

Mindfulness Enhances Use of Secondary Control Strategies in High School Students at Risk for Mental Health Challenges

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Abstract Adolescence is a developmental period marked by considerable biological, social, and psychological changes, with rates of self-reported stress on the rise mirroring those of adults. Mindfulness interventions are increasingly being implemented in high schools to improve students' stress management and psychosocial outcomes. Despite the well-researched role of primary and secondary control strategies in the management of adolescent stress, the impact of mindfulness on these attributions has not been examined. The current study addressed this gap in the extant literature. A mindfulness-based martial arts program was delivered to 17 high school students at risk for self-regulation challenges. Measures of primary and secondary control and cognitive errors were completed at pre- and post-treatment and compared to a waitlist control ($n=18$). Findings suggested that students in the mindfulness program showed significant improvements in secondary control and reductions in cognitive errors from pre- to post-treatment compared to the waitlist control. No significant group by time changes were found for primary control. Findings are discussed in relation to changes in control-related attributions associated with cognitive behavioral therapy, with specific consideration of possible

mechanisms by which mindfulness may improve secondary control and decrease cognitive errors. Directions for future research are discussed.

Keywords Mindfulness · Secondary control · High school · Intervention

Introduction

Characterized by dramatic changes in biological, social, cognitive, and psychological domains, adolescence is a developmental period of significant transition. As children mature physically, experiencing significant pubertal and neurological changes, they simultaneously embark on their high school career. This transition includes navigating growing academic expectations and complex and increasingly central peer relationships in the midst of pressure to develop more autonomy from their parents and teachers (Yeager et al. 2014). The experience of stress is to be expected and is a natural part of the transition and growth. For example, research has shown that approximately half of defined casual friendships change from one month to the next in the first year of high school (Chan and Poulin 2007). When experienced within the context of supportive relationships and appropriately managed, stress can promote resilience and the development of essential skills in emotion regulation and executive functions (Thompson 2011). While some students are able to flexibly and adaptively draw on their internal resources and actively seek support from people in their environment to address challenge, others experience more difficulty and an associated increase in stress. In fact, current statistics suggest that adolescent stress levels are on the rise, with levels experienced similar to those of adults (Bethune 2014).

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Stress is an important risk factor to consider for adolescents because unmitigated stress can have significant consequences for physical health (Frank et al. 2014) and educational outcomes (Hanson et al. 2004; Murray et al. 2007). Adolescence also marks a prime time for the onset of psychological disorders (Kessler et al. 2001; Merikangas et al. 2010), and chronic stress has been shown to play a consequential role in the development and/or maintenance of psychological problems, including depression (Deardorff et al. 2003; Diaz et al. 2002; van der Wal et al. 2003), and suicide (Diaz et al. 2002; Johnson et al. 2002). Adolescence therefore represents a key developmental period for helping youth to develop effective and adaptive means of coping with challenge and managing associated stress.

There has been a recent surge of interest among educators in mindfulness and its potential role in equipping adolescents with the skills to adaptively manage stress (Zoogman et al. 2014). Mindfulness interventions aim to enhance awareness of the present moment and to increase non-judgmental observation and acceptance of challenge (Kabat-Zinn 2003). This, in turn, sets the stage for improvements in attention, psychological flexibility, self-knowledge, emotion regulation, and stress reactivity (Flook et al. 2010; Greenberg and Harris 2012; Semple et al. 2010). Review of the extant literature highlights the effects of mindfulness on a broad range of psychological outcomes, including improvements in mood (Kuyken et al. 2013; Raes et al. 2014), emotional and behavioral outcomes (Huppert and Johnson 2010; Metz et al. 2013), and perceived stress (Metz et al. 2013; Wisner and Norton 2013). The broad-based impact of mindfulness on such different areas of psychological functioning begs the question: Are there common processes that underlie these diverse outcomes?

Cognitions and more specifically the ability to manage the psychological impact of stress may mediate the relation between the experience of stress and psychological outcomes. The two-process model of control (Morling and Evered 2006), and in particular the theory posed by Weisz (Rothbaum et al. 1982; Weisz et al. 1984), suggests that adolescents cope with stress using *primary control* and *secondary control* strategies. *Primary control* strategies entail active attempts to try to change aspects of the objective situation or their thoughts, feelings, or behavior to achieve a desired outcome (e.g., “If I study hard, I can get a good grade”). *Secondary control* strategies are embedded in cognition and involve adjusting one’s way of thinking about a challenge (e.g., through acceptance, cognitive restructuring, positive thinking) to fit the current reality. Use of secondary control strategies has been associated with engaging in and maintaining positive affect during a stressful encounter and with lower levels of parent- and self-reported depressive symptoms (Jaser et al. 2011). In fact, challenges with secondary control are associated with symptoms of psychological disorders over and above the impact of stress alone (Peterson et al. 2009), and have been shown to mediate

the relation between parental depression and the occurrence of child psychopathology (Jaser et al. 2008).

