MIND, BRAIN, AND EDUCATION

Greater Mindfulness is Associated With Better Academic Achievement in Middle School

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ABSTRACT— Despite increasing interest in improving academic outcomes for students by enhancing mindfulness, there is a paucity of evidence that greater mindfulness is associated with success in school. We measured mindfulness with the short-form Mindful Attention Awareness Scale (MAAS) in over 2,000 urban students in Grades 5–8. The MAAS had good internal consistency and scale homogeneity. Greater mindfulness correlated significantly with better academic achievement as measured by grade point average and standardized tests of mathematics and literacy, greater improvement in academic performance from the prior school year, better attendance, and fewer suspensions. The relation between mindfulness and academic achievement was similar across demographic characteristics. These findings support the reliability of the MAAS as a measure of mindfulness among youth and provide initial evidence of an association between mindfulness and academic achievement. This association strengthens the rationale to explore whether mindfulness-based interventions can enhance academic outcomes by leveraging the malleability of mindfulness.

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Mindfulness has captured the attention of educators as an important, yet traditionally overlooked, capacity that could support both cognitive and social–emotional abilities in students, and, in turn, enhance academic and behavioral outcomes. Mindfulness is defined in Western cultures as the ability to "[pay] attention in a particular way, on purpose, in the present moment, and nonjudgmentally" (Kabat-Zinn, 1994; Van Dam et al., 2018). Well-controlled studies have shown that interventions designed to augment mindfulness in students have enhanced cognitive abilities relevant to academic achievement, including reading comprehension and working memory capacity (Corbett, 2011; Mrazek, Franklin, Phillips, Baird, & Schooler, 2013; Napoli, Krech, & Holley, 2005; Zenner, Herrnleben-Kurz, & Walach, 2014). Additionally, research has documented the value of mindfulness-based interventions (MBIs) for enhancing social–emotional wellbeing (Broderick & Metz, 2009; Huppert & Johnson, 2010; Waters, Barsky, Ridd, & Allen, 2015). These findings have motivated efforts to introduce school-based MBIs as a means to support the cognitive and social–emotional growth of students (Lawlor, 2014). An individual's level of mindfulness is typically measured using self-report questionnaires, such as the Mindful Attention Awareness Scale (MAAS) designed for adults (Brown & Ryan, 2003) and a short form, adapted for children and adolescents (Black, Sussman, Johnson, & Milam, 2012). Here, we asked whether mindfulness, as measured by the short-form MAAS, is associated with academic outcomes of grade point average (GPA), standardized test scores, attendance, and suspension for U.S. urban students in Grades 5–8.

There is some evidence that MBIs can enhance academic achievement, but there is no direct evidence that mindfulness per se is associated with academic achievement in U.S.

students. Promising MBIs, with either quasi-experimental or randomized control trials (RCT) designs, have led to gains in vocabulary and reading grades in pre-K and kindergarten (Thierry, Bryant, Nobles, & Norris, 2016), reading grades in third graders (Bakosh, Snow, Tobias, Houlihan, & Barbosa-Leiker, 2016), math grades in fourth and fifth graders (Schonert-Reichl et al., 2015), and literature grades in ninth graders (Franco, Mañas, Cangas, & Gallego, 2011; Klingbeil et al., 2017). Two quasi-experimental control trials found that elementary and middle school students had improved standardized test scores in Mathematics and English Language Arts (ELA) (S. Nidich et al., 2011; S. I. Nidich & Nidich, 1989). In another MBI, UK high school students improved on their General Certificate of Education Exams (Bennett & Dorjee, 2016). Mindfulness measurements were not collected in these studies, precluding investigation into the relationship between mindfulness and academic achievement.

A reliable questionnaire measure of mindfulness that is validated as a correlate of academic achievement in students would be valuable for research and instruction in mindfulness. First, a documented relation between mindfulness and academic achievement would strengthen the case for school-based efforts to enhance mindfulness. Second, the questionnaire could be used as an outcome measure for MBIs to assess changes in mindfulness. A candidate for measuring mindfulness is the short-form MAAS that was validated in a single study of adolescents in Chengdu, China (Black et al., 2012). The reliability of the MAAS and its relation to academic achievement in U.S. students are unknown.

