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This study assessed the effectiveness of a mindfulness-based program, Learning to BREATHE, on adolescent emotion regulation. Participants included 216 regular education public high school students with pretest and posttest data participating in the program or instruction-as-usual comparison condition. Program participants reported statistically lower levels of perceived stress and psychosomatic complaints and higher levels of efficacy in affective regulation. Program participants also evidenced statistically larger gains in emotion regulation skills including emotional

awareness, access to regulation strategies, and emotional clarity. These findings provide promising evidence of the effectiveness of Learning to BREATHE on the development of key social-emotional learning skills.

Adolescents face a number of potential risk factors that can threaten their social-emotional well-being. Increases in feelings of distress during adolescence are quite common and often attributable to commonplace conflicts with parents and the stresses of managing school, work, and friends. The ability to effectively regulate one's emotions during stressful experiences is increasingly viewed as a foundation for well-being, academic performance, and positive adjustment throughout the life span (Eisenberg, Spinrad, & Eggum, 2010). This ability, generally called "emotion regulation," includes specific skills used to moderate affective experiences to meet the demands of different situations or achieve goals like learning (Gross, 1998). Emotion regulation plays a central role in information processing and is supported by the same, primarily prefrontal, brain circuitry underlying cognition (Best, Miller, & Jones, 2009). Component skills involved in the regulation of emotion, such as the ability to delay gratification and monitor attention, help to facilitate success in school (Rothbart & Sheese, 2007), and serve as protective factors against the emergence of psychosomatic symptoms and emotion and behavioral difficulties (Greene & Walker, 1997; Gross, 1998).

Conversely, deficits in emotion regulation represent a core feature of many emotional and behavioral problems in adolescence such as anxiety, depression, self-injury, and substance abuse (Wolff & Ollendick, 2006). Internalizing disorders are fundamentally disorders of affect and are exacerbated by poor affective-cognitive management strategies such as suppression and rumination (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). In educational contexts, deficits in the ability to modulate emotions can also impair goal-directed behavior (Blair, 2002) and interfere with achievement-related performance (Elliot & McGregor, 1999). In nonclinical adult samples, chronic emotional stress has been shown to impair prefrontal cortex functions by reducing creativity, efficiency of working memory, attentional control, and problem-solving capacities—precisely those functions most necessary for effective learning (Arnsten, 1998). Although modest levels of stress hormones may facilitate arousal and learning, chronic activation of stress hormones interferes with consolidation of learning (Joels, Wiegert, Oitzi, & Krugers, 2006), and prolonged exposure to high levels of stress hormones can cause atrophy of hippocampal neurons and memory impairments (Sapolsky, 1999).

Mindfulness-Based Interventions

Mindfulness-based interventions promote social-emotional well-being by supporting the development of key emotion regulation skills. *Mindfulness* has been

defined as “a way of paying attention that is intentional, trained in the present moment, and maintained with an attitude of non-judgment” (Kabat-Zinn, as cited in Broderick & Metz, 2009, p. 37). The practice of mindfulness involves two primary mechanisms: self-regulation of attention and nonjudgmental awareness of experience. Regulation of attention promotes awareness of emotional, cognitive, and physical experience as it occurs moment to moment. Nonjudgmental awareness, characterized by curiosity, openness, and acceptance of that experience, can increase coping by decreasing reactivity.

Practices designed to increase mindfulness typically involve the deliberate training of attention to cultivate present moment awareness of experience, including emotional experience. A key aspect of this practice is being aware of present-moment experiences without resorting to avoidance or excessive preoccupation with thought. The theory of action underlying these practices is that mindful awareness practices offer skills for restoring balance when strong emotions arise. Thus, these skills are thought to promote distress tolerance in the face of uncomfortable feelings that otherwise might provoke harmful cognitions and behaviors involved in negative rumination, self-blame, anxiety, poor school performance, and so on.

Similarities and differences to related treatment models. Although mindfulness-based approaches to emotion regulation share some elements with cognitive-behavioral therapies (CBTs), they also differ in fundamental ways. CBT and mindfulness-based treatments advocate awareness of thoughts, feelings, and sensations to allow for a distanced, decentered perspective that is less reactive to thoughts, feelings, and the experience of stress. Both approaches also view thoughts as connected to feelings and behaviors. CBT interventions (see Beck & Beck, 2011) target dysfunctional core beliefs about the self, the world, and the future that are considered to be the root of emotional and behavioral problems. CBT interventions are directed toward recognizing and monitoring patterns of irrational thinking, clarifying and challenging the belief systems that support maladaptive thoughts and behaviors, and working to replace them with more adaptive alternatives. A typical CBT technique involves examining the degree of belief about dysfunctional cognitions (e.g. “I never do well on math tests”) using experiential feedback to confirm or negate the accuracy of the belief. Once the unrealistic nature of maladaptive cognitions is recognized, efforts to modify thinking using cognitive restructuring (e.g., written records of dysfunctional thoughts) can be applied to diminish their influence on emotions and behavior.

