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Associations among dispositional mindfulness, self-compassion, and executive function proficiency in early adolescents

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Abstract

The study objective was to examine the effects of two conceptually related constructs, self-compassion and dispositional mindfulness, on executive function (EF) proficiency among early adolescents. Executive function refers to a set of psychological processes governing emotional regulation, organization, and planning. While the benefits of positive psychology appear evident for mental health and wellness, little is known about the etiological relationship between dispositional mindfulness and self-compassion in their associations with EF. Two hundred and ten early adolescents attending middle school (age $M=12.5$ years; $SD=0.5$; 21% Hispanic, 18% Mixed/bi-racial, 47% White, and 9% Other/Missing; 37.1% on free lunch program) self-reported levels of dispositional mindfulness (Mindful Attention Awareness Scale; MAAS), self-compassion (Self-Compassion Scale; SCS; self-judgment and self-kindness domains), and EF proficiency (Behavior Rating Inventory of Executive Function; BRIEF-SR). A sequential linear regression stepwise approach was taken entering the independent variables as separate models in the following order: self-kindness, self-judgment, and dispositional mindfulness. All models controlled for participant age and sex. SCS *self-kindness* was not associated with EF proficiency, but SCS *self-judgment* (reverse-coded) contributed to the variance in EF ($\beta=0.40$, $p<.001$). When adding MAAS to the model, MAAS scores were significantly associated with EF ($\beta=0.64$, $p<.001$) and accounted for the initial variance explained by SCS. When considering the influence of positive psychology constructs on EF proficiency in adolescents, the measure of dispositional mindfulness appears to outweigh that of specific self-compassion domains, when independent of contemplative training.

Keywords

Mindfulness; meditation; self-compassion; executive function; positive psychology; self-regulation; cognitive control; adolescents; children; school

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INTRODUCTION

Executive function (EF) is an umbrella term referring to a set of psychological processes responsible for purposeful, goal-directed behavior and that govern human emotional regulation, organization, and planning (Anderson, 2002). Executive function is mediated by prefrontal cortical development and functioning which proceed through phases of rapid structural and functional growth during childhood and adolescence (Davidson, Amso, Anderson, & Diamond, 2006). Examples of behavioral EF skills relevant for youth learning include time management, switching focus to a new learning task, and regulating inappropriate speech or behavior in the classroom. Children and adolescents with low EF proficiency commonly display difficulty carrying out school projects, memorizing information, and staying on task; thus EF proficiency is a major contributor to school and other academic achievement (Best, Miller, & Jones, 2009).

Dispositional mindfulness and self-compassion are commonly-studied etiological and mechanistic measures in the investigation of socio-emotional development interventions and may be useful in explaining EF skills. Dispositional mindfulness refers to the capacity for enhanced attention to and awareness of moment-to-moment experience (Brown & Ryan, 2003). Self-compassion can be defined as the characteristic of being open to and understanding nonjudgmentally one's own and other people's suffering, inadequacies, and failures (Neff, 2003a). These constructs are often described as being interwoven to a degree (Kabat-Zinn, 2003; Neff, 2003a), and it would be empirically useful to determine their relative associations with EF in early adolescence to inform the field about the relevance of positive psychology constructs in cognitive skill development.

A small group of studies reveals a significant positive association between dispositional mindfulness and executive function (EF) in children, adolescents, and young adults (Oberle, Schonert-Reichl, Lawlor, & Thomson, 2012; Riggs, Black, & Ritt-Olson, 2014); however results vary across studies depending on the type of EF measurement used (Black, Semple, Pokhrel, & Grenard, 2011). A study by Oberle et al. (2012) showed that mindfulness positively predicted inhibitory control measured by a computerized EF task assessment (i.e., Dots task) among early adolescents. Similar results were found by Riggs et al (2014), showing that mindfulness was significantly associated with a latent factor of self-reported EF including inhibitory control, working memory, and cognitive flexibility (Guy, Isquith, & Gioia, 2004). However, a null relationship was observed between mindfulness and working memory when assessed by an automated operation span task (AOSPAN), which measured the active state of memory while interferences were present (Unsworth, Heitz, Schrock, & Engel, 2005). These discrepant results may be due to the differing domains captured across EF measures. For example, some have suggested that the Behavior Rating Inventory of Executive Function – Self-Report (BRIEF-SR) represents more of a measure of problem behavior (McAuley, Chen, Goos, Schachar, & Crosbie, 2010). However, it is considered an appropriate and ecologically valid measure of EF skills that are associated with goals and actions in everyday situations (Toplak, West, & Stanovich, 2013). While there are reports showing discrepancies between self-reported and performance-based EF measures (Buchanan, 2015), self-report measures (e.g., BRIEF-SR) are considered more appropriate

