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Emotional self-efficacy moderates anxiety-related impairments in math performance in elementary school-age youth

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ABSTRACT

Excessive anxiety is associated with impairments in academic achievement. However, not all children with elevated anxiety share an equal risk for academic difficulty. The current study investigated whether individual differences in emotional self-efficacy – confidence in one's ability to regulate negative emotions – protected against anxiety-related impairments in a standardized math exam in a sample of elementary school youth ($N = 139$). Results indicated that anxiety negatively predicted math test performance only for children with low levels of emotional self-efficacy. Students reporting high levels of emotional self-efficacy did not show anxiety-related decrements on the test performance. Emotional self-efficacy appears useful in managing negative effects of anxiety.

1. Introduction

Elevated anxiety is a common pediatric ailment (Cartwright-Hatton, McNicol, & Doubleday, 2006), and is associated with functional impairments across multiple domains. One of the more robust anxiety-related impairments involves executive attention and working memory (Eysenck, Derakshan, Santos, & Calvo, 2007; Eysenck, Payne, & Derakshan, 2005). Specifically, elevated anxiety is associated with a biasing of attention preferentially toward threat-related information (Mathews & MacLeod, 2005), which can make effortful processing of non-threatening information difficult or impossible (Eysenck et al., 2007). As such, elevated anxiety (and subsequent worry) might constrain the limited cognitive resources necessary for engaging in academic work (Eysenck et al., 2005; Klein & Boals, 2001; Ma, 1999). For example, Owens, Stevenson, Norgate, and Hadwin (2008) found that the negative association between children's trait anxiety and academic performance was mediated by working memory impairments. In general, a sizeable body of research has also found a strong negative association between anxiety and academic achievement (e.g., Hembree, 1988; Ialongo, Edelsohn, Werthamer-Larsson, Crockett, & Kellam, 1994; Normandeau & Guay, 1998).

Despite the findings that elevated anxiety is associated with academic impairments, there are likely moderating factors that can serve to buffer its negative effects. One such protective factor might be the ability to effectively regulate negative emotions. Emotion regulation is an umbrella term that describes a collection of processes involved in altering various aspects of an emotional response (Cole, Martin, & Dennis, 2004; Thompson, 1994). In the context of the current study, the ability to down-regulate excessive anxiety might serve to free up essential cognitive resources required for the academic work, which in turn might facilitate learning and performance. For example, several studies have shown that reductions in youth anxiety following participation in cognitive behavioral interventions – which trained many coping strategies for managing anxiety – predicted subsequent gains in academic competencies (Keogh, Bond, & Flaxman, 2006; Wood, 2006). The current study investigated whether individual differences in emotional self-efficacy might have a similar buffering effect against academic impairments associated with elevated anxiety.

Self-efficacy generally relates to individuals' conviction in their own competence to attain desired goals in particular domains (Bandura, 1997). In the current study we focus on *emotional* self-efficacy, which refers to an individual's perceived confidence in his/her ability to regulate negative emotions when activated by stressful or adverse events (Caprara et al., 2008; Muris, 2001). While *perceived* ability and *actual* ability are conceptually distinct, self-efficacy beliefs seem essential pre-requisites for effective action (Caprara et al., 2008), and therefore might serve as one among multiple proxies for performance indicators (Bandura, 1997). Empirical work does seem to support the associations between perceived capabilities to regulate negative emotions and a host of beneficial psychological outcomes. For example, studies by Muris

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(2001, 2002) suggest that emotional self-efficacy is strongly and negatively associated with symptoms of both anxiety and depression, even after controlling for personality characteristics such as neuroticism. In a related study, emotional self-efficacy was shown to mediate the associations between attentional control and both emotional and behavioral problems in preadolescent youth (Muris, Mayer, van Lint, & Hofman, 2008). Other research has found negative associations between emotional self-efficacy and aggressive behaviors (Caprara et al., 2008), and several studies revealed that low self-efficacy predicted the development of childhood depression prospectively (Bandura, Caprara, Barbaranelli, Gerbino, & Pastorelli, 2003; Bandura, Pastorelli, Barbaranelli, & Caprara, 1999).

