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# Cultivating Adolescents' Self-Compassion Through Mindfulness: The Role of Self-Regulation at Both the Individual- and Classroom-Level

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## Abstract

School-based mindfulness programs help students manage stress and promote well-being. These programs largely reflect a developmental psychological mindfulness framework that posits that intrinsic states of mindfulness and basic compassion can be cultivated into traits through socialization and training. Yet less is known about how program effects vary depending on individual and classroom differences in key mindfulness-related constructs. This study intended to examine how initial individual and class-level self-regulation impacted the effect of the program on adolescents' self-compassion. Participants included students from the Inner Strength Education Teen Program (N = 2,121), representing 97 classrooms from six high schools within the Philadelphia City School District. Students participated in a 12-week school-based mindfulness intervention program and completed the Self-compassion Scale-Short Form and the Adolescent Self-Regulation Inventory at pretest (T1) and posttest (T2). After controlling gender and initial self-compassion, at the individual-level, between-person T1 self-regulation significantly predicted individual-level growth in T2 self-compassion. At the classroom-level, T2 self-compassion changed less for students in classrooms with higher average levels of self-regulation at T1 compared to their peers in classrooms with lower average levels of self-regulation at T1. That is, the effect of the program was stronger for classrooms with lower levels of self-regulation at T1. These findings provide evidence that self-regulation at both the individual and classroom levels contributes to heterogeneity in the effectiveness of a mindfulness-based program in promoting self-compassion among adolescents.

**Keywords** Self-regulation · Self-compassion · School-based mindfulness program · Adolescents · Multilevel modeling

Although societal concerns for adolescent mental health have increased over the last decade, the situation was significantly exacerbated by the COVID-19 pandemic (Daly et al., 2021; Jones et al., 2022). In particular, recent estimates suggest that 20% of adolescents report clinical levels of depression, while 25% report symptoms consistent with anxiety disorders (Racine et al., 2021). These harrowing statistics, together with the fact that almost 50% of adolescents in the United States had a lifetime prevalence of any mental disorder (Merikangas et al., 2010), highlight the critical need for mental health promotion in schools. Schools function as a primary support system for students; they have both the opportunity and responsibility to promote social-emotional competence and prevent mental health disorders among youth (Cavioni et al., 2020; Greenberg et al., 2003).

Over the last decade, one of the most prolific school-based strategies to reduce stress and cultivate well-being has been mindfulness-based programs (MBPs). The results of numerous reviews indicate that these interventions are effective in promoting multiple constructs associated with adolescent psychological well-being and positive functioning (Felver et al., 2016; Garro et al., 2023; Phan et al., 2022; Roeser et al., 2022; Tortella et al., 2021; Zenner et al., 2014). The promotion of self-compassion is of particular interest, as it is viewed as an important mechanism underlying resilience to stress that can contribute to emotional well-being and alter adolescents' developmental trajectories (Bluth et al., 2018;

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Kuchar et al., 2023). Moreover, a growing body of research confirms that adolescent self-compassion can be cultivated by MBPs (Bluth & Eisenlohr-Moul, 2017; Galla, 2016; Razza et al., 2021). Despite these successes, what remains unclear is whether and how the effects of the programs vary depending on initial levels of related constructs, particularly self-regulation, that support self-compassion (Cary et al., 2023; Perry-Parrish et al., 2016). Given the importance of the group dynamic within MBPs (Cormack et al., 2018; Imel et al., 2008), it is important to identify how variations in self-regulation at both the individual and classroom levels contribute to heterogeneity in effectiveness. This information can help interpret variations in findings across students and classrooms and inform future curriculum development and targeted programmatic efforts (Flay & Collins, 2005; Greenberg & Abenavoli, 2017).

Mindfulness refers to the purposeful attention to and non-judgmental acceptance of present moment experiences, including thoughts, emotions, and physical sensations (Kabat-Zinn, 2003). Mindfulness is regarded as a mental characteristic that varies naturally from low to high levels within the population as a dispositional trait but also has the ability to be promoted via training and practice (Brown & Ryan, 2003). While there is considerable variation across MBPs for youth, a recent consensus identified the following core program components: self-awareness, non-judging, focused attention, orienting to the present moment, acceptance, compassion, somatic awareness, non-reacting, and decentering (Felver et al., 2022). These essential program elements are typically cultivated via secular practices that include seated breath meditations, body scans, mindful movement or yoga postures, and loving-kindness contemplations. Collectively, these practices generate effective coping and appraisal strategies that help mitigate the negative effects of stress on mental health and learning in the classroom (see Palacios et al., 2022; Tortella et al., 2021, for review). More specifically, these experiences involve affective- and cognitive-based processes associated with psychological well-being and stress response, including self-compassion and self-regulation (Britton et al., 2021; Volkaert et al., 2022).