Mindfulness approaches to emotion regulation and coping do not involve changing the specific content of the experience through cognitive restructuring, thought stopping, or other CBT techniques. Instead, mindfulness approaches seek to change the nature of one’s relationship to the experience. Mindfulness approaches do not include controlling, challenging, or revising thoughts, given

that such attempts at control can lead to greater distress (Moses & Barlow, 2006). Rather than directing attention to changing beliefs, mindfulness builds attentional capacity to become aware of and less reactive toward the whole range of pleasant, unpleasant, or neutral experience. Uncomfortable thoughts and feelings are viewed as temporary mental events that are allowed to exist without need to challenge, change, or be captured by them. Mindfulness practices directly reduce experiential avoidance, which is at the core of many emotional disorders (Roemer & Orsillo, 2002). Reduced experiential avoidance and improved distress tolerance enhance emotion regulation and coping by increasing one's ability to observe the changing nature of internal experience and to let go of maladaptive cognitions (i.e., "I don't need to believe everything I think"). Identification with negative thoughts and emotions (e.g., "I am an angry person") is replaced with greater self-compassion and nonjudgmental awareness of experience (e.g., "I am experiencing sensations of anger"). Mindfulness-based practices do not encourage holding on to thoughts or emotions or ascertaining their veracity. In fact, recognizing the transience of thoughts and emotions as temporary states is a key goal, allowing for exposure without avoidance (Hayes et al., 2004). As a result, attentional resources are freed up to engage in more adaptive functions. Thus, mindfulness provides a different way of relating to thoughts, feelings, and perceived stressors than one based on cognitive-behavioral approaches.

Empirical Evidence for the Effectiveness of Mindfulness-Based Practices

Research on the effects of mindfulness training with adults has shown an array of benefits. Practicing mindfulness enhances self-regulatory processes that buffer against psychological distress (Jimenez, Niles, & Park, 2010). A recent study found that mindfulness practices change the brain in ways that are associated with improved self-regulation. Magnetic resonance imaging (MRI) brain scans taken before and after an 8-week Mindfulness-Based Stress Reduction (MBSR) program found increased gray matter in the hippocampus, an area important for learning and memory, and a reduction of gray matter in the amygdala, a region connected to anxiety and stress, compared to a control group that did not practice mindfulness (Hölzel et al., 2011). Other research has found changes in brain activity in areas related to attention (Lazar et al., 2005), enhanced performance on attentional tasks (Jha, Kropinger, & Baime, 2007), increases in positive mood and immune system functioning (Davidson et al., 2003), improved academic achievement in college students (Hall, 1999), enhanced empathy (Shapiro & Brown, 2007), and reduced physical symptoms and stress (Grossman, Niemann, Schmidt, & Walach, 2004). Application of mindful awareness and nonjudgment to appetitive urges has demonstrated effectiveness in reducing use of alcohol, marijuana, cocaine, and cigarettes (Ostafin & Marlatt, 2008).

Although research involving mindfulness training with adolescents is more limited (Greenberg & Harris, 2011), some studies have documented improvements in attention skills (Bogels, Hoogstad, van Dun, de Schutter, & Restifo, 2008), sleep quality (Bootzin & Stevens, 2005), and reductions in anxiety, depression, somatic and externalizing symptoms in clinic-referred adolescents (Biegel, Brown, Shapiro, & Schubert, 2009). For a more thorough review of effectiveness evidence with youth see Meikeljohn et al. (2012).

Learning to BREATHE: Core Components and Processes

Learning to BREATHE is a mindfulness-based training program designed to facilitate the development of emotion regulation and attentional skills for middle and high school students (Broderick, 2013). Goals of the program include helping students understand their thoughts and feelings, learning how to use mindfulness-based skills to manage emotions, and providing opportunities for guided group practice. The program is designed to be easily integrated into school health education or other similar modularized courses and includes six themes. Each theme is manualized and takes approximately 45 minutes to complete. Lessons can be offered once per week; however, the program can be delivered over a longer period of time to accommodate school schedules. Lesson content focuses on six core themes: (1) body awareness; (2) understanding and working with thoughts; (3) understanding and working with feelings; (4) integrating awareness of thoughts, feelings, and bodily sensations; (5) reducing harmful self-judgments; and (6) integrating mindful awareness into daily life. Specific program components include an in-class presentation of lesson topics provided by the facilitator, group activities that illustrate the lesson theme components, guided discussion about the premise of the lesson, and in-class mindfulness practices. The core practices include body scan, mindfulness of thoughts, mindfulness of emotions, loving kindness practice, and mindful movement. Student workbooks and individual practice CDs for home mindfulness practice are provided to students as part of this program.