Despite a growing body of evidence supporting the associations between emotional self-efficacy and psychosocial outcomes, few published studies have examined the influence of emotional self-efficacy on academic outcomes. A notable exception is a study by Petrides, Frederickson, and Furnham (2004) in which trait emotional intelligence (EI) moderated the relations between verbal reasoning and academic performance indices. Specifically, they showed that trait EI (also called "trait emotional self-efficacy") exerted a positive influence on educational outcomes only for students low in verbal IQ. Using an abbreviated measure implemented in Petrides et al. (2004), Ferrando et al. (2011) also recently showed that trait EI predicted academic achievement above and beyond IQ and other personality factors in a sample of preadolescents. While these and other studies (e.g., Parker et al., 2004) speak on the role of trait EI in academic performance, this construct is distinct from the current formulation of emotional self-efficacy in several important ways (Kirk, Schutte, & Hine, 2008). First, Petrides and Furnham (2001) and Petrides, Pita, and Kokkinaki (2007) describe trait EI as a broad amalgam of emotion-related dispositions and self-perceptions that includes, but is not limited to, emotion regulation and stress management (trait EI facets also include assertiveness, self-esteem, empathy, and social awareness, among others). In the current investigation, emotional self-efficacy refers specifically to perceptions about one's capacity to voluntarily regulate negative emotions. Second, trait EI is assumed to be dispositional in nature, and is afforded a place at the lower levels of the personality hierarchy (Petrides et al., 2007). Emotional self-efficacy beliefs, on the other hand, are characterized as dynamic self-perceptions that are malleable to experience in and reflection on the given domain (Bandura, 1997; Caprara et al., 2008).

In the current study, we sought to expand the literature by testing specifically whether emotional self-efficacy would moderate the relations between anxiety and performance in a standardized math test. We focused on math achievement because anxiety's negative academic effects might be especially pernicious for learning and performing mathematics given the high reliance on executive attention and working memory to both maintain and update complex abstract concepts simultaneously (Ma, 1999). Following Petrides et al. (2004), we did not predict emotional self-efficacy would have any direct impact on math performance, although we did predict that elevated anxiety would impair performance on a standardized math test exclusively for children with low emotional self-efficacy.

2. Method

2.1. Participants and procedure

Participants were 139 children (52% female) attending a university laboratory school in a major metropolitan area of the western United States. Participants were between 65 and 144 months old (M_{age} = 100.2 months, SD = 18.4), and racial composition of the sample included 46% Caucasian, 19% Latino, 9% Asian/Pacific Islander, 4% African American, and 22% mixed or other racial backgrounds. Children were predominantly from two-parent homes (92%), and yearly household income ranged from $7500 to over $250,000, with a median income range of $90,000 to $120,000 per year. In the area where the study was conducted, where housing costs are far above average for the US as a whole, this median range of family income is approximately middle-class.

Recruitment of subjects entailed the school principal in distributing information letters and consent forms to parents via children's take-home folders. Overall participation rate was 51%. Children were not excluded based on age, race, ethnicity, socioeconomic background, academic profile (e.g., English language learners), or any other factor; all students were eligible to participate in the study.

Children completed questionnaires assessing emotional self-efficacy and anxiety during individually administered interviews. Trained undergraduate or graduate students read each questionnaire item aloud to the child and allowed the child to circle their responses on score sheets, or assisted them as needed. Interviews were conducted during regular school days and hours.

Standardized test scores and family demographic information were collected at the end of the academic year from school records.

2.2. Measures

2.2.1. Anxiety

Children rated their anxiety symptoms on the 39-item Multidimensional Anxiety Scale for Children (MASC; March, 1998), using a 4-point Likert scale (1 = *never true of me* to 4 = *always true about me*). The MASC is a highly reliable and valid measure of pediatric anxiety (March, Parker, Sullivan, Stallings, & Conners, 1997). Items on the MASC combine to form four subscales (Separation Anxiety, Physical Symptoms, Harm Avoidance, Social Anxiety), which can be further combined to form a total score. Only the MASC total score is reported here. Sample items from each subscale include: "I try to stay near my mom or dad" (separation), "I feel sick to my stomach" (physical), "I keep my eyes open for danger" (harm), "I worry about getting called on in class" (social). For the current study, the MASC exhibited high internal consistency (α = .89).

2.2.2. Emotional self-efficacy

Children rated their perceived ability to cope with negative emotions using the 8-item emotional self-efficacy subscale from the Self-Efficacy Questionnaire (SEQ; Muris, 2001). The items on the emotional self-efficacy (*e*SE) scale load consistently onto one factor (Muris, 2001, 2002), and exhibited adequate internal consistency (α = .77). Children rate "how well" they are capable of performing each statement using a 1 (*not at all*) to 5 (*very well*) scale (e.g., "How well do you succeed in becoming calm again when you are very scared?," "How well do you succeed in not worrying about things that might happen?," "How well can you prevent becoming nervous?"). The SEQ was selected over other possible self-efficacy measures (e.g., Bandura et al., 2003) because the items appeared developmentally suitable for our young age group, it had desirable psychometric properties showing that the *e*SE scale was well-differentiated from the other types of self-efficacy (Muris, 2001), and the *e*SE scale was strongly related to anxiety (Muris, 2002), the specific mental health outcome of the current study.

