The Role of Emotion Regulation and Children's Early Academic Success

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Abstract

This study investigated the role of children's emotion regulation skills and academic success in kindergarten, using a sample of 325 five-year-old children. A mediational analysis addressed the potential mechanisms through which emotion regulation relates to children's early academic success. Results indicated that emotion regulation was positively associated with teacher reports of children's academic success and productivity in the classroom and standardized early literacy and math achievement scores. Contrary to predictions, child behavior problems and the quality of the student teacher relationship did not mediate these relations. However, emotion regulation and the quality of the student-teacher relationship uniquely predicted academic outcomes even after accounting for IQ. Findings are discussed in terms of how emotion regulation skills facilitate children's development of a positive student-teacher relationship and cognitive processing and independent learning behavior, both of which are important for academic motivation and success.

Keywords

emotion regulation; academic success; student-teacher relationship; behavior problems; elementary students

The Role of Emotion Regulation in Children's Early Academic Success

The early childhood years have recently been identified as a crucial period for the development of important executive functions such as attention, inhibition, working memory (Anderson, 2002; Blair, 2002) and literacy skills (Aram, 2005) that are necessary for successful school transition and later academic success. Children demonstrating early academic and learning difficulties are not only more likely to display later academic difficulties including school drop-out (Horn & Packard, 1985), but they are also at risk for developing later peer rejection (Ladd, 1990; Risi, Gerhardstein, & Kistner, 2003) as well as emotional and behavioral disorders including conduct disorder (Bennett, Brown, Boyle, Racine, & Offord, 2003; Moffit, Gabrielli, Mednick, & Schulsinger, 1981). Given these negative outcomes as well as the consistent finding that academic success tends to be stable after first grade (Entwisle & Hayduk, 1988), researchers have attempted to examine sociocultural, school, family, and individual factors that contribute to a child's early school

success. Among the individual factors associated with academic success, most research has focused on anxiety (Ashcraft, 2002; Eady, 1999; Normandeau & Guay, 1998; Strauss, Frame, & Forehand, 1987), aggression (Farmer, Bierman, & Conduct Problems Prevention Research Group, 2002; Wentzel, 1993), verbal abilities (Kastner, May, & Hildman, 2001), and intelligence (Lassiter & Bardos, 1995; Lynam, Moffit, & Stouthamer-Loeber, 1993). Because of the co-occurrence of children's emotional and behavioral difficulties and academic difficulties (Dodge & Petit, 2003; Horn & Packard, 1985), one additional factor that is important to investigate is emotion regulation.

Although definitions vary, most researchers agree that emotion regulation involves efforts to modulate emotional arousal in a way that facilitates adaptive functioning (Calkins, 1997; Garber & Dodge, 1991; Keenan & Shaw, 2003). Adaptive functioning refers to numerous global positive outcomes including normative social, cognitive, and language development as well as the ability to cope with daily living tasks and environmental changes (Kamphaus, 1987). In children, academic functioning is a significant component of adaptive functioning. Little research, however, has investigated the role of emotion regulation in children's early academic performance. Given the early stability of academic competence, it is particularly important to examine how emotion regulation contributes to academic success upon formal school entry (i.e., kindergarten).

The kindergarten year marks an important transition period for children. As outlined by Rimm-Kaufman and Pianta's (2000) Ecological and Dynamic Model of Transition, the kindergarten environment is qualitatively different from both preschool and home environments. In kindergarten, children must adapt to an ecological system that expects them to accomplish numerous goals such as literacy, numeracy, and socialization skills. Moreover, these goals must be accomplished under decreased supervision due to increased class size and increased emphasis on autonomy (Bronson, Tivnan, & Seppanen, 1995). The novel demands of learning new academic and interpersonal skills, in combination with a lack of the extensive supports offered in preschool, presents a challenge for many young children. Consequently, these novel demands coupled with a new academic environment likely elicits various arousing emotions such as excitement, anxiety, and fear. Children's ability to regulate these emotions efficiently may facilitate their transition to kindergarten and consequently their ability to acquire academic information.

There is some evidence that emotional regulation aids performance on cognitive tasks, particularly in adults (Phillips, Bull, Adams, & Fraser, 2002). In terms of academic success, Blair (2002) suggests that inefficient emotion regulation physiologically inhibits a child's use of higher order cognitive processes (e.g., working memory, attention, and planning) in the classroom. One consequence of this disruption in higher order cognitive processes is an inability to attend to and retain novel information presented by the classroom teacher. In addition to directly affecting cognitive processing, emotion regulation may also be indirectly related to early academic success. One mechanism by which children's emotion regulation skills may contribute to their early academic success is through behavioral control in the classroom. A number of studies have indeed found that adolescents with deficits in behavioral control—such as those with externalizing problems including aggression and antisocial behavior— are more likely to have both co-occurring (Al Otaiba & Fuchs, 2002; Malecki and Elliot, 2002; Wentzel, 1993) and later academic difficulties (Masten et al., 2005; Risi, Gerhardstein, & Kistner, 2003). These observed deficits in behavioral control negatively impact the student's ability to attend to information presented by teachers as well as complete school related tasks or assignments that foster learning (Kuhl & Kraska, 1989). Most of these studies, however, have focused on middle-school children or adolescents (Masten et al., 2005; Normandeau & Guay, 1998) while the early childhood period remains less explored. One of the few studies conducted with a younger, kindergarten sample

(Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003) found positive associations between parental reports of young children's emotion regulation and children's scores on a standardized achievement test. Moreover, this relation was mediated by children's behavioral regulation in the classroom (i.e., their ability to refrain from disruptive behavior in the classroom).