FOCUS OF THIS STUDY

The purpose of this study is to examine the effectiveness and acceptability of the Learning to BREATHE program on key emotion regulation skills, efficacy in emotion regulation, perceived stress, and somatic complaints. Based on prior research (Broderick & Metz, 2009), we anticipated that students who completed the Learning to BREATHE program would demonstrate significantly higher gains in emotion regulation skills and level of efficacy in emotion regulation as a

consequence of participating in Learning to BREATHE activities. Given the link between effective emotion regulation skills and other psychosomatic regulatory processes (see Cole, Martin, & Dennis, 2004 for a review), we anticipated significant decreases in perceived stress and somatic complaints among treatment group participants as well.

METHOD

Procedure

A quasi-experimental pretest-posttest comparison group design was utilized to assess the effectiveness of the Learning to BREATHE program. A convenience sample of students attending two public high schools matched on school-level demographics in the same suburban Philadelphia, Pennsylvania, U.S. school district serving a largely middle- to high-income population was selected to participate in the study. The Learning to BREATHE treatment high school holds a 99% graduation rate; 89% continue their academic studies at a 2- or 4-year college, and 90% are White with 10% of another race (including Latino, Black, Asian, or Native American). The instruction-as-usual comparison high school displayed similar characteristics: 99% graduation rate, 85% to 88% continue studies at a 2- or 4-year college, and 87% are White with 13% of another race.

All students actively enrolled in a concert choir course elective in either of the two participating high schools were eligible to participate in the study. Participants from each of the selected high schools were assigned as a group to either the Learning to BREATHE treatment or instruction-as-usual comparison group. All students in the Learning to BREATHE treatment group participated in the program (100% participation rate) during the first 15 to 25 minutes of their concert choir class session and completed the session with regular music instruction following the treatment. Participants assigned to the instruction-as-usual condition participated in a concert choir elective that involved teacher-directed in-class presentation of music instruction, active singing, and discussion. Both classes were of similar time and duration.

This design did not involve randomization due to the likelihood of diffusion of treatment and/or compensatory rivalry, which could lead to invalid posttest results (Shadish, Cook, & Campbell, 2001). Instead, the design incorporated a pretest assessment to establish pretest equivalence between the program and comparison groups. Active parent consent and student assent was obtained in accordance with university Institutional Review Board procedures prior to implementation. No incentives were provided to students.

Participants

Participants included students from two suburban high schools in Pennsylvania ($N = 244$; 216 with complete data). In the treatment group, 34.9% of participants in the treatment condition were male (vs. 33.3% in the comparison group). The average age of participants in the treatment group was 16.5 years ($SD = .9$) (vs. 16.4, $SD = 1.0$) (Table 1). Within the treatment group, 31.8% of students were in Grade 10 (vs. 41.4% in comparison group), 33.3% of students were in Grade 11 (vs. 28.7%), and 34.9% of students were in Grade 12 (vs. 29.9%).

Attrition and Treatment of Missing Data

Initially 148 students were assigned to treatment and 95 to comparison groups. Fewer were included in the final analysis due to absence during posttesting, scheduling conflicts, invalid posttest data, or parental refusal of participation. The treatment group attrition rate was 12.8%, leaving 129 in the analysis, whereas the comparison group attrition rate was 8.4%, leaving 87 in the comparison group. Differential attrition is acceptable at 4.4%. No significant differences were detected in pretest demographic characteristics between those who completed the posttest and the students lost to follow-up: gender, $\chi^2(1, N = 243) = 1.58, p = .210$, age, $t(241, N = 242) = -1.24, p = .217$, grade level, $\chi^2(2, N = 243) = .19, p = .910$, and self-reported stress level, $t(240) = -1.42, p = .157$.

TABLE 1
Demographic and Baseline Sample Characteristics

	<i>Experimental</i> (<i>n</i> = 129)		<i>Comparison</i> (<i>n</i> = 87)		<i>t</i> (<i>df</i>)	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
Demographics						
Age (years)	16.5	0.9	16.4	1.0	0.91 (214)	.366
Self-Report						
Stress level	6.2	2.0	6.6	2.3	-1.34 (213)	.182
Total difficulties in emotion regulation	88.3	24.9	85.7	23.8	0.78 (214)	.438
Non-acceptance emotional response	14.1	6.1	13.4	5.2	0.91 (214)	.363
Difficulties in goal-directed activity	16.5	4.6	16.2	4.9	0.58 (214)	.565
Impulse control difficulties	12.3	5.5	11.9	5.1	0.48 (214)	.631
Lack of emotional awareness	14.8	4.7	14.6	4.6	0.33 (214)	.743
Ltd access to regulation strategies	19.3	7.9	18.9	9.1	0.32 (214)	.753
Lack of emotional clarity	11.3	4.2	10.7	3.3	1.12 (214)	.264
Psychosomatic complaints	36.0	10.5	36.3	10.6	-0.24 (214)	.810
Affective self-regulatory efficacy	45.5	9.5	47.2	9.8	-1.21 (213)	.229