To test for the hypothesized positive correlation between mindfulness and academic achievement, we administered the MAAS to a large sample of students in Grades 5–8 attending urban public charter schools. We first examined the psychometric properties of the MAAS in this sample by assessing the internal consistency and the homogeneity of the scale items. We then analyzed the relation of mindfulness as measured by the MAAS to three academic performance measures: GPA and standardized tests of academic achievement in Mathematics and ELA. We further examined the relationship of mindfulness to measures of suspensions and attendance.

METHODS

Participants

The MAAS was administered in spring 2015 to 2,311 students in Grades 5–8 attending 14 public charter schools that are part of a research-practice partnership to facilitate the collection and sharing of data. All schools are in urban centers in the Boston, Massachusetts metro area and predominantly serve minority students from low-income families. Analyses of MAAS reliability and consistency and its relation to attendance and suspensions were conducted on the full study sample.

MAAS, Attendance, and Suspensions Sample

Of the 2,311 students with MAAS scores, 51% were female, 88% had ever been on the free/reduced price lunch (FRPL) program for low-income families, 19% had ever had an individualized education plan (IEP) for special education services, and 32% had ever been designated as English language learners (ELLs) at one point in their educational history. This population of students was 50% Hispanic, 35% African American, 12% White, 2% Asian, and 1% other or multiple racial identities. On average, these students attended 97% of school days during the 2014–2015 academic year. Approximately 16% of these students were suspended at least once in the 2014–2015 academic year. Almost 80% of students with at least one suspension were suspended between 1 and 4 days; longer suspensions were rare.

GPA, Math Partnership for Assessment of Readiness for College and Career, and ELA PARCC Samples

Analyses of the relation between MAAS and academic performance were conducted on subgroups within this sample for whom data were available on either grades or standardized tests of academic achievement (Partnership for Assessment of Readiness for College and Careers [PARCC]). Schools did not report grades for some students ($N = 177$). PARCC scores were missing for some students (Math: $N = 154$, ELA: $N = 161$) primarily due to absences during the testing period and the administration of alternative assessments to some students. Thus, MAAS and GPA scores were available for 2,134 students across 13 charter schools, MAAS and PARCC Math scores available for 2,157 students across 14 charter schools, and MAAS and ELA scores available for 2,150 students across 14 charter schools. The were no significant differences in demographic characteristics between any of these subgroups and the overall sample ($ps > .32$).

Measures

Mindful Attention Awareness Scale

A previously validated 6-item scale adapted from the original 15-item MAAS scale was used to measure mindfulness (Black et al., 2012; Brown & Ryan, 2003). This 6-item MAAS (Black et al., 2012) has similarly strong reliability (Cronbach's $\alpha = .89–.93$; test–retest $r = .35–.52$) and convergent/discriminant validity when administered to adolescents as with adults. The shortened MAAS includes questions such as "I rush through activities without being really attentive to them" (1: *almost never*, to 6: *almost always, reverse*

coded). Students' average responses to all six items were standardized within our sample.

Grade Point Average

Students' grade reports were converted into comparable GPAs using credit allocations for weighting. Core subjects, which were often consistent across grade levels and schools (e.g., math), were assigned twice as much weight as electives (e.g., art). GPA was standardized separately by school to account for differences in grading standards across schools.

PARCC Math and ELA

The PARCC is a standardized test that is aligned with the Common Core Standards in Mathematics and ELA. We standardized students' PARCC scores separately by subject and grade to create measures of students' academic performance that are comparable across grades within our sample.

Suspensions a Attendance

Each student had a binary indicator of whether they were ever suspended during the academic year and a cumulative count of number of days suspended. Attendance data included the total number of days students attended and the total number of days they were enrolled in the academic year, enabling us to calculate the percentage of days each student was absent.