Another potential mechanism by which emotion regulation skills affect children's early academic success is by affecting the quality of the student-teacher relationship. The quality of children's relationships with their teachers has increasingly been recognized as an important contributor to children's early school adaptation (Birch & Ladd, 1997; Pianta, Steinberg, & Rollins, 1995; Pianta & Stuhlman, 2004). A high quality student-teacher relationship supports the child (e.g., offering praise, encouragement, guidance, and discipline) throughout the challenging and novel educational environment to which the child must adjust. Several studies have examined how the quality of the student-teacher relationship relates to children's classroom behavior. Recent research demonstrates that a positive student-teacher relationship characterized by warmth and closeness decreases children's subsequent aggressive behavior in the classroom (Hughes, Cavell, & Jackson, 1999) and is a protective factor for children at risk of behavioral problems (Howes, Matheson, & Hamilton, 1994; Pianta, Steinberg, & Rollins, 1995). Hamre and Pianta (2001) found that kindergarteners whose relationships with teachers were characterized by dependency and low conflict had fewer disciplinary actions and were less likely to be suspended from school through the eighth grade. Conversely, a student-teacher relationship characterized by conflict and controlling interactions increases a child's risk for later behavior problems (Pianta et al., 1995)

The development of a positive relationship requires both the teacher and student to exhibit some aspects of social competence such as social skills (e.g., good eye contact, knowing when to start and stop a conversation) as well as the ability to inhibit negative behaviors (e.g., aggression). Consequently, we postulate that the child's level of social competence will likely affect how easy or difficult it will be for that child to enter and prosper in the relationship. Empirical evidence has shown that teachers have low tolerance for behaviorally disordered children who do not exhibit appropriate social behavior, and interact with these children in a more angry, critical, and punishing manner (Coie & Koeppl, 1990). On the other hand, children who display appropriate interpersonal skills may be more likely to elicit warm and positive interactions.

The modulation of arousal required by emotion regulation has been hypothesized to affect children's social relationships by facilitating an organism's ability to engage and disengage with the environment (Porges, 2003). This ability can be thought of as a core aspect of good social skills as children must know when to appropriately engage with others (i.e., talk to or play with them) and when to disengage with them (i.e., ignore them). This constant shift in communication and behavioral engagement and disengagement during social interactions may be easier for children who are able to regulate their emotions. Not surprisingly children who appropriately regulate emotions have been found to display greater social competence, better social skills, and greater peer popularity (Dunn & Brown, 1994; Eisenberg et al., 1993, 1996, 1997; Fabes et al., 1999; Graziano, Keane, & Calkins, in press). In the same manner, students who do not appropriately regulate emotions are more likely to have poor interpersonal skills and greater externalizing problems, such as defiance, hyperactivity, and fighting behavior (Dunn & Brown, 1994; Rydell, Berlin, & Bohlin, 2003). It is therefore reasonable to expect that children's emotion regulation skills will be related to the quality of the student-teacher relationship.

The student-teacher relationship has been shown to predict academic success over several years (Hamre & Pianta, 2001; Pianta & Stuhlman, 2004). More specifically, the student-teacher relationship affects children's motivation to learn. Children who are highly motivated and self-confident are more engaged in the learning process (Deci & Ryan, 1985). A positive, warm relationship with a teacher motivates students to achieve to please their teachers (Urdan & Maehr, 1995). Furthermore, teachers use a warm and positive relationship with their students to encourage and reinforce appropriate self-regulatory behaviors that are important for learning (Tyson, 2000). Conversely, children who have a relationship characterized by conflict with the teacher are less engaged in the classroom and are more likely to struggle academically (Ladd, Birch, & Buhs, 1999; Ladd & Burgess, 2001). Removing students from a supportive teacher relationship to one in which they perceive lower support decreases academic motivation (Midgley, Feldlaufer, & Eccles, 1989). Thus, it is clear that the student-teacher relationship is important in promoting children's academic success via classroom engagement as well as improved motivation.

Although various lines of evidence support the notion that the student-teacher relationship is related to emotion regulation and academic success, to our knowledge no study to date has examined these components in a single model. Because teachers tend to interact more positively with children with good social skills and fewer behavior problems – two indicators of appropriate emotion regulation skills – it is reasonable to predict that these children receive more encouragement and positive attention compared to children who are emotionally dysregulated. This positive relationship likely motivates students to engage in learning behavior to please the teacher. Greater engagement and motivation during classroom activities and tasks will then help children learn, which may lead to greater academic success.

Most studies that have examined children's academic competence have used standardized achievement tests as a measure of children's long term retention of learned information (Birch & Ladd, 1997; Howse et al., 2003; Martin et al., 1988). Standardized tests allow researchers to assess children's ability to retain the curriculum learned as well as to compare children's scores across ages and grades. As with all measures, however, they have some limitations such as the use of a limited number of items to sample various skills as well as the use of response formats (e.g., multiple choice) that may not tap into the students' full knowledge of the subject (DuPaul, Rapport, & Perriello, 1991). Teacher ratings of students' achievement in the classroom are a useful complement to standardized achievement tests for several reasons.

First, examining academic success via teacher reports provides important information regarding the student's academic behavior in the classroom, such as the ability to independently attend to and complete assignments. Second, teacher report also provides information regarding the student's ability to independently grasp new information and complete classroom assignments accurately. Thus, teacher ratings provide a more comprehensive and representative sample of academic content (Gresham, Reschly, & Carey, 1987), as well as provide unique information on children's academic behavior. The method of using teacher ratings of children's academic success, however, has its own limitations such as rater bias. For example, children who display good interpersonal skills are typically also rated higher in intellectual competence (Ford, 1982). Thus, to obtain a comprehensive assessment on children's academic competence and to build on previous research, the current study examined both a teacher rating of academic success as well as individually administered standardized achievement tests.

The first goal of the current study was to determine whether children's emotion regulation skills relate to early academic success in the classroom as well as on standardized reading

and mathematics achievement tests. Based on prior research (Howse et al., 2003), it was hypothesized that children who display higher levels of emotion regulation would have greater academic success in the classroom and on standardized tests. Secondly and most importantly, the current study sought to examine and compare the mechanisms by which emotion regulation relates to academic success. Thus, children's behavior problems as well as the quality of the student-teacher relationship were examined as possible mechanisms explaining the relation between emotion regulation and academic success. This examination of both an individual factor (i.e., behavior problems) as well as a transactional or relationship factor (i.e., the student-teacher relationship) as potential mediators in a single model will significantly advance our knowledge in this area by identifying the most salient mechanism by which a child's emotion regulation skills relate to early academic success. Moreover, by accounting for multiple mediators in a single model it is possible to determine if emotion regulation does indeed affect cognitive processing independent of other factors that have been shown to be important for learning and academic success.