Among the pretest scale outcomes, only two were statistically different between completers and non-completers. The Difficulties in Emotion Regulation Scale lack of emotional clarity subscale was statistically higher in noncompleters ($M = 12.7$, $SD = 4.1$) as compared to those completers ($M = 11.0$, $SD = 3.8$), $t(264) = -2.17$, $p = .031$. Moreover, the total Affective Self-Regulatory Efficacy Scale score was statistically lower in the noncompleters ($M = 42.2$, $SD = 10.6$) versus completers ($M = 46.2$, $SD = 9.7$), $t(263) = 2.04$, $p = .042$. Therefore, completers reported higher emotional clarity and emotional regulation self-efficacy at pretest than those students lost to follow-up.

In those participants who completed the pre and posttest assessments, only 0.2% of the data were missing with 89.4% ($n = 193$) reporting data for all variables at pre- and posttest. There was no difference in the number of missing values per student by gender, $\chi^2(3, N = 216) = 2.924$, $p = .403$, and grade level, $\chi^2(6, N = 216) = 6.58$, $p = .361$. There was also no correlation between the number of missing values with age, $r(N = 215) = .041$, $p = .547$, and self-reported stress level, $r(N = 215) = .067$, $p = .325$; suggesting the missing data were missing at random. Series mean imputation was performed on subscale missing values at pretest and posttest assessments unless a student was missing on 20% or more of a scale's items.

Implementation of Learning to BREATHE

Students participating in the treatment condition completed all six Learning to BREATHE thematic lessons. Curriculum implementation occurred during an elective concert choir course during February and March 2012. The concert choir average class size was 25 for the treatment school (six classes) and 32 for the comparison school (three classes). The program was taught in 18 sessions over 16 weeks, typically once per week at the beginning of class. Sessions lasted approximately 15 to 25 minutes. Because the Learning to BREATHE curriculum was being administered in ongoing choir courses, thematic lessons were divided into smaller components to accommodate the regular choir curriculum. No adverse effects were reported in the treatment group participants.

Teacher professional development and fidelity. The teacher (choir director), who taught the Learning to BREATHE program in the treatment school, attended an 8-week MBSR program (facilitated by a certified MBSR teacher) in fall 2011 for teachers at the high school that was offered for professional development, followed by a 2-day in-service training for Learning to BREATHE in January 2012. Training was held in the school and delivered by the program developer. The program developer was available for questions during the implementation of the curriculum.

Program fidelity was assessed using teacher feedback/fidelity logs and teacher observations. To assess program fidelity, trained teachers delivering the program were asked to complete a teacher feedback form for each session taught (form adapted from work published in Crane, Kuyken, Hastings, Rothwell, & Williams, 2010). Teachers were asked to assess on a 5-point Likert-type scale several instructor and session characteristics including (1) lesson organization and pacing, (2) management of the group process, (3) instructor ability to teach students to notice and describe their direct experience, and (4) instructor attitude, genuineness, and embodiment of mindfulness. Open-ended questions were also asked to assess strengths and areas for improvement. Due to feasibility issues, few session logs were completed; however, the teacher did not report any difficulties with any sessions or the process. Project staff trained in the intervention model also conducted fidelity observations of the teacher that included a lesson checklist and a qualitative section to report teacher preparedness and student engagement. Project staff observed approximately 5% of all sessions, with all observations indicating lesson adherence, teacher enthusiasm and preparedness, and high student engagement.

Measures

A voluntary self-report survey packet was compiled and administered to the student sample. It took 20 minutes on average to complete. Table 2 provides Cronbach's alpha reliability estimates for each scale at baseline as well as the reliability for change score estimates (Watkins, 2008).