While secondary control strategies involve restructuring cognitions in a positive way, the inverse of enacting these strategies is to engage in negative thinking, or negative cognitive errors. These cognitive biases reflect four kinds of thinking: (1) overgeneralizing the likelihood of negative outcomes, (2) catastrophizing negative outcomes, (3) incorrectly attributing responsibility for negative outcomes to the self, and (4) selectively attending to the negative aspects of an event (Leitenberg et al. 1986). Unsurprisingly, distorted thinking patterns are strongly linked to low self-esteem, (Leitenberg et al. 1986), as well as depressive (Hoffman et al. 2000) and anxious (Weems et al. 2001) symptoms.

Despite the central role of primary and secondary control strategies in theories of adolescent stress management, no studies to date have examined the impact of mindfulness treatment on perceptions of primary and secondary control. The objective of the present study was to address this current gap in the literature. We hypothesized that high school students who participated in a school-based mindfulness intervention called Integra Mindfulness Martial Arts™ or Integra MMA™ would show improvements in their perceptions of primary and secondary control, as well as decreases in number of cognitive errors, as compared to those not participating in the program.

Method

Participants

All students participating in Integra MMA™ were invited to participate in the present study. Students were admitted to the program based on the recommendation by staff at the school or partnering mental health agency due to self-regulation challenges, including behavioral difficulties, anxiety, anger management, and ADHD. Students were informed about the program at the student orientation at the beginning of the school year and could also self-refer. All students participating in this study lived in a rural area with no public transportation (with the exception of school buses) and high rates of poverty. The majority of the 22 students who initiated participation in the mindfulness program completed it. Early in the program, two female students decided not to participate due to disinterest and one male student moved. Two students who completed the program were not included in this study due to one student experiencing problems completing the questionnaires reliably and one student not attending academic classes due to suspension from school.

The final sample consisted of 17 students (10 males, 7 females) in grades 9 to 11 (aged 13 to 17 years; $M=14.94$, $SD=0.97$) who participated in the intervention. A waitlist control group was comprised of 18 students (16 males, 2

females) also in grades 9 to 11 (aged 13 to 17 years, $M=14.61$, $SD=1.09$). Within treatment and control groups, three and four students, respectively, were actively taking medication both a pre- and post-test (e.g., for symptoms of anxiety/depression, ADHD). Four students in the treatment and three students in the control group were receiving some additional counselling support outside of Integra MMA™.

The mental health needs section of The Child and Adolescent Needs and Strengths (CANS; Lyons 1999), a semi-structured interview, was administered to determine the presence of mental health challenges. Students were asked to rate challenges with anxiety, mood, attention/hyperactivity, impulse control, oppositional behavior, conduct disorder, adjustment to trauma, and substance use on a four-point scale (0, “no evidence”; 1, “history or sub-threshold”; 2, “causing problems, consistent with diagnosable disorder”; and 3, “causing severe/dangerous problems”). In the treatment group, two participants had at least one diagnosis causing severe/dangerous problems, three participants had symptoms causing problems/consistent with at least one diagnosable disorder, and three participants had a history or sub-threshold level of at least one diagnosis. In the control group, one participant had at least one diagnosis causing severe/dangerous problems, six participants had symptoms causing problems/consistent with at least one diagnosable disorder, and five participants had a history or sub-threshold level of at least one diagnosis. Nine and six participants in the treatment and control groups, respectively, did not endorse symptoms of any psychological disorder, but did present with school or social-emotional challenges, including managing stress, work completion/school attendance, and peer relation challenges.

Procedure

This study used a quasi-experimental design with a mindfulness intervention group and a waitlist control. All measures were completed individually with a research assistant in a private room at the school at the beginning of the school year prior to starting treatment and again at the completion of the program in January. Assistance with reading and completing questionnaires was provided as needed. At the end of each data collection session, students were given a food voucher for \$5.00 CAD for the school cafeteria. The study received approval by the Ryerson University Research Ethics Board.

