, I tested whether a mindfulness intervention may increase self-regulation, in turn yielding a positive impact regarding decision making to engage in or to refuse to engage in, risk behavior. I furthermore suggested that by implementing a mindfulness intervention, risk behavior would decrease.

I implemented a six-week mindfulness intervention within the youth mentoring program Campus Corps during the fall 2013 semester, and compared this to a control group that included youth in the "Campus Corps as usual" condition. As previously mentioned, Campus Corps is a one-on-one mentoring program where the youth and the mentors are closely supervised by a therapist in the program of marriage and family therapy in the department of Human Development and Family Studies at CSU. The mindfulness intervention, Learning to Breathe (Broderick, 2009), was implemented between time two and time four of data collection and covered various lessons that bring awareness to the self, including the physical, cognitive, and emotional self as well as bringing awareness to stressors in the youth's life and how to change

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thoughts around the stressors. The mindfulness intervention was facilitated by PhD-level marriage and family therapy students. Among the 178 students who took part in the study, 50.6% of the youth were a part of the mindfulness intervention group.

Overall, the mindfulness intervention did not have a strong impact on decision-making bases related to engagement in or refraining from risk taking. Nevertheless, some intriguing findings did emerge and they are highlighted and discussed below.

Sensation Seeking and Impulsivity

First, consistent with the literature on the relation between impulsivity, sensation seeking, and risk behavior (e.g., Luciana & Collins, 2012), I found positive correlations between impulsivity and sensation-seeking, and these two variables were in turn correlated with engagement in risk. I hypothesized that there would be a relation between impulsivity and sensation seeking and the various decision-making bases. I further hypothesized that there would be a significant relationship between impulsivity and sensation seeking and report of actual risk behavior. Impulsivity was significantly related to some of the decision-making bases, as highlighted by the initial multiple regressions. For example, impulsivity was significantly related to lower levels of youth refusing to engage in risk for both moral and externally based reasons. Impulsivity further significantly predicted higher scores in risk behavior. Impulsivity predicted higher scores in making decisions for both external as well as personal reasons to take part in risk. It did not, however, predict higher scores in coping reasons for engagement in risk. Impulsivity further significantly predicted lower moral reasons to refuse to engage in risk scores after controlling for age. This means that the higher the impulsivity scores, the lower the scores for refusing to engage in risk for moral reasons are. Finally, impulsivity statistically significantly predicted an increase in risk behavior.

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Overall, these correlational results are consistent with the literature on dual-processing models of decision making, namely that impulsivity is related to less "thought-out" decision making. Therefore, it seems plausible to speculate that impulsive youth are more likely to make decisions to engage in risk for both personal and external reasons, as several of the items on these scales indicate a decreased logical thought process (i.e., "it just happened," "I thought it would be cool," "someone else wanted me to do it"). It is interesting to note that impulsivity and sensation seeking were not significant predictors of "coping reasons" for risk engagement. I speculate that reasoning involving coping may have more to do with thoughtful and engaged cognitive process than with impulsive personalities. Namely, the items that make up "coping reasons" are "it helps me relax" and "it helps me feel better." Such decision-making bases seem to require a more mindful understanding of the cognitive, emotional, and physical state of the self than the impulsive and/or reactive approach to risky situations. This may be grounds for further investigation. Namely, such rationales for decision making may have more to do with distress tolerance than with impulsivity and sensation seeking. Further investigation with respect to how mindfulness may affect distress tolerance particularly may aid in the understanding of coping reasons for decision making.

Self-regulation

Magar, Phillips, and Hosie (2008) describe self-regulation as having the ability to regulate emotion and cognitive processes. They specifically found that decreased self-regulation, and particularly decreased cognitive regulation (also described as executive function), was related to an increased propensity to take part in health compromising risk-taking behavior. Consistent with this research, the correlations presented in this study suggest that self-regulation is significantly negatively correlated with all of the decision-making bases to engage in risk

except in the case of "coping reasons" (e.g., "it helps me relax;" "it makes me feel better"). Self-regulation was further statistically significantly negatively related to reported engagement in risk behavior. Finally, self-regulation was statistically significantly positively associated with decision making bases to refuse to engage in risk behavior.

The results reported are consistent with previous literature on self-regulation as it relates to risk behavior decision making. Namely, self-regulation has been described as a process of cognitive and emotional control that allows youth to delay reward gratification (e.g., Magar et al., 2008; Baumeister & Heatherton, 1996). What is interesting, however, is that again, self-regulation was not significantly correlated with "coping reasons" for decisions to engage in risk. This is an interesting finding in that I previously speculated that coping reasons to engage in risk may involve a more thought-out process that involves an awareness of cognitive and emotional states. However, this may not capture in the moment "need to feel better" response (or reaction) that "coping reasons" arguably encompass (e.g., "it helps me relax," "it makes me feel better"). This warrants further investigation. Again, hinting at a potentially different mechanism of decision making with respect to engagement in risk for coping reasons. Again I speculate that distress tolerance is associated with such decision making bases rather than directly with impulsivity and sensation seeking and the moderating factor of self-regulation. Further investigation with respect to how mindfulness may affect distress tolerance in particularly may aid in the understanding of coping reasons for decision making.

