Regulatory Contributors to Children's Kindergarten Achievement

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Abstract:

The present study sought to examine whether preschool children's emotion regulation, problem behaviors, and kindergarten behavioral self-regulation in the classroom were predictors of kindergarten achievement scores. The children (N = 122, 47% male and 63% European American) who were participating in an ongoing longitudinal study, were seen at both a preschool and kindergarten assessment. The present study examined the relation between parent report, teacher report, and laboratory measures of regulation and children's achievement test scores. Children's emotion regulation and behavioral self-regulation in the classroom were related to all measures of achievement. The relation between preschool emotion regulation and kindergarten achievement was mediated by behavioral self-regulation in the kindergarten classroom. In addition, all measures of regulation were correlated, suggesting that some children who have difficulty regulating their behavior in one setting (such as home) may also have difficulty with regulation in other settings (such as school).

Article:

Regulatory Contributors to Children's Kindergarten Achievement

Previous research has found that children's academic performance remains on an extremely stable trajectory after the first grade (e.g., Entwisle & Hayduck, 1988). Several factors that consistently predict achievement are relatively stable and beyond the child's control, such as socioeconomic status and IQ. Although identifying these predictors is important, it is also important to understand the characteristics of the child that lead to success in the first years of schooling. For example, little research has examined whether regulatory processes predict academic achievement in young children (Blair, 2002). These processes have been implicated in adjustment in other domains of child functioning (Calkins & Fox, in press; Eisenberg & Fabes, 1992; Eisenberg et al., 1997) and may play a role in academic adjustment as well.

Although, previous research has found a strong link between motivation and older children's achievement (Pintrich & Schunk, 1996), recent research has suggested that younger children's motivation is at best a weak predictor of achievement. This is most likely due to the fact that most preschoolers and kindergartners tend to be highly motivated and optimistic about school (Stipek & Ryan, 1997). Therefore, researchers must look to other processes to understand individual differences in young children's achievement. One such factor may be the child's regulatory ability. At least two regulatory processes may play a role in early academic

achievement: emotion regulation and behavioral self-regulation. Regulatory processes have recently been postulated to play a role in multiple dimensions of child functioning (Calkins & Fox, in press), but little has been done to examine these processes as they relate to young children's academic performance.

Behavioral self-regulation as a predictor of achievement

Although a large body of research has examined predictors of older children's achievement, only recently have researchers begun to examine the relation between behavioral self-regulation and academic achievement (Bronson, 2000). Paris and Newman (1990) define self-regulation as involving planfulness, control, reflection, competence, and independence. Self-regulation has also been defined as self-directedness and performance-control before, during, and after a task activity (Zimmerman, 1998). Borkowski and Thorpe (1994) have argued that underachievers are not self-regulated; specifically, they are not as skilled at using strategies and being planful and reflective to achieve intended outcomes, and therefore show poorer scholastic mastery behaviors and lower levels of achievement.

Much of the research on behavioral self-regulation as a predictor of achievement has focused on the self-regulatory strategies of secondary and college students (Schunk & Zimmerman, 1994). For these students, behavioral self-regulation involves goal setting, planning, self-monitoring, and asking for help when needed (Meichenbaum, 1984; Pressley, Woloshyn, Lysynchuk, Martin, Wood, & Willoughby, 1990; Zimmerman & Schunk, 1989). Although behavioral self-regulation is clearly related to achievement in older school-age children, only a few studies have examined its role in early academic success (Martin, Drew, Gaddis, & Moseley, 1988; Normandeau & Guay, 1998; Schoen & Nagle, 1994). Martin and colleagues found that several aspects of behavioral self-regulation including approach/ withdrawal, distractibility, and persistence were related to early elementary school children's achievement scores. Additionally, Howse, Lange, Farran, and Boyles (in press) found that both teacher ratings of children's behavioral self-regulation and children's performance on a behavioral self-regulation task predicted the achievement test scores of economically disadvantaged young elementary school students. Children's behavioral self-regulation also predicted their gains in achievement test scores from kindergarten to first grade and from second to third grade.

Results from these few studies suggest that the role behavioral self-regulation plays in young children's academic success needs to be explored further. Because Entwisle and colleagues have found that achievement trajectories are often very stable by first grade (e.g., Entwisle & Hayduk, 1988), it is imperative that we gain a greater understanding of the relation between behavioral self-regulation and academic achievement in the first years of school. The first goal of the present study was to examine whether teacher ratings of children's behavioral self-regulation were related to children's kindergarten achievement scores.

Emotion regulation as a predictor of achievement

It is possible that in addition to behavioral self-regulation in the classroom, emotion regulation may also be related to academic achievement. Kuhl and Kraska (1993) argue that children's school performance is influenced not only by behavioral self-regulation, but also by other areas of control or regulation, including emotion regulation. Emotion regulation refers to efforts on the part of the individual to manage, modulate, inhibit, and enhance emotions (Cicchetti, Ganiban, & Barnett, 1991; Kopp, 1982, 1989; Thompson, 1994). Emotion regulation processes have been

found to be related to multiple dimensions of child functioning (Calkins & Fox, in press; Eisenberg & Fabes, 1992; Eisenberg et al., 1997), but a connection between emotion regulation and achievement has not been examined.