Data Collection

Data were collected for the 2014–2015 academic year, with the MAAS administered during the spring semester. Administrative data on suspensions, absences, grades, and PARCC assessments (administered in the spring) were acquired from the Massachusetts Department of Elementary and Secondary Education at the end of the academic year. The MAAS was administered either through an online platform or on paper, depending on computer availability and school preference. Educators ran the testing sessions after reviewing standardized proctor guidelines. Student demographics and outcome measures were stored and analyzed at Harvard University's Center for Education Policy Research Level 4 data room.

Data Analysis

Histogram distributions of the MAAS, GPA, and PARCC scores appeared normal. Two-sample *t*-tests were used to determine whether each subgroup in GPA, Math PARCC, and ELA PARCC Samples section was significantly different in their demographic characteristics from the overall sample of all students who completed the MAAS. Pearson's *r* correlation coefficients were calculated to quantify shared variance between the MAAS and academic outcomes.

We used multivariate regression models to quantify the observed relationships between MAAS and academic performance collected at a single time point. First, we regressed each measure of academic performance on MAAS and a set of grade-level indicators to account for possible differences in rigor of grading across grades. Second, in another set of models we controlled for demographics to quantify the variance in academic performance that MAAS explains above and beyond demographic factors. Third, we additionally controlled for students' academic performance from the previous year to investigate whether MAAS is correlated with change in academic performance over time. Finally, we investigated whether the observed relationship between MAAS and academic performance differed across demographic subgroups with another set of models with interaction terms. For the models examining any interaction with demographic subgroups, we regressed each measure of academic performance on MAAS with indicator variables as well as an interaction term for MAAS for each of the indicator variables (e.g., Hispanic). The standard errors of all correlation and regression analyses were clustered at the school-grade level to account for the possibility of correlated errors among students attending the same school and in the same grade.

RESULTS

MAAS Construct

Internal Consistency

Descriptive statistics for each of the six items are included in Table 1. A reliability analysis revealed a Cronbach's alpha of $\alpha = 0.79$. This indicates good internal consistency among the items, particularly for a 6-item scale (reliability estimates tend to become larger as the number of items increases). Additional estimates of internal consistency, such as average interitem covariance (mean = .87) and item-test correlation (mean = .70), ranged from medium to large magnitudes indicating good internal reliability while avoiding redundant individual items (Clark & Watson, 1995).

Scale Homogeneity

A principal component factor analysis (PCA) of the six items' responses revealed one significant component with eigenvalue >1 (eigenvalue: 2.907) that accounted for 48.45% of total variance. Furthermore, the individual scale items' factor loadings on this single component were all high (Table 1). This indicates that the MAAS has good homogeneity with all six scale items assessing a single underlying construct.

Table 1
Descriptive Statistics for Each Mindful Attention Awareness Scale (MAAS) Item

	Min.	*Max.*	*Mean*	SD	*Loading*
1. It seems I am "running on automatic," without much awareness of what I am doing.	1	6	3.84	1.47	0.71
2. I rush through activities without being really attentive to them.	1	6	4.24	1.44	0.68
3. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.	1	6	3.74	1.54	0.68
4. I do jobs or tasks automatically, without being aware of what I am doing.	1	6	3.82	1.51	0.71
5. I find myself preoccupied with the future or the past.	1	6	3.20	1.54	0.64
6. I find myself doing things without paying attention.	1	6	3.83	1.57	0.75

Note. Max. = maximum response option on a 6-point Likert scale (MAAS scoring described in Mindful Attention Awareness Scale section); Min. = minimum response option on a 6-point Likert scale; SD = standard deviation of responses. The loading descriptive statistic indicates the loading of individual items onto the one significant component identified with principal component factor analysis of the responses.

Correlations Between Mindfulness and Academic Outcomes

Academic Performance: GPA and PARCC Scores

Greater mindfulness (higher MAAS scores) correlated positively with better GPA ($N = 2{,}134$, $r = .23$, $p < .001$) and accounted for 7% of GPA variance (Figure 1a). Greater mindfulness also correlated positively with better standardized test scores (Math: $N = 2{,}157$, $r = 0.24$, and $p < .001$; ELA: $N = 2{,}150$, $r = 0.27$, and $p < .001$)) and accounted for 5% of variance in PARCC Math (Figure 1b) and 7% of variance in PARCC ELA (Figure 1c).