The concept of self-compassion was introduced by Neff (2003), who defined it as a multifaceted construct comprised of three components: self-kindness (e.g., being kind and understanding towards oneself), common humanity (e.g., recognizing that suffering and imperfections are a part of the human experience), and mindfulness (e.g., being present and non-judgmental towards one's thoughts, emotions, and physical sensations). It is important to note that while there is conceptual overlap between self-compassion and mindfulness, they are considered distinct constructs (Bluth & Blanton, 2014). Moreover, the mindfulness inherent in the conceptualization of self-compassion refers more to mental disposition, while MBPs typically portray mindfulness as practices or skills that promote positive outcomes, including self-compassion. For example, mindfulness practices can help individuals become more aware of their thoughts and emotions without getting caught up in self-judgment or criticism (Davis & Hayes, 2011). This heightened awareness can enhance individuals' recognition of the degree of rumination and self-judgment, which cultivates greater self-kindness and self-compassion (Bluth & Blanton, 2014; Davis & Hayes, 2011).

Adolescents undergo significant physical, cognitive, and emotional changes, resulting in a shift in self-perception, heightened self-awareness, and self-consciousness (Bluth et al., 2016; Marshall et al., 2015). These developmental shifts impact self-compassion as adolescents navigate challenges, setbacks, and social comparisons (Neff, 2009). Notably, there is evidence that self-compassion declines during older adolescence, especially among females (Bluth & Blanton, 2014). Adolescent self-compassion has been associated with a range of positive outcomes, including increased social connectedness, resiliency, and curiosity, as well as lower levels of stress, depression, and anxiety (Bluth et al., 2018; Lathren et al., 2019; Neff & McGehee, 2010; Volkaert et al., 2022). Moreover, the results of a meta-analysis examining the link between self-compassion and psychological distress suggest that lack of self-compassion may cause or contribute to emotional difficulties during adolescence and advocate for targeting it via intervention (Marsh et al., 2018).

While MBPs often target self-compassion and related constructs simultaneously, there is evidence that these mechanisms of change may be ordered such that self-regulation skills enable and allow for the actualization of self-compassion (Holas & Jankowski, 2013; Verhaeghen, 2019). Self-regulation is a multidimensional construct that refers to the ability to modulate attention, cognition, and emotions in response to environmental or contextual demands (Kopp, 1982). For example, self-regulation includes metacognitive skills that allow individuals to notice negative thought patterns as well as attentional control to redirect their focus or implement cognitive reappraisal (Inwood & Ferrari, 2018). Moreover, research suggests that self-regulatory skills are responsible for both cognitive and emotional regulatory strategies that underlie self-compassion processes (Muris et al., 2019; Scoglio et al., 2018). As such, it is possible that an individual's initial level of self-regulation has implications for how they engage in, experience, and benefit from the intervention. Thus, models that explicitly test between-person effects are necessary to fully understand how individual differences in initial self-regulation impact change in self-compassion within the context of the mindfulness-based intervention.

Given that universal school-based programs are embedded within classrooms, it is also critical to understand how variations in contextual factors influence program effectiveness (Low et al., 2014). The effect of the classroom may be particularly critical for MBPs, given the essential role of the group process in the traditional Mindfulness-Based Stress Reduction (MBSR) model (Griffith et al., 2019). Albeit with adults, qualitative research found that the group was viewed as a collective unit that shared the mindfulness journey and enriched the practice; example themes included cohesion, trust, safety, normalizing, and building culture (Cormack et al., 2018). Additional evidence from MBSR indicated that the group accounted for significant variability in change in individual psychological symptoms (Imel et al., 2008). Similar to how group membership may impact individual outcomes in MBSR, it is possible that between-class differences may influence individual-level outcomes in school MBPs. Specifically, it is possible that there is an initial threshold in terms of class-level self-regulation that is necessary for individuals to benefit from the program; this could be true if facilitators were unable to engage students in the practices due to frequent classroom disruptions. In this case, individuals in classrooms with higher levels of initial self-regulation may benefit more from the intervention than their peers in classrooms with lower initial classroom self-regulation. It is also possible, however, that children in classrooms with lower initial self-regulation have the most to grow, and will show the greatest change. Thus, between-class differences are important to consider when evaluating MBPs in schools, as this information can help interpret differences in program efficacy across individuals.