for large-scale school based study assessment due to time, cost, and structural constraints (Pentz et al., 2015).

Although the literature is scant, the current state of findings suggests that dispositional mindfulness may increase opportunities for children to engage in error detection or correction involving emotional/behavioral regulation and cognitive control because children are more aware of cognitions in the moment when self-regulatory behavior is needed (Brown & Ryan, 2003). Similarly, it has been suggested that mindful individuals, as compared to those who are less mindful, have a heightened awareness of their cognitions and future behaviors, yielding greater insight into the precursors of behavior (Black, Sussman, Johnson, & Milam, 2012a; Brown & Ryan, 2003). Given that mindful people may have greater conscious awareness of their cognitive and behavioral scripts in the present, it follows that they might have higher EF proficiency.

A review of self-compassion by Bernard and Curry (2011) suggested that self-compassion is related to emotional intelligence, emotional control and goal achievement, which are common subdomains of EF. To our knowledge, the direct relationship between self-compassion and EF proficiency has not yet been examined. Further, it has been argued that mindfulness is an integral component of self-compassion (Neff, 2003a). If this is the case, then the two constructs should possibly demonstrate inter-correlations with each other and in their relationship to EF. Conversely, self-compassion may represent a distinctly different construct than mindfulness, representing an individual's positive sense of self outside of mindful awareness. Recent studies consider mindfulness and self-compassion as separate constructs (Baer, Lykins, & Peters, 2012; Van Dam, Sheppard, Forsyth, & Earleywine, 2011). While dispositional mindfulness focuses on individual differences in attention and awareness in the present moment (Brown & Ryan, 2003), self-compassion includes an adaptive and active component associated with finding balance within oneself when confronting difficult situations (Neff, 2003a).

While meditation-based practices of mindfulness (Black et al., 2012a; Brown & Ryan, 2003) and self-compassion (Bernard & Curry, 2011) may possibly function to increase EF proficiency in adolescents, it remains an open question whether dispositional mindfulness and self-compassion reported outside of meditation-based practices have distinct relationships with EF during adolescence, a life stage when higher-order cognitive skills of EF are still developing. Identifying individual differences that are associated with cognitive skill proficiency during early development points to an intriguing line of investigation that has direct relevance to child and adolescent learning in schools. Thus, the primary objective of this analysis was to explore the unique associations of dispositional mindfulness and self-compassion with EF proficiency in early adolescence in a school setting.

METHOD

Participants

Of all 7th grade students in the two participating middle schools ($N = 496$), 410 (82.7%) provided parental consent and self-assent for participation in the study. (Parents declined in 5.6% of cases, and 11.7% were administrative declines due to non-return of consent forms).

