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Examining the link between preschool social–emotional competence and first grade academic achievement: The role of attention skills

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ABSTRACT

Recently, research has begun to identify cognitive and social–emotional predictors of early academic success. Yet few studies have examined the mechanisms by which children's social–emotional skills are associated with later academic success. The present study examines the associations between preschool emotion knowledge, kindergarten attention skills, and first grade academic competence in a sample of mostly disadvantaged children. Results indicate that attention during kindergarten is a significant mediator of this association, even after accounting for the effects of maternal education, family income, and children's age, sex, and receptive vocabulary skills. The findings provide further support for the implementation of preventive curricula that focus on both social and emotional development as well as attentional development as one strategy for improving future academic success in young children.

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There has been a dramatic increase in research surrounding factors that influence children's school readiness. As children's academic trajectories during their first few years in school significantly impact later outcomes (Snow, Burns, & Griffin, 1999), policy makers and school administrators alike are interested in how to promote children's early academic competence. Thus, it is important to identify modifiable precursors to academic success and their mediating mechanisms.

Recently, the integration of emotional and cognitive processes has become central to conceptualizations of social and academic success in the early elementary school classroom (Izard, 1991, 2009; Thompson & Raikes, 2007). Blair (2002) has described the interrelation of emotional competence and cognitive competence as central to understanding children's functioning at school entry. Given this increased theoretical focus on the joint contribution of emotion and cognitive skills, this longitudinal study examines how early emotion skills (i.e., emotion knowledge) and cognitive skills (i.e., attention) interact to influence early academic achievement.

1. Emotion knowledge, attention skills, and academic success

Children's knowledge and understanding of emotion is an important aspect of social awareness which is one of several skills that reflect social–emotional competence (Collaborative for

Academic, Social, and Emotional Learning; CASEL, 2003). Basic receptive and expressive understanding of emotions is among the first skills to emerge during early childhood. The importance of these competencies for concurrent and longer term social and behavioral adjustment is well established (Denham et al., 2003; Garner, Jones, & Miner, 1994; Howse, Calkins, Anastopoulos, Keane, & Shelton, 2003; Izard et al., 2001; Miller et al., 2005; Mostow, Izard, Fine, & Trentacosta, 2002; National Institute on Child Health and Human Development's Early Child Care Research Network, 2004; Schultz, Izard, Ackerman, & Youngstrom, 2001). In general, these studies provide support for associations between social–emotional competence, broadly defined, and academic success; however, less is known about the contributions of specific social–emotional and cognitive skills to early academic achievement. Here we focus on the role of two specific factors that impact early academic success: early emotion knowledge and early attentional skills. We first review previous research on each domain, and then their interrelations.

1.1. Emotion knowledge and academic competence

Children's knowledge and understanding of emotion is an important core of social awareness within broader social–emotional competence (CASEL, 2003). Basic receptive and expressive understanding of emotions is among the first social–emotional skills to emerge during early childhood. Young children become increasingly adept at labeling emotional expressions from two to four and a half years of age (Denham, 1998; Denham & Couchoud, 1990; Saarni, 1999). Children's accurate

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emotion labeling and understanding of typical responses to emotional situations has been associated with adaptive behavior within peer interactions (Denham, 1986; Miller et al., 2006). These emotionally competent children are rated as more prosocial by their teachers, and more liked by their peers (Arsenio, Cooperman, & Lover, 2000; Denham, 1986; Denham & Couchoud, 1991; Denham, McKinley, Couchoud, & Holt, 1990; Miller et al., 2005; Mostow et al., 2002; Smith, 2001). A meta-analytic synthesis of the literature finds relatively consistent moderate associations between emotion knowledge and social behavior (Trentacosta & Fine, 2010). Given this established association between emotion knowledge and prosocial behavior, it is likely that children with greater understanding of their own and others emotions may also have greater academic success within the socially complex context of elementary school classrooms (Zins, Bloodworth, Weissberg, & Walberg, 2004).

Emotion knowledge may represent an important early skill that fosters effective learning interactions, thereby promoting academic success; however few empirical studies have examined this specific association. In a sample of preschoolers, Garner and Waajid (2008) found that emotion situation knowledge was a concurrent predictor of concept knowledge and language competence, controlling for age, sex, and income level. In addition, Leerkes, Paradise, O'Brien, Calkins, and Lange (2008) examined the latent structure of emotion and cognitive processes in preschool children and found that emotion understanding was a unique, concurrent predictor of academic competence. Izard and colleagues report consistent longitudinal associations between early emotion knowledge and later academic competence in young children even after controlling for other important child factors such as age, verbal ability, and temperament (Izard et al., 2001; Trentacosta & Izard, 2007). These studies provide some evidence for the positive association between emotion knowledge and academic competencies; however several researchers have called for further research in this area (Denham, 2007; Garner & Waajid, 2008).