The Difficulties in Emotion Regulation Scale (DERS) assessed the ability to regulate emotions (Gratz & Roemer, 2004). This instrument contains a total scale score (36 items) and six factors including nonacceptance of emotional response (6 items), difficulties in engaging in goal-directed activity (5 items), impulse

TABLE 2
Cronbach's Alphas at Baseline and Difference Score Reliability

<i>Scale</i>	<i>n Items</i>	α	$\Delta\alpha$
Total difficulties in emotion regulation	36	.935	.807
Nonacceptance of emotional response	6	.882	.712
Difficulties in engaging in goal-directed activity	5	.878	.664
Impulse control difficulties	6	.904	.670
Lack of emotional awareness	6	.797	.491
Limited access to regulation strategies	8	.823	.634
Lack of emotional clarity	5	.830	.508
Psychosomatic complaints	13	.884	.555
Affective self-regulatory efficacy	14	.870	.682

control difficulties (6 items), lack of emotional awareness (6 items), limited access to emotion regulation strategies (8 items), and lack of emotional clarity (5 items). Items were measured on a 5-point Likert-type scale from 1 (*almost never*) to 5 (*almost always*), with higher values indicating difficulty in emotion regulation.

Psychosomatic complaints. The 13-item Psychosomatic Complaints Scale assessed how often the student experienced psychosomatic complaints such as headaches, difficulty concentrating, worry, and fatigue. Items were pulled from three published scales to capture relevant psychosomatic complaints and to minimize respondent burden. Seven items were adapted from the Somatization Index of the Child Behavior Checklist (Achenbach, 1991), one item from the Worry and Anxiety Questionnaire (Dugas et al., 2001), and five items from the symptom checklist created for the survey of Health Behaviour in School-aged Children (Haugland & Wold, 2001). These 13 items were subjected to a factor analysis that confirmed the validity of test structure (findings not presented but available from author). Each item was measured on a 5-point Likert-type scale from 1 (*not at all*) to 5 (*very often*). Higher scores indicate increased frequency of the complaint.

Perceived stress. A single-item measure of perceived stress level was administered as well (i.e., “Sometimes people feel really stressed out and sometimes they don’t feel really stressed out. On a scale of 1 (*no stress*) to 10 (*a lot of stress*), circle the number for how stressed out you have been feeling in the past week”).

The 14-item Affective Self-Regulatory Efficacy Scale (ASRES) was created by the program developer to measure self-efficacy in emotion regulation. The format of the ASRES measure follows Bandura’s recommended design format for self-efficacy items (Bandura, 2006). The 14 items were measured on a 5-point Likert-type scale from 1 (*I am not confident at all*) to 5 (*I am very confident in my ability to do this*). A principal components analysis with orthogonal (varimax) rotation was computed to maximize variation explained for individual component loadings and the collection of components. Oblique and orthogonal rotations were initially performed which resulted in substantively similar interpretations. Following the recommendations of Nunnally and Bernstein (1994) we report results of the simpler orthogonal rotation. Although the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was 0.873 (above the recommended 0.6), the three extracted components (with eigenvalues > 1) were difficult to interpret because no component included more than three items with loadings above 0.6 and the items composing each component demonstrated unacceptable internal consistency. Hence, the full scale was retained and a total ASRES summary score was computed. Within each subgroup, internal consistency of the 14 items was acceptable (see Table 1). Construct validity was also preliminarily established for

the measure. A higher level of self-efficacy (total ASRES score) was correlated with fewer difficulties in emotion regulation on the DERS, $r(266) = -0.71$, $p = .001$ and fewer reported psychosomatic symptoms, $r(266) = -0.50$, $p = .001$. All DERS subscales were also negatively correlated with the total ASRES score, with correlations ranging from $r = -0.41$ to $r = -0.59$.

Acceptability and social validity. The program group also received a survey created by the program developer to assess student acceptability and perceived social validity of the curriculum. This survey comprised 10 close-ended items measuring perceived benefit of the overall program and each of its components. These items were measured from 1 (*not useful*) to 10 (*very useful*). Three open-ended items were also included on this survey: (1) what they learned/gained from the program, (2) what would they add to or change about the program, and (3) would they recommend the program to others—why or why not?

Demographic information. In addition to the above scales, students were asked to provide demographic background information including their gender, age, and grade. Due to concerns regarding student confidentiality, we were unable to collect information on student race, socioeconomic status, or achievement.

Analyses

Demographic characteristics at pretest for those participants with complete pretest-posttest data were summarized using SPSS (ver. 20.0). Chi-squared tests (for categorical variables) and independent t tests (for continuous variables) were computed to assess statistical differences on pretest indicators between program groups.