Impact of Mindfulness on Self-Regulation

Self-regulation has been identified in the literature as an ability to resist the need for instant gratification as driven by the pleasure center of the brain (Baumeister & Heatherton, 1996). The purpose of a mindfulness intervention such as Learning to Breathe is to bring

awareness to sub-conscious thoughts, feelings, and emotions that influence behavior (Broderick, 2009). I therefore hypothesized that the mindfulness intervention would positively impact self-regulation and that self-regulation would further moderate the relationship between impulsivity and sensation seeking and the various decision making outcomes. This relationship was not supported by the results. However, it is interesting to note that although there was no interaction effect of mindfulness on self-regulation, there was a significant interaction between mindfulness and self-regulation with respect to self-reported engagement in risk behavior. Namely, youth in the mindfulness intervention group, who were one standard deviation above the mean, were predicted to decrease in their reported risk taking behavior at faster rates than similar youth in the Campus Corps as usual condition.

Because mindfulness is more broadly thought to affect not only subconscious thoughts, but feelings and emotions that influence *behavior* more specifically, and because to have greater self-regulation has been identified as having the ability to resist the need for instant gratification driven by the pleasure center of the brain (Baumeister & Heatherton, 1996), one might speculate that the interaction between self-regulation and mindfulness more strongly affects the "in the moment," gratification-seeking, and/or emotional drive to engage in a particular *behavior* than the reflective cognitive process. Furthermore, the decision making measures ask youth to reflect back on *why* they make the decisions that they do – essentially making this a more calculatory process in and of itself. The way that the decision-making bases measure is constructed and administered may thus hinder the ability to capture the youths' "in the moment" process when faced with a potentially risky situation. Future research may thus choose to use diary study methodology, attempt to simulate risk behavior in a laboratory setting (i.e. the Iowa Gambling Task), or to use implicit association testing. On the other hand, asking youth about which risks

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they partook in is simply asking youth to recall engagement in risk (or potential engagement in risk) without asking them to reflect back on the cognitive-process-laden "why." The active recall is retroactively reflective in and of itself, which may make measuring "reasons for engagement" particularly difficult to measure after the fact.

Limitations

The current study contributes to our understanding of self-regulation as a potentially malleable developmental construct, as is indicated by results highlighting an interaction between self-regulation and mindfulness with decreased report of engagement in risk behavior. However, the study had several limitations. First, engaging youth in the survey process is difficult because taking the survey removes the youth from engaging with the other youth and with their mentor. Many youth describe the survey as a "test," or "quiz." This may provoke a sense of dread for some of the youth, as many youth taking part in Campus Corps struggle with academic engagement more generally.

It is also important to note that the decision-making measure asked youth to recall their thought process before engaging in risk behavior. This measure therefore does not gauge the decision making process in the moment that youth are deciding to engage in risk taking behavior. As previously noted, research posits that adolescents and adults are very similar in appraising risk and show few significant differences in making decisions about *hypothetical* risk, however, adolescents continue to be overrepresented in health-compromising risk-taking behavior (e.g. Millstein & Halpern-Felsher, 2002; Steinberg, Graham, O'Brien, Woolard, Cauffman, & Banich, 2009). Taking into account the decision-making bases measure, it is possible that in asking youth to reflect on a wide range of "types" of risks, this measure is too broad. Future research may want to narrow down the scope of the risk behavior when asking youth about their decision

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making regarding engagement or refusal of such risk. It may be that youth use different processes when deciding whether or not to use or refuse to use drugs versus deciding whether or not to use or refuse to use a seatbelt as highlighted by the various decision-making theories. Though both of the aforementioned risk behaviors are health-compromising behaviors, the scope may be too broad, thus limiting the precision with which I was able to capture youths' decision making process.

Third, there is an issue with sample size and power. Although 178 youth took part in the study, missing data decreased the number of cases available for data analysis. Hierarchical linear modeling (HLM), due to the use of multiple data points, does provide a robust method in handling missing data (Raudenbush & Bryk, 2002). However, for the decision-making bases to engage in risk, only 84 youth were considered in the data analyses, as not all youth completed all of the questions needed for analysis. For the decision-making bases to refuse engagement in risk, the data of 92 youth were analyzed. Finally 112 youth were considered in data analyses with respect to the reported risk behavior outcome. However, according to Scherbaum and Ferreter (2009), sample sizes at level-2 that are close to 100 are thought to be sufficient when the variance components are of interest. If fixed effects are of interest, Scherbaum and Ferreter (2009) suggest a sample size greater than 50. Although the power analysis guidelines for HLM are complex, after taking into account the suggestions by Scherbaum and Ferreter (2009) this study may be at the "cut-off" with respect to having just enough power to detect an effect that in fact is present. Finally, although the six-week Learning to Breathe program is published and seems to show some effect in risk behavior, a 12-week version of the program exists and may have a greater positive impact on youth self-regulation. That is, receiving mindfulness for one

hour per week for six weeks may not be sufficient to substantially impact habit forming behavior that ultimately has a positive impact on self-regulation, leading to developmental change.