1.2. Attention skills and academic competence

Attention skills are also essential for social-emotional and academic competence (Blair, 2002). This includes the ability to maintain or sustain attention on a particular subject as well as the ability to shift attention from one subject to another. Studies of young children indicate that attention skills, in general, are positively related to both social-emotional competence and academic skills (Eisenberg et al., 1995; McClelland et al., 2007; Rothbart, Posner, & Kieras, 2006; Trentacosta & Izard, 2007; Trentacosta, Izard, Mostow, & Fine, 2006; Wilson, 2003). Considering the tasks required of children in an elementary school classroom (e.g., maintaining attention on repetitive and sometimes boring tasks), it is not surprising that research shows that children with attention disorders are more likely to have language, reading, and math deficits (Faraone, Biederman, Weber, & Russell, 1998; Marshall, Hynd, Handwrk, & Hall, 1997). Also, more general attention problems have been negatively associated with academic achievement (Alexander, Entwisle, & Dauber, 1993; Hinshaw, 1992; Spira & Fischel, 2005). This research suggests that children with better attention skills are more likely to be able to attend to academic tasks and therefore more likely to benefit from these learning opportunities, thus increasing their overall academic success.

1.3. Emotion knowledge and attention skills

Few empirical studies have directly examined the association between early emotion knowledge and later attention skills, but differential emotions theory suggests that children with increased emotion knowledge may be better able to use positive emotions

(e.g., interest) in service of tasks that require attention and concentration (Izard, 1991, 2009). Wilson and Gottman (1996) describe attention as the “shuttle” between emotional and cognitive processes and they suggest that the effects of emotional processes on performance are mediated through attention and that attention is a prerequisite for the attainment of cognitive and social skills. Developmental research suggests that basic emotion skills, such as receptive and expressive knowledge, come online prior to more advanced cognitive processes, such as attentional flexibility and shifting, and therefore it seems appropriate to examine how earlier emotion knowledge may influence later attention skills (Blair, 2002).

In one study of primarily white, middle-class, rural children, Trentacosta et al. (2006) reported a positive association between emotion knowledge and teacher-rated attention skills across one school year, after accounting for age, sex, verbal ability, and attention skills at the beginning of the academic year. They reported similar findings in a sample of primarily minority, low-income, urban children where after controlling for age and verbal ability, they found a positive association between emotion skills (i.e., emotion knowledge and emotion regulation) during kindergarten and teacher-rated attention (e.g., ability to pay attention and stay on task) and academic competence (child-assessed and teacher-ratings) during first grade. In this study, teacher-rated attention mediated the relationship between emotion regulation and academic competence but it did not mediate the relationship between emotion knowledge and later academic competence (Trentacosta & Izard, 2007). Additional direct, child-assessed measures of each construct may provide further refinement of this developmental process by more accurately measuring the development of the children's skill levels as opposed to adult reports, which give a more general estimate of children's abilities.

Given the theoretical role of attention in emotional and cognitive processes, it is surprising that few studies have focused on attention as the mediating mechanism linking social-emotional and academic competence. Children with greater emotion knowledge skills are likely to be better able to identify and process emotional cues in their environment, thus facilitating positive social interactions and avoiding distracting, negative interactions. These positive interactions are likely to facilitate their ability to maintain attention to academic tasks. Children who can focus on the material presented by the teacher are more likely to benefit from instruction and attain greater academic skills.

Based on both past research findings and theories of the inter-related nature of emotion and cognition, we hypothesize that in the present study there will be a positive association between preschool emotion knowledge and kindergarten attention skills as well as a positive association between kindergarten attention skills and first grade academic competence. We further hypothesize that the association between preschool emotion knowledge and first grade academic competence will be mediated by kindergarten attention skills.

1.4. Other predictors of academic competence

Sociodemographic factors and children's verbal abilities are important to consider in the development of academic skills as well. Numerous studies have shown that young children living in poverty consistently lag behind their more affluent peers in a variety of school readiness skills, including emotional, behavioral, and academic competence (Brooks-Gunn & Duncan, 1997; Janus & Duku, 2007; McLoyd, 1998; Pungello, Kupersmidt, Burchinal, & Patterson, 1996). More general social and family background risks, including minority status and low maternal education, have also been linked to poor academic outcomes in children (Foster, Lambert, Abbott-Shim, McCarty, & Franze, 2005; Gutman, Sameroff, & Cole, 2003;

Ladd, Birch, & Buhs, 1999; Lee & Burkam, 2003). Another strong predictor of academic achievement is children's verbal abilities. Children who are better able to understand and express verbal concepts tend to outperform children with lower verbal abilities on a variety of academic-related tasks and achievement (Duncan et al., 2007; Kastner, May, & Hildman, 2001; Lonigan, 2006; McClelland, Frederick, & Holmes, 2000). Consistent with previous work examining the association between social-emotional skills and academic competence, the present study includes maternal education, family income, and children's race and verbal abilities as covariates in our statistical models.

2. The present study

We conduct the present study in the context of a larger evaluation study of a comprehensive public preschool program. Our goal is to examine the associations among emotion knowledge, attention skills, and academic competence. These outcomes were a subset of a broader battery of social, behavioral, and academic measures that were collected to determine the impact of the program. The district in which the preschool operates has formally adopted a universal, evidence-based, social-emotional program as part of its standard curriculum for preschool and elementary grades. Based on the prior research regarding the efficacy of the program (Domitrovich, Cortes, & Greenberg, 2007), we expected growth over time in the skills examined in this particular study.

Developmental research suggests that basic knowledge of emotions emerges during preschool and therefore this is an opportune time to investigate individual differences (Denham, 2007). As children move from the less structured preschool classroom to the more structured environment of the kindergarten classroom, there are increased demands placed on children's attention skills (Pianta & Rimm-Kaufman, 2006). By first grade children have accumulated a variety of academic skills which can be reliably assessed. For these reasons, preschool emotion knowledge, kindergarten attention skills and first grade academic competence will be the focus of the present investigation.