Outcome analyses estimated complier average causal effects. Given the absence of significant differences on potential covariates at baseline, a more conservative multivariate general linear model test (i.e., MANOVA) was used to detect any main program effects on subscale mean gain scores (i.e., posttest – pretest summary scores). Mean gain scores were computed and treated as the primary dependent variables. Although the use of gain scores has been long and widely debated in the literature (e.g., Cohen, Cohen, Aiken, & West, 2003; Cronbach & Furby, 1970), because our central research questions pertained to “how groups, on average, differed in gains over time,” we employed gain scores as this method was a more direct test of our research questions as opposed to methods involving tests of residualized scores (for a review, see Fitzmaurice, Laird, & Ware, 2004). However, in light of concerns we demonstrated baseline equivalence among treatment and comparison groups and calculated the reliability of change scores (see Table 2) which all exceed accepted thresholds (Oakes & Feldman, 2001). Finally, effect size (i.e., magnitude of mean gain score differences between

the groups) was also computed via partial eta squared, which is interpreted as 0.01 small, 0.06 medium, and 0.14 large effect (Cohen, 1988). To assist in effect interpretation in the case of unbalanced group sizes, Cohen's *d* are reported as well with values of 0.15 indicating a small, 0.45 moderate, and 0.90 a large effect (Lipsey, 1990). Significance levels were set at $\alpha = .05$ for multivariate tests and each pairwise univariate contrasts.

It is important to note that although this study took place within two schools, our initial screening of data suggested that multilevel modeling would be unnecessary in these cases. Specifically, consistent with the procedures as described by Kreft and De Leeuw (1998), our initial examinations of Intraclass Correlation Coefficient (ICC) values within the null model indicated ICC values for all but one dependent variable ranged from 0.00 to 0.06, indicating that less than 10% of variance in the outcome measure was between schools. The ICC value for the mean gain score for the total ASRES was 0.15. However, because our initial inspection of data revealed our ICC values were trivial (less than 10% of total variance in outcome with exception of one dependent variable) our standard error estimates are reasonable and correction via multilevel modeling unnecessary (see Lee, 2000, p. 128).

Quantitative responses to the student acceptability and social validity survey were summarized descriptively. Qualitative responses to the open-ended acceptability and social validity questions were first independently coded for themes by the first author and a trained research assistant (Creswell, 2008). Inter-coder reliability was 93.1%, and all discrepancies were resolved by consensus.

RESULTS

Retention and Base Rates

Pretest demographic and attitudinal characteristics for those participants in the program versus the comparison group are presented in Table 1 for those who have complete data at pretest and posttest. Treatment and control group participants did not significantly differ on the basis of gender, $\chi^2(1, N = 216) = .055, p = .814$, or the percentage of students at each grade level, $\chi^2(2, N = 216) = 2.086, p = .352$. *t* Tests of remaining continuous pretest demographic and self-report measures revealed no statistically significant differences between participants in the treatment and comparison group (see Table 1). Both groups were approximately two thirds female, had mean age of 16, and an approximate even breakdown across 10th through 12th grades. At pretest, on average, participants reported a moderate amount of stress, slight to moderate level of difficulties with emotion regulation, moderate frequency of psychosomatic complaints, and a moderate amount of self-efficacy in the ability to regulate emotions.

Main Effects of Learning to BREATHE

The multivariate general linear model (i.e., MANOVA) was used to determine if scale mean gain scores were statistically different between program and comparison groups. Prior to conducting analyses, data were inspected for multivariate normality and linearity and only one significant departure from assumptions was detected. Although the Bartlett's test was found to be significant, $\chi^2(44) = 979.77$, $p = .000$, only the Levene's test on the total DERS scale mean gain score was found to be significant, $F(1, 211) = 6.780$, $p = .010$. All other outcomes displayed non-significant Levene's tests, indicating that the variances of each variable and variances/covariances were roughly equal across groups. The total DERS scale mean gain score remained in the MANOVA procedure since there were no univariate differences when omitted.

The initial multivariate test was significant, Pillai's trace = .120, $F = 2.759$, $p = .003$, partial $\eta^2 = 0.120$, suggesting that Learning to BREATHE program participants had at least one or more mean vector pairing that produced a significant difference between treatment and comparison groups and that approximately 12% of multivariate variance of the dependent variables is associated with the group factor. To determine the effects of group assignment on specific subscale measures, a series of univariate ANOVAs were performed. As illustrated in Table 3, three of the six subscales on the DERS and the total summary score displayed statistical significance. Program participants experienced more of a mean reduction in the limited access to regulation strategies, $F(1, 211) = 4.418$, $p = .037$, and lack of clarity, $F(1, 211) = 3.924$, $p = .049$, and in the total DERS scale score, $F(1, 211) = 5.441$, $p = .021$, as compared to the comparison group. In addition, the program group reported a mean reduction in the lack of emotional awareness DERS subscale, while the comparison group's mean subscale score did not change from pretest to posttest, $F(1, 211) = 5.900$, $p = .016$.