Based on Rimm-Kaufman and Pianta's (2000) Ecological and Dynamic Model of Transition, we hypothesized that the transactional process of the student-teacher relationship will help account for how children's emotion regulation skills relate to academic competence. Consistent with this theory, the quality of the student-teacher relationship was hypothesized to be the most salient mediator, above and beyond the effects of an individual factor such as behavior problems. Thus, a positive student-teacher relationship, characterized by warmth and low conflict, was expected to be related to greater academic success and better regulation skills. Finally, given that children's poor emotion regulation skills may affect the development of a positive student-teacher relationship, we hypothesized that the quality of the student-teacher relationship would mediate the relation between children's emotion regulation and academic success both in the classroom and on standardized tests.

Method

Participants

Participants for this study included 325 5-year olds (143 boys, 172 girls) who were participating in a larger ongoing longitudinal study. Four hundred and forty seven participants were initially recruited at 2-years of age (Cohort 1: 1994-1996, Cohort 2: 2000-2001, Cohort 3: 1998) through child day care centers, the County Health Department, and the local Women, Infants, and Children program. To obtain a broad, community-based sample of children with a wide range of parent reported disruptive behavior, potential participants were screened using the externalizing subscale of the Child Behavior Checklist (CBCL 2-3; Achenbach, 1992). A cut-off T-score of 60 was used to identify children with externalizing problems. Further details about the recruitment sample may be found in Smith, Calkins, Keane, Anastopoulos, and Shelton (2004) and Calkins and Dedmon (2000). Of the original 447 participants, 365 participated at the 5-years of age assessment. The focus of the present study is the 325 children who were assessed during two laboratory visits at five and a half years of age and/or who were enrolled in schools granting permission for a school assessment during the kindergarten year. There were no significant differences in gender, SES, or 2-year externalizing T-score between families who did and did not participate at the 5-years of age assessment.

The current study's sample of children was racially and economically diverse (see Table 1), and primarily from intact families (78%). Twenty-three percent of the children scored at or above the clinical or borderline range (T-score $\geq$ 60) on externalizing behavior only, 12% scored at or above the clinical or borderline range on both externalizing and internalizing behavior, and 65% scored below the clinical or borderline range (T-score < 60) on both externalizing and internalizing behavior at the time of recruitment. Participants were

assessed in kindergarten during two laboratory visits and one school visit. Due to the multiple assessments, sample sizes vary for each analysis. All available data were used for each analysis. There were no significant differences in terms of gender, race, or SES between children with complete versus partial data. Standardized academic achievement tests were individually administered to a subset of children (N=92). The proportion of African-American children was slightly higher in the subsample compared to the larger sample ($\chi^2 = 6.6$, $p = .08$). There were no other demographic differences between the two groups.

Procedures

The focus of this study involved multiple assessments at the kindergarten period, which included parent report of children's emotional and behavioral functioning and teacher report of academic functioning and the quality of the student-teacher relationship. Children's achievement data were collected during individual assessments conducted at school. Intellectual functioning was assessed during a laboratory visit.

Measures

Emotion regulation—To assess children's behavioral display of emotion regulation, parents completed the Emotion Regulation Checklist (ER Checklist; Shields & Cicchetti, 1997). The ER Checklist is a 24-item questionnaire that yields two subscales: the Negativity/Lability scale (10 items), which represents negative affect and mood lability, and the Emotion Regulation scale (14 items), which assesses processes central to adaptive regulation such as equanimity. The two scales are only moderately negatively correlated ($r = -.50$, $p <.001$) suggesting that they assess different aspects of children's emotional functioning. The Emotion Regulation scale (Cronbach's alpha = .68) was the focus of the current study.

Academic competence—Children's academic competence in the kindergarten classroom was assessed through the Academic Performance Rating Scale (APRS; DuPaul, Rapport, & Perriello, 1991). The APRS is a 19-item, teacher-rated scale that assesses academic performance and behavior in the classroom. This measure yields three subscales: impulsivity, academic success, and academic productivity. The impulsivity scale has three items that assess the child's impulsive behavior in the classroom (e.g., begins written work prior to understanding the directions). The academic success scale has seven items that assess the accuracy of the child's work completion in math, reading, and general areas. The academic productivity scale consists of nine items that assess academic behavior (e.g., follows directions, completes work in a timely manner). This study focused on positive academic behavior, thus, the impulsivity scale (3 items) was not included. In addition, two socialization items (child appears withdrawn, appears to be staring excessively) were originally included in the academic productivity scale, but were dropped from the current study because their original purpose was to assess psychostimulant treatment (DuPaul, Rapport, & Perriello, 1991). Given the high correlation between the academic productivity and academic success subscales ($r = .88$, $p < .001$), the 14 items were averaged to create an academic success/productivity composite score (Cronbach's alpha = .79).

Behavior Problems—To assess children's behavior problems, parents completed the Behavior Assessment System for Children (BASC; Reynolds & Kamphaus, 1992). The BASC is a widely used behavior checklist that taps emotional and behavioral domains of children's functioning. The parent version used for children ages 2 1/2-5 contains 109 items whereas the version used for children ages 6-11 contains 148 items. Because some of the children in our sample turned six during the kindergarten year, it was necessary to give them the ages 6-11 version of the BASC. Each item on the BASC is rated on a four-point scale

with respect to the frequency of occurrence (never, sometimes, often, and almost always). The measure yields scores on broad internalizing, externalizing, and behavior symptom domains as well as nine specific content scales. The BASC has well-established internal consistency, reliability and validity (Doyle, Ostrander, Skare, Crosby, & August, 1997; Reynolds & Kamphaus, 1992). For the purpose of the present study, the general externalizing t-score was examined.

Student-teacher relationship—Teachers also completed the Student-Teacher Relationship Scale (STRS; Pianta, 2001). The STRS is a 16 item scale that assesses a teacher's perception of his or her relationship with a particular student. This scale yields three subscales (Conflict, Closeness, and Dependency) and an overall positive relationship scale, which is calculated using closeness and the reverse scores of conflict and dependency. Because we were interested in the overall quality of the student-teacher relationship, we only examined the overall positive scale (Cronbach's Alpha = .86).