The present study explored how initial individual and class-level self-regulation impacted changes in self-compassion among adolescents who participated in the Inner Strength Education (ISE) teen mindfulness program. Our first aim was to examine the effect of between-person differences in initial self-regulation on change in self-compassion. The ISE program has previously reported significant increases in self-regulation and self-compassion among students who participated in the intervention compared to their peers in a control group, who remained stable over time (Author, blinded for review). Moreover, there is evidence that self-regulation preceded and supported changes in self-compassion, but not vice versa, among participants in this program (Zhang et al., 2022). Thus, we hypothesized that individual-level self-regulation at the pre-test would be positively associated with self-compassion at the post-test. Our second aim was to explore the effect of between-class differences in initial self-regulation on change in self-compassion. Given the limited prior research in this area and the aforementioned alternative scenarios, we hypothesized that differences in self-regulation at the class level would be associated with individual's self-compassion at the post-test, but we did not specify an a priori hypothesis for the direction of the class-level association.

## Method

### Participants

The dataset included a total of 2,121 students (54.1% male) ranging in approximate age from 15 to 19 years old ($M$=16.25, $SD$=0.53) across 97 classrooms. Participants were recruited from six public high schools in the city of Philadelphia, PA, between fall 2015 and spring 2019. District data indicate that the schools served students who were both racially and economically diverse. Specifically, the racial composition of the schools varied as follows: Asian ($M$=22%; range 1–39%), Black/African American ($M$=42%; range 13–93%), Hispanic/Latino ($M$=7%; range 1–20%), Multi-Racial ($M$=7%; range 3–9%), and White non-Hispanic/Latino ($M$=26%; range 1–39%). Economic disadvantage, indexed using the community eligibility provision rate, ranged from 31 to 100% ($M$=71.14%); these values reflect the number of students eligible for free lunch.

## Procedure

The Inner Strength Education (ISE; Edelstein, 2016) teen mindfulness program was implemented in classrooms as part of the school's curriculum. This 12-lesson curriculum, endorsed by the Collaborative for Social and Emotional Learning (CASEL), was delivered during regular classroom instruction time by ISE instructors who completed a 56-hour training protocol that included virtual sessions, conference calls, and a three-day in-person workshop. Lessons were primarily delivered once per week via 45-minute sessions; a subset of classrooms followed a twice-a-week, six-week format due to other grade-related requirements. The ISE program includes instruction and practice of seven evidence-based mindfulness techniques introduced and reinforced across the lessons: Mindful Listening, Mindful Breathing, Thought Bubble, Body Scan, Open Awareness, Mindful Eating, and Love & Kindness. These practices were combined with contextual thinking and trauma-sensitive approaches to simultaneously target both cognitive and emotional processes, including self-regulation and self-compassion, to alleviate stress and negative self-ideation. During each session, students spent approximately 30% of the time practicing these mindfulness-based exercises, 40% of the time engaged in theme-based instruction and large

group discussion, and 30% of the time in small-group peer discussions and writing activities.

All students in classes that received the ISE teen program were invited to participate in the research study. Participation in the research included completing two surveys, one at pre-test (T1) before the start of the intervention and a second at post-test (T2) within two weeks of the last program lesson. All procedures followed a standard protocol approved by both the first author's University IRB and the Philadelphia City School District IRB. Passive consent forms were sent home to the student's legal guardians; students under the age of 17 also provided oral assent, and students over the age of 18 provided written consent to participate. There were no parental refusals and limited youth refusal (less than 5%). Students completed the surveys during the school day in their classrooms during the time that the intervention facilitators were present. The surveys took approximately 20 min to complete, were administered approximately 3 months apart, and were originally in paper-pencil format, but transitioned to online administration in 2017. The survey included self-reports of both self-compassion and self-regulation, as well as gender, age, and grade.