This study extends previous work in this area in a number of important ways. First, by examining these constructs over a two-year period from preschool to first grade, we are better able to make conclusions about the meditational process as it unfolds across time (Collins, Graham, & Flaherty, 1998; MacKinnon, Fairchild, & Fritz, 2007). Second, few studies have directly examined the importance of emotion knowledge in the prediction of academic success and therefore the present study improves our knowledge of this general association via a multi-method assessment of children's emotion identification and emotion situation knowledge skills in preschool. Third, rather than relying only on teacher ratings of attention skills, the present study uses two sources; interview-ratings and a child-based assessment to provide a more accurate multi-method assessment of attention. Finally, these relationships are examined with covariation of possible confounding variables including maternal education, family income level, and children's age, sex, race, and receptive vocabulary.

3. Method

3.1. Participants

The data for the present study come from an economically disadvantaged sample of children ($n=341$) in a public preschool program in an urban school district in the Northeastern United States across three years. The broader evaluation study included

Table 1

Descriptive information for observed variables.

Manifest variables	M (SD) or %		
Demographics			
Child's sex	53% female		
Child's race	69% African American 18% Multi-racial 12% Hispanic 1% White		
Child's age	56.4 (3.7)		
Maternal education	32% less than high school 38% high school diploma 30% additional training/college		
Family income	\$12,533 (\$11,382)		
Latent variables	M (SD)	Range	N missing
Preschool variables			
PPVT	86.8 (13.5)	–	40
AKT	14.1 (2.5)	0–16	46
KEI	1.3 (.3)	0–2	45
Emotion situation knowledge	.87 (.2)	0–1	49
Kindergarten variables			
Leiter-R AS	10.5 (3.6)	–	70
Interview rating	3.7 (.4)	1–4	67
1st grade variables			
WJ Letter-Word Id	104.2 (15.3)	–	96
WJ Applied Probs	95.7 (15.4)	–	96
WJ Dictation	96.4 (12.1)	–	96

Note: Percent missing ranges from 0% to 3%, $N=341$.

a comparison sample of Kindergarten students who were not exposed to the preschool program. This sample was not included in the present study. The program was implemented in 12 classrooms in the first year, 24 classrooms in the second year, and 22 classrooms in the third year. The district collaborated with the local Head Start program to establish and run the preschool program, therefore the majority of the participants (74%) met income eligibility for Head Start. Building upon national Head Start standards, the comprehensive program provided (a) half-day preschool (8 a.m.–1 p.m.) five days a week within the public school buildings children would eventually attend for kindergarten and first grade, (b) three home visits a year, (c) two parent-teacher conferences and (d) wrap-around childcare before and after the program. Each classroom had two teachers, one who was state-certified in education and one who met Head Start educational standards. The classroom curriculum was based on the High/Scope model infused with the evidence-based social-emotional curriculum, Promoting Alternative Thinking Strategies (PATHS; Kusché & Greenberg, 1994), Everyday Math (Bell, 1988–1996), and a balanced literacy approach (Pressley, 1998).

Table 1 contains demographic information on the sample. The sample was composed of approximately an equal number of boys and girls, the majority of which were African American and lived in single-parent homes. Approximately three-quarters (76%) of the primary caregivers were biological mothers and approximately one-third obtained less than a high school education. At the beginning of the preschool assessment, children were approximately four and a half years old.

Samples sizes varied across the core measures included in the model (i.e., latent variable indicators). Eighty four percent of the sample had at least five of the eight core measures. In the present analyses, children were included if they had data on at least one of these core measures. We used a structural equation modeling approach and Full Information Maximum Likelihood to make use of all available information from this sample.

3.2. Procedures

Child assessments and interview ratings were collected over two months during the fall (beginning of October to end of November) for preschool and kindergarten assessments and during two months during the winter (January/February to March/April) for the first grade assessment. Parent interviews were conducted once at the beginning of the child's preschool year. All interviewers were college graduates with prior experience working with children as educators or in some other child-related field (e.g., counseling psychology). Prior to data collection, they attended 20 h of formal training and completed several practice interviews (one of which had to be with a child). Interviews were monitored by video-tape or live observation to assure that the battery of measures was administered reliably across interviewers.

Children were tested outside the classroom in a quiet location with minimal distractions by trained child interviewers. They completed the battery of measures (receptive vocabulary, emotion knowledge, attention, academic competence) during two separate, 30-min sessions within a two-month period during preschool and kindergarten. During first grade, they completed the interview battery (receptive vocabulary, attention, academic competence) during one session that took approximately 1 h and 15 min. Although the vast majority of first grade interviews were completed during one session, the interviewers used their own discretion to determine if a particular child needed two sessions to complete the interview battery due to attention or behavior issues.

4. Measures

4.1. Sociodemographic characteristics

Information about the child's sex (0 = male, 1 = female), maternal education (1 = up to 8th grade, 2 = 9th–11th grade, 3 = 12th grade, no diploma, 4 = high school diploma/GED, 5 = vocational training, no diploma, 6 = vocational training with diploma, 7 = some college, no degree, 8 = associates degree, 9 = Bachelors degree), and total family yearly income were collected at the parent interview which occurred at the beginning of the child's preschool year.