The few studies that have examined emotion-achievement relations with young children have explored the link between emotional intensity, not the regulation of emotion and found mixed results (Martin, et al., 1988; Martin, Nagle, & Paget, 1983; Newman, Noel, Chen, & Matsopoulos, 1998; Schoen & Nagle, 1994). Martin et al. (1988) found positive correlations between children's kindergarten emotional intensity and both first-grade reading scores and first-grade teacher assigned grades. Although results from other studies found correlations between emotional intensity and achievement (Martin et al., 1983; Newman et al., 1998; Schoen & Nagel, 1994), emotional intensity did not account for variance above and beyond other temperament variables, such as persistence, adaptability, and approach/withdrawal. Due to the mixed results from studies examining whether there are connections between children's emotional intensity and their academic achievement, further studies need to be conducted to explore the emotion-achievement connection. Because recent research has revealed a connection between emotion regulation and other areas of child functioning (Calkins & Fox, in press; Eisenberg & Fabes, 1992; Eisenberg et al., 1997), it is possible that children's emotion regulation may predict academic achievement as well. Emotion regulation should play a role in academic performance because children who become easily frustrated or angry in the classroom should have difficulty learning. Moreover, children who are skilled at maintaining a positive mood should be more capable of completing difficult school-related tasks (Kuhl and Kraska; 1989). A second goal of the present study was explore whether young children's emotion regulation was related to their academic achievement.

The relation between behavioral self-regulation and emotion regulation

In addition to differing on the narrowness of the construct, researchers have examined self-regulation in different domains, such as social, emotional, behavioral, physiological and cognitive (see Bronson, 2000 for a review). Researchers have focused on the development of self-regulation in these domains (e.g., Shields & Cicchetti, 1998; Eisenberg et al., 1997; Porges, Doussard-Roosevelt, Portales & Greenspan; 1996; Schunk & Zimmerman, 1994) but have examined those domains separately. It is of interest to explore whether children tend to exhibit a consistent degree of regulation or whether children may be well-regulated in one area (such as emotion), but have difficulty with regulation in another area (such as behavior). Blair (2002) argues that several areas of regulation are interrelated, including, but not limited to, emotional and behavioral regulation. A third goal of the present study was to examine whether emotion regulation and behavioral self-regulation were related in a sample of young children.

Behavioral regulation as a mediator of the relation between emotion regulation and achievement

Developmentally, one might expect emotion regulation processes that emerge during the preschool period to influence children's behavioral regulation in the classroom, and in turn affect children's school performance. Blair (2002) argues that different areas of regulation are interconnected and the development of several areas of self-regulation are affected by emotional maturity. Although there is some evidence of a direct link between emotional intensity and achievement, Martin and colleagues (Martin et al., 1983; Newman et al., 1998; Schoen & Nagle, 1994), found that emotional intensity did not account for variance above and beyond other measures of behavioral regulation, such as activity level, distractibility, and persistence. These

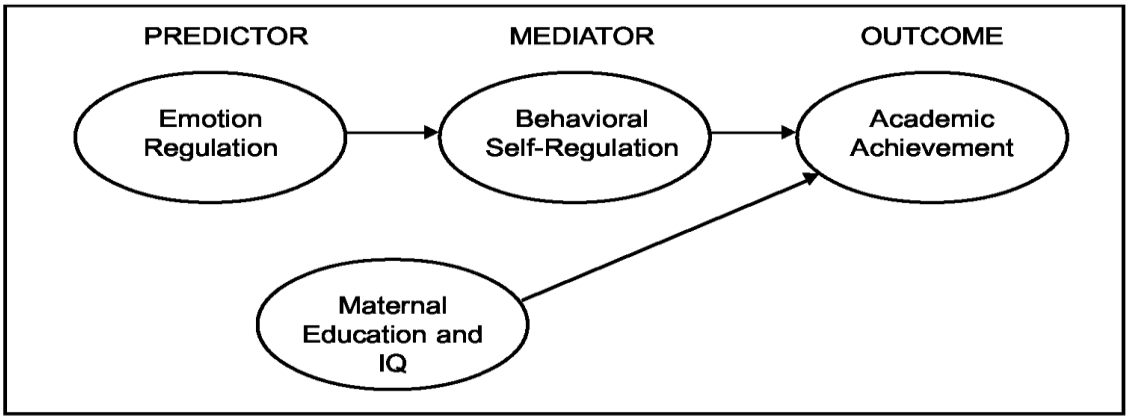
results suggest that behavioral self-regulation may mediate the relation between emotion regulation and achievement. Children who are better at maintaining a good mood, or dealing with frustration during the school day, should be more likely to stay on task, finish tasks, be planful, and focus attention on learning, all of which are aspects of behavioral self-regulation. If there is a direct link between children's regulation and achievement, a fourth goal of the present study was to explore whether the relation between children's emotion regulation and their achievement test scores was mediated by their level of, or capacity for, behavioral self-regulation.