Achievement—A subsample of children (N = 92) were administered five subtests from the Wechsler Individual Achievement Test (WIAT; Wechsler, 1992) to assess academic achievement. The WIAT was administered by trained clinical doctoral students who were blind to the recruitment status and other study measures of the children. The five subtests administered were: basic reading, mathematical reasoning, spelling, numerical operations, and listening comprehension. The basic reading subtest measures a child's ability to recognize letter sounds and small words out of context. The spelling subtest measures a child's ability to write down letters and small words. Due to the high correlation between the standardized scores of the spelling subtest and basic reading subtest, $r = .80$, $p<.001$, they were combined to obtain an overall early literacy score. A math composite score was also calculated according to procedures indicated by the WIAT as the correlation between the math reasoning subtest and numerical operations subtest was high, $r = .71$, p<.001. For the purposes of this study, the early literacy and math composites were used.

Intelligence—To assess children's intelligence, the Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R; Wechsler, 1989) was administered by trained clinical psychology doctoral students who were blind to the recruitment status and other study measures of the children. The Full Scale IQ standard score from the WPPSI-R was used as the measure of intelligence in the present study.

Results

Preliminary Analyses

Descriptive statistics and sample sizes for all measures are presented in Table 2. All available data were used for each analysis, thus the sample size varies among analyses. Preliminary analyses were conducted to examine race, SES, and gender differences in the outcome measures. Multivariate analyses found no racial, SES, or gender differences in academic achievement. As expected, children's full scale IQ was significantly correlated with academic success/productivity in the classroom ($r = .42$, $p <.001$), with the WIAT math composite scores ($r = .54$, $p < .001$), and with the WIAT early literacy composite scores ($r = .43$, $p < .001$). Thus, all analyses involving academic achievement controlled for IQ.

Emotion Regulation and Academic Competence

The first goal of the current study was to determine whether children's emotion regulation skills relate to early academic success/productivity in the classroom and to standardized achievement measures of early literacy and mathematics. To address this research question, hierarchical regression analyses were conducted. To control for children's intellectual

ability, the full scale IQ was entered first into the regression. The main effect of emotion regulation as reported by parents was then entered in the second step. The dependent variable for the regression analysis was academic success/productivity in the classroom, derived from teacher reports. As predicted, after controlling for IQ, emotion regulation was a significant predictor of academic success/productivity in the classroom, *total R^2 = .29, R^2 change* = .07, *F(2, 204) change* = 20.64, *p*<.001, *β* = .27. Thus, children with better emotion regulation skills were more likely to obtain higher scores on teacher reported academic success/productivity in the classroom.

We also tested whether emotion regulation predicted standardized measures of academic achievement (WIAT). After controlling for IQ, emotion regulation was a significant predictor of mathematics *(total R^2 = .33, R^2 change = .03, F(2, 87) change = 4.36, p<.05, β = .18)* and early literacy *(total R^2 = .22, R^2 change = .04, F(2, 87) change = 4.22, p<.05, β = . 20)*. As hypothesized children with better emotion regulation skills obtained higher scores on standardized measures of mathematics and early literacy skills.

Mediational Analyses

Due to the significant findings between emotion regulation and academic success, mediational analyses were conducted to examine the second goal of the current study: to examine and compare the mechanisms by which emotion regulation relates to academic success. Thus, children's behavior problems as well as the quality of the student-teacher relationship were examined as potential mediators in the relation between emotion regulation and academic success. To test for mediation, procedures recommended by Baron and Kenny (1986) were followed. First, the independent variable must predict the mediators. Second, the independent variable must predict the dependent variable. Third, the mediators must predict the dependent variable. Full mediation holds if the independent variable has no significant effect on the dependent variable when the mediators are controlled. Hierarchical regression analyses were conducted to test the mediational model. Although our main mediational model involved the dependent measure of academic success/productivity in the classroom, we also conducted mediational analyses using standardized test scores to ensure that any effects found were not due to shared method variance as both the quality of the student-teacher relationship and children's academic success/productivity in the classroom were rated by teachers.

We first tested whether the independent variable (emotion regulation) predicted the two mediators (behavior problems and student-teacher relationship). As hypothesized emotion regulation was a significant predictor of parent reported behavior problems *(total R^2 = .05, F(1, 317) change = 16.55, p<.001, β = -.22)* and the quality of the student-teacher relationship *(total R^2 = .02, F(1, 248) change = 3.91, p<.05, β = .13)*. Thus, children with better emotion regulation skills had fewer behavior problems and had a better relationship with their teachers.

Next, we tested whether the two mediators (behavior problems and the student-teacher relationship) significantly predicted the academic outcome variables. Our first potential mediator, behavior problems, significantly predicted academic success/productivity in the classroom, after controlling for IQ, *(total R^2 = .31, R^2 change = .09, F(2, 208) change = 26.13, p<.001, β = -.30)* as well as standardized mathematic scores *(total R^2 = .33, R^2 change = .04, F(2, 87) change = 4.58, p<.05, β = -.19)* and standardized early literacy scores *(total R^2 = .25, R^2 change = .07, F(2, 87) change = 8.18, p<.01, β = -.27)*. Thus, children with greater behavior problems performed worse academically both in the classroom and on standardized measures of math and early literacy skills.

Our second potential mediator, the quality of the student-teacher relationship, was also a significant predictor of academic success/productivity in the classroom, after controlling for IQ, (*total R^2 = .37, R^2change = .14, F(2, 203) change* = 44.11, *p*<.001, *β* = .38) as well as standardized math scores (*total R^2 = .36, R^2change = .04, F(2, 73) change* = 4.20, *p*<.05, *β* = .19) and standardized early literacy scores (*total R^2 = .25, R^2change = .08, F(2, 73) change* = 7.82, *p*<.01, *β* = .29). Thus, children with better relationships with their teachers performed better academically both in the classroom and on standardized measures of math and early literacy skills.