4.2. Receptive vocabulary

The Peabody Picture Vocabulary Test-Revised (PPVT-R; Dunn & Dunn, 1981) is a well-established measure of children's receptive vocabulary. Children were presented with four pictures and asked to identify the picture of the word that is orally presented. The measure consisted of 175 items. The PPVT-R has shown good convergent validity, and the split-half reliability coefficient for the PPVT-R is .71 for children 48–53 months of age. The median internal consistency across age groups is $r = .95$ (Dunn & Dunn, 1981).

4.3. Emotion knowledge

Emotion knowledge during preschool was measured utilizing three child assessments. The receptive and expressive identification of emotions portion of the *Affect Knowledge Test* (AKT; Denham, 1986) assessed children's emotion knowledge. Children were presented with four cartoon-like faces depicting happy, sad, angry, and afraid and asked to verbally label each face (expressive labeling). Receptive comprehension was assessed by asking the child to identify the same expressions by pointing. Each item was scored as follows: two points for correct emotion, one point for the correct valence, and zero points for an incorrect response. The summary score was created by summing the scores of all items and ranged from 0 to 16. Internal consistency for this measure in the present sample was good with Cronbach's alpha of .75.

The *Kusché Emotional Inventory* (KEI; Kusché, 1985) assessed children's ability to recognize various emotional expressions accurately. Children were presented with 32 trials of four drawings of emotion expressions (1 target; 3 distracters) and asked to identify the cartoon picture best matching a given feeling label. The emotional expressions included were happy, mad, sad, and scared. Each item was scored as follows: two points for correct emotion, one point for the correct valence, and zero points for an incorrect response. The summary score was created by taking the mean score across all items and ranged from 0 to 2. Internal consistency within the present sample was good with a Cronbach's alpha of .75.

The *Emotion Situation Knowledge* measure assessed children's knowledge of the normative reactions to emotion-eliciting situations. Children were presented with eight of the 10 vignettes used in the original study by Garner et al. (1994) that described situations applicable to children that are likely to produce an emotion (two each for happy, sad, angry, afraid) The two vignettes that depicted the emotion 'surprise' were not included. For each vignette, children were shown a drawing of the situation (provided by the first author with the copy of the measure) and then asked to report if the child in the story felt happy, sad, angry or afraid. Each item was scored as follows: two points for correct emotion, one point for the correct valence, and zero points for an incorrect response. However, due to problems of low reliability ($\alpha = .50$ using the original scoring system), we collapsed the scores for correct emotion and correct valence into one category equal to one point resulting in dichotomously items (i.e., 1 = correct emotion or valence, 0 = incorrect emotion). The summary score was created by calculating the mean across all dichotomously scored items and ranged from 0 to 1. Cronbach's alpha for this measure within the present sample was .53. For each measure, the aforementioned summary score was used as the manifest indicators of emotion knowledge in a latent model.

4.4. Attention skills

Attention skills during kindergarten were measured with both a child assessment and interviewer ratings. The *Leiter-Revised Attention Sustained Task* (Leiter-R AS; Roid & Miller, 1997) assessed the ability to sustain attention to detail in a repetitive task. Children were shown a target figure (i.e., flower) located at the top of the stimulus and were instructed to scan an array of figures and cross out all of the target figures as quickly as then can. A total adjusted correct (total errors subtracted from total correct) score was calculated and standardized according to national norms with a mean score of 10 ($SD = 3$). The scaled score was used as one of the manifest indicators of the attention latent variable. The Leiter-R AS has been shown to have good internal consistency with a Cronbach alpha coefficient of .83 for the 4–5 year old version and good test-retest reliability of .85 (Roid & Miller, 1997).

Attention skills were also measured using interview ratings, which assessed the children's attention span during the course of the child interview battery with four items (i.e., task persistence, attention span, body movement, attention to directions). Each item was rated on a four-point scale where larger numbers reflected greater competence. Interviewers completed these ratings immediately following the interview session. The average of these four items was used as the other manifest indicator of attention skills in the latent model. Internal consistency of these items was good with a Cronbach's alpha of .79.

4.5. Academic competence

Academic achievement at first grade was measured with three subtests from the achievement subtests from the standardized *Woodcock-Johnson Psycho-Educational Batter-Revised* (Woodcock &

Table 2
Intercorrelations among observed variables.

Variable	1	2	3	4	5	6	7	8
Preschool variables								
1. PPVT	–							
2. AKT	.47*	–						
3. KEI	.64*	.49*	–					
4. Emotion situation knowledge	.42*	.30*	.41*	–				
Kindergarten variables								
5. Leiter-R AS	.25*	.19*	.35*	.29*	–			
6. Interview rating	.16*	.13*	.20*	.25*	.25*	–		
1st grade variables								
7. WJ Letter-Word Id	.28*	.19*	.23*	.09	.25*	.26*	–	
8. WJ Applied Probs	.43*	.23*	.34*	.12	.41*	.25*	.56*	–
9. WJ Dictation	.28*	.14*	.17*	.05	.28*	.18*	.72*	.54*

Note: $N = 209$ – 298 .

* $p < .05$.