Hypotheses

The primary goal of the present study was to test a model of the relations among regulation and achievement in young children (see Figure 1). Several specific questions were addressed in the present study. First, it was hypothesized that emotion regulation and behavioral self- regulation would be positively correlated in the present study based on the argument that different areas of regulation are interrelated, (e.g., Blair, 2002). The second and third questions addressed whether

Figure 1.

Model of the relation between regulation and achievement.



behavioral self-regulation and emotion regulation were directly related to kindergarten achievement test scores. Based on prior research, it was hypothesized that children who exhibited higher levels of regulation would also have higher achievement test scores. Because children begin to regulate emotions before they are expected to regulate behavior in a classroom setting, a fourth question addressed whether behavioral self-regulation may mediate the relation between emotion regulation and achievement. It was hypothesized that measures of behavioral self-regulation would serve as a mediator between emotion regulation and achievement test scores. To test for mediation, procedures recommended by Baron and Kenny (1986) were employed. Three regression equations were computed: first, regressing the mediator (behavioral self-regulation; COMPSCALE) onto the independent variable (Emotion Regulation; ER Checklist); second, regressing the dependent variable (achievement; WIAT) on the independent variable (Emotion Regulation; ER Checklist); and third; regressing the dependent variable (achievement; WIAT) on the both independent variable (Emotion Regulation; ER Checklist) and the mediator (behavioral self-regulation; COMPSCALE). In order to establish mediation, the

following conditions must be met: first, the independent variable must affect the mediator in the first equation; second, the independent variable must be shown to affect the dependent variable in the second equation; and third, the mediator must affect the dependent variable in the third equation. If these conditions all hold in the predicted direction, then the effect of the independent variable on the dependent variable must be less in the third equation than in the second. Perfect mediation holds if the independent variable has no effect when the mediator in controlled.

All relations between regulation and achievement were examined with IQ and maternal education held constant, based on previous research that both IQ and SES are consistently predictive of academic achievement (e.g., Alexander & Entwisle, 1988; Brody, 1992).

METHOD

Participants

Participants for this study were recruited as part of an ongoing longitudinal study that began when children were 2-years-old. One hundred fifty-four 2-year-old children and their mothers were initially recruited through child day care centers, the County Health Department, and the local Women, Infants, and Children program. Children were initially selected on the basis of their scores on the Child Behavior Checklist 2-3 (CBCL 2-3; Achenbach, Edelbrock, & Howell, 1987) and comprised three groups: 1) children with externalizing scores on the CBCL in the clinical or borderline clinical range, with T-scores of 60 or above, (n = 46); 2) children with both externalizing and internalizing scores on the CBCL in the clinical or borderline clinical range (n = 24); and 3) children with CBCL T-scores below 60 on both internalizing and externalizing scales (n = 84). This sample of 2-year-olds was racially and economically diverse (65 % European American, mean Hollingshead score = 39.2), and consisted of 78 male and 76 female children. In addition, the three groups did not differ from one another on any of these sociodemographic measures.

Two years after the original assessment, the families were contacted by mail and telephone and asked to participate in a follow-up study of the children at preschool, kindergarten, and first grade. Of the original 154 mother-child dyads, twelve families moved from the county of recruitment, eight families refused to continue in the study and nine families could not be located. One hundred and twenty five families agreed to participate in the follow-up phase of the study. More families with boys as the target child discontinued participation in the study; however, there were no differences in race, SES, and CBCL externalizing, internalizing, or total scores between the subjects who continued participating in the study and those who did not, nor between the boys who discontinued participation and those who did not. Three children were dropped from the study at the preschool assessment because they had already entered kindergarten. Children retained in the sample were 4.5 years old (mean age = 56 months; SD = 2.9 months) at the time of the preschool assessment; 47% of the children were male and 53% were female. Thirty-seven percent of the participants were African-American, and 63% were European-American. Socioeconomic status of the participants again ranged from lower to upper-middle class.

For the present study, data were collected during one preschool (4.5-year-old) assessment and three kindergarten assessments in the Spring of or Summer following the kindergarten year. Data collected from the preschool assessment and kindergarten assessments are described below.

Because data were collected at several different assessments, the sample size varies; therefore specific sample sizes are reported in Table 1.

Overview of Design and Procedure

Data were collected at preschool and kindergarten. Mothers were contacted by telephone and a laboratory assessment that lasted approximately 2 hours was scheduled. Information about children's emotion regulation and parent ratings of emotion regulation were collected during the preschool assessment in the laboratory. These measures are described below. Approximately one year after the preschool assessment, when the children were in kindergarten, mothers and children came back to the laboratory for an IQ assessment. Mothers completed questionnaires in one room while children were administered an IQ test in a separate room. At a third visit in the Spring of or Summer after the kindergarten year, mothers were contacted about bringing in the children for a 45-minute achievement assessment. At this assessment, children were administered an individual academic achievement test while their parents waited in a nearby waiting room. Also towards the end of the kindergarten year, kindergarten teachers were contacted and asked to complete questionnaires on the children. The present study included teacher ratings of the children's behavioral self-regulation in the classroom.