Future Directions

To reiterate, Learning to Breathe aims to foster awareness and identification of emotion experience and intensity and to further foster skills that aid adolescents' emotion regulation and tolerance of distressful circumstances (Broderick, 2009). This study provides some indication that mindfulness intervention has the potential to affect self-regulation among adolescents which in turn has a positive impact on risk taking behavior. However, given that Learning to Breathe particularly fosters awareness surrounding identification of emotion experience, measuring youth cognitive process surrounding risk behavior may not have captured the true effect of the mindfulness intervention. Future research should take into account the specific emotional experience of adolescents when engaging in real world risk behavior.

This study took into account a broad range or risk behaviors and asked youth to reflect on their reasoning with respect to their engagement in risk behavior more generally. Keeping in mind the Learning to Breathe goals of fostering skills to better tolerate distressful circumstances and to foster adolescent emotion regulation, narrowing the scope of the type of risk behavior, and honing in on the emotional aspect of self-regulation may be a beneficial addition to the literature on decision making with respect to health compromising risk behavior. For example, for many individuals, not being able to tolerate distress leads to the need for an escape from the difficult and/or perceived negative emotion – leading to potential substance abusing behaviors (e.g., Bornovalova, Gratz, Daughters, Hunt, and Lejuez, 2011). Because of the detrimental nature of risk taking behavior linked to substance abuse, future research may narrow the scope of the risk

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behaviors studied, and opt to examine how emotion regulation, in particular, is more specifically related to risk behavior surrounding substance abusing behavior.

Conclusion

There is a high propensity for youth to be involved in risk related casualties (Boyer, 2006). Therefore, understanding the mechanisms that lead to engagement in health compromising risk behavior may provide practitioners and policy makers with the necessary information to provoke change with respect to prevention efforts targeting adolescent engagement in risk taking behavior. The various decision making theories discussed at the beginning of this study illustrate the tendency for youth to make more reactive, unintentional, decisions based on a potential lack in experience with the environment as well as the desire for reward gratification.

Furthermore, the literature on brain development indicates that as the prefrontal cortex matures, adolescents become more calculated in their decision-making process. However, several decision making theories highlight the notion that there may be an interplay between cognitive development and experience with respect to more purposeful and less reactive decision making. For example, the literature on executive function proposes that during the first frontal lobe growth-spurt (during the childhood years), if self-control (self-regulation and delayed gratification) is encouraged and modeled, children are more likely to be able to regulate their reactions to frustrations and their ability to delay gratification (Mischel, Shoda, & Rodriguez, 1989). Therefore, based on this notion that self-regulation can be practiced, I proposed that a mindfulness intervention would provide a plausible intervention to foster improved self-regulation in turn leading to decreased risk engagement and more thoughtful processes in decision making with respect to risk engagement. I chose mindfulness, in particular, for the

reason that mindfulness is defined as a way of paying attention, or being mindful, of the present moment (Kabat-Zinn, 1994). Furthermore, mindfulness practice one way by which one may increase awareness of mental and emotional processes in an attempt to self-regulate and become balanced when strong emotions arise (Broderick & Metz, 2009).

Thus, as self-regulation increases so does the ability to delay reward gratification (Mischel, Shoda, & Rodriguez, 1989). Reward gratification is indicated as a precursor to risk taking behavior. Namely, more impulsive youth are likely to be driven by reward gratification and thus more likely to engage in risk behavior (Zermatten & van der Linden, 2005).

With this study I hoped to indicate mindfulness as a potential intervention effort to enhance self-regulation in turn addressing the decision making bases for risk engagement. I found that, although mindfulness did not impact self-regulation as it related to various decision making bases, an interaction effect was found between self-regulation and mindfulness with respect to risk behavior engagement. Youth in the mindfulness intervention group, who were one standard deviation above the mean on self-regulation, decreased significantly in their risk taking behavior compared to similar students in the control group.

This study therefore provides some preliminary results indicating that self-regulation may, in fact, be a viable construct for intervention when considering the desire to decrease maladaptive risk taking behavior during the adolescent years. This study further provides evidence that indicates mindfulness intervention as a potential practical option for increasing self-regulation among adolescents.

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