## Measures

### Self-Compassion

The Self-Compassion Scale-Short Form (SCS-SF; Raes et al., 2011) 12-item measure was used to assess self-compassion. This measure reflects all six dimensions of self-compassion, including self-kindness, self-judgment, common humanity, isolation, mindfulness, and overidentification. Example items included, "I try to be understanding and patient towards those aspects of my personality that I don't like" and "When something painful happens, I try to take a balanced view of the situation." Responses were recorded on a 5-point Likert scale ranging from *almost never* (1) to *almost always* (5). The items tapping self-judgment, isolation, and over-identification were reverse coded, such that higher scores represented increased total self-compassion. The McDonald's ω were 0.85 and 0.87 for self-compassion at T1 and T2, respectively. We reported McDonald's omega as an estimate of internal consistency reliability, as it is often considered a more robust alternative to Cronbach's alpha. Unlike Cronbach's alpha, which assumes that all items contribute equally to the underlying construct (i.e., tau-equivalence), McDonald's omega allows for variation in item loadings. This can result in a more accurate estimate of reliability, particularly when the assumption of equal item contributions is not met (McNeish, 2018).

### Self-Regulation

Self-regulation was assessed using the 14-item long-term regulation scale from the Adolescent Self-Regulation Inventory (ASRI; Moilanen, 2007). This adolescent self-report measure tapped an individual's ability to plan, prepare and self-monitor behaviors to meet and achieve long-term goals. Example items included, "I can stay focused on my work even when it's dull" and "I can find ways to make myself study even when my friends want to go out." Responses were recorded on a 5-point Likert scale with options ranging from *not at all true for me* (1) to *really true for me* (5). Items with negative wording were reverse coded so that higher scores represented greater self-regulation. The McDonald's ω was 0.81 for long-term self-regulation at T1.

## Data Analyses

Multilevel modeling was used in the current study to account for the nested nature of individuals within classrooms. This approach did not assume independence among individuals and modeled classroom-level dependency. Multilevel modeling accounted for shared group variance and correlated residual by partitioning variance at the between-person and between-classroom levels. Given previous research reporting gender differences in self-compassion (Yarnell et al., 2019), adolescent self-reported gender was included as a control variable in the models.

A series of 2-level models (i.e., level 1 between-person and level 2 between-classroom) were fitted using Mplus 8.7. The first step began with calculating the intraclass correlation coefficient for self-compassion by estimating an intercept-only model. The intraclass correlation suggested that 1.6% of the variance in self-compassion at the T2 was presented at the between-classroom level. Considering the intraclass correlation was larger than zero, it was necessary to adjust for the classroom-level dependency. Next, we fit a series of multilevel models to examine our research questions. In Model 1, both grade and gender were included as demographic variables; gender was the only significant demographic variable to be included in the subsequent models. Model 2 added the between-person variables self-regulation at T1 and T1 self-compassion score; this step allowed us to examine whether differences between individuals in their initial levels of self-regulation and self-compassion were associated with differences in their self-compassion scores at T2. Model 3 added the between-classroom self-regulation at T1 and classroom size as predictors; this step allowed us to determine whether classrooms that differed in their average levels of self-regulation at T1 were associated with differences in students' self-compassion scores at T2. Model 4 tested the interaction between individual-level

(between-person) self-regulation at T1 and classroom-level (between-classroom) self-regulation at T1 to rule out a cross-level interaction, in which the associations between individual-level self-regulation at T1 and self-compassion at T2 might vary depending on the classroom average levels of self-regulation.

We used grand-mean centering to create between-person and between-classroom predictors for both self-regulation and self-compassion in the pre-test. Between-person variables (Level 1) were grand-mean centered and represented average differences between people from the grand mean. To grand-mean center the between-person variable, we subtracted each individual's raw score from the grand mean. This allowed us to compare each individual's score relative to the overall sample average, facilitating the interpretation of individual-level effects within the multilevel model. Between-classroom variables (Level 2) were grand-mean centered and referred to average differences between classrooms. To grand-mean center the between-classroom variables, we subtracted each classroom mean from the grand mean. This allowed us to interpret each classroom-level score relative to the average across all classrooms. The Full Information Maximum Likelihood and Robust Maximum Likelihood were used to handle missing data and nonnormality. The equation for the final model (Model 3) can be found in Eq. 1, the BP represents the between-person effect, and the BC stands for the between-classroom effect.