Integra MMA™, a play on mixed martial arts to decrease stigma associated with mental health treatment is a 20-week manualized group treatment. Integra MMA™ integrates mindfulness treatment into the milieu of mixed martial arts and yoga training. This setting has been reported to enhance treatment motivation, decrease stigma, and build mastery in a social-valued activity (Milligan et al. 2015). The program is described in detail in Milligan et al. (2015). In brief, mindfulness meditation practices teach students to increase their

awareness of their thoughts and feelings and to practice acceptance and letting go. Strategies include practices that focus on breath and body sensation awareness. A central practice is the “mindful moment” (an adaptation of the 3-minute breathing space developed by Segal et al. 2002). These breathing spaces are akin to “mini-meditations” during which one takes the opportunity to reflect on what is happening in the present moment in an accepting manner that makes space for positive and negative information. More specifically, youth (1) focus on their breath (saying the word “BE”), (2) open and soften, and (3) note their experience in a non-striving manner; that is, actively being present with one’s experience without having to do anything with it. Youth also complete other meditations, such as the body scan, a guided meditation that involves directing one’s attention to a specific part of the body (e.g., toes) and then flexibly moving attention to the other parts of the body one at a time in a non-judgmental manner (Kabat-Zinn 2003). While not the primary focus, some cognitive therapy strategies are integrated into Integra MMA™, including instructed use of mindful self-talk to promote present focus and acceptance. Mindfulness and cognitive components are embedded into yoga and martial arts to provide students with lived experience of challenge to practice strategies. For example, yoga requires slow strength moments and static postures that afford present moment awareness through training the breath. These physical challenges create an opportunity to experience distress during posture performance and to practice staying present with challenge rather than engaging in patterns of fight, flight, or freeze. Martial arts similarly presents physical challenge that must be observed and accepted, but differs from yoga in that the movements are fast and more dynamic and afford the opportunity to hone skills in the context of interaction with another person (i.e., opponent).

Building on a partnership between a community-based children’s mental health agency and local high school, Integra MMA™ was offered during the school day once a week for 20 weeks, with sessions lasting 1.5 h. Students were excused from regular course work the period (90 min) prior to lunch once a week to participate in the program. Teachers were informed about Integra MMA™ and its objectives, and were asked to provide support to assist students with obtaining notes and catching up on missed course work. Students also met with one of the group leaders to collaboratively set goals for home practice (e.g., mindful moment, meditation, body scan). During this meeting they also discussed implementation of strategies to the student’s life at home and school to promote generalization (e.g., discuss how the mindful moment, self-talk, facing challenges rather than engaging in fight, flight, or freeze can be applied to current challenges that the student is experiencing). Group leaders included a children’s mental health counsellor with a social services worker diploma and 20 years of experience in the mental health field and a

high school teacher with a black belt in Karate and personal experience with mindfulness. Group leaders received experiential training in Integra MMA™ from the supervisor of Integra MMA™ (P. Badali) at the time of training. This included co-leading a group with the supervisor and leading their own group with weekly supervision.

Measures

Perceived Primary Control The Perceived Control Scale for Children (Weisz et al. 2001) is a 24-item youth-report questionnaire that assesses perceived ability to bring about change based on one's own effort. Youth are asked to rate how much they agree with various statements, such as "I can do well on tests if I study hard." This questionnaire has acceptable internal consistency ($\alpha=0.89$) and test-retest reliability ($r=0.57$; Weisz et al. 2010).

Perceived Secondary Control The Secondary Control Scale for Children (Weisz et al. 2010) is a 20-item youth-report questionnaire that assesses perceived ability to change the impact of challenges by adjusting one's thoughts about a situation. Youth rate how much they agree with statements, such as "I can usually find something good to like, even in a bad situation." Internal consistency for this questionnaire was acceptable ($\alpha=0.89$) as was test-re-test reliability ($r=0.74$; Weisz et al. 2010).

Negative Cognitive Errors Given the relation between perceived secondary control and errors in thinking or cognitive distortions, a modified version of the Children's Negative Cognitive Errors Questionnaire (Leitenberg et al. 1986) developed by Weisz et al. (2010) was administered. Adolescents completed a self-report questionnaire that included 16 negative hypothetical situations (e.g., missing a basketball shot, doing poorly on a test) and were asked how likely they would be to think a specific statement (e.g., "If I had played better, we would not have lost"). Statements reflected common cognitive distortions, such as catastrophizing and overgeneralization. Internal consistency for this questionnaire was acceptable ($\alpha=0.82$) as was test-re-test reliability ($r=0.70$).