Random split-form sampling (Form A & Form B) among participating students was used due to time constraints for in-class data collection. From 410 participant student sample, approximately half of the students (210) randomly received survey forms measuring self-compassion (Form A), while the other half (200) received Form B. Both survey forms included questions on demographics, substance use, physical activity, sedentary activity, sleeping, food intake, mindfulness (MAAS), and perceived stress scale. Form A included questions on self-compassion and strengths and difficulties, while Form B included questions on parent monitoring, child well-being, distress tolerance, anhedonia, and sensation seeking. The resulting analytic sample receiving Form A with self-compassion scale ($n=210$) had a mean age of 12.4 years ($SD=0.5$); 48.3% were female, 34.9% reported receiving free lunch [an indicator for low Socio Economic Status (SES)], and 52.9% were non-White. Even though students were randomly assigned to receive the survey on self-compassion, we assessed potential sample bias. The participants in the study sample ($n=210$) were compared to those who did not receive the self-compassion survey ($n=200$) on demographic variables. Results showed all variables were comparable between the two groups. Demographics of the analytic sample were similar to surrounding school populations (Ed-Data, accessed July 8, 2014), and the ethnic diversity reflects a growing number of interventions being conducted on diverse adolescent populations (Mazzeo et al., 2013; Semple, Lee, Rosa, & Miller, 2010).

Procedure

The convenience sample comprised 7th grade youth from two large, ethnically diverse public middle schools in Southern California. Cross-sectional data were collected in Spring 2014. The survey was administered during a 45-minute session in the classroom to a total of 210 students. The University of Southern California Institutional Review Board approved all procedures.

Measures

Dispositional mindfulness was measured using the 15-item Mindful Attention Awareness Scale (MAAS) (Brown & Ryan, 2003). As with previous item adaptations for adolescents (Brown, West, Loverich, & Biegel, 2011), the MAAS wording was very slightly modified in this study to lower the readability level to 7th grade and increase comprehensibility [e.g., “walking” instead of “driving” as revised in (Black, Sussman, Johnson, & Milam, 2012b)]. Internal consistency reliability remained high in our sample (15 items, $\alpha=.89$). Response choices were 1 = *Almost never* to 6 = *Almost always*. Items were reverse-coded, and a mean was calculated, with higher scores indicating a greater disposition of mindfulness.

Self-compassion was measured with 10-items ($\alpha=.82$) from the *self-kindness* (5 items, $\alpha=.81$) and *self-judgment* (5 items, $\alpha=.88$) subscales of the Self-Compassion Scale (SCS) (Neff, 2003b). Subscales were significantly correlated with one another ($r=.24$, $p<.001$). Wording was modified slightly to increase comprehensibility (ex. “I’m kind to myself when I’m experiencing suffering” was changed to “I’m kind to myself when I’m having difficulties or feeling bad”). Response choices were 1 = *Almost never* to 5 = *Almost always*. Items on the *self-judgment* subscale were reverse-coded. Higher scores indicated greater self-compassion. Mean scores of *self-kindness* and *self-judgment* subscales were examined separately, given

that there is evidence suggesting two conceptually distinct domains (Neff, 2003a). Moreover, of the six original sub-scales of the complete Self-Compassion Scale (i.e., self-kindness, self-judgment, common humanity, isolation, mindfulness and over-identification), *self-kindness* and *self-judgment* (reverse-scored) were combined to represent a single sub-component that measured positivity toward oneself. Only two sub-scales were selected due, in part, to the time constraints of school-based data collection and to relevance of study purpose. Items from the *mindfulness* subscale of the SCS overlapped with MAAS and were excluded. The other component of self-compassion, *common humanity*, was less relevant to the aims of the study.

Executive Function Proficiency was measured with items from 4 of 8 clinical subscales of the Behavioral Rating Inventory of Executive Function-Self-Report (BRIEF-SR): emotional control (9 of 10 items), inhibitory control (11 of 13 items), working memory (all 12 items), and organization of materials (all 7 items) (Guy et al., 2004; Riggs, Chou, Spruijt-Metz, & Pentz, 2010). Emotional and inhibitory control represent the ability to modulate behavior in the face of strong emotions and to inhibit undesired behavior, respectively. Working memory represents the ability to solve problems and organize materials (e.g., keeping spaces and supplies orderly). Response choices were: *1 = Never*, *2 = Sometimes*, *3 = Often*. Items were reverse-coded such that higher scores indicated greater EF proficiency. As with the full BRIEF-SR, subscales were combined for a global EF score (Guy et al., 2004), which was the mean of the 4 subscales ($\alpha=.92$). Subscales were significantly correlated with one another (ranging from $r=.48$ to $.64$, $p's<.001$). Extensive testing described in previous studies indicated acceptable internal consistency reliability and concordance between these sub-scales and the full BRIEF-SR (Pentz & Riggs, 2013; Riggs, Sakuma, & Pentz, 2007). The BRIEF demonstrates high ecological validity (Guy et al., 2004) and concordance with parent/teacher reports; however, concurrent validity with performance-based measures of EF has been low to moderate (McAuley et al., 2010; Mahone et al., 2002).