2.2.3. Math performance

Scaled (age-normed) math scores from the Stanford Achievement Test, 9th edition (SAT-9; Harcourt Educational Measurement, 1996) were used to assess math performance. The Stanford Achievement Test is a widely used standardized test that

assesses academic knowledge in a variety of subject areas, and can be used from kindergarten through high school (Harcourt Educational Measurement, 1996). The mathematics section is composed of two subtests – procedures and problem-solving – and the scaled score is an age-normed conversion of the combined raw scores from both subtests.

3. Results

3.1. Descriptive statistics

Table 1 provides the means and standard deviations for major study variables. Independent samples *t*-tests revealed no differences between girls and boys on anxiety ($t = -.497$, $p = .62$), *e*SE ($t = .514$, $p = .608$), or SAT-9 performance ($t = .896$, $p = .591$). A one-way analysis of variance with Bonferroni post hoc comparisons revealed significant differences between Asians and Latinos on SAT-9 performance ($M = 666.10$, $SD = 48.60$; $M = 618.05$, $SD = 38.42$, respectively). No other differences between ethnic groups on major study variables emerged.

Table 2 presents zero-order correlations for major study variables. SAT-9 scores were moderately related to household income ($r = .253$, $p < .01$) and negatively related to anxiety ($r = -.274$, $p < .01$). Finally, anxiety and *e*SE were negatively correlated ($r = -.308$, $p < .01$).

3.2. Moderating effects of emotional self-efficacy

We next performed a moderated regression analysis (Aiken & West, 1991) to examine whether *e*SE moderated the impact of anxiety on math SAT-9 performance. As predictors, we entered gender, household income, ethnicity, anxiety, *e*SE, as well as the cross-product between anxiety and *e*SE. All variables in the model were *z*-standardized prior to calculating the interaction term to ascertain the correct standardized beta weights (Aiken & West, 1991).

The regression analysis revealed a main effect of anxiety, $\beta = -.269$, $t = -2.663$, $p = .009$, but, as predicted, not *e*SE, $\beta = .105$, $t = 1.085$, $p = .281$, on SAT-9 performance (see Table 3). The analysis also revealed a positive interaction between anxiety and *e*SE on SAT-9 performance, $\beta = .186$, $t = 2.180$, $p = .032$ (see Fig. 1). A simple slope analysis (Aiken & West, 1991) showed that anxiety negatively predicted SAT-9 performance in children scoring one standard deviation below (−1 SD) the mean on *e*SE, $\beta = -.455$, $t = -3.223$, $p = .002$. Importantly, anxiety no longer predicts SAT-9 performance in children scoring one standard deviation above (+1 SD) the *e*SE mean, $\beta = -.083$, $t = -.673$, $p = .503$.

4. Discussion

In the current study, we explored whether emotional self-efficacy protected against anxiety-related math impairments in a typically developing sample of elementary school youth. In support of previous research, results of the current study confirmed that anxiety is negatively associated with performance on math assessments. Importantly, results also revealed that students with a high perceived ability to cope with negative emotions – emotional self-efficacy – were protected from anxiety-related math impairments. Specifically, we showed that high levels of anxiety negatively predicted the performance on a standardized math test only for children with low levels of emotional self-efficacy (this impairment was robust; the difference between math SAT-9 performance in these children with low vs. high anxiety was nearly 1 standard deviation, or, 44.6 points). High anxiety students reporting high levels of emotional self-efficacy did not show anxiety-related decrements in the test performance. These results suggest that high emotional self-efficacy serves as an effective prophylactic against the negative academic effects of anxiety.

To our knowledge this is the first study of its kind, and it expanded upon the growing corpus of research relating effective emotion regulation to various adjustment indices. Theory and

Table 1
Descriptive statistics for major study variables ($N = 105–133$).

Variable	Minimum	Maximum	Range	Mean	Std. deviation
Anxiety	1.22	9.19	7.97	5.11	1.63
Emotional self-efficacy	8.00	28.00	20.00	19.48	4.10
Math SAT-9	524.00	782.00	258.00	633.37	44.59

Note: SAT-9 = Stanford Achievement Test, 9th edition (Harcourt Educational Measurement, 1996).

Table 2
Correlation matrix for major study variables.

Variable	Household income	Gender	Math SAT-9	Anxiety
Household income	–			
Gender	.06	–		
Math SAT-9	.25*	.05	–	
Anxiety	−.16	−.05	−.27*	–
Emotional self-efficacy	.00	.05	.15	−.31*

Note: $N = 104–139$.
SAT-9 = Stanford Achievement Test, 9th edition (Harcourt Educational Measurement, 1996).
* $p < .01$.

Table 3
Moderated regression analysis predicting math SAT-9 performance from anxiety and emotional self-efficacy.