Data Analyses

Repeated measures analysis of variance (ANOVA) were conducted to examine group by time differences for all measures from pre- to post-treatment.

Results

Two repeated measures ANOVAs were conducted to examine group by time differences in perceptions of primary and secondary control from pre- to post-treatment. There was a

significant group \times time difference for secondary control, Wilks' $\lambda=0.88$, $F(1,31)=4.34$, $p=0.05$, Cohen's $d=0.49$, suggesting significantly higher levels of secondary control from pre- to post- in the treatment group but not for the waitlist controls. This suggests that following Integra MMA™, the treatment group were more likely to change their way of thinking about a challenge (e.g., through acceptance, cognitive restructuring, positive thinking) to fit the current reality, compared to the control group. No significant main effects or interactions were found for primary control, which suggests that students did not show significant increases in their attempts to change aspects of the objective situation or their thoughts, feelings, or behavior to achieve a desired outcome. See Table 1.

A repeated measures ANOVA was conducted to examine group by time differences in participants' engagement in patterns of thinking that reflected cognitive errors from pre- to post-treatment. There was a significant group \times time difference, Wilks' $\lambda=0.88$, $F(1,33)=4.48$, $p=0.04$, Cohen's $d=0.44$, suggesting a decrease in patterns of thinking related to cognitive errors for the Integra MMA™ group, but not for the waitlist controls. See Table 1.

Discussion

The present study examined the impact of a school-based mindfulness program on the use of primary and secondary control strategies for managing challenge and stress. At the end of the mindfulness program, treatment participants reported greater decreases in cognitive errors (e.g., catastrophizing, overgeneralization) and greater increases in the use of secondary control strategies, such as acceptance, positive thinking, adjusting cognition, and avoiding rumination, in situations of challenge compared to a waitlist control. Reductions in cognitive errors and improved perceptions of control are noteworthy outcomes given the strong relations found between these variables and anxiety, depression, and oppositional behavior in child and adolescent populations (Barriga et al. 2008; Muris and Field 2008; Pereira et al. 2014; Weisz et al. 2010).

The cognitive improvements demonstrated in the present study are similar to those found for cognitive behavior therapy (CBT). Numerous studies have shown that CBT significantly increases perceptions of control and realistic thinking (Muris et al. 2009), and that these cognitions may in fact mediate, in part, the relation between CBT and reduction in anxiety (Hogendoorn et al. 2014). The relation between CBT and these changes in cognition seems intuitive given that secondary control strategies, such as adjusting cognition and avoiding rumination, resemble the precise methods central to CBT. A core tenet of CBT is that emotional states are more affected by an individual's cognitive and behavioral response than the objective conditions of the situations themselves

Table 1 Mean scores at pre- and post-intervention by group

	Treatment		Control	
	Pre- (<i>n</i> = 17) <i>M</i> (SD)	Post- (<i>n</i> = 17) <i>M</i> (SD)	Pre- (<i>n</i> = 18) <i>M</i> (SD)	Post- (<i>n</i> = 18) <i>M</i> (SD)
Primary perceived control	56.17 (11.25)	56.88 (13.90)	57.31 (8.48)	58.50 (8.00)
Secondary perceived control	39.58 (9.54)	44.29 (10.86)*	40.37 (9.48)	39.75 (11.67)
Negative cognitive errors	31.58 (7.76)	25.76 (7.31)*	30.0 (6.23)	27.89 (8.45)

**p* < 0.05

(Weisz et al. 2010). Modifying thoughts, however, is less central and in some mindfulness treatments is actually at odds with the overarching objective of treatment (e.g., Acceptance and Commitment Therapy, Hayes et al. 1999). Specifically, mindfulness programs aim to improve *self-awareness and acceptance* of thoughts and aspects of the present moment rather than *effortful control* over thoughts (Gootjes and Rassin 2014).