Johnson, 1990). The subtests were individually administered and were designed to measure the intellectual and academic development of preschoolers through adults. The *Letter-Word Identification* subtest consisted of 23 items that measure the child's ability to match a rebus (pictographic representation of a word) with the actual picture of that object and the ability to identify letters and words in large type in the test booklet. The *Dictation* subtest consisted of 12 items that measure the child's prewriting skills, ability to write specific upper and lower case letters, and ability to write specific words, phrases, punctuation and capitalization. The *Applied Problems* subtest consisted of 23 items that measure the child's ability to analyze and solve practical math problems. Standard scores were calculated according to the national norms ($M = 100$, $SD = 15$) for each subtest and were used as the manifest indicators of academic competence in the latent model. Woodcock and Johnson (1990) report that the average internal consistency for preschool age children for each subtest is as follows: Letter-Word Identification, .92; Applied Problems, .91; Dictation, .92.

5. Results

5.1. Preliminary analyses

Table 1 presents descriptive information for the study variables. On average, the sample was approximately one standard deviation below national norms for receptive vocabulary at the beginning of preschool, slightly above national norms for first grade reading, and slightly below national norms for first grade math and writing. At the beginning of preschool, on average, the children could correctly identify 88% of the cartoon emotional expressions they were presented. At kindergarten, this sample scored at approximately the national average for sustained attention.

Table 2 presents the interrelations among the observed variables. The strength of the relations among the majority of the study variables was between small and moderate (Cohen, 1992). The correlations between the measure of receptive vocabulary and the preschool emotion knowledge indicators are especially noteworthy. The relations among these variables were quite strong, indicating that it is important to covary receptive vocabulary when trying to isolate the influence of emotion knowledge on later academic competence.

Table 3 presents information on the factor loadings for the latent factors, preschool emotion knowledge, kindergarten attention, and first grade academic competence, which are included in the mediation models below. The observed variables have moderate to high loadings (i.e., .496–.849) on their specified factors demonstrating they form good latent variables.

6. Latent mediation models

6.1. Model specifications

The structural equation models were examined with maximum likelihood estimation using AMOS 16.0 (Arbuckle, 2007). Two models were examined: (1) the baseline model, and (2) the conditional model. For the baseline model, kindergarten attention skills were specified as the mediator of the relationship between emotion knowledge in preschool and academic competence in first grade. For the conditional model, several important covariates were included to determine if the mediational relationship remained after controlling for the relations between maternal education, family income, child's age at preschool assessment, child's sex, child's race (coded as 1 = African American and 0 = Non-African American), child's receptive vocabulary, and first grade academic competence. In both models, one item was fixed to 1.0 with the variances freely estimated for each latent factor. Before interpreting the parameter estimates, identification status and goodness of fit were assessed to determine how well the baseline and conditional models fit the data.

6.2. Goodness of fit

The chi-square for both the baseline and conditional models was significant (baseline $\chi^2 = 29.58$, $df = 17$; conditional $\chi^2 = 85.90$, $df = 53$). However, because Chi-square is typically sensitive to even

Table 3
Factor loadings for the latent variables in the conditional mediation model.

	Emotion knowledge	Attention skills	Academic competence
Preschool variables			
AKT	.619	–	–
KEI	.789	–	–
Emotion situation knowledge	.518	–	–
Kindergarten variables			
Leiter-R AS	–	.496	–
Interview rating	–	.531	–
1st grade variables			
WJ Letter-Word Id	–	–	.849
WJ Applied Probs	–	–	.667
WJ Dictation	–	–	.822

Note: Dashes indicate that the manifest indicator was not specified to load on that latent variable.

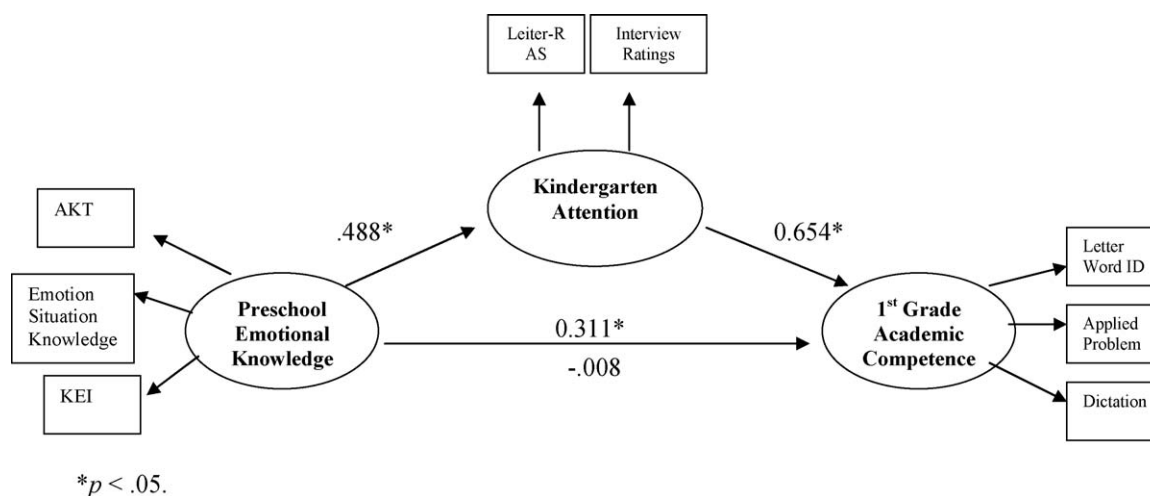


Fig. 1. Baseline model: Kindergarten attention as a mediator of the relation between preschool emotion knowledge and first grade academic competence.

the smallest deviations from a perfect model, especially as the sample size increases, it is important to consult other indicators of fit. Three indices of practical fit were utilized here: the Tucker Lewis Index (TLI; Tucker & Lewis, 1973), Comparative Fit Index (CFI; Bentler, 1990), and Root Mean Square Error of Approximation (RMSEA; Browne & Cudeck, 1993). According to Hu and Bentler (1999), values below .06 for the RMSEA and values above .95 for the CFI and TLI indicate good model fit. Based on the overall pattern of fit indices, the fits of the baseline model (TLI = .949, CFI = .976, RMSEA = .046) and the conditional model (TLI = .920, CFI = .960, RMSEA = .042) were judged to be good (e.g., Hu & Bentler, 1999).

