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Preschoolers' emotion knowledge: Self-regulatory foundations, and predictions of early school success

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Abstract

Preschoolers (N= 322 in preschool, 100 in kindergarten) were assessed longitudinally to examine the self-regulatory roots of emotion knowledge (labeling and situation) and the contributions of emotion knowledge to early school adjustment (i.e., including social, motivational, and behavioral indices), as well as moderation by age, gender, and risk. Age, gender, and risk differences in emotion knowledge were also examined. Emotion knowledge skills were found to be more advanced in older children and those not at economic risk, and in those with higher levels of self-regulation. Overall, the results support the role of emotion knowledge in early school adjustment and academic success even with gender, age, and risk covaried, especially for boys, older preschoolers, and those at economic risk.

Keywords

Emotion; Social cognition; Early childhood; School readiness

School readiness is defined as young children's mastery of skills that help ensure success in school settings (Hair, Halle, Terry-Humen, Lavelle, & Calkins, 2006), including social-emotional competence, positive attitudes toward learning, persistence, and attainment of preacademic milestones (e.g., counting). Readiness to move into the formal learning environment of school is critically important to later classroom adjustment and academic success, often setting up cycles of success or failure (McClelland, Acock, & Morrison, 2006). Further, as Zins and colleagues (2007) assert, "schools are social places...learning is a social process" (p. 191). Preschoolers already learn alongside and in collaboration with teachers and peers, and utilize their emotions to facilitate learning. Social-emotional skills especially undergird their adaptation to the sometimes-challenging preschool environment and subsequent successful schooling. In our view, one such key contributor to readiness is emotion knowledge. Even very young children think about their own and others' behaviors, including emotions; such cognitions about self and others can be powerful determinants of a variety of actions. Specifically, emotions of self and others convey information that is crucial to social interactions and relationships (Denham, 1998).

Given this potential importance, what is involved in preschoolers' emotion knowledge? Emotion knowledge shows age-related progress, in both recognition of emotional expressions and understanding of situation that elicit emotions (Denham, 1998). Throughout

preschool, children gradually differentiate among negative emotions of self and other, and begin to identify others' emotions that may differ from their own.

Along with these normative developmental progressions, there also are marked individual differences in recognition of emotional expressions and discrimination of emotional situations. Preschoolers with access to emotion knowledge are more prosocially responsive to their peers, and rated more positively by teachers and peers, both contemporaneously and predictively (Denham et al., 2003; Ensor & Hughes, 2011; Schultz, Izard, Ackerman, & Youngstrom, 2001). Conversely, inability to interpret emotions can make preschool classrooms confusing places, increasing children's risk for aggression (Denham, Caverly, et al., 2002). Trentacosta and Fine's (2010) meta-analysis confirmed many of these relations. Thus, emotion knowledge buttresses preschoolers' social competence, so central to their early school adjustment.

Increasingly, researchers also corroborate associations between preschoolers' emotion knowledge and other aspects of early school adjustment. Specifically, Head Start preschoolers' emotion situation knowledge predicted later classroom adaptation, even with age, verbal ability, emotional lability, and emotion regulation covaried (Shields et al., 2001). Emotion knowledge is also related to preschoolers' pre-academic achievement (Garner & Waajid, 2008; Leerkes, Paradise, O'Brien, Calkins, & Lange, 2008). Further, kindergarteners' emotion knowledge is concurrently related to attention to academic tasks, and predicts later academic competence (Izard et al., 2001; Trentacosta & Izard, 2007). In this study, we examine relations between preschoolers' emotion knowledge and their early school adjustment and academic success.

One mechanism by which advantages of greater emotion knowledge are conferred may be through associations with self-regulation. Self-regulation can be described well within a new rubric heuristically distinguishing related constructs, "cool" and "hot" executive function. "Cool" executive function (CEF) is ascendant in tasks requiring attentional and behavioral inhibitory control, working memory, and ability to suppress prepotent responding, via prefrontal cortical support. In contrast, "hot" executive function (HEF) comes to the fore in tasks additionally involving emotional and appetitive content, and requiring orbitofrontal cortical and limbic, in addition to prefrontal, control (Willoughby, Kupersmidt, Voegler-Lee, & Bryant, 2011).

Thus, emotion knowledge should be bidirectionally related to self-regulation (i.e., knowledge of emotions—one's own and others')—can facilitate regulation of behavior, and self-regulation can support acquisition of such social cognitive understanding. In support of the self-regulation-to-emotion-knowledge direction of effect, Schultz and colleagues (2001) found that preschoolers' attentional and behavioral control predicted 1st grade emotion knowledge.