Program participants reported a larger reduction in psychosomatic symptoms from pretest to posttest as compared to their comparison group counterparts, $F(1, 211) = 4.131$, $p = .043$. Additional univariate analyses assessed program impact on individual psychosomatic items. There were reductions in difficulty concentrating for the program group ($M = -0.37$, $SD = 1.05$) from pretest to posttest as compared to no change in the comparison group ($M = -0.01$, $SD = 1.05$), $t(214) = -2.419$, $p = .016$. Reductions were also found for the item feeling irritable/cranky in the program group ($M = -0.36$, $SD = 0.99$) compared to no change in the comparison group ($M = -0.02$, $SD = 0.99$), $t(214) = -2.430$, $p = .016$.

Program participants, as compared to their counterparts, showed more of an improvement in the overall self-regulation efficacy, $F(1, 211) = 19.682$, $p = .001$. Lastly, there was, on average, a 10% decrease in the self-reported amount of stress

TABLE 3
Mean Gain Scores, Univariate F tests, and Effect Sizes for All Follow Up Comparisons

	Experimental (<i>N</i> = 129)		Comparison (<i>n</i> = 87)		<i>F</i>	<i>p</i>	Partial η^2	<i>d</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>				
Stress level	-0.9	2.3	0.0	2.3	8.075	.005	.037	.40
Total difficulties in emotion regulation	-9.8	20.3	-3.9	14.7	5.441	.021	.025	.33
Nonacceptance emotional response	-2.4	5.1	-1.2	4.2	2.934	.088	.014	.24
Difficulties in goal-directed activity	-1.5	4.3	-1.4	3.7	0.097	.756	.000	.04
Impulse control difficulties	-0.8	4.4	-0.4	3.5	0.514	.474	.002	.10
Lack of emotional awareness	-1.1	4.2	0.2	3.4	5.900	.016	.027	.34
Ltd access to regulation strategies	-3.1	6.3	-1.1	7.6	4.418	.037	.021	.30
Lack of emotional clarity	-1.0	3.5	-0.1	2.8	3.924	.049	.018	.28
Psychosomatic complaints	-3.7	7.9	-1.6	6.4	5.441	.021	.025	.28
Affective self-regulatory efficacy	5.4	8.0	0.5	8.2	19.682	.001	.085	.62

in the past week from pretest to posttest as compared to no change reported for the comparison group, $F(1, 211) = 8.075, p = .005$.

Although not a predefined analysis because Learning to BREATHE is intended to be a universal prevention program, we conducted a multivariate General Linear Model (GLM) procedure in program participants to assess if mean change scores from pretest to posttest differed by gender (male, female) and grade (10, 11, 12). A two-way MANOVA did not reveal a significant multivariate main effect for gender, Pillai's trace = .089, $F(9, 122) = 1.33, p = .229$, for grade, Pillai's trace = .106, $F(18, 244) = 0.77, p = .739$, or for the interaction effect, Pillai's trace = .177, $F(18, 244) = 1.34, p = .173$.

Program Acceptability and Social Validity

The overall mean program satisfaction (measured from 1–10, with 10 the most satisfaction) was high ($M = 8.2, SD = 1.7$). Partial correlations were performed to assess the association between program satisfaction and each change score, while controlling for pretest score. All partial correlations, except for two, were non-negligible. Higher program satisfaction was associated with improvement from pretest to posttest in affective self-regulatory efficacy, $r(131) = .31, p = .000$ and with reduction from pretest to posttest in lack of emotional awareness DERS subscale, $r(133) = -0.26, p = .002$.

When asked if they would recommend the program to others, 89.1% stated yes, 7.0% reported some uncertainty or that only specific student groups should receive the program, and 3.9% expressed they would not recommend to others. The most useful program components reported included the body scan ($M = 8.5, SD = 2.1$), sitting mindfulness practice ($M = 8.0, SD = 2.1$), mindful breathing practice ($M = 7.7, SD = 2.1$), and mindful movement practice ($M = 7.2, SD = 2.5$). Other program components were rated slightly lower but still of moderate value including in-class presentation ($M = 6.6, SD = 2.2$), group discussion ($M = 6.6, SD = 2.1$), practice CDs ($M = 6.4, SD = 2.6$), and workbook/handouts ($M = 5.1, SD = 2.3$).

When asked what they learned or gained from the program in an open-ended format, 97.7% responded to the question with the majority writing it taught ways to calm, relax, and/or breathe (65.9%). One student mentioned “that just closing your eyes, taking breaths, and listening to your body can help you to relieve stress.” Other common responses included ways to accept or recognize emotions (19.4%), ways to control self/thoughts/feelings (18.6%), how to live in the present moment (14.0%), and how to concentrate/focus (11.6%). Acceptance of emotions was captured in two student comments including “things have become much clearer and before getting too upset or angry about a situation, I am more able to see all sides of it and accept that it is okay” and “I’ve learned to accept my feelings for what they are.”