In mindfulness interventions, perceived control over thoughts may be achieved indirectly through improvements in attentional and emotional reactivity (Bergen et al. 2015; Gootjes and Rassin 2014). Emotional attention, in the form of increased self-awareness and self-monitoring, is an essential prelude to effortful control over or change of emotions or thoughts (Thompson 2011). Mindfulness (e.g., Bogels et al. 2008; Haydicky et al. 2015; van de Weijer-Bergsma et al. 2012) and meditation (Baijal et al. 2011) have been associated with improvements in attentional control in children and adolescents. Further, meta-analytic evidence suggests that attentional control may potentially mediate the relation between mindfulness and psychological outcomes, given that the strength of the observed effect sizes for mindfulness is similar for attention and other psychological outcomes (Zoogman et al. 2014). In the present study, Integra MMA™ meditation practices provided students with the opportunity to learn to direct their attention by focusing on their breath and flexibly bringing their attention back to the present moment when their attention wanders. Similarly, when engaged in the martial arts and yoga components of the program, students learned to notice thoughts that may arise related to challenge and stress and to bring themselves back to the present moment and the challenge before them using positive self-talk and acceptance of the challenge rather than engaging in patterns of avoidance.

Purposeful shifting of attention may, in turn, decrease emotional reactivity to stressors. Mindfulness treatments have been associated with improvements in emotional and behavioral reactivity in children (Flook et al. 2010; Haydicky et al. 2012; Huppert and Johnson 2010; Kuyken et al. 2013; Metz et al. 2013; Milligan et al. 2015; Raes et al. 2014; Wisner and Norton 2013). Similarly, in adults, mindful breathing has been shown to reduce reactivity to repetitive and unwanted

thoughts (Berry et al. 2010; Feldman et al. 2010; Joormann et al. 2015) and to increase heart rate variability, a pattern associated with improved emotion regulation (Lumma et al. 2015). In our previous qualitative research, adolescents participating in mindfulness treatment have found that mindfulness practices helped them to be present with stress, not engage in automatic patterns of fight or flight, and provided them with the space to notice their thoughts and choose how they wanted to respond (Milligan et al. 2015). This may be further strengthened by a sense of mastery in both being able to decide which thoughts to focus on and which ones to minimize attention to, and the experience of successful attainment of martial arts and yoga goals. Hogendoorn et al. (2014) discussed the possible influence of mastery in the enhancement of perceived control with CBT. They found that gains in perceived control preceded and followed changes in anxiety, and related this to the experience of mastery and success over anxiety. Students who experience success, and thus believe that psychological change is possible in the face of stress, are more likely to set goals when confronted with challenge and believe in their ability to be successful, which in turn promotes positive psychological and educational outcomes (Yeager and Dweck 2012).

While attention and emotion regulation may set the stage for changes in cognitive errors and secondary control, the present results highlight that the impact of mindfulness extends beyond attention and staying present to insight and cognitive strategies. Practicing mindfulness necessarily neutralizes the process of distorted information processing (Stewart 2004). Perceptions involving cognitive errors are associated with reality being viewed through a narrow, judgmental, and negative lens. In contrast, mindfulness widens this lens of reality, allowing the individual to choose from many states of being (Stewart 2004). Being fully engaged in the present moment creates an opportunity to navigate reality free of distorted information processing and the negative mood states (e.g., fear, anxiety, depression) that this evokes thus widening the lens through which to interpret reality (Stewart 2004). Research from adult populations supports the role of mindfulness in minimizing cognitive errors and further suggests that this change mediates the effects of mindfulness treatment on

outcomes such as anxiety, negative affect, and hope (Sears and Kraus 2009). Similarly, Jain et al. (2007) found that changes in rumination (i.e., secondary control strategy reflecting the ability to shift) partially mediated the effects of mindfulness meditation on distress. Rumination has also been shown to mediate the relation between trait mindfulness and verbal aggression, hostility, and anger (Borders et al. 2010) in adolescents and adults. While no treatment studies to date have examined the impact of mindfulness treatment on cognitive errors, low levels of trait mindfulness in the context of high levels of stress have been shown to predict dysphoria in adolescents, with rumination partially mediating this relation (Ciesla et al. 2012). Future dismantling research studies are needed to better understand the impact of mindfulness treatment on cognitive factors. Ideally, future research will include studies that examine the impact of mindfulness treatments, such as Integra MMA™, on the inter-relations between processes such as attention, emotion regulation, and cognitive errors in adolescents, including their potential role as mediators between mindfulness treatment and mental health outcomes.

While a significant increase in perceived secondary control (i.e., changing thinking) was found, a similar significant increase in perceived primary control (i.e., changing aspects of the situation or their condition) was not found. In some respects, this is to be expected given that Integra MMA™ prioritizes acceptance and use of positive self-talk to stay present with challenge rather than objectively changing a situation. However, these results are also surprising given that Integra MMA™ promotes goal-setting in students and behavioral activation of goal-directed behavior from a present-focused stance. It is possible that direct training and behavioral exposure to areas of challenge outside of therapy (e.g., studying hard to pass a test) may be required to promote significant generalization of primary control strategies used in session (e.g., practicing to master a martial arts move) to challenge experienced in everyday life. This is an area for further research.