Finally, as depicted on Table 4, we tested our mediational model by examining whether emotion regulation continued to have a significant effect on academic outcome measures, after controlling for both mediators (behavior problems and student-teacher relationship) and children's IQ. Contrary to our hypotheses, neither the student-teacher relationship nor behavior problems mediated the relation between emotion regulation and academic success/ productivity in the classroom. Thus, emotion regulation provided unique variance towards the prediction of academic success/productivity in the classroom after accounting for children's IQ, behavior problems, and the student-teacher relationship. In addition, the second step of the mediational test provided a means of comparing the contributions of the quality of the student-teacher relationship and children's behavior problems towards the prediction of academic success/productivity in the classroom. This second step of the mediational test revealed that only the quality of the student-teacher relationship uniquely predicted academic success/productivity in the classroom, after controlling for IQ. Behavior problems did not uniquely predict academic success/productivity in the classroom once the quality of the student-teacher relationship was accounted for.

Similarly, neither the student-teacher relationship nor behavior problems mediated the relation between emotion regulation and standardized achievement measures of math and early literacy after controlling for children's IQ. Once again, emotion regulation provided unique variance towards the prediction of standardized math and early literacy scores, after accounting for children's IQ, behavior problems, and the student-teacher relationship. Additionally, the second step of the mediational test revealed that only the quality of the student-teacher relationship uniquely predicted standardized math and early literacy scores, after controlling for IQ. Thus, behavior problems did not uniquely predict academic achievement once the quality of the student-teacher relationship was accounted for.

Discussion

The present study sought to examine the role of children's emotion regulation skills in early academic success. Specifically, we examined whether kindergartners with better emotion regulation skills would perform better academically in the classroom as well as on standardized tests. In addition, we conducted mediational analyses to determine the most salient mechanism by which emotion regulation relates to academic success. The two mechanisms examined in our mediational model were the student-teacher relationship and children's behavior problems.

Prior to discussing the findings, it is important to recognize the limitations of the current study. First, the concurrent nature of our study limits the extent to which we can determine the causality of the relation among children's emotion regulation skills and academic functioning. Although we were able to control for children's intellectual functioning, the concurrent nature of our study precludes any conclusions regarding the long-term effects of emotion regulation on academic functioning across settings. In addition, while we examined different measures of academic success to avoid teacher report bias, we were not able to obtain standardized test scores on our entire sample. Lastly, we were not able to obtain

children's report of their relationship with their teachers, making the focus of our study teacher's perceptions of their relationship with students.

With these limitations in mind, our study provided important information on the relation between children's emotion regulation skills and their early academic success in kindergarten. Consistent with our hypothesis, emotion regulation as reported by parents positively predicted academic success/productivity in the classroom setting as well as on both math and early literacy standardized tests. This is the first study to examine how children's emotion regulation skills relates to not only performance on standardized tests as past research has done (Birch & Ladd, 1997; Howse et al., 2003; Martin et al., 1988), but also teacher rated classroom performance. Our examination of classroom performance is unique because it allowed us to examine which particular aspects of learning are affected by children's poor emotion regulation skills. Our findings suggest that children who have difficulty regulating their emotions have trouble learning in the classroom and are less productive and accurate when completing assignments.

Exactly how children's inefficiency in regulating emotions contributes to their lack of productivity and accuracy when completing assignments in the classroom is unclear, but it is likely that learning new information arouses young children's emotions. These emotions may range from anxiety, when encountering new information that has to be learned, to frustration that may occur while attempting to complete new assignments. Kindergarteners who are unable to cope with such arousal may become frustrated when attempting to complete new assignments, which results in inaccurate completion of such assignments. We also found a moderately high correlation between children's academic success/productivity in the classroom and children's performance on both math and early literacy standardized tests. This finding emphasizes the importance of productivity and accuracy in completing classroom assignments as it relates to children's long-term learning (i.e., standardized test performance) and how poor emotion regulation skills may disrupt such performance.

Due to the significant relation between emotion regulation and children's academic success across settings, we conducted mediational analyses to examine the quality of the student-teacher relationship and children's behavior problems as potential mechanisms by which emotion regulation affects academic success. Based on Rimm-Kaufman and Pianta's (2000) Ecological and Dynamic Model of Transition we expected that the transactional process evidenced by a positive student-teacher relationship would mediate the relation between children's emotion regulation skills and academic success. We also expected that the student-teacher relationship would be the most salient mediator, above and beyond the effects of an individual factor such as behavior problems.

As predicted, children with greater levels of emotion regulation had a slightly more positive relationship with their teachers and were less likely to have behavior problems. These finding are consistent with previous research showing that teachers have low tolerance for children with behavior problems (Cunningham & Sugawara, 1988), and that teachers interact with these children more negatively (Coie & Koeppl, 1990). The current study's use of an individual trait such as emotion regulation, rather than the classification of children based on behavior problems, demonstrates one specific aspect of children's behavioral functioning that is seen by teachers as troublesome. This finding suggests that as early as kindergarten teachers form more positive relationships with children demonstrating good emotion regulation skills compared to children who have difficulty regulating their emotions. It is likely that teachers view children with inappropriate emotion regulation as difficult to manage, requiring more energy on their part to control their behavior and assist them with engaging in classroom activities. On the other hand, children with good emotion

regulation skills do not require such monitoring, allowing teacher-child interactions to be more positive.

The quality of the student-teacher relationship was also related to greater academic success/ productivity in the classroom and math and reading standardized test scores. This finding further solidifies the importance of having a positive relationship with teachers for children's academic functioning and is consistent with previous research (Birch & Ladd, 1997; Pianta, Steinberg, & Rollins; 1995; Pianta & Stuhlman, 2004). Kindergarteners who had a positive relationship with teachers were more likely to complete assignments with thoroughness, accuracy, and in a timely way. This finding suggests that teachers have a motivational role in children's early academic success. Teachers who have a positive relationship with students are more likely to encourage these students to achieve, and in turn these students may be motivated to achieve to please their teachers (Urdan & Maehr, 1995). The fact that a positive student-teacher relationship was also related to better performance on math and reading standardized tests provides evidence that our finding is not simply due to a rater bias.

Children's level of behavior problems was also negatively related to academic success in the classroom as well as standardized math and early literacy test scores. This finding is consistent with previous research showing that children with deficits in behavioral control— such as those with externalizing problems including aggression and antisocial behavior— are more likely to have co-occurring academic difficulties (Al Otaiba & Fuchs, 2002; Malecki and Elliot, 2002; Wentzel, 1993). Given that most of the past studies focused on middle or high school children, our study contributes to the literature by demonstrating that this co-occurrence of behavior problems and academic difficulties starts immediately upon entrance to school. In addition, our use of both standardized and teacher report measures of academic competence provide evidence for the robust academic difficulty that children with behavior problems and emotion regulation deficits have.