Suspensions and Attendance

Greater mindfulness was associated with a decreased likelihood of being suspended ($N = 2{,}311$, $r = -0.03$, $p = .004$; 0.6% of the variance) and fewer days of suspension ($N = 2{,}311$, $r = -.14$, $p = .003$; 0.3% of the variance in days suspended). Due to the low proportion of students with any suspensions, we also examined the mean difference in mindfulness between students who had a suspension and those who did not. On average, students without a suspension reported mindfulness of 0.04. In comparison, those with a suspension had a mean of −0.18 ($t(2{,}309) = 3.93$, $p < .001$) Greater mindfulness also correlated with fewer absences ($N = 2{,}305$, $r = -0.22$, $p = .003$; 0.4% of the variance).

Regression Models of the Relationship Between Mindfulness and Academic Performance

The first set of regression results is consistent with the correlations reported in Academic Performance: GPA and PARCC Scores section while accounting for potential differences in academic performance measures across grade levels (models 1, 4, 7 in Table 2). An increase of one standard deviation in the MAAS score significantly predicted a 0.22 higher standardized GPA ($b = 0.22$, $t(4) = 9.66$, and $p < .001$), 0.24 higher PARCC Math ($b = .24$, $t(4) = 8.86$, and $p < .001$), and 0.27 higher PARCC ELA ($b = .27$, $t(4) = 10.30$, and $p < .001$). These models accounted for a small amount of the variance in academic outcomes (GPA: $R^2 = 8\%$, $F(4, 40) = 24.71$, and $p < .001$; PARCC Math: $R^2 = 5\%$, $F(4, 41) = 20.62$, and $p < .001$; PARCC ELA: $R^2 = 7\%$, $F(4, 41) = 26.69$, and $p < .001$).

Greater mindfulness continued to predict better academic achievement even when adjusting for demographic characteristics (models 2, 5, and 8 in Table 2). An increase of one standard deviation in the MAAS score significantly predicted a 0.15 higher standardized GPA ($b = .15$, $t(11) = 7.27$, and $p < .001$), 0.17 higher PARCC Math ($b = .17$, $t(11) = 7.63$, $p < .001$), and 0.19 higher PARCC ELA ($b = .19$, $t(12) = 8.04$, and $p < .001$). These models accounted for a moderate amount of the variance in academic outcomes (GPA: $R^2 = 25\%$, $F(11, 40) = 24.49$, and $p < .001$; PARCC Math: $R^2 = 19\%$, $F(11, 41) = 36.57$, and $p < .001$; PARCC ELA: $R^2 = 22\%$, $F(11, 41) = 48.51$, and $p < .001$).

Further multivariate regressions (models 3, 6, and 9 in Table 2) showed that MAAS was related not only to current levels of academic performance but also to change in academic performance from the previous year, while still adjusting for demographics and grade-level differences. This means that the following models included the previous year's academic performance score as a covariate, while the current year's academic performance outcome measure remained the dependent variable. An increase of one standard deviation in the MAAS score significantly predicted a 0.08 higher standardized GPA ($b = .08$, $t(13) = 4.61$, and $p < .001$), 0.05 higher PARCC Math ($b = .05$, $t(13) = 3.64$, and $p = .001$), and 0.07 higher PARCC ELA ($b = .07$, $t(13) = 3.99$, and $p < .001$). These models accounted for a moderate amount of the variance in the academic outcomes (GPA: $R^2 = 48\%$, $F(13, 40) = 30.63$, and $p < .001$; PARCC Math: $R^2 = 64\%$, $F(13, 41) = 130.47$, and $p < .001$; PARCC ELA: $R^2 = 56\%$, $F(13, 41) = 124.31$, and $p < .001$).