The discrepant results between primary and secondary control may also be reflective of inconsistency in defining and measuring these constructs (Morling and Evered 2006), and specifically the process versus outcome nature of the two scales. Primary control was originally defined as “attempts to change the world so that it fits the self’s needs” (Rothbaum et al. 1982, p. 8). The Perceived Control Scale for Children asks broadly about adolescents’ perceptions that their efforts will be met with success (e.g., “If I try, I can make friends or do well at school” or in reverse “No matter how hard I try, I cannot stay out of trouble”). It is possible that adolescents may focus more heavily on objective evidence of success when rating these statements (e.g., how many friends they have, how much trouble they are getting into) rather than the amount of effort they are expending. In contrast, the Secondary Control Scale more specifically assesses

the use of strategies adolescents employ to dampen the psychological impact of challenge or stress (e.g., acceptance, taking their mind off the issue, cognitive restructuring). As such, the focus is directed much more to perceptions of an internal process as being reflective of success than an objective reality. It is possible that engagement in secondary strategies may be more sensitive to change than perceptions of success regarding objective experience. Similar to the findings of Hogendoorn et al. (2014), the experience of success using secondary strategies may lead to mastery which may eventually influence an adolescent’s perception that their efforts impact on objective aspects of challenging situations. Future development and evaluation of a questionnaire that emphasizes the process of primary control (e.g., “If I try to behave, adults will like the way I act” modified to “I try to behave so that adults will like the way I act.”) may further our understanding of the impact of mindfulness and other therapies on these two types of perceived control.

While the present results enhance our understanding of the impact of mindfulness treatments on cognitive outcomes, such as secondary control and cognitive distortions, there are limitations to this study that need to be addressed in further research. First, the waitlist control group in the present study did not receive the opportunity to engage in a social, community-building opportunity at school. It is therefore possible that some of the gains made by students in Integra MMA™ were due, in part, to the social experience and not to the treatment itself. Future research should include a control group that participates in a social or martial arts only group to control for the influence of the group experience. Second, the present study did not examine the relation between Integra MMA™ and stress or psychological outcomes or the potential mediating role of control strategies in this relation. Future studies should consider investigating the relation between changes in cognitive distortions and secondary control and psychological outcomes. Given the heterogeneity of the at-risk high school sample, possible outcomes applicable to a range of students may include perceived stress, optimism, academic outcomes (attendance and achievement), and specific psychological symptoms (e.g., anxiety, depression, oppositional behavior). Third, given our small sample size, we were unable to explore the potential moderating role of participant characteristics, including gender, presenting psychological issues, and medication use, or past treatment or martial arts experience. In light of research that has suggested gender-based differences in primary and secondary strategy use and stress reactivity, this is also an important direction for future research (Weisz et al. 2010). Finally, it is important to note that the mindfulness treatment (implemented) did include some cognitive strategies, including use of self-talk and examination of thought (e.g., thoughts are not facts). It is possible that cognitive strategies and not the mindfulness component itself might have influenced the findings on cognitive distortions and secondary

control. Future research can address this by examining the relative impact of “pure” mindfulness and mindfulness programs with cognitive components, such as Integra MMA™, to determine the active components of therapy that may be responsible for change. In addition, future studies could investigate the pathways by which mindfulness may influence cognition. Increased attentional control, decreased emotion reactivity, and experience of success (mastery) have been posited here and could be examined in future work to deepen our understanding of the mechanisms of mindfulness.

In conclusion, adolescence is a time of considerable change and increasing autonomy that is associated with heightened levels of stress that are commensurate with those of adults. The cognitions high school students attribute to situations and their sense of perceived control over their thoughts play a role in increasing the onset, maintenance, and recurrence of psychological challenges, including stress reactivity. While the experience of stress is inevitable, students can control the psychological impact of stress through secondary control strategies, including acceptance, positive self-talk, and reduction in cognitive errors, such as catastrophizing. As such, decreased use of secondary control strategies may be useful as a broad vulnerability factor to identify students at risk (Weisz et al. 2010) who may benefit from mindfulness intervention. Changing perceptions of control and cognitive errors may serve to decrease stress reactivity during this critical period of development, and place adolescents on more positive trajectories of psychological and educational well-being.

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Compliance with Ethical Standards

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