Contrary to our hypothesis, we found that the student-teacher relationship did not mediate the relation between emotion regulation and academic success across settings. Instead, we found that both emotion regulation and the quality of the student-teacher relationship uniquely contributed to the prediction of children's academic success. A child's level of behavior problems was not a significant mediator nor did it contribute to the prediction of academic success once the student-teacher relationship was accounted for. This finding indicates that the student-teacher relationship has a stronger effect on academic success compared to children's behavior problems.

The independent contribution of emotion regulation to academic success, after accounting for children's intellectual functioning, the student-teacher relationship, and behavior problems—significant factors that the literature has shown to be important for academic functioning— supports Blair's (2002) assertion that emotion dysregulation disrupts cognitive processing of executive functions that are important for learning. Children with good emotion regulation skills are thus better equipped to handle the qualitative shift in the learning environment that occurs during kindergarten compared to children with poor emotion regulation skills. Future research may want to examine the extent to which specific executive functions (i.e., attention, working memory, and planning) are disrupted in children with poor emotion regulation skills.

Better emotion regulation skills also facilitate children's ability to independently attend to and learn new information presented by their teachers. A positive student-teacher relationship may further reinforce such independent behavior and motivate children to continue to learn. As children get older and adapt to the independent academic environment,

however, the overall influence of the student-teacher relationship may become weaker and children's own internal motivation to learn as well as their emotion regulation skills may become the main factors involved in their academic success. Consequently, it may be the case that the student-teacher relationship will exert a bigger influence on children lacking independent skills and at risk for academic failure. Longitudinal research examining these factors would help determine if that is the case.

Acknowledgments

References

Achenbach, TM. Manual for the Child Behavior Checklist/2-3 & 1992 Profile. University of VT Department of Psychiatry; Burlington, VT: 1992.

Al Otaiba S, Fuchs D. Characteristics of children who are unresponsive to early literacy intervention: A review of the literature. Remedial and Special Education 2002;23:300–316.

Anderson P. Assessment and development of executive function in childhood. Child Neuropsychology 2002;8:71–82. [PubMed: 12638061]

Aram D. Continuity in children's literacy achievements: A longitudinal perspective from kindergarten to school. First Language 2005;25:259–289.

Ashcraft M. Math anxiety: Personal, educational, and cognitive consequences. Current Directions in Psychological Science 2002;11(5):181–185.

Baron R, Kenny D. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. Journal of Personality and Social Psychology 1986;51(6):1173–1182. [PubMed: 3806354]

Bennett K, Brown S, Boyle M, Racine Y, Offord D. Does low reading achievement at school entry cause conduct problems? Social Science & Medicine 2003;56:2443–2448. [PubMed: 12742607]

Birch S, Ladd G. The teacher-child relationship and children's early school adjustment. Journal of School Psychology 1997;35(1):61–79.

Blair C. School readiness: Integrating cognition and emotion in a neurobiological conceptualization of children's functioning at school entry. American Psychologist 2002;57(2):111–127. [PubMed: 11899554]

Bronson M, Tivnan T, Seppanen P. Relations between teacher and classroom activity variables and the classroom behaviors of prekindergarten children in chapter 1 funded programs. Journal of Applied Developmental Psychology 1995;16:253–282.

Calkins S. Cardiac vagal tone indices of temperamental reactivity and behavioral regulation in young children. Developmental Psychobiology 1997;21(2):125–135. [PubMed: 9298638]

Calkins SD, Dedmon S. Physiological and behavioral regulation in two-year-old children with aggressive/destructive behavior problems. Journal of Abnormal Child Psychology 2000;28:103–118. [PubMed: 10834764]

Coie, J.; Koeppl, G. Adapting intervention to the problems of aggressive and disruptive rejected children.. In: Asher, S.; Coie, J., editors. Peer rejection in childhood. Cambridge University Press; New York: 1990. p. 309-337.

Cunningham B, Sugawara A. Preservice teachers' perceptions of children's problem behaviors. Journal of Educational Research 1988;82(1):34–39.

Deci E, Ryan R. The support of autonomy and the control of behavior. Journal of Personality and Social Psychology 1985;53(6):1024–1037. [PubMed: 3320334]

Dodge K, Petit G. A biopsychosocial model of the development of chronic conduct problems in adolescence. Developmental Psychology 2003;39:349–371. [PubMed: 12661890]

Doyle A, Ostrander R, Skare S, Crosby RD, August GJ. Convergent and criterion-related validity of the Behavior Assessment System for Children-Parent Rating Scale. Journal of Clinical Child Psychology 1997;26:276–284. [PubMed: 9292385]

Dunn J, Brown J. Affect expression in the family, children's understanding of emotions, and their interactions with others. Merrill-Palmer Quarterly 1994;40(1):120–137.

DuPaul G, Rapport M, Perriello L. Teacher ratings of academic skills: The development of the Academic Performance Rating Scale. School Psychology Review 1991;20(2):284–300.

Eady S. An investigation of possible correlation of general anxiety with performance in eleven-plus scores in Year 6 primary school pupils. Educational Psychology 1999;19(3):347–359.

Eisenberg N, Cumberland A, Spinrad T, Fabes R, Shepard S, Reiser M, Murphy B, Losoya S, Guthrie I. The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. Child Development 2001;72:1112–1134. [PubMed: 11480937]

Eisenberg N, Fabes RA, Bernzweig J, Karbon M, Poulin R, Hanish L. The relations of emotionality and regulation to preschoolers' social skills and sociometric status. Child Development 1993;64:1418–1438. [PubMed: 8222881]

Eisenberg N, Fabes R, Guthrie I, Murphy B, Maszk P, Holmgren R, Suh K. The relations of regulation and emotionality to problem behavior in elementary school. Development and Psychopathology 1996;8:141–162.