DISCUSSION

The purpose of this study was to determine the potential feasibility, acceptability, and effectiveness of the mindfulness-based program, Learning to BREATHE, in a regular high school setting. The results of this study support the hypotheses that Learning to BREATHE has a positive effect on measures of emotional regulation, self-regulation efficacy, psychosomatic complaints, and self-report stress level. Students in the treatment group reported small yet statistically significant reductions in emotional regulation difficulties, psychosomatic complaints, and self-report stress level, while moderately increasing self-regulation efficacy of emotions compared to their counterparts.

Congruent findings were reported in other studies (Beauchemin, Hutchins, & Patterson, 2008; Biegel et al., 2009; Bogels et al., 2008; Huppert & Johnson, 2010), which conducted mindfulness programs for adolescents. These results are also similar to Broderick and Metz's (2009) evaluation of Learning to BREATHE in a private girls' high school sample, showing a moderate statistically significant reduction in negative affect and increases in feelings of calmness, relaxation, and self-acceptance for the program group compared to the comparison group. The results, however, extend the work of the Broderick and Metz program evaluation in that this investigation included students of both genders and a more reliable comparison group of similar size and pretest characteristics. This study was also different in that Learning to BREATHE was implemented in a public high school in the context of regular education, and the program was not delivered by an outside expert but by a regular teacher in the school who was trained in mindfulness. A recent meta-analysis of social-emotional learning programs showed that the benefits of SEL were related to programs taught by classroom teachers (Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, 2011).

The Learning to BREATHE program in this evaluation failed to show effects on the impulse control difficulties scale. There are several possible reasons why the intervention did not elicit treatment effects. First, it is possible that Learning to BREATHE is ineffective in changing youth impulse control. Impulse control may be heavily influenced by biological or environmental factors that transcend the scope of the intervention. Second, this study was underpowered to detect significant small effects ($d = .10$) with regard to this variable. However, we believe this finding is still worth reporting given modest effect sizes are pervasive in universal education programs. For example, the average effect size in reading growth as a consequence of public education exposure between Grades 9 through 12 is 0.06 to 0.19, growth in math yields an effect size between 0.01 to 0.25, and growth in science between 0.04 to 0.19 (Bloom, Hill, Rebeck-Black, & Lipsey, 2008). Third, it is possible adolescents are not reliable reporters of their own impulse control skills. Future research designed to further explore these possibilities will be required to determine which hypothesis is most plausible.

Our approach to delivering the Learning to BREATHE program appeared to be sound based on our MBSR teacher training, overall high student satisfaction ratings, and positive open-ended feedback from students. The high level of student satisfaction was also exemplified when a high majority of the students expressed they would recommend the program to others. Students described the program as teaching ways to relax and offering skills to handle difficult thoughts and feelings. The notion of acceptance is captured by one student who stated, “I learned that thoughts are just thoughts, nothing more. Whether they are positive or negative, silly or senseless, they are nothing but travelers stopping in for a quick stay. I’m much better off thinking this way.” Another student wrote, “One must take the time to experience things not for good or for bad, but for what they are. I already find myself taking a pause to examine moments or sensations in my life just to see how they are constructed, and I hope to continue doing so.”

Limitations and Directions for Future Research

Results of this study provide further evidence of the promise of mindfulness-based practices with adolescents in school settings. As their use becomes more widespread, further research is clearly needed. This pilot study focused only on high school students attending regular education classes with only a select number of demographic variables. As such, it will be important to examine whether these same findings generalize to students in different grade levels and abilities and explore whether results hold for students across diverse racial, language proficiency, and socioeconomic backgrounds. Second, although demographically matched within the same district, the sample included only two high schools, which limits the generalizability of these findings beyond this sample. Future random effects research examining the potential moderating effects of school system variables such as socioeconomic status, urbanicity, average achievement levels on implementation quality, and outcomes is recommended. Third, the central outcome measures employed in this study consisted exclusively of student-self report. Establishing the link between student self-reported improvement in emotion regulation and efficacy with observable changes in classroom behavior and academic performance is an important next step. Future research utilizing a more diverse array of measurement methods and respondents is warranted.

Despite these limitations, the results of this study provide promising evidence to support the use of Learning to BREATHE as a feasible and effective universal program for improving adolescent’s emotion regulation skills, reducing psychosomatic complaints, and improving student’s sense of efficacy regarding their capacity to engage in affective self-regulation. Students participating in the study reported a high degree of social validity and acceptability for program materials and activities. Although future research is warranted, results of this study underscore the promise of Learning to BREATHE as a potentially effective

universal program to promote the development of key social-emotional learning skills during adolescence.

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