Preschool Assessments and Measures

Emotion Regulation (Frustration). Children were observed in a laboratory procedure designed to elicit emotion regulation. The laboratory assessment of emotion regulation consisted of two age-appropriate tasks developed by Goldsmith and Riley (1993) designed to evoke anger/frustration in children.

Attractive Toy in a Transparent Box: The child was able to see an object of desire (in this case a toy) through a clear plastic box but was unable to attain it because the box was locked with a padlock and the keys the child was given would not open it. The experimenter entered the experiment room and showed the child the two sets of toys and said, " Which toys do you like best?" After the choice was made, the experimenter put the unwanted toys on her lap out of view and said, "OK, here's how you play the game. I'm going to put the _____(desired toys) in this box (while in the act of doing so), and then I'm going to put this lock on it. You can use these keys to open the lock and when you do, you can play with the (desired toys), OK?" The child was given a large ring of keys (none of which was the correct key). The experimenter then made sure the child could open the lock by letting the child open a separate lock and key. If the child had difficulty, the experimenter made sure that they child knew how to work the lock and key before she left the room. The child was left alone to work with the box and the ring of incorrect keys for four minutes. The experimenter then returned with the correct key and explained that " I guess I gave you the wrong keys. Let's try this one." The box was then opened and the child was encouraged to play for one minute with the toys that were inside.

Impossibly Perfect Circles: The child was given a piece of paper and green pen and was instructed to draw a perfect green circle. Each circle drawn by the child was critiqued in a neutral voice and the child was asked to draw another one. The task was terminated after 3.5 minutes. The child was then given positive feedback on the last circle and asked to turn it into a smiley face.

Frustration Measure. Three emotional reactivity variables were coded for both the *Attractive Toy in a Transparent Box* and the *Impossibly Perfect Circles*. Latency to frustration was measured as number of seconds until the child expressed the first visible sign of frustration. If the child did not express any visible frustration during the task, the latency score equaled the total duration of the task. *Duration of frustration* was measured as the total duration, in seconds, of visible frustration, including verbal and/or physical signs of frustration. *Intensity of frustration* was assessed by measuring the intensity of facial, verbal and bodily signs of anger on an interval rating scale ranging from 0 (*no visible signs of frustration*) to 4 (*highly intense, sustained demonstrations of frustration*).

Reliability. Two trained individuals completed the coding who were blind to the children's CBCL scores. To assess reliability, 15% of the videotapes were also coded by the study coordinator. Reliability for latency and duration scores was computed as the percent of episodes in which ratings were within 2 seconds of each other. Reliabilities for the coded latency to frustration scores were within 2 seconds difference in 86% of the judgements. Duration of frustration codes were reliable within 2 seconds difference for 86% of the judgements. Reliability of frustration intensity was computed using Cohen's kappa and percent agreement and was found to be adequate for both tasks (Toy task, Cohen's kappa = .74, percent agreement = .82; Circle task, Cohen's kappa = .88, percent agreement = .93).

Three emotional reactivity variables were coded for each of the two frustration tasks in the study: latency to frustration, duration of frustration, and intensity of frustration. To reduce these variables into a single construct, a principal components analysis with a varimax rotation was conducted. Separate analyses were done for each task (Toy and Circle). For each analysis, a single factor emerged, explaining 85% of the variance for the Circle task and 74% of the variance in the Toy task. In the Circle task, high loadings were achieved for all three variables entered. In the Toy task, high loadings were achieved for the duration and intensity of frustration, and moderate loadings were obtained for latency to frustration. Latency loaded negatively on each factor, which was expected given that shorter latency to frustrate is associated with greater intensity and duration of frustration. Emotional reactivity factor scores for the Toy and Circle tasks were significantly positively correlated, $r(122) = .34$, $p < .001$. Thus, a composite frustration score was created by averaging the factor scores for each task.

Emotion Regulation. During this preschool assessment, parents completed the Emotion Regulation Checklist (ER Checklist; Shields & Cicchetti, 1998). The Emotion Regulation Checklist (Shields & Cicchetti, 1998) is a 24-item questionnaire that was administered to parents and teachers to assess children's emotion regulation. Two subscales were created, a *Negativity/Lability* scale that contained 10 items (Cronbach's Alpha = .77) and an *Emotion Regulation* scale that contained 14 items (Cronbach's Alpha = .68). The two factors were correlated -.50. The *Negativity/Lability* scale represents negative affect and mood lability. The *Emotion Regulation* scale represents displaying appropriate affect, empathy, and emotional self-awareness.