Eisenberg N, Fabes R, Murphy B, Maszk P, Smith M, Karbon M. The role of emotionality and regulation in children's social functioning: a longitudinal study. Child Development 1995;66:1360–1384. [PubMed: 7555221]

Eisenberg N, Guthrie IK, Fabes RA, Reiser M, Murphy BC, Holgren R, Maszk P, Losoya S. The relations of regulation and emotionality to resiliency and competent social functioning in elementary school children. Child Development 1997;68:295–311. [PubMed: 9180003]

Entwisle D, Hayduk L. Lasting effects of elementary school. Sociology of Education 1988;61(3):147–159.

Fabes R, Eisenberg N, Jones S, Smith M, Guthrie I, Poulin R, Shepard S, Friedman J. Regulation, emotionality, and preschoolers' socially competent peer interactions. Child Development 1999;70(2):432–442. [PubMed: 10218264]

Farmer A, Bierman K, The Conduct Problems Research Group. Predictors and consequences of aggressive-withdrawn problem profiles in early grade schools. Journal of Clinical Child and Adolescent Psychology 2002;31(3):299–311. [PubMed: 12149968]

Ford M. Social cognition and social competence in adolescence. Developmental Psychology 1982;18(3):323–340.

Garber, J.; Dodge, K., editors. The development of emotion regulation and dysregulation. Cambridge University Press; New York: 1991.

Goldsmith, HH.; Rothbart, MK. The laboratory temperament assessment battery (LAB-TAB). University of Wisconsin; 1993.

Graziano P, Keane S, Calkins S. Cardiac vagal regulation and early peer status. Child Development. in press.

Gresham F, Reschly D, Carey M. Teachers as "tests": Classification accuracy and concurrent validation in the identification of learning disabled children. School Psychology Review 1987;16:543–553.

Hamre B, Pianta R. Early teacher-child relationships and the trajectory of children's school outcomes through eighth grade. Child Development 2001;72(2):625–638. [PubMed: 11333089]

Hollingshead, AB. Four factor index of social status. Yale University; New Haven, CT: 1975. Unpublished manuscript

Horn W, Packard T. Early identification of learning problems. A meta-analysis. Journal of Educational Psychology 1985;77:597–607.

Howse R, Calkins S, Anastopoulos A, Keane S, Shelton T. Regulatory contributors to children's academic achievement. Early Education and Development 2003;14(1):101–119.

Howes C, Matheson C, Hamilton C. Maternal, teacher, and child care history correlates of children's relationships with peers. Child Development 1994;65(1):264–273. [PubMed: 8131652]

Hughes J, Cavell T, Jackson T. Influence of the teacher-student relationship on childhood conduct problems: A prospective study. Journal of Clinical Child Psychology 1999;28(2):173–184. [PubMed: 10353077]

Kamphaus R. Conceptual and psychometric issues in the assessment of adaptive behavior. Journal of Special Education 1987;21(1):27–35.

Kastner J, May W, Hildman L. Relationship between language skills and academic achievement in first grade. Perceptual and Motor Skills 2001;92:381–390. [PubMed: 11361297]

Keenan, K.; Shaw, DS. Exploring the Etiology of Antisocial Behavior in the First Years of Life.. In: Lahey, BB.; Moffitt, TE.; Caspi, A., editors. Causes of Conduct Disorder and Juvenile Delinquency. The Guilford Press; New York: 2003. p. 153-181.

Kuhl, J.; Kraska, K. Self-regulation and metamotivation: Computational mechanisms, development, and assessment.. In: Kanfer, R.; Ackerman, P.; Cudeck, R., editors. Abilities, motivation, and methodology: The Minnesota Symposium on learning and individual differences. Lawrence Erlbaum Associates; Hillsdale, NJ: 1989. p. 373-374.

Ladd G. Having friends, keeping friends, making friends, and being liked by peers in the classroom. Predictors of children's early school adjustment? Child Development 1990;61:1081–1100. [PubMed: 2209179]

Ladd G, Birch S, Buhs E. Children's social and scholastic lives in kindergarten: Related spheres of influence? Child Development 1999;70(6):1373–1400. [PubMed: 10621962]

Ladd G, Burgess K. Do relational risks and protective factors moderate the linkages between childhood aggression and early psychological and school adjustment? Child Development 2001;72(5):1579–1601. [PubMed: 11699688]

Lassiter K, Bardos A. The relationship between young children's academic achievement and measures of intelligence. Psychology in the Schools 1995;32:170–177.

Lynam D, Moffitt T, Stouthamer-Loeber M. Explaining the relation between IQ and delinquency: Class, race, test motivation, school failure, or self-control? Journal of Abnormal Psychology 1993;102:187–196. [PubMed: 8315131]

Malecki C, Elliot S. Children's social behaviors as predictors of academic achievement: A longitudinal analysis. School Psychology Quarterly 2002;17:1–23.

Martin R, Drew K, Gaddis L, Moseley M. Prediction of elementary school achievement from preschool temperament: Three studies. School Psychology Review 1988;17(1):125–137.

Masten A, Roisman G, Long J, Burt K, Obradovic J, Riley J, et al. Developmental cascades: Linking academic achievement and externalizing and internalizing symptoms over 20 years. Developmental Psychology 2005;41:733–746. [PubMed: 16173871]

Midgley C, Feldlaufer H, Eccles J. Change in teacher efficacy and student self- and task-related beliefs in mathematics during the transition to junior high school. Journal of Educational Psychology 1989;81(2):247–258.

Moffitt T, Gabrielli W, Mednick S, Schulsinger F. Socioeconomic status, IQ, and delinquency. Journal of Abnormal Psychology 1981;90:152–156. [PubMed: 7288005]

Normandeau S, Guay F. Preschool behavior and first-grade school achievement: The mediational role of cognitive self-control. Journal of Educational Psychology 1998;90:111–121.

Phillips L, Bull R, Adams E, Fraser L. Positive mood and executive function: Evidence from stroop and fluency tasks. Emotion 2002;2:12–22. [PubMed: 12899364]

Pianta, R. Enhancing relationships between children and teachers. American Psychological Association; Washington, DC: 1999.

Pianta, R. Implications of a developmental systems model for preventing and treating behavioral disturbances in children and adolescents.. In: Hughes, J.; LaGreca, A.; Conoley, J., editors. Handbook of psychological services for children and adolescents. Oxford University Press; New York: 2001. p. 23-41.