6.3. Parameter estimates for the baseline model

The results of the baseline mediation model are presented in Fig. 1. The total effect of emotion knowledge on academic competence was significant, indicating that emotion knowledge was significantly associated with academic competence with the mediator excluded from the model. That is, children with better emotion knowledge skills during preschool were more likely to demonstrate increased levels of academic competence in first grade. Emotion knowledge also had a significant total effect on attention. After controlling for all of the other variables in the model, the relationship between attention and academic competence was significant. Thus, attention was a unique predictor of academic competence, such that children with better attention skills in preschool were more likely to demonstrate greater academic competence in first grade. Using the Sobel (1982) test, the indirect effect of preschool attention on academic competence in first grade through kindergarten emotion knowledge skills was significant, $t = 2.37, p < .05$. To determine how much of the effect was mediated, the indirect effect was divided by the total effect for emotion recognition on academic competence (MacKinnon, 2008). This calculation indicated that 98% of the total effect of emotion knowledge on academic competence was mediated by attention skills.

6.4. Parameter estimates for the conditional model

In order to control for the effects of important covariates including maternal education, family income, and children's age at preschool assessment, sex, race, and preschool receptive vocabulary, a second model examined a more stringent test of the mediational role of attention. Regression paths were specified from all the covariates to first grade academic competence. All possi-

ble correlations among the covariates and between the covariates and preschool emotion knowledge were included as well. Fig. 2 presents the results from the conditional model. There were several significant, positive correlations between maternal education and the other covariates, including family income, receptive vocabulary, and emotion knowledge. Children's age at the preschool assessment and receptive vocabulary were also significantly positively related to preschool emotion knowledge indicating that children who entered preschool at an older age and those with better receptive vocabulary skills had greater emotion knowledge at preschool. Also, there were significant associations between family income and race (indicating that minority children were more likely to be in lower income families) and receptive vocabulary (indicating higher vocabulary skills for children in higher income families). Age at the preschool assessment and preschool receptive vocabulary were also significantly related to first grade academic competence. Children who were older at the time of the preschool assessment performed worse academically in first grade. Although this may seem counterintuitive, one likely explanation for this is the fact that some of this sample entered preschool at three years old and had two years of preschool and some entered at four years old and had only one year of preschool. Previous analyses using this sample have shown that children with two years of this preschool program perform better academically at first grade (Domitrovich, Freeman, & Jacobson, 2005). Preschool receptive vocabulary was positively related to first grade academic competence such that children with greater vocabulary skills at preschool performed better academically in first grade.

After controlling for these covariates, evidence for the mediational role of attention remained. As in the baseline model, the Sobel (1982) test indicated that the indirect effect of attention on the relation between emotion knowledge and academic competence was significant, $t = 2.27, p < .05$. Calculation of how much of the effect was mediated indicated that 66% of the total effect of emotion knowledge on academic competence was mediated by attention skills in the conditional model.

7. Discussion

As predicted, preschool emotion knowledge was a significant predictor of later academic achievement. These findings support the growing body of empirical evidence that social-emotional skills play an important role in children's academic success (Denham, 2006; DiPerna, Lei, & Reid, 2007; Howse et al., 2003; Izard et al.,