**Table 1** Descriptives of key variables (N = 2, 121)

| | Mean (SD or %) |
|---|---|
| Gender | |
| Male | 1,148 (54.1%) |
| Female | 932 (43.9%) |
| Other Gender | 27 (1.3%) |
| Grade | |
| 9th grade | 317 (14.9%) |
| 10th grade | 38 (1.8%) |
| 11th grade | 1,422 (67%) |
| 12th grade | 344 (16.2%) |
| School | |
| A | 766 (36.1%) |
| B | 28 (1.3%) |
| C | 305 (14.4%) |
| D | 30 (1.4%) |
| E | 896 (42.2%) |
| F | 96 (4.5%) |
| Classroom Size | 28.26 (10.45) |
| Between-person self-regulation (T1) | 3.67 (0.53) |
| Between-classroom self-regulation (T1) | 3.67 (0.13) |
| Between-person self-compassion (T1) | 2.99 (0.68) |
| Between-classroom self-compassion (T1) | 2.99 (0.16) |
| Self-compassion (T2) | 3.07 (0.67) |

Note: The mean and standard deviation are reported for continuous variables; the percentage is reported for the categorical variables

$$
\begin{aligned}
SelfCompassion_{ij} &= \beta_0 + \beta_1(Female_{ij}) + \beta_2(Other\ Gender_{ij}) + \beta_3(School\ Grade_{ij}) \\
&+ \beta_4(Classroom\ Size_{ij}) + \beta_5(BPSR_{ij}) + \beta_6(BPSC_{ij}) + \beta_7(BCSR_j) \\
&+ \beta_8(BCSC_j) + e_{ij} + i_j
\end{aligned} \quad (1)
$$

## Results

### Descriptives

Table 1 presents means, standard deviations, and percentages for the study variables. The average age of the participants was 16.25 years old, and approximately 54.1% of the sample was male. The majority of the students were in the 11th grade (67%). Six diverse schools were represented, with the majority of students coming from School E (42.2%). Moreover, there was more variability for the T1 between-person self-regulation ($SD = 0.53$) compared to the T1 between-classroom self-regulation ($SD = 0.13$), and the T1 between-person self-compassion ($SD = 0.68$) compared to T1 between-classroom self-compassion ($SD = 0.16$).

### Multilevel Model

We used a series of multilevel modelings to understand both individual-level (between-person) and classroom-level (between-classroom) factors that predicted students' self-compassion scores in T2. In the preliminary model with demographic variables (Model 1), we found gender differences in predicting self-compassion in T2. Adolescents identified as female ($b = -0.24$, $SE = 0.04$, $p < .001$) and other gender ($b = -0.29$, $SE = 0.12$, $p = .01$) reported lower levels of self-compassion at T2 compared to male students. Next, in Model 2, both individual-level (between-person) predictors were significantly associated with self-compassion at T2 (Table 2). In line with our first hypothesis, individual level self-regulation at T1 was positively associated with self-compassion at T2 ($b = 0.09$, SE=0.03, $p < .001$), such that a one-unit increase in self-regulation at T1 was associated with a 0.09 increase in self-compassion at T2. Thus, on average, adolescents who reported higher levels of self-regulation at T1 also reported higher rates of self-compassion at T2. Furthermore, individual-level self-compassion at T1 was a significant predictor of T2 self-compassion ($b = 0.64$, $SE = 0.03$, $p < .001$), such that a one-unit increase in self-compassion at T1 was associated with a 0.64 increase in self-compassion at T2. This suggests that, on average, adolescents who reported higher levels of self-compassion at T1 also reported higher rates of self-compassion at T2.

In Model 3, we added classroom-level (between-classroom) predictors (Table 2). The classroom size was a significant predictor of self-compassion at T2 ($b = -0.004$, $SE = 0.001$, $p = .002$), suggesting that students in larger

**Table 2** Main effects of between-person and between-classroom self-regulation (T1) on self-compassion (T2) (N = 2, 121)

| | Model 1: Demographic | Model 2: Demographic + Between-person | Model 3: Demographic + Between-person + Between-Classroom |
|---|---|---|---|
| | *b* (*SE*) | *b* (*SE*) | *b* (*SE*) |
| Female | −0.24*** (0.04) | −0.04 (0.03) | −0.04 (0.03) |
| Other Gender | −0.28* (0.12) | −0.03 (0.11) | −0.01 (0.11) |
| Classroom size | | | −0.004**(0.001) |
| Between-person SR (T1) | | 0.09*** (0.03) | 0.10*** (0.03) |
| Between-person SC (T1) | | 0.64*** (0.03) | 0.63*** (0.03) |
| Between-classroom SR (T1) | | | −0.49*** (0.14) |
| Between-classroom SC (T1) | | | 0.15 (0.09) |