Pianta R, Steinberg M, Rollins K. The first two years of school: Teacher-child relationships and deflections in children's classroom adjustment. Development and Psychopathology 1995;7(2):295–312.

Pianta R, Stuhlman M. Teacher-child relationships and children's success in the first years of school. School Psychology Review 2004;33(3):444–458.

Porges S. The polyvagal theory: Phylogenetic contributions to social behavior. Physiology & Behavior 2003;79:503–513. [PubMed: 12954445]

Rimm-Kaufman S, Pianta R. An ecological perspective on the transition to kindergarten: A theoretical framework to guide empirical research. Journal of Applied Developmental Psychology 2000;21:491–511.

Risi S, Gerhardstein R, Kistner J. Children's classroom peer relationships and subsequent educational outcomes. Journal of Clinical Child and Adolescent Psychology 2003;32:351–361. [PubMed: 12881024]

Rydell A, Berlin L, Bohlin G. Emotionality, emotion regulation, and adaptation among 5- to 8-year-old children. Emotion 2003;3(1):30–47. [PubMed: 12899315]

Shields A, Cicchetti D. Emotion regulation among school-age children: The development and validation of a new criterion Q-sort scale. Developmental Psychology 1997;33(6):906–916. [PubMed: 9383613]

Smith C, Calkins S, Keane SP, Anastopoulos A, Shelton T. Predicting stability and change in toddler behavior problems: Contributions of maternal behavior and child gender. Developmental Psychology 2004;40:29–42. [PubMed: 14700462]

Strauss C, Frame C, Forehand R. Psychosocial impairment associated with anxiety in children. Journal of Clinical Child Psychology 1987;16(3):235–239.

Tyson K. Using the teacher-student relationship to help children diagnosed as hyperactive: An application of intrapsychic humanism. Child and Youth Care Forum 2000;29(4):265–289.

Urdan T, Maehr M. Beyond a two-goal theory of motivation and achievement: A case for social goals. Review of Educational Research 1995;65(3):213–243.

Wechsler, D. Wechsler Preschool and Primary Scale of Intelligence – Revised. The Psychological Corporation; San Antonio, TX: 1989.

Wentzel K. Does being good make the grade? Social behavior and academic competence in middle school. Journal of Educational Psychology 1993;85(2):357–364.

Table 1

Gender, SES, and Age by Race for entire sample.

Race	Gender			SES (Hollingshead)	Age (in months)
	Male	*Female*	*Total*		
African-American	40	53	93	37.2	69.5
Caucasian	104	110	214	42.1	69.5
Other	7	11	18	33.5	68.8

Table 2

Descriptive Statistics for All Measures

	M	SD	Min	Max	N
Kindergarten Measures					
<u>Emotion Regulation (ER Checklist)</u>					
Emotion Regulation (P)	3.01	.28	2.2	3.64	234
<u>Behavior Problems (BASC)</u>					
Externalizing General T-Score (P)	46.12	10.48	27.00	92.00	328
<u>Student-Teacher Relationship (STRS)</u>					
Overall Positive Relationship (T)	114.5	12.1	74.00	132.00	212
<u>Academic Competence (APRS)</u>					
Academic Success (T)	3.7	.73	1.33	5.00	218
<u>Academic Achievement (WIAT)</u>					
Early Literacy (L)	113.1	15.4	79.00	148.00	92
Math (L)	107.8	14.3	73.00	145.00	92
<u>IQ (WPPSI)</u>					
Full Scale IQ (L)	103.9	14.8	72.00	135.00	204

(P) = parent report

(T) = teacher report

(L) = laboratory measure

Table 3

Correlations Between Variables of Interest

Variable	1	2	3	4	5	6	7
1. Full Scale IQ (L)	-						
2. WIAT early literacy composite (L)	.43*** N = 90	-					
3. WIAT math composite (L)	.54*** N = 90	.65*** N = 92	-				
4. Academic success/productivity in the classroom (T)	.48*** N = 213	.53*** N = 44	.49*** N = 44	-			
5. Emotion regulation (P)	.08 N = 306	.22* N = 87[a]	.22* N = 87[a]	.30** N = 204[a]	-		
6. Overall quality of the student-teacher relationship (T)	.21** N = 243	.31** N = 73[a]	.23* N = 73[a]	.42*** N = 203[a]	.13* N = 250	-	
7. Behavior Problems (P)	-.10 N = 310	-.29** N = 87[a]	-.22* N = 87[a]	-.33*** N = 208[a]	-.28*** N = 319	-.41*** N = 247	-

[a]Controlled for Full Scale IQ, (P) = parent report; (T) = teacher report; (L) = laboratory measure

*
p <.05

**
p<.01

***
p<.001

Table 4

Regression Analyses Testing Behavior Problems and the Student–Teacher Relationship as Mediators of the Relation between Emotion Regulation and Academic Success

	Outcome	β	R^2	R^2 Change	F Change
	Academic Success in the Classroom (n =197)				
Step 1.	Full Scale IQ (L)	.34***	.22	.22	54.08***
Step 2.	Behavior Problems (P)	-.07	.38	.16	24.71***
	Quality of the Student–Teacher Relationship (T)	.35***			
Step 3.	Emotion Regulation (P)	.19**	.41	.03	10.30**
	Standardized Math Achievement (n = 75)				
Step 1.	Full Scale IQ (L)	.54***	.32	.32	35.13***
Step 2.	Behavior Problems (P)	.06	.36	.04	2.08
	Quality of the Student–Teacher Relationship (T)	.20*			
Step 3.	Emotion Regulation (P)	.18+	.39	.03	3.40+
	Standardized Early Literacy Scores (n = 75)				
Step 1.	Full Scale IQ (L)	.36**	.17	.17	15.06***
Step 2.	Behavior Problems (P)	-.10	.27	.10	4.90*
	Quality of the Student–Teacher Relationship (T)	.24*			
Step 3.	Emotion Regulation (P)	.18+	.30	.03	2.94+

(P) = parent report; (T) = teacher report; (L) = laboratory measure

+
p<.092

*
p <.05

**
p<.01

***
p<.001.