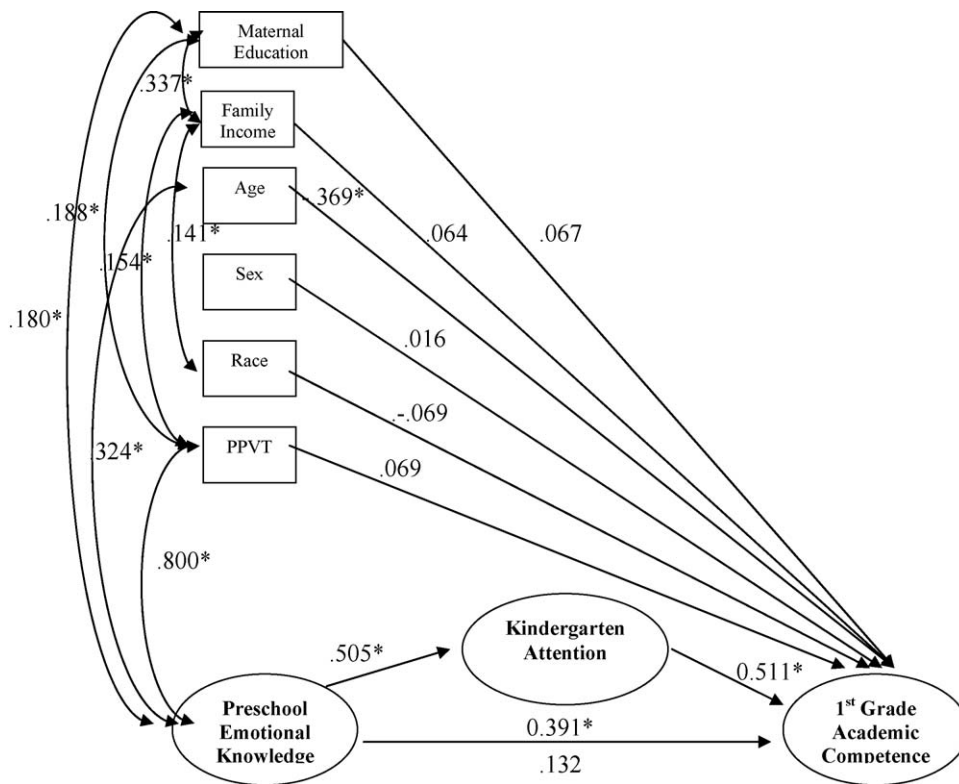


Fig. 2. Conditional model: Examining meditational role of attention after controlling for maternal education, family income, child's age at preschool assessment, child's sex, child's race, and child's preschool receptive vocabulary.

2001; Ladd et al., 1999; Ladd, Kochenderfer, & Coleman, 1996; Ladd, Kochenderfer, & Coleman, 1997; Raver & Knitzer, 2002). The results also suggest that attention skills are one mediator of this relationship. Even after controlling for the effects of maternal education, family income, and child's age, sex, race, and receptive vocabulary, attention skills remained a significant mediator of the association between preschool emotion knowledge and first grade academic competence, with over half of the effect of emotion knowledge and academic competence explained by attention skills. These results support and extend the work by Trentacosta and colleagues who report positive associations between emotion-related skills, attention, and academic skills (Trentacosta & Izard, 2007; Trentacosta et al., 2006). They also provide further support for theories that posit key roles among emotional and cognitive processes in children's social and academic success (Blair, 2002; Blair & Diamond, 2008; Izard, 1991, 2009; Thompson & Raikes, 2007).

The present analyses utilized rigorous methodology to build upon existing work regarding the link between social-emotional competencies and academic success. We used a structural equation modeling approach, which allowed us to account for measurement error and use Full Maximum Likelihood to make use of all available information from the present sample, despite some attrition. We also used direct child assessments as indicators of children's emotion knowledge. Although parent and teacher reports represent an important perspective and are well suited to assess children's general behavioral competencies and social interactions, they provide a poor assessment of specific emotional skills like receptive and expressive knowledge of emotions. Direct child-assessments provide a more accurate measure of individual skills, without the bias parent and teacher reports may introduce (Ladd & Proffitt, 1996; Weisz, Chaiyasit, Weiss, Eastman, & Jackson, 1995). For this reason, we believe that the direct measures of children's skills used in the present study were better suited than teacher ratings to iso-

late the unique contribution emotion knowledge made to academic competence. Finally, prior research has focused on concurrent associations, while the present study examined a longitudinal mediation model with the predictor (i.e., emotion knowledge), the mediator (i.e., attention skills), and the outcome (i.e., academic competence) at three time points (i.e., preschool, kindergarten, first grade). This technique helps strengthen our understanding of the meditational processes (Collins et al., 1998; MacKinnon et al., 2007).

7.1. Attention as a key mediator

The findings from the present study align well with theoretical and empirical evidence that supports the underlying role of self-regulatory and attentional processes in facilitating academic success (Blair, 2002; Howse et al., 2003; McClelland, Acock, & Morrison, 2006; McClelland et al., 2007; Ponitz, McClelland, Matthews, & Morrison, 2009) and provide further support for the link between emotional and cognitive processes in early development (Bell & Wolfe, 2004; Blair, 2002; Gray, 2004). Blair's recent conceptualization of school readiness highlights the importance of children's ability to harness emotional arousal to focus attention and participate in the learning process. According to his model, the response to emotional arousal is a "prerequisite for the use of cognitive-processing resources necessary for learning" (Blair, 2002, p. 119). Although the present study did not assess emotion regulation directly, there is empirical evidence which suggests that emotional awareness and the ability to correctly identify and label emotions promotes successful regulation of emotional arousal (Greenberg, Kusché, Cook, & Quamma, 1995; Schultz et al., 2001). It is possible that children's emotional knowledge provides them with skills to respond appropriately to emotional arousal and decrease interference associated with this arousal, which in turn may enable them to use their attentional resources in ser-

vice of learning. This hypothesis could be tested in future studies by including both measures of emotion knowledge and emotion regulation in similar mediation analyses.

Trentacosta and Izard (2007) provided an initial examination of these associations by testing direct and indirect effects with assessments of both emotion knowledge and emotion regulation during kindergarten on first grade academic skills. Although they found positive associations between both types of emotion skill and later academic skills (similar to the present study), only the link between emotion regulation and academic competence was mediated by teacher-rated attention skills. It is important to note, however, that the current study varied from Trentacosta's study in a number of ways that may explain the disparate findings. First, the present study used a latent variable modeling strategy that encompassed multiple measures for each construct, rather than relying on only one measure for each construct. Second, attention skills were measured through both interview ratings and a direct child assessment, rather than solely by teacher ratings. Third, our study examined these constructs across three time points (preschool, kindergarten, 1st grade), rather than only two (preschool, kindergarten). Future work would benefit from using a methodologically rigorous approach (e.g., multi-measurement assessment of constructs across three time points) such as the one utilized in this study to further explicate the relations among emotion knowledge, emotion regulation, attention, and academic skills.