Note: *$p$<.05. **$p$<.01. ***$p$<.001. All models predicted self-compassion in T2. Reference in gender is being male. SR = Self-regulation. SC = Self-compassion

classrooms showed less change in self-compassion at T2. We also found that classroom-level self-regulation at T1 was a significant predictor of adolescents' self-compassion scores at T2 ($b$ = −0.49, $SE$ = 0.14, $p$ < .001); for each one-unit increase in the classroom average of self-regulation, self-compassion scores at T2 were 0.49 units lower, on average. Specifically, students in classrooms with higher average self-regulation at T1 (compared to the overall sample mean across classrooms) showed fewer changes in individual-level self-compassion at T2. In contrast, students in classrooms with lower average self-regulation at T1 reported higher levels of individual-level self-compassion at T2. Given that the model controlled for the individual-level self-compassion at T1, these results suggest that the effect of the MBP was stronger for classrooms with lower levels of initial self-regulation. In Model 4, we tested the potential interaction between individual-level self-regulation and classroom-level self-regulation. The interaction was not significant and was removed from the final model. The lack of interaction means that it did not matter whether an adolescent was in a highly self-regulated or less self-regulated classroom; their individual self-regulation at T1 still had the same positive link to their self-compassion at T2.

## Discussion

The present study examined how initial levels of self-regulation, both at the individual and classroom level, impacted change in self-compassion among adolescents who participated in a school-based mindfulness program. The findings indicated that at the individual level, between-person differences in self-regulation were positively associated with growth in self-compassion. In contrast, at the classroom level, between-classroom differences in initial self-regulation were negatively associated with growth in self-compassion, such that students in classrooms with higher initial self-regulation benefitted less than students in classrooms with lower initial self-regulation. These patterns highlight the role that self-regulation at both the individual and class levels plays in supporting self-compassion within the context of mindfulness-based intervention.

The first aim of our study focused on how between-person differences in self-regulation impacted change in self-compassion among adolescents participating in a school-based mindfulness program. The results supported our hypothesis that self-regulation at the pretest would be positively associated with the change in self-compassion at the post-test. These findings are consistent with previous analyses examining the Inner Strength Education teen program (Zhang et al., 2022). Given that this earlier study included only 25% of the current sample, we were able to substantiate the directional link between self-regulation and self-compassion using a larger sample that included additional schools and cohorts. Moreover, the person-centered approach allowed us to identify this pattern using between-person differences in self-regulation rather than mean scores. Thus, within this particular program, individual-level self-regulation supported the acquisition of self-compassion, which aligns with cognitive perspectives on mindfulness that consider self-regulation in the present moment as a precursor to self-compassion and other aspects of psychological well-being (Holas & Jankowski, 2013; Verhaeghen, 2019). Specifically, the metacognitive skills included in self-regulation, including inhibitory control and attentional flexibility, may be instrumental for cultivating self-compassion by allowing individuals to avoid negative thoughts and feelings towards themselves and instead shift attention to their positive qualities and shared experiences (Neff, 2003; Strauss et al., 2016).

The second aim of our study explored how between-classroom differences in initial self-regulation were associated with individual change in self-compassion across the intervention. The results identified a significant negative association between classroom-level self-regulation at the pretest and self-compassion at the post-test. Thus, individuals in classrooms with higher levels of self-regulation

experienced less growth in self-compassion compared with individuals in classrooms with lower levels of self-regulation who experienced more growth. While this pattern may appear at odds with our individual-level findings, it is consistent with intervention research that reports greater benefits for students most at risk (Lertladaluck et al., 2021). Given that lower levels of self-regulation in the classroom have significant negative consequences for students' academic, emotional, and behavioral development (Cambron et al., 2017; Yerdelen & Sungur, 2019), this may have increased the need for MBPs, which consequently amplified its effectiveness and brought about greater enhancements in self-compassion. In other words, students in classrooms with lower levels of self-regulation had more to gain from the intervention.