Data Analyses

Descriptive statistics were calculated and histograms examined for kurtosis and skew. Missing data on study scales ranged from 0.5-5%; thus, no imputation methods were applied. Intercorrelations among demographic and study variables were examined. SES and ethnicity were not strongly correlated with self-kindness, self-judgment, MAAS, or EF and were subsequently eliminated from further analyses. Stepwise multiple linear regressions were conducted to examine relationships between mindfulness and self-compassion (i.e., self-kindness, self-judgment, SCS combined score for self-kindness and self-judgment) as independent cross-sectional predictors of EF. Participant age and gender were included as covariates in all regression models. Analyses were performed using SAS software Version 9.2 (SAS Institute Inc.).

RESULTS

The total sample included 210 students (see participant flow in Figure 1). Table 1 presents the baseline demographic characteristics of all participants. Table 2 presents the zero-order correlation coefficients among all variables under study. EF was positively correlated with

reverse-coded self-judgment ($r=.40, p<.001$), SCS total score ($r=.32, p<.001$) and MAAS ($r=.69, p<.001$). Self-kindness was not significantly correlated with EF or MAAS. Self-judgment (reverse-coded) was positively correlated with self-kindness ($r=.24, p<.001$), SCS total score ($r=.82, p<.001$) and MAAS ($r=.48, p<.001$).

Table 3 presents the stepwise multiple regression analysis, entering the following independent variables in sequence as separate steps predicting EF proficiency: SCS self-kindness, SCS self-judgment, and MAAS. Self-kindness was not associated with EF proficiency, but adding self-judgment in the subsequent model significantly contributed to the variance in EF (adjusted $R^2=.15$; $\beta=0.40$, $SE=0.07$, 95% CI [0.26, 1.53], $p<.001$). Mindful Attention Awareness Scale was added as the third model step to evaluate whether MAAS was a unique predictor of EF controlling for self-kindness and self-judgment. Results indicated that MAAS was associated with EF over and above the measured SCS variables (adjusted $R^2=.34$; $\beta=0.65$, $SE=0.06$, 95% CI [0.53, 0.76], $p<.001$). The SCS self-judgement subscale was no longer significant when MAAS was entered in the model.

A final model was tested separately from the stepwise regression to examine the combined self-kindness and self-judgment score with MAAS included in the model. Here, the SCS combined score ($R^2=.49$, $\beta=0.12$, $SE=0.05$, 95% CI [0.01, 0.22], $p<.05$) and MAAS ($R^2=.49$, $\beta=0.64$, $SE=0.05$, 95% CI [0.54, 0.75], $p<.001$) were each significantly associated with EF proficiency. While the SCS self-judgement and self-kindness were non-significant in the models when entered separately, combining them in one score seemed to provide sufficient power to detect a significant relationship with EF proficiency, independent of MAAS.

DISCUSSION

The objective of this analysis was to examine the associations between dispositional mindfulness, self-compassion domains (i.e., self-kindness and self-judgment), and EF proficiency in a sample of early adolescents. Both dispositional mindfulness and a self-compassion sub-domain (i.e., reverse-coded self-judgment) were positively associated with EF proficiency when examined in independent models. The magnitude of association between dispositional mindfulness and EF was much greater than that of self-judgment and EF. Self-kindness was not associated with EF proficiency. Further, self-judgment was no longer associated with EF proficiency when accounting for the effects of dispositional mindfulness. Dispositional mindfulness contributed to 34% of the variance in EF proficiency after controlling for the effects of both self-compassion subscales. Our data suggest that individual differences in EF among a sample of early adolescents are best accounted for by dispositional mindfulness when compared to domains of self-compassion. This finding corroborates previous research suggesting a framework that dispositional mindfulness and EF may reciprocally influence each other initially (Holas & Janowski, 2013), which could then possibly lead to the development of self-compassion.