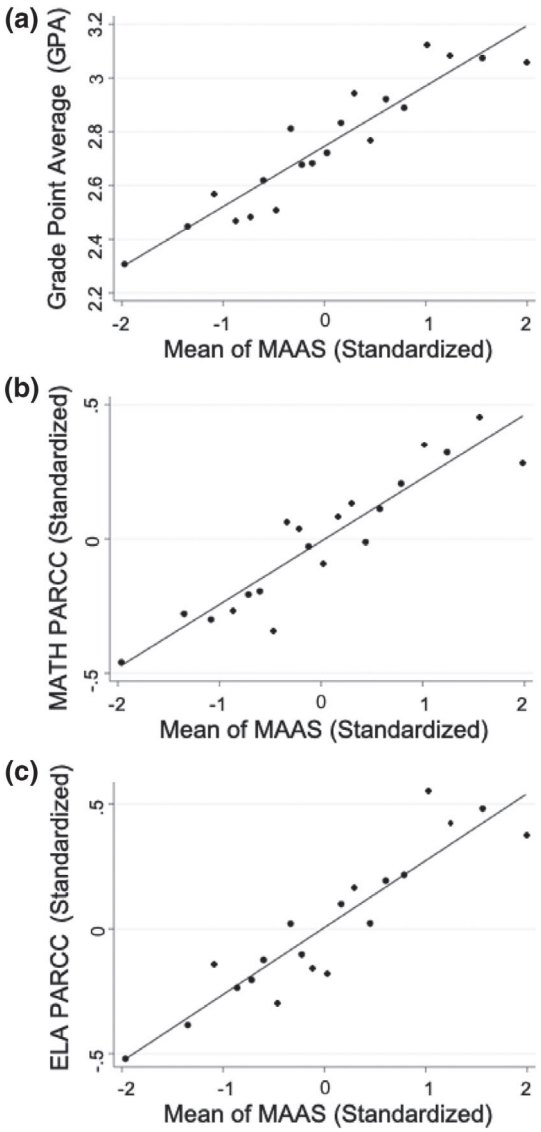

Fig. 1. Relationship between mindfulness and academic outcomes: (a) Mindful Attention Awareness Scale (MAAS) and grade point average, (b) MAAS and mathematics Partnership for Assessment of Readiness for College and Career (PARCC), (c) MAAS and English language arts PARCC. *Note:* Each data point represents the average of the relevant outcome among students within 20 equally sized (five percentile point) intervals of the MAAS variable; the regression lines show the linear relationship between MAAS and each outcome variable in the individual-level data. Charts created using the binscatter command developed by Michael Stepner.

Patterns in Demographic Characteristics

Students who have ever been on an IEP or designated as ELL had significantly lower MAAS scores than students not in that group (IEP: $t(2,309) = 7.19$, and $p < .001$; ELL: $t(2,309) = 3.96$, and $p < .001$; Table 3 for this section). Male students had significantly lower MAAS scores than female students ($t(2,309) = 5.57$, $p < .001$). African American students had significantly lower MAAS scores than students that did not identify as African American ($t(2,309) = 2.08$, $p = .04$); there were no significant differences for other ethnic or racial groups ($ps > .13$). The same differences in MAAS scores held for the subgroups with grades and PARCC scores. Additionally, MAAS scores did not differ significantly across grade levels. Critically, the association between MAAS scores and academic outcomes did not significantly differ across racial or ethnic (i.e., White/other, African American, Hispanic, Asian), sex, IEP, or ELL subgroups (i.e., no interactions were significant for any of these subgroups for GPA ($ps > .18$), PARCC Math ($ps > .22$), or PARCC ELA ($ps > .21$).

DISCUSSION

Greater levels of mindfulness, as measured by the MAAS, were associated with better academic outcomes for over 2,000 urban U.S. students in Grades 5–8 as measured by GPA and statewide tests of English Language Arts and Mathematics achievement, as well as better attendance and fewer suspensions. This relationship continued to hold when accounting for demographic characteristics and previous academic performance, signaling that mindfulness captures distinct variance in academic achievement outcomes beyond these individual student factors. Indeed, mindfulness was associated not only with current academic performance, but also improvement in academic performance from the prior year. Mindfulness was similarly related to academic outcomes across all demographic groups, suggesting that for all students, greater mindfulness was associated with better academic outcomes. The MAAS exhibited good psychometric properties of reliability as well. These findings support the value of the MAAS to measure variation in mindfulness across students, as well as mindfulness in improving academic achievement and school behaviors.