7.2. Prevention implications

In an era of increasing accountability, teachers, schools, and administrators are responsible for the academic performance of their students. This trend has extended downward to preschool as well. There is increasing pressure for early childhood programs to demonstrate their impact on school readiness and later academic competencies. The current findings suggest that preventive interventions that target social–emotional skills and children's abilities to regulate their emotional arousal and attention may also improve children's academic achievement (cf. Durlak, Weissberg, Dymnicki, Taylor, & Schellinger, *in press*; Zins, Payton, Weissberg, & O'Brien, 2007).

Prevention scientists and educators have stressed the importance of promoting social–emotional competence from preschool through high school (www.CASEL.org; Zins et al., 2007). Greenberg et al. (2003) suggested that through coordinated social–emotional school-based programming, schools can reduce problems at the root of academic underachievement. However, until recently, many prevention programs that include social–emotional components have rarely examined their impact on academic achievement. A recent meta-analysis by Durlak et al. (*in press*) provides empirical evidence that social–emotional competence building programs have substantial effects on children's academic success. They found that, on average, school-based interventions contributed to an 11 percentile increase in standardized achievement test scores. These findings, taken together with the results of the present study, provide an empirical case for the link between social–emotional and academic competencies and provide further justification for social–emotional based prevention programs in educational settings.

7.3. Limitations and future directions

Despite the important contributions of the present study, it is important to remain cautious when drawing conclusions. First, the present sample was primarily low-income, African American children. While often understudied, the generalizability of these findings may be limited to this population. Future work should examine these relations in more economically and racially diverse

samples. Also, it is important to note that the income variable in the present study did not account for family size (i.e., income is at least partially confounded by family size) and therefore may underestimate its effect on the variables of interest. Second, the present analyses only included measures of children's emotion knowledge, one of which had relatively low reliability in the present sample. Although emotion knowledge is an important indicator of social awareness, it is only one component of the much broader construct of social–emotional competence. Future work would benefit from administering a more comprehensive battery of valid and reliable measures that represent multiple domains of social–emotional competence and investigating the potential mediational role of attention for these other social–emotional components (e.g., DiPerna et al., 2007; Howse et al., 2003). Moreover, the present study focused on direct assessments of children's emotion skills, but future work may also want to include teacher-rated skills, which may provide a broader picture of children's ability to use these social–emotional skills within the classroom context.

Similarly, the present study examined only one aspect of attention. Attention is a broad construct which includes both the ability to sustain and shift attention flexibly. The measures used in the present study only tapped children's sustained attention. Attention shifting should also be examined as a possible mediator of the link between social–emotional competence and academic achievement. Research has shown that executive functions, which include the ability to flexibly shift attention, are related to children's social–emotional behavior (Rhoades, Greenberg, & Domitrovich, 2009; Riggs, Jahromi, Razza, Dillworth-Bart, & Mueller, 2006) and their academic achievement (Blair & Razza, 2007; Espy et al., 2004). Finally, the measurement of academic competence was limited to directly assessed standardized tests. Despite the advantages associated with standardized measures, future work should consider incorporating other school-based measures (i.e., grades, teacher-reports of academic performance) to determine if these relations remain when predicting more practical, "everyday" measures of academic success.

As recommended by methodologists, the present study included measures from three time points to strengthen our examination of the mediational process among preschool emotion knowledge, kindergarten attention skills, and first grade academic achievement (Collins et al., 1998; MacKinnon et al., 2007). Although the longitudinal nature of these data increases our ability to examine mediation, we are still unable to make casual statements about the relations among these constructs. Future intervention work may be able to better illuminate this causal process through the implementation of a program designed to enhance children's emotion knowledge and attention skills. By examining the impact program participation has on children's emotion, attention, and academic competence, we could make firmer conclusions regarding the causal relations among these constructs. Also, although our selection of time points for specific constructs was informed by developmental research, we acknowledge it is a potential limitation of this study. Future studies should consider exploring the interrelationships of emotion knowledge, attention, and academic skills at multiple time points across time to determine which developmental period is most predictive of future competencies.

Although we controlled for the influence of third variables by covarying maternal education, family income, and children's sex, age, and vocabulary skills, it is possible that omitted variables like executive function or behavioral self-regulation may explain the association between these constructs (e.g., Blair, 2002; Howse et al., 2003). Other possible third variables include related social–emotional components such as emotion regulation or interpersonal skills (e.g., Trentacosta & Izard, 2007). Questions also remain regarding the direction of effects among the constructs

included in the present study. As we do not have comparable measures of attention at the first wave of data collection we cannot confirm this directionality.

8. Conclusions

Success in the academic realm has crucial implications for life success. Children who fall behind early in life often never completely catch up to their more academically successful peers (Jimerson, Egeland, Sroufe, & Carlson, 2000). This gap in achievement is a hallmark of poverty, and research shows that it is present long before children enter school (Lee & Burkam, 2003). Examining the early precursors and mechanisms of academic achievement are important for enhancing our knowledge of the developmental processes that lead to academic success. The findings from the present study make an important step toward this end by suggesting that children's emotion knowledge and attention skills are two key components of this process and therefore may be fruitful targets for preventive interventions aimed at improving academic competence in the early school years.

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