Kindergarten Assessments and Measures

Intelligence. Mothers and children returned to the laboratory for the first kindergarten assessment when the children were 5 and a half. Mothers completed questionnaires while the

children were administered an IQ test in the next room. The Wechsler Preschool and Primary Scale of Intelligence – Revised (WPPSI-R; Wechsler, 1989) was administered to the children during the 5.5-year assessment to assess intelligence. The Full Scale IQ standard score from the WPPSI was used as the measure of intelligence in the present study.

During a second assessment at the Spring of or Summer following the kindergarten year, mothers brought the children in and five subtests from the Wechsler Individual Achievement Test (WIAT; Wechsler, 1992) were administered to assess early academic achievement. Children were administered the following subtests by a trained examiner: basic reading, mathematical reasoning, spelling, numerical operations, and listening comprehension.

The standard scores from the basic reading and spelling subtests were correlated, $r = .80$, $p < .001$, therefore they were combined to obtain an overall early literacy score. Although basic reading and spelling are not usually combined in this way, at this young age they appear to be measuring the same area. The basic reading subtest measures whether children can recognize letter sounds and small words out of context. The spelling subtest measures whether children can write letters and small words. A standard score was calculated for the math composite which combines both mathematical reasoning and numerical operations. The standard score for listening comprehension was also used in the analyses. The listening comprehension subtest involves reading a passage to the children and then asking them to remember a few details from the passage. These start with a couple of sentences and increase in difficulty. The listening comprehension subtest measures children's ability to sustain attention and recall details. Because these behaviors may be related to regulation it was of interest to include this subtest with the traditional measures of reading and math.

Behavioral Self-Regulation. Teachers were contacted in the Spring of the kindergarten year and asked to complete questionnaires on the children. Teacher ratings of behavioral self-regulation consisted of eight items from the COMPSCALE (Instrumental Competence Scale for Children; Adler & Lange, 1997). The COMPSCALE is an 18-item rating scale that assesses children's motivation and behavioral self-regulation in home and classroom settings.

Initial test-retest reliability was assessed on the overall measure by collecting teacher responses over a six-week interval (Adler & Lange, 1997). Teacher responses were correlated from time 1 to time 2, $r =.86$, $p < .001$. Correlations between the COMPSCALE and children's end-of-the-year achievement scores suggested good predictive validity of the measure, $r = .61$, $p < .001$. The COMPSCALE was administered to teachers during the Spring of the kindergarten year. Teachers rated children on the following 8 items on a 4- point Likert scale: "is impulsive and careless in tasks and activities," "has difficulty planning and carrying out activities that have several steps (reverse)," "finishes tasks and activities," "concentrates well and is not easily distractible when doing a task," "actively uses resources for help and information," "is not a self-starter (reverse)," "does not readily ask questions (reverse)," and "likes to do challenging tasks." The previous 8 items were included because they loaded highly on a dimension of self-regulation in the original development of the questionnaire and with the present sample. Cronbach's alpha for the eight items was .89. The mean teacher rating across the eight items was used a predictor in this study. Scores could range from 1 to 4, with 4 reflecting the greatest regulation and 1 the least.

RESULTS

Preliminary Analyses

A description of the means, standard deviations, ranges and sample sizes for all measures are included in Table 1.

Preliminary analyses were conducted to examine the relation between maternal education, gender, and age and the outcome measures examined in the present study. Maternal education was used as a measure of socioeconomic status. As might be expected, maternal education was significantly correlated with child IQ, $r = .3\ 8$, $p < .001$, with literacy achievement, $r = .22$, $p = .04$, and with listening comprehension, $r = .32$, $p = .002$. The relation between maternal education and math achievement was marginally significant, $r = .19$, $p = .07$. A oneway ANOVA was conducted to examine gender differences. There were no gender differences on IQ or on any

Table 1.

Descriptive Statistics for All Measures

Preschool Measures	Mean	*SD*	Min	Max	*N*
Emotion Regulation					
ER Checklist Regulation Factor (P)	1.30	.33	1.30	2.95	119
ER Checklist Negativity Factor (P)	2.55	.39	1.43	5.29	119
Child Frustration (L)	.00	.82	-1.57	2.09	122
Kindergarten Measures					
Behavioral Self-Regulation					
Kindergarten Behavioral Self-Regulation (COMPSCALE) (T)	2.91	.64	1.25	4.00	86
Achievement					
Literacy Composite (L)	109.32	12.05	87	145	92
Math Composite (L)	104.59	9.87	78	129	92
Listening Comprehension (L)	102.07	12.58	81	133	89
IQ					
WPPSI (L)	103.56	14.08	76	135	101

(P) = Parent Report; (T) = Teacher Report; (L) = Laboratory Observation or Assessment

of the achievement measures. Standard scores were calculated for the IQ and achievement measures, accounting for age.

Correlations Between IQ and Achievement Measures. Table 2 contains correlations between achievement measures and IQ. All cognitive measures were significantly related.

Table 2.