In this study, we examine associations among aspects of emotion knowledge and self-regulation during preschool. In considering self-regulation as foundational, aspects of both emotional *expressions* and *situations* may require attentional control to correctly distinguish amongst emotions. However, although identifying both expressions and situations involves emotional content, reflecting upon emotional situations may arouse some emotion, so that both CEF and HEF may be related to situation knowledge. In sum, following this logic, and given that CEF and HEF are likely to be correlated (Denham, Warren-Khot, Bassett, Wyatt, & Perna, 2011; Willoughby et al., 2011), we expect clearer contributions of CEF than HEF to emotion knowledge. We also address directions of effects in our analyses.

Along with exploring these associations, we examine differences in emotion knowledge according to age, gender, and risk. Normative age increases in many types of social

cognitive understanding should be mirrored in emotion knowledge. Girls are often expected to outperform boys on skills of emotion knowledge; for example, Garner and Waajid (2008) also found girls scoring higher than boys on emotion knowledge. In terms of poverty-related risk, several investigators have found significant relations between low income preschoolers' emotion knowledge and their social competence, classroom adjustment, and achievement (Garner & Waajid, 2008; Izard et al., 2001; Schultz et al., 2001). Most did not contrast emotion knowledge of children in poverty versus more advantaged counterparts'.

In summary, young children's understanding of emotion has increasingly been identified as an important predictor of their ability to navigate social and academic worlds of early schooling, and may be closely allied with self-regulation. Accordingly, we explore these questions by: (a) examining short-term developmental change and stability, according to important demographic dimensions (i.e., age, gender, and risk); (b) uncovering associations with self-regulation; (c) predicting preschool and kindergarten school adjustment and preacademic skills; and (d) giving special attention to moderation of relations found in goals (b) and (c), by age, gender, and risk. Each goal increases our understanding of emotion knowledge's development (particularly in examining risk processes), its relation to both children's self-regulation and early school success, and groups for whom emotion knowledge is particularly useful.

Method

Participants

This study is part of a larger investigation focused on developing a portable assessment battery for measuring social and emotional aspects of school readiness. Participants were recruited at Head Start and private childcare centers in greater Northern Virginia. 322 children were administered the Affect Knowledge Test (AKT) in fall of the first year of study; 34.5% of these children were 3-year olds and 65.5% were 4-year olds; mean age at time 1 (T1) was 49.4 months ($SD=6.86$ mos). Approximately half were female, with a majority either Caucasian or African American (43.5% Caucasian, 38.5% African-American); 12.1% were Hispanic. Because confidentiality agreements precluded asking families about income, economic status was broadly classified by children's enrollment in private childcare centers versus Head Start; about half attended private childcare (54.6%). Median maternal education for children in private childcare was associate degree, and for children in Head Start was high school diploma; these differences were significant, $\chi^2(5, N = 322) = 56.03, p < .001$. In analyses to follow, center type was utilized to mark socioeconomic risk.

Children's emotion knowledge and self-regulation were assessed in late fall to early spring (T1) and at school year's end (time 2; T2); teacher measures were collected at T2 and in children's kindergarten year. Duration of time between T1 and T2 data collection was, on average, 93.24 days ($SD = 33.63$). Teachers were paid \$15 per child for completing questionnaires; kindergarten teachers were paid \$25 per child (they completed more questionnaires, most not part of this study). Children received stickers for participation.

Data from kindergarten teachers were collected for 100 children who were enrolled in area schools giving consent for research. Kindergartners remaining in the study, and those who could not be followed, differed on no T1/T2 measure, and no demographic characteristic except age and risk. More original 3-year-olds were lost, probably given greater time until kindergarten testing, $\chi^2(1, N = 322) = 4.61, p < .05$, and more children in private childcare were lost, because one school system did not give permission to collect their data, whereas both schools where Head Start children were enrolled gave permission, $\chi^2(1, N = 322) = 6.65, p < .01$.

Measures

Preschoolers' emotion knowledge was assessed with the game-like AKT, using puppets with felt detachable faces that depict happy, sad, angry, and afraid expressions (Denham, 1986). Importantly, the AKT minimizes verbal requirements and embeds assessments within play. For the *labeling* subtest, children were asked to reference the detachable faces, and identify happy, sad, angry and afraid facial expressions by naming them (expressive knowledge), and then by pointing to them (receptive knowledge). For the *situation knowledge* subtest, 20 age-appropriate vignettes were enacted using puppets. Each was accompanied by vocal and visual affective cues emitted by the puppet/experimenter. For eight vignettes, the puppet depicted the same emotion most people would feel (e.g., happiness in receiving an ice cream cone; see Denham, 1986), to index children's stereotypical emotion knowledge. In the remaining 12 vignettes, to index children's nonstereotypical emotion knowledge, the puppet depicted different emotions from what each child's mother had reported, in a questionnaire, that their child would feel. Among nonstereotypical situations, six vignettes pitted