Another explanation for this pattern involves social comparison processes. Social comparison theory suggests that individuals may evaluate their own abilities, opinions, and behaviors by comparing themselves to others and may experience negative emotions when they perceive themselves as inferior (Festinger, 1954). In the context of a classroom with high levels of self-regulation, students may tend to engage in upward social comparison, which could limit self-compassion (Choi et al., 2014; Homan & Tylka, 2015; Thøgersen-Ntoumani et al., 2017). Additionally, classroom-level self-regulation may also influence classroom culture in other ways that influence the effectiveness of the program for individuals, particularly for MBPs, where group processes play an important role in the delivery and impact (Cormack et al., 2018; Griffith et al., 2019). Thus, it is possible that students' experiences in the practices and subsequent discussions varied based on the classroom-level self-regulation such that students in classrooms with lower levels of self-regulation were exposed to a greater variety of perspectives and/or benefited more from the group processes than their peers in classrooms with higher self-regulation.

As MBPs continue to proliferate in schools, it is critical that studies examine what programs work for whom, under what conditions, and how. The importance of understanding the heterogeneity of treatment effects has been emphasized within the youth mental health promotion field for decades (Weisz et al., 2005). Interestingly, results from the largest study to explore these questions within the context of a school-based MBP for early adolescents (i.e., My Resilience in Adolescents; MYRIAD) indicated that the effects were not universal across students, with differential effects based on individual-level mental health risk; school-level factors including school climate were not significant (Montero-Marin et al., 2022). The present study contributes to this area of research by demonstrating that individuals' self-regulation could be a beneficial predictor of their growth in self-compassion and that classroom-level self-regulation also impacted self-compassion change.

Collectively, our results suggest that both individual and classroom-level processes may contribute to heterogeneity in program effectiveness and are important to consider as we evaluate universal MBPs within schools. Interestingly, these effects were independent; in other words, individual-level self-regulation did not interact with classroom-level self-regulation to drive change in self-compassion. There could be several explanations for why the classroom-level and individual-level self-regulation did not interact in this study and why group-level self-regulation is still important to consider. One possible explanation is that while individual self-regulation is a trait, it can also fluctuate across time and context (Moschko et al., 2022; Schmid et al., 2023). Although this variation was not captured in this study, future work could use ecological momentary assessment or observation to better understand the role of self-regulation as a state rather than a trait and model this at both the individual and group-level within the context of intervention. Related to this idea, there is evidence that students' perceptions of classroom management are associated with their reported levels of self-regulation during specific classroom lessons (Blume & Schmiedek, 2024). Another possibility is that the classroom level self-regulation was a proxy for other classroom factors that were not modeled in this study, but that are relevant for mindfulness and self-compassion. For example, groups are agents of control and thus it is important to consider self-regulation as a group phenomenon, as opposed to just an individual phenomenon (Levine et al., 2010).

## Limitations and Future Research

While the current study advances our understanding of how differences in between-person and between-classroom self-regulation impact students' growth in self-compassion within the context of a school-based MBP, there are notable limitations that can inform future studies. First, given that the students in this study were all participants in the ISE mindfulness program, the current study cannot guarantee that the changes in self-compassion were due to the intervention. Notably, however, self-compassion among adolescents has been shown to be relatively stable over time (Donald et al., 2018) and has not demonstrated improvement within control groups (Neff & Germer, 2013). Thus, spontaneous increases in self-compassion would not be typical or expected, particularly among older adolescents (Bluth & Blanton, 2014), who comprise the majority of students in this sample. Moreover, the goal of this study was not to further validate the effectiveness of the ISE curriculum (Author, blinded for review), but rather to examine self-regulation as an important construct associated

with heterogeneity in self-compassion growth among MPB participants.

Second, there were limitations in measurement and design that restricted our understanding of the complex associations among mindfulness, self-regulation, and self-compassion. For example, self-regulation was assessed using a global measure. Given that mindfulness has been associated with multiple facets of self-regulation, including attention, executive function, and emotion regulation (Lyvers et al., 2014; Tang, 2014), future research is needed to clarify which specific facets contribute to intervention effectiveness for self-compassion. Self-compassion is also a multidimensional construct, and thus it is possible that the role of self-regulation varies across the six components. The SCS-SF used in this study is predominately reliable for assessing overall self-compassion (Neff, 2003), and thus we did not compute subscales. Moreover, although Neff (2020) defends the use of the total score, there is an active debate in the field regarding the need to deconstruct self-compassion in a way that differentiates the protective facets from the vulnerable facets (Muris & Otgaar, 2022) when considering implications for adaptive coping versus psychopathology, respectively (Muris et al., 2019).