According to Neff (2003b), self-kindness and self-judgment are separate factors composing a single higher order factor. Items of the self-kindness subscale are positively worded (e.g., “I’m kind to myself when I’m having difficulties or feeling bad.”), while items of self-judgment subscale are negative (e.g., “I’m disapproving and judgmental about my

shortcomings and weaknesses.”) (Neff, 2003b), which may contribute to the separate factor loadings observed in our analysis. Examining the impacts of self-compassion as separate factors indicated that self-judgment is associated with EF whereas self-kindness is not in this sample.

Dispositional mindfulness has previously been associated with various measures of EF in children, adolescents, and adults (Lyvers, Makin, Toms, Thorberg, & Samios, 2013; Oberle et al., 2012; Riggs et al., 2014; Unsworth et al., 2005). In the present study, we expanded this work by examining the role of self-compassion in relation to EF and mindfulness. Self-compassion (combined) score and dispositional mindfulness contributed to explaining unique variance in EF proficiency, which corroborate findings from other studies suggesting the two are distinct constructs (Baer et al., 2012; Van Dam et al., 2011). Although there is some overlap suggested across these constructs, our findings suggest that dispositional mindfulness has a stronger association with EF than does self-compassion. Future longitudinal studies with larger sample size may investigate how different levels of self-compassion may moderate or mediate the effects of mindfulness on EF outcomes.

The study of self-compassion in the context of mindfulness-based interventions (MBIs) is growing, and conceptual models are just beginning to integrate positive psychology constructs such as self-compassion with EF (see Teper, Segal, & Inzlicht, 2013). Newer models are also beginning to explore self-regulation processes involved in children and adolescents who engage in MBIs, yet empirical data is not yet available to test these models (O'Reilly & Black, 2015). Implications of these current findings possibly extend to teaching mindfulness practices inclusive of self-compassion to early adolescents in schools, wherein MBIs have been shown to enhance the disposition of mindfulness or improve mental health and cognitive skill measures among adolescents (Black, 2015; Black & Fernando, 2014; Black, Milam & Sussman, 2009; Black et al., 2012a; Flook, Goldberg, Pinger, & Davidson, 2015; Schonert-Reichl et al., 2015), which would possibly help subserve continued growth in EF proficiency among adolescents.

Study limitations include the small sample size and use of cross-sectional data that restricted temporal ordering of observed effects. Further, we used abbreviated scales for self-compassion and EF. The entire survey (which contained measures other than those for the current study) had to be administered within 45 minutes during one classroom period. To remain within this time limit, the mindfulness sub-scale of the self-compassion measure was not included because we had a separate measure of mindfulness (MAAS). The self-kindness (and self-judgement) subscales were chosen because they were thought to be more closely aligned with EF proficiency than the third self-compassion component, common humanity. For example, motivation for self-kindness and less self-judgment, specifically, has been shown to correlate with fewer negative emotions about one's health and greater motivation for proactive health behaviors (Terry, Leary, Mehta, & Henderson, 2013). While there is a short form of the self-compassion scale (Raes, Pommier, Neff & Van Gucht, 2011), our interest in specific sub-scales led us to maximize the number of items devoted to that specific sub-scale. Additionally, although an increased survey administration time may have permitted use of a different EF measure, these EF items have previously been found psychometrically sound (Riggs et al., 2007). However, results may not represent what would

be found with the full self-compassion scale or with performance-based EF measures. Future studies constrained by in-school time limits may consider using the 12-item SCS as an alternative that would utilize all components of the full scale (i.e., self-kindness, mindfulness and common humanity). Finally, while this was technically a convenience sample, efforts were undertaken to ensure that the sample was culturally, socio-economically, and environmentally (urban vs. rural) diverse, which may extend generalizability of our findings to adolescents in urban and ethnically-diverse schools.