Mindfulness as a Reliable and Valid Social–Emotional Construct

The MAAS self-report measure was a reliable and internally consistent measure of mindfulness among U.S. middle school students. The psychometric statistics of the 6-item MAAS within our diverse U.S. sample were on par with the only other adolescent validation study in Chengdu, China (Black et al., 2012). Interitem consistency in our sample of U.S. middle-school students (Cronbach's $\alpha = .79$) was high and similar to that of Chinese adolescents (Cronbach's $\alpha = .89–.93$).

Establishing the MAAS as a reliable questionnaire is valuable for mindfulness research in educational settings. Even with increasing emphasis on social–emotional learning in schools, the dimensions of mindfulness are

Table 2
Mindful Attention Awareness Scale (MAAS) and Academic Performance Regressions

	1[a]	2[b]	3[c]	4[a]	5[b]	6[c]	7[a]	8[b]	9[c]
	GPA			*PARCC Math*			*PARCC ELA*		
	Beta coefficient (SE)			*Beta coefficient (SE)*			*Beta coefficient (SE)*		
MAAS	.22***(0.02)	.15***(0.02)(0.02)	.08** (0.02)	.24***(0.02)(0.03)	.17***(0.02)(0.02)	.05** (0.02)	.27***(0.02)(0.03)	.19***(0.02)(0.02)	.07***(0.02)(0.02)
Male	NA	−.28***(0.02)(0.04)	−.25***(0.02)(0.03)	NA	−.02 (0.05)	−0.02 (0.03)	NA	−.29***(0.02)(0.03)	−.18***(0.02)(0.02)
FRPL ever	NA	−.10 (0.06)	−.05 (0.04)	NA	−.03 (0.06)	.05 (0.04)	NA	−.11 (0.06)	−.03 (0.05)
IEP ever	NA	−.65***(0.02)(0.05)	−.26***(0.02)(0.03)	NA	−.82***(0.02)(0.07)	−.19***(0.02)(0.05)	NA	−.70***(0.02)(0.08)	−.17** (0.06)
ELL ever	NA	−.16** (0.05)	−0.004 (0.03)	NA	−.17*(0.07)	.04 (0.03)	NA	−.29***(0.02)(0.06)	−.08 (0.05)
African American	NA	−.27** (0.08)	−.15*(0.08)	NA	−.21*(0.10)	−.01 (0.05)	NA	−.28** (0.08)	−.12*(0.05)
Asian	NA	.38** (0.12)	.17 (0.09)	NA	.83***(0.02)(0.17)	.46***(0.02)(0.11)	NA	.50*(0.22)	.25 (0.14)
Hispanic	NA	−.10 (0.06)	−.006 (0.05)	NA	−.04 (0.09)	.10 (0.06)	NA	−.22** (0.07)	−.08 (0.05)
PY Math	NA	NA	.30***(0.02)(0.03)	NA	NA	.67***(0.02)(0.03)	NA	NA	.23***(0.02)(0.03)
PY ELA	NA	NA	.24***(0.02)(0.05)	NA	NA	.19***(0.02)(0.03)	NA	NA	.53***(0.02)(0.93)
Grade	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N		2,134			2,157			2,150	
R^2	0.08	0.25	0.48	0.05	0.19	0.64	0.07	0.22	0.56

Note. All regressions were clustered by school level. ELL ever = English language learner; FRPL ever = free/reduced price lunch; grade = grade level dummy variable indicator; IEP ever = identifier for special education services; PARCC = Partnership for Assessment of Readiness for College and Career; PY ELA = 2014 MCAS English Language Arts; PY Math = 2014 MCAS Math.

[a]Models 1, 4, and 7 = Regression includes 2015 MAAS variable and grade level indicators.

[b]Models 2, 5, and 8 = Regression includes 2015 MAAS variable, grade level indicators demographic covariate variables.

[c]Models 3, 6, and 9 = Regression includes 2015 MAAS variable, grade level indicators, demographics, and previous year standardized test scores.

*$p < .05$. **$p < .01$. ***$p < .001$.