Model	*B*	Std. error	*β*	*t*	*p*
(Constant)	−.299	.130		−2.294	.024
Gender	−.041	.092	−.043	−.444	.658
Household income	.208	.095	.226	2.190	.031
Ethnicity	.044	.196	.023	.224	.824
Anxiety	−.269	.101	−.277	−2.663	.009
Emotional self-efficacy	.105	.097	.111	1.085	.281
Anxiety × emotional self-efficacy	.186	.085	.210	2.180	.032

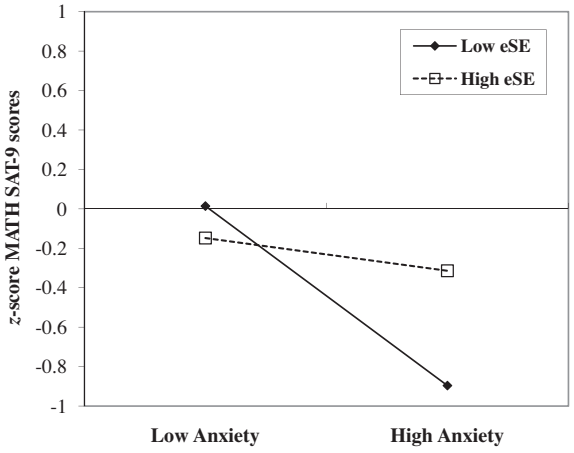

Fig. 1. Emotional self-efficacy moderates the influence of anxiety on math SAT-9 performance. SAT-9 = Stanford Achievement Test, 9th edition (Harcourt Educational Measurement, 1996). *e*SE = emotional self-efficacy (Muris, 2001).

research suggests that anxiety reduces executive cognitive abilities, such as working memory (Eysenck et al., 2007), which in turn explains the negative associations between anxiety and academic performance (Owens et al., 2008). Despite the risks associated with elevated anxiety, not all children are equally affected. Having confidence in one's ability to cope with negative emotions like anxiety was shown to buffer against anxiety-related impairments on a standardized math test. Conviction in one's competency might translate into the deployment of effective coping strategies for anxiety (Bandura, 1997; Caprara et al., 2008), which in turn reduces the cognitive load placed on the executive system, thereby enabling more processing resources to handle academic work.

Of course, *confidence* and *ability* are not synonymous (Pérez, Petrides, & Furnham, 2005), and it might be argued that high emotional self-efficacy is simply a result of having relatively low levels of anxiety (Muris, 2001). Given the cross-sectional nature of the study we were not able to entirely rule out this possibility. However, self-efficacy beliefs are thought to be based (in part) on previous experience in a given area (Caprara et al., 2008), suggesting that high emotional self-efficacy tracks previous successes regulating negative emotions. The current results also argue against the claim that high confidence *exclusively* follows low anxiety as we showed that it is possible to have both high emotional self-efficacy *and* high anxiety concurrently. Secondly, if emotional self-efficacy did not relate at all to engaging in effective emotion regulation strategies, then it seems unlikely that it should buffer anxiety's functional impairment on a math test performance.

These findings, while robust, must be considered in light of several limitations. Though our sample was racially and ethnically diverse, a majority of students in this study were from middle class, two-parent households. Therefore, caution should be used in the generalization of these findings for children from lower-income families. Furthermore, the results were based on cross-sectional data, thus preventing an analysis of the directionality of effects. We were also unable to fully examine the hypothesized model due to the lack of executive cognitive assessments. Finally, we relied solely on children's reports of both anxiety and self-efficacy. As we noted in Section 2.2, we included Muris' (2001) self-efficacy scale based on its developmental appropriateness, sound psychometric properties, distinct factor structure, and specificity toward the regulation of negative emotions. There are however several emotional self-efficacy scales (e.g., Bandura et al., 2003; Caprara et al., 2008) that assess the expression of positive affect in addition to negative affect regulation. Future research would benefit from including a battery of both emotional self-efficacy and trait EI (e.g., Petrides et al., 2007) scales to determine whether and how they interact with mental health factors to predict academic achievement. Given that the emotional self-efficacy scales do not assess specific strategies children might use to regulate negative emotions (e.g., cognitive reappraisal, distraction, etc.), it would also be prudent to examine whether certain regulatory strategies are more effective in protecting against poor academic outcomes than others. To this point however, most coping skills questionnaires (e.g., Connor-Smith, Compas, Wadsworth, Thomsen, & Saltzman, 2000) assess only the frequency of strategy use, not competency in executing the strategies. Therefore, it would be useful to combine assessments of frequency with children's perceptions on how confident they feel they are in implementing such strategies.

Despite these limitations, we showed that children's reports of emotional self-efficacy buffered against anxiety-related performance impairments on a standardized math exam. This study offers useful data for directing future research investigating methods for ameliorating functional impairments stemming from elevated anxiety in school-age youth.

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