Correlations Among Kindergarten Achievement/Ability Measures

	Literacy	Math	Listening Comprehension	IQ
Literacy (L)		.64**	.40**	.45**
Math (L)			.44**	.60**
Listening Comprehension (L)				.53**
IQ (L)				

(P) = Parent Report; (T) = Teacher Report; (L) = Laboratory Observation or Assessment

+*p* < .10; **p* < .05; ***p* < .01

Hypothesis Testing

Correlations Among Regulation Measures. To address the first research question, whether there were relations among indices of children's regulatory measures, Pearson Product Moment Correlations were computed (see Table 3).

Table 3.

Correlations Among Socioemotional and Behavioral Measures

	Preschool ER Checklist Negativity	Preschool ER Checklist Regulation	Preschool Child Frustration	Kindergarten Behavioral Self-Regulation
Preschool ER Checklist Negativity (P)		-.50*	.26**	-.24*
Preschool ER Checklist Regulation (P)			-.27**	.37**
Preschool Child Frustration (L)				-.28*
Kindergarten Behavioral Self-Regulation (COMPSCALE) (T)				

(P) = Parent Report; (T) = Teacher Report; (L) = Laboratory Observation or Assessment

+*p* < .10 *p* < .05 **p* < .01

These correlations suggest that children who have difficulty with emotion regulation are also exhibiting problems with regulation in the kindergarten classroom. In addition, children with lower scores on teacher ratings of behavioral self-regulation (COMPSCALE) had significantly

higher scores on parent ratings of children's negativity (ER Checklist), lower scores on parent ratings of children's emotion regulation (ER Checklist), and they displayed greater frustration in the lab. The measure of frustration in the lab was positively related to parent ratings of negativity and negatively related to parent ratings of regulation from the ER Checklist.

Correlations Between Regulation and Achievement. The second research question addressed whether there is a relation between behavioral self-regulation and achievement. To examine this relation, Pearson Product Moment Correlations were computed between teacher ratings of behavioral self-regulation (COMPSCALE) and the three achievement measures, literacy, math, and listening comprehension (See Table 4). As predicted, children exhibiting greater regulation in the classroom had higher achievement scores in literacy, math, and listening comprehension.

Table 4.

Correlations Between Behavior Measures and Kindergarten Cognitive Measures (Partial Correlations Controlling for IQ and Maternal Education are in Parentheses)

	Literacy (L)	Math (L)	Listening (L)	IQ (L)
Preschool ER Checklist Negativity (P)	-.22* (-.16)	-.27* (-.34*)	-.28* (-.27*)	-.11
Preschool ER Checklist Regulation (P)	.28** (.29*)	.40** (.29*)	.37** (.31*)	.16
Preschool Child Frustration (L)	-.09 (-.02)	-.08 (.02)	-.07 (00)	-.20*
Kindergarten Behavioral Self-Regulation (COMPSCALE) (T)	.49** (.36*)	.46** (.30*)	.32** (.19)	.43*

(P) = Parent Report; (T) = Teacher Report; (L) = Laboratory Observation or Assessment

+$p < .10$ *$p < .05$ **$p < .01$

To address the third research question, Pearson Product Moment Correlations were also employed to examine the relation between emotion regulation and achievement (See Table 4). Both parent ratings of children's negativity (ER Checklist) and emotion regulation (ER Checklist) were related to children's literacy, math, and listening comprehension scores. Similar to findings with classroom measures of behavioral self-regulation (COMPSCALE), children higher in emotion regulation skills (ER Checklist) had higher achievement scores in literacy, math, and listening comprehension. The children's emotion regulation in the lab was not significantly correlated with any of the achievement measures. Because this was inconsistent with the parent ratings of frustration and our predictions, correlations were computed examining the relation between the item from the Emotion Regulation Checklist that measures frustration ("Is easily frustrated") and the achievement measures. The parent ratings of the frustration item were related to Literacy, $r = -.22$, $p = .04$, math, $r = -.22$, $p = .04$, and listening comprehension, $r = -.28$, $p = .01$.

Partial Correlations Between Regulation and Achievement Measures. Because both maternal education and IQ were related to the achievement measures, it was necessary to examine the relation between regulation and the achievement measures with IQ and maternal education held constant. To examine this, partial correlations were computed controlling for IQ and maternal education. These correlations are presented in Table 4. The partial correlations and regression analyses were computed only for the sample of children that had complete data (N = 61). T-tests were computed to examine whether the children who were included in these analyses differed in any way from the children who did not have complete
data on all of the variables and were not included in the final analyses. There were no differences on any measures between the two groups of children.

Parent ratings of negativity (ER Checklist) were related to children's math and listening comprehension scores, but not to literacy achievement scores. Parent ratings of emotion regulation (ER Checklist) were related to all three achievement test scores. Teacher ratings of children's behavioral self-regulation (COMPSCALE) were related to children's literacy and math scores, but not to listening comprehension. Similar to zero-order correlations, none of the achievement measures were related to children's frustration in the lab.

Predictors of achievement. The fourth question and primary goal of the study was to determine whether kindergarten behavioral regulation (COMPSCALE) mediated the relation between emotion regulation and achievement. Mediation was examined based on procedures suggested by Baron and Kenny (1986). Hierarchical regression analyses were conducted to test this mediational model (See Table 5).