Table 3
Mean Standardized Mindful Attention Awareness Scale (MAAS) Score by Demographics

	Included	*Not in group*	*Norm. difference*
IEP ever	−0.31 (1.01, 444)	0.07 (0.98, 1,867)	−0.38***
ELL ever	−0.12 (0.99, 743)	0.06 (1, 1,568)	−0.18***
FRPL ever	−0.01 (1, 2,023)	0.1 (1, 288)	−0.11
Male	−0.12 (1.01, 1,121)	0.11 (0.98, 1,190)	−0.23***
African American	−0.06 (0.97, 803)	0.03 (1.01, 1,508)	−0.09*
Hispanic	0.02 (1, 1,146)	−0.02 (1, 1,165)	0.04
Asian	0.24 (1.18, 38)	0 (1, 2,273)	0.22
White	0.09 (1.07, 278)	−0.01 (0.99, 2,033)	0.10

Note. Standard deviations and sample size in parentheses. ELL ever = English language learner; FRPL ever = free/reduced price lunch; IEP ever = individualized education plan identifier for special education services; Included = student identified as having this demographic characteristic; Norm. difference = normalized difference between the groups; and Not In group = student never has identified as having this demographic characteristic.
*$p < .05$. **$p < .01$. ***$p < .001$.

relatively novel to students compared to other more widely assessed noncognitive characteristics such as growth mindset (Dweck, 2006) or grit (Duckworth, Peterson, Matthews, & Kelly, 2007). Growth mindset captures a student's implicit theory of intelligence and ability to change (Dweck, 2006), whereas grit measures a student's tenacity and consistency in effortful work toward long-term goals (Duckworth et al., 2007). In contrast to educator awareness of the importance of a growth mindset and perseverance, the mindfulness skills captured by the items in the MAAS (described in Methods section) are seldom discussed in classrooms. The present discovery that higher scores on the MAAS were associated with better academic outcomes suggests that mindfulness may be a promising socio-emotional characteristic for schools to encourage and measure in students.

Mindfulness accounted for an average of 6% variance in academic performance, and this finding can be interpreted in the context of how much widely measured constructs of social–emotional characteristics account for the variation in academic outcomes. A study with 1,368 Boston eighth graders (including many of the schools in the present study) found that variation in growth mindset accounted for an average of 11.6% variance in test scores, 1% variance in absences, and did not significantly correlate with days suspended (West et al., 2016). In the same sample, variation in grit accounted for 1% variance in days suspended but did not account for significant variance in test scores or absences. These variances are in the range of findings in other samples. For example, variation in grit accounted for 4% of the variance in GPA at selective colleges, retention among West Point cadets, and ranking in the National Spelling Bee (Duckworth et al., 2007), although stronger associations have also been found (e.g., variation in growth mindset accounted for 11.8% of the variance in achievement test scores in Chilean high school students; Claro, Paunesku, & Dweck, 2016). Altogether, the variance in academic performance accounted for by mindfulness is similar to that of growth mindset and grit.

The present findings, coupled with MBI results, suggest that higher levels of mindfulness may promote academic achievement in students. Being more mindful may boost a student's academic achievement through increased attentional control both while learning and during testing. Although there is variability in defining mindfulness, the literature does converge on sustained attention as a core mindfulness component (Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006; Bishop Scott et al., 2006; Brown & Ryan, 2003; Dreyfus, 2011; Grossman & Van Dam, 2011; Wallace & Shapiro, 2006). Increased attentional control—as boosted by MBIs—in the classroom reduces mind-wandering (Levinson, Stoll, Kindy, Merry, & Davidson, 2014; Mrazek, Smallwood, & Schooler, 2012; Zanesco et al., 2016; Zedelius & Schooler, 2016). Mind-wandering, as an opposing construct of mindfulness, impacts academic performance by interfering with learning (Smallwood, 2011; Smallwood, Fitzgerald, Miles, & Phillips, 2009; Smallwood, Nind, & O'Connor., 2009) and during performance (Mrazek et al., 2013). Mind-wandering during test performance is deleterious, explaining almost 50% of the shared variance in SAT performance, working memory capacity, and fluid intelligence (Mrazek et al., 2013). Thus, improving attentional control and diminishing mind-wandering during learning and performance are potential mechanisms through which mindfulness may boost academic achievement.