Third, the current study adds to the field's over-emphasis on self-regulation as the dominant mechanism implicated in self-compassion (Cha et al., 2023). Thus, future research should address a wider range of mediators, such as motivation or values, as other processes that support changes in self-compassion (Cha et al., 2023). Moreover, there may be important moderating variables that add to the heterogeneity in improvements across individuals. For example, in our preliminary model, there were gender differences indicating that females and individuals identifying as other genders exhibited lower levels of self-compassion than those who identified as males. Prior research has indicated that female adolescents tend to employ affective coping strategies but also engage in self-criticism more frequently than males, which can have negative implications for self-compassion (Calvete & Cardeñoso, 2005; Yarnell et al., 2019). Thus, future work should examine other moderators at both the individual- and classroom-level to better understand differences in the program effectiveness of universal MBPs. This type of inquiry is consistent with a recent call from the school-based mindfulness field to examine student and school characteristics as moderators to assist educators and inform program design around issues of diversity, equity, accessibility, and inclusion (Roeser et al., 2023). This information could also be helpful for school psychologists, counselors, and other mental health professionals who work with adolescents, as they may be able to provide additional support for subgroups of students that complement the program and promote overall effectiveness.

Fourth, research is needed to clarify exactly how variation in classroom-level factors, such as self-regulation but also classroom composition (e.g., size, honors, or advanced track), and instructor style or embodiment of mindfulness (Mischenko et al., 2024), impacts intervention effects. Specifically, it would be useful to expand the perspective of analysis within MBPs to include the group process and how cohesion is formed among the participants (Cormack et al., 2018). Including interview-based information could allow researchers and program developers to explore the role of group processes within the MBP and identify potential moderators of program impact within their logic models. The extent to which the program was implemented as intended, as well as whether the participants were positively or negatively immersed in the classroom setting, could also lead to variation across classrooms in how participants engaged with the material and classroom climate. Thus, future studies could examine how key aspects of implementation fidelity, particularly integrity, uptake, and participant responsiveness, vary across classrooms and may impact heterogeneity in program benefits (Baelen et al., 2023). Fifth, the participants were drawn from a specific geographical region in Philadelphia, which may limit the generalizability of the findings to national or international populations. Cultural, educational, and contextual differences across regions could influence how adolescents respond to mindfulness-based programs (Hytman et al., 2025), and future research should explore whether similar patterns emerge in more diverse geographic settings. Finally, it should be noted that although self-compassion differed across classrooms, these differences were modest. Specifically, the intraclass correlation suggested that only 1.6% of the variance in post-test self-compassion was between classrooms. Thus, as is common in multilevel modeling, most of the variance was at the person level; the classroom-level findings should be interpreted with that in mind and warrant additional investigation.

In sum, the current study highlighted the unique contributions of both individual- and classroom-level self-regulation on self-compassion among adolescents participating in an MBP. Given that self-compassion is crucial for resilience among youth (Bluth & Blanton, 2014), understanding factors that support its change has implications for the implementation and evaluation of universal mindfulness programs within schools. The results of this study highlight the significant role of individual self-regulation in promoting growth in self-compassion. Furthermore, they suggest that we may be overlooking the important role of classroom-level factors within the context of MBPs and propose group processes as a potentially fruitful area for future inquiry into heterogeneity in program effectiveness.

**Author Contribution** Rachel Razza: Conceptualization, Data curation, Writing - Original Draft, Writing - Review & Editing, Supervision.

Qingyang Liu: Methodology, Data Curation, Writing - Original Draft, Writing - Review & Editing. Ruohan Feng: Literature review, Writing - Original Draft. Xin Hao: Literature review, Writing - Original Draft. Kaylynn Kirkman: Literature review, Writing - Original Draft. Gabriel Merrin: Methodology, Supervision. All authors approved the final version of the manuscript for submission.

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**Data Availability** The data and syntax to reproduce all study findings are uploaded to the GitHub repository (https://github.com/QingyangLiu-Final/ISP-Multilevel-F15S19.git) and available upon request.

## Declarations

**Ethical Approval** This study was performed in line with the principles of the Declaration of Helsinki. All procedures followed a standard protocol approved by both the first author's university institutional review board and the philadelphia city school district research board.

**Consent to Participate** Passive parental consent was approved by the participant's legal guardians. Participants under the age of 17 also provided oral assent, and participants over the age of 18 provided written informed consent to participate.

**Consent for Publication** The authors affirm that human research participants provided informed consent for their data to be summarized for publication.

**Competing Interests** The authors have no relevant financial or non-financial interests to disclose.



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