Because Maternal Education and IQ were correlated with achievement scores, these variables were entered first in the equations when achievement was the dependent variable. Frustration in the lab was not related to any of the achievement measures; therefore, it was not entered into the regression equations. To establish mediation, first the independent variable (parent ratings of emotion regulation; ER Checklist) must be related to the mediator (behavioral self-regulation; COMPSCALE). The first regression equation revealed that emotion regulation and behavioral self-regulation are related, $r = .41$, $p = .001$. Because the independent variable was related to the mediator, two regression equations were computed to examine mediation for each area of achievement.

To test the mediational model for Literacy Achievement, two hierarchical regression equations were computed (see Table 5). First, the independent variable (emotion regulation; ER Checklist) must be significantly related to the dependent variable (achievement; WIAT). Secondly, the mediator (behavioral self-regulation; COMPSCALE) must be significantly related to the dependent variable (achievement; WIAT). Finally, the association between the independent variable and dependent variable must be stronger when the mediator was not included in the model. Results from the first regression equation revealed that there was a relation between emotion regulation and literacy achievement with Maternal Education and IQ held constant.

Table 5.

Regression Analyses Predicting Kindergarten Achievement Scores (N = 61)

PREDICTORS OF LITERACY	β	R^2	R^2 change	F change
Regression Examining Emotion Regulation as a Predictor of Literacy Achievement:				
Kindergarten IQ	.29	.13	.13	8.59**
Maternal Education	.06	.13	.00	ns
Preschool E R Checklist Emotion Regulation	.23	.18	.05	3.38+
Regression Examining Behavioral Regulation as a Mediator				
Kindergarten IQ	.19	.13	.13	8.59*
Maternal Education	.01	.13	.00	ns
Kindergarten Behavioral Self-Regulation	.40	.29	.16	12.59**
Preschool E R Checklist Emotion Regulation	.09	.30	.01	ns
PREDICTORS OF MATH	β	R^2	R^2 change	F change
Regression Examining Emotion Regulation as a Predictor of Math Achievement:				
Kindergarten IQ	.53	.28	.28	22.91**
Maternal Education	-.09	.28	.00	ns
Preschool ER Checklist Emotion Regulation	.22	.33	.05	4.05*
Regression Examining Behavioral Regulation as a Mediator				
Kindergarten IQ	.48	.28	.28	22.19**
Maternal Education	-.13	.28	.00	ns
Kindergarten Behavioral Self-Regulation	.21	.34	.06	5.11**
Preschool ER Checklist Emotion Regulation	.15	.36	.02	ns
PREDICTORS OF LISTENING COMPREHENSION	β	R^2	R^2 change	F change
Regression Examining Emotion Regulation as a Predictor of Listening Comprehension:				
Kindergarten IQ	.34	.23	.23	17.62**
Maternal Education	.22	.28	.05	4.21*
Preschool ER Checklist Emotion Regulation	.23	.33	.05	4.21*
Regression Examining Behavioral Regulation as a Mediator				
Kindergarten IQ	.32	.23	.23	17.62**
Maternal Education	.21	.28	.05	4.21*
Kindergarten Behavioral Self-Regulation	.11	.31	.03	ns
Preschool ER Checklist Emotion Regulation	.19	.34	.03	ns

+p < .10 *p < .05 **p < .01

Behavioral self-regulation (COMPSCALE) also predicted literacy achievement scores with Maternal Education and IQ already in the equation. When emotion regulation (ER Checklist) was entered last, it no longer predicted literacy achievement scores. Therefore, as predicted, behavioral self-regulation mediated the relation between emotion regulation and literacy achievement. Similar results were found with math achievement scores (see Table 5). The regression analysis predicting listening comprehension revealed that emotion regulation did predict listening comprehension, however, when behavioral self- regulation was entered previously, neither measure of regulation predicted listening comprehension (see Table 5).

DISSCUSSION

The primary goal of this study was to examine the regulatory processes that predict kindergarten achievement. First, the question of whether two areas of regulation would be related was addressed. Second, the present study sought to reexamine preliminary evidence that behavioral self-regulation predicts achievement in young children, even when IQ and Maternal Education are held constant. Because of preliminary evidence for a connection between behavioral self-regulation and achievement, it was of interest whether there might also be a direct relation between preschool emotion regulation and kindergarten academic achievement. Because results of the present study revealed such a connection, the question of whether behavioral self-regulation mediated the emotion regulation–achievement connection was examined.

As expected, results from the present study revealed more evidence that behavioral self-regulation in the classroom is related to achievement, even for very young children. Moreover, this relation is robust even when IQ and Maternal Education are held constant. Although it has been well established that children who are highly motivated do better in school (Pintrich & Schunk, 1996), the present study helps to isolate the specific behaviors that lead these students to academic success. Additional research should be conducted to examine whether aspects of the classroom environment can encourage behavioral self- regulation in young children. Specifically, it may be of interest to examine whether there is a connection between teachers who encourage children to regulate their own behavior, and the academic success of their students. The present study only finds a connection between these behaviors and achievement, but does not examine if children can be taught to become more self-regulated.