In summary, a dispositional mindfulness measure explained more variance in EF proficiency than self-compassion domain measures; yet the findings suggest that the combined self-kindness and self-judgment sub-scale do contribute unique variance to EF proficiency when not accounting for dispositional mindfulness. Given that learning performance depends heavily on EF proficiency, results from this study support investigation of dispositional mindfulness and self-compassion as possible mechanistic targets for school-based MBIs aiming to improve higher-order cognitive function in early adolescents, with particular promise for dispositional mindfulness. Further investigation is needed to understand how dispositional mindfulness and the facets of self-compassion are related to the development of EF proficiency in youth both within and outside of the context of mindfulness-based interventions.

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Figure 1.

Flow diagram according to STROBE* recommendations

Notes. STROBE=STrengthening the Reporting of OBservational studies in Epidemiology

Administrative decline defined as non-return of consent forms

Table 1

Baseline demographics for early adolescent sample, N = 210

	Mean (SD) or N (%)
Age (in years)	12.5 (0.5)
Gender (% , female)	109 (51.9%)
Receive free lunch (%)	78 (37.1%)
Race/Ethnicity	
% White	99 (47.1%)
% African American	3 (1.4%)
% Hispanic	44 (21.0%)
% Asian	8 (3.8%)
% Mixed/Bi-Racial	37 (17.6%)
% Other/Missing	19 (9.0%)
SCS	6.5 (1.6)
Self-judgment	3.7 (1.0)
Self-kindness	2.5 (0.9)
MAAS	4.6 (0.9)
BRIEF-SR	
EF, Global	2.5 (0.3)

Notes. Note: SCS=Self Compassion Scale, MAAS=Mindful Attention Awareness Scale, BRIEF-SR=Behavior Rating Inventory of Executive Function-self-report; EF = Executive Function

Table 2

Bivariate correlations across study variables, N=210

	1	2	3	4	5	6	7	8
1. EF	-							
2. Self-kindness	.10	-						
3. Self-judgment ^a	.40***	.24***	-					
4. SCS total	.32***	.69***	.82***	-				
5. MAAS	.69***	.05	.48***	.32***	-			
6. Age	.08	-.01	.01	.01	-.03	-		
7. Gender ^b	-.10	.01	-.11	-.06	-.11	-.11	-	
8. SES ^c	-.18*	-.23**	-.10	-.19*	-.15*	.02	.01	-

Notes:

⁺ p<.10,

* p<.05,

** p<.01,

*** p<.001

^aSelf-judgment: reverse coded (higher score means less self-judgment)^bGender: 1=Male, 0=Female;^cSES: 1=Receive free lunch, 0=Do not receive free lunch; SCS: Self Compassion Scale; MAAS: Mindful Attention Awareness; EF: Executive function proficiency

Table 3

Stepwise linear regression model with EF proficiency on MAAS and SCS, N=210

<u>Variable</u>	Executive Function β (SE, 95% CI)			
	Step I	Step II	Step III	SCS combined
SCS				
Self-Kindness	0.10 (0.07, -0.04, 0.24)	0.01 (0.07, -0.13-0.14)	0.05 (0.05, -0.06, 0.15)	
Self-Judgment		0.40 (0.07, 0.26-0.53) ***	0.08 (0.06, -0.04-0.20)	
Total score ^a				0.12 (0.05, 0.01-0.22) *
MAAS			0.65 (0.06, 0.53-0.76) ***	0.64 (0.05, .0.54-0.75) ***
Adjusted R ²	.00	.15	.49	.49
R ²	-	.15	.34	-
<i>F</i>	0.96	9.49 ***	37.59 ***	48.08 ***

SCS: Self-Compassion Scale; MAAS: Mindful Attention Awareness Scale; EF: Executive Function proficiency; CI= Confidence interval

Notes:

Estimates are standardized, and models control for age, gender, and either MAAS or SCS.

^aSelf-kindness and self-judgment (reverse-scored) combined*
p<.05,**
p<.01,***
p<.001 based on two-tail test