Limitations

While the present study establishes an association between greater mindfulness and better academic outcomes in middle school students, some limitations are noteworthy. One limitation is that the findings are correlational rather than causal, and future MBI RCTs that measure both mindfulness and academic achievement are needed to demonstrate causality. Additional constructs that are strongly correlated

with academic outcomes—such as self-regulation and cognitive ability (Duckworth, Quinn, & Tsukayama, 2012; Galla et al., 2019)—would also be beneficial to measure to further elucidate how mindfulness might uniquely explain part of the variance in academic outcomes above and beyond these other constructs. A second limitation is lack of knowledge about experiences that may promote or demote mindfulness in students. School practices such as socio-emotional learning curricula, culturally responsive pedagogical practices, or mindfulness-based professional development for teachers may influence mindfulness in students (Hwang, Bartlett, Greben, & Hand, 2017; Ladson-Billings, 2017). A third limitation is that this sample of urban students is disproportionately comprised of lower-income, minority students. Student experiences related to race, ethnicity, gender, and socioeconomic status (SES) may all influence mindfulness. For example, children in urban public schools are more likely to experience stressful, adverse events than children in suburban neighborhoods (Brady & Matthews, 2002; Chandler, Million, & Shermis, 1985; Gillum, Prineas, Gomez-Marin, Chang, & Finn, 1984; Gore, Aseltine & Colton, 1992; Turner & Avison, 2003). This may be notable for our sample given that 88% of students were eligible for FRPL (i.e., their family income was less than 185% of the federal poverty line). Future studies should expand to students from rural and suburban school districts and across a full distribution of SES. Additionally, as MBIs become widespread across different socioeconomic and cultural contexts, variation in teaching methods that is culturally sensitive may promote MBI efficacy (Proulx et al., 2018). Furthermore, future studies may distinguish among multiple aspects of mindfulness beyond attentional awareness, such as kind intention and loving awareness (reviewed in Chiesa, 2013).

Mindfulness and Education

Variation in mindfulness, on average, paralleled demographic trends in achievement gaps that educators aim to close, including gaps based on race (Valencia, 2015), sex (Voyer & Voyer, 2014), special education (Schulte & Stevens, 2015), and ELL (Genesee, Lindholm-Leary, Saunders, & Christian, 2005) status. These findings suggest that mindfulness may be salient for closing some of those achievement gaps. Indeed, our results suggest that the association between mindfulness and academic achievement is similar across diverse student characteristics. First, we included statistical models that controlled for demographics to quantify the variance in academic performance that mindfulness explained above and beyond demographic factors. Second, there were no statistically significant interactions between demographic groups and the association between mindfulness and academic achievement. The similar relation between mindfulness and academic outcomes across demographic characteristics indicates that all students may benefit academically from greater mindfulness. The finding that greater mindfulness was associated not only with current academic performance but also with greater improvement from the prior academic year further suggests that enhancing mindfulness might boost learning.

Perhaps more than any other social–emotional characteristic, there is evidence that curricula can foster mindfulness. MBI RCTs within low-SES, urban school settings have found positive outcomes, such as improvements in working memory (Quach, Jastrowski Mano, & Alexander, 2016), lower levels of psychopathology and stress-related symptoms (Sibinga, Webb, Ghazarian, & Ellen, 2016), and reduced self-perceived stress associated with functional brain plasticity (Bauer et al., Submitted). Thus, mindfulness is not a fixed trait, but rather a malleable characteristic that can be fostered by education. The evidence is less clear that other social–emotional characteristics (e.g., grit and growth mindset) can be altered in such a direct and actionable manner, especially for adolescents (e.g., (Orosz, Peter-Szarka, Bothe, Toth-Kiraly, & Berger, 2017; Sisk, Burgoyne, Sun, Butler, & Macnamara, 2018). Our findings encourage further development of school-based MBIs that foster mindfulness because greater mindfulness relates to better academic outcomes for diverse middle school students.

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