Although behavioral self-regulation may be directly implicated in academic achievement, other dimensions of regulation and behavior may be important as well. Results from the present study provide evidence that parents' perceptions of preschool children's emotion regulation are directly related to the children's kindergarten achievement scores. However, this relation is mediated by children's behavioral self-regulation in the classroom, for both literacy and math. Therefore, preschoolers who have difficulty regulating their emotions may become kindergartners who have difficulty regulating their learning in the classroom, which ultimately could lead to difficulties in academic achievement. Perhaps children who have limited strategies for managing frustration or other negative emotions also have difficulty regulating learning behaviors in the classroom. For example, it is possible that children who are easily frustrated or often in a negative mood and have difficulty effectively dealing with these emotions, may also have trouble concentrating on school work or planning and finishing tasks.

The finding that the relation between emotion regulation and achievement is mediated by behavioral self-regulation in the classroom may explain why previous research that has examined the relation between emotion and achievement has found mixed results. Emotion regulation should affect children's ability to regulate their own learning. Children who have difficulty with frustration or maintaining a good mood may also have difficulty focusing their attention, planning and finishing tasks, and regulating other achievement related behaviors. Interestingly, both measures of regulation predicted listening comprehension. This subtest may be more sensitive to the specific types of regulation measured by the Emotion Regulation Checklist. The children's scores on the listening comprehension subtest may be affected by behavioral self-regulation, such as an ability to focus attention and finish tasks, but also directly affected by children's ability to maintain a positive mood and regulate their frustration. This may be because this subtest is longer and may be more effortful. The results from all three areas of achievement suggest that young children who show early signs of difficulty with emotion regulation may be at-risk for academic achievement problems as early as school entry.

Although parent ratings of children's emotion regulation were related to their academic achievement scores, children's frustration in the laboratory was not. This may be due to the fact that the laboratory task measured children's reactivity to a frustrating situation. The parent ratings of emotion regulation were a more global measure of children's emotion regulation. The children's frustration in the lab was moderately correlated with parent ratings of emotion regulation, suggesting that this tendency to become frustrated was only one aspect of regulation that parents were reporting. The fact that parent ratings predicted achievement and the lab measure did not, may be due to the fact that the lab measure only examined how the child dealt with one type of potentially frustrating situation. It may be that some children who did not react negatively to the lab task are frustrated by other types of challenging tasks. Their parents have had the opportunity to observe their behavior in many different situations, and are more likely to realize their typical level of frustration in many different potentially frustrating situations. Indeed, parent ratings on the one item from the Emotion Regulation Checklist that measures frustration were related to all types of achievement.

Perhaps one of the most important findings from the data presented here is that there appears to be a relation between several different types of regulation. The results of the present study are consistent with the argument that emotion regulation and behavioral self- regulation are related, and that some children who have difficulty at home with regulation have difficulty in both a lab task and the school environment as well. Blair (2002) offers several explanations as to why children with deficits in emotion regulation are at risk for problems with school performance. When children are making an effort to regulate emotion they are not able to simultaneously engage in effortful behavioral and cognitive self-regulation, such as planning and problem-solving. Children who have difficulty with regulating emotion may also have a tendency to withdraw in response to anxious situations and this interferes with their ability to engage in learning in the classroom. In addition, children who tend to become easily frustrated or have difficulty regulating emotion have had less practice than other children with other regulatory behaviors like planning and problem-solving, and these skills are under-used and underdeveloped (Blair, 2002). Future research should continue to examine the role that regulation plays in school performance. One caveat of the present study is that it only examined

academic achievement in the form of an individual achievement test. It would be of interest to examine how regulation is related to other areas of school performance, such as grades and levels of productivity.

Future research on self-regulation in children and adults should examine whether regulation is indeed a global characteristic that is likely to be consistent across domains or whether it may be domain specific in certain situations. In addition, it would be of interest to examine if the development of emotion regulation precedes the development of these self-regulated learning behaviors or if they are similar dimensions and develop simultaneously. Research with infants has found that there are individual differences in physiological regulation at a very young age (Porges et al., 1996). In addition, differences in emotion regulation also appear to be present very early (e.g., Kopp, 1989). Parents of toddlers begin to make demands that their children regulate emotions in social and home situations. In addition, many very young children are in child-care centers where there are clear demands for emotional maturity. Although children are expected to regulate emotions very early, the type of behaviors that are expected in the classroom may develop later. Again, these new regulatory skills may be due to the new demands presented by the school environment. When children enter school and there is a greater focus on achievement, the need to regulate one's own learning becomes imperative. The results of the present study suggest that both emotion regulation and behavioral self-regulation are important for school success, but some children who have difficulty regulating emotion become children who have difficulty regulating their classroom behavior, and their academic achievement is affected. The evidence is mounting that there are clear individual differences in the regulatory skills of young children, and these differences are related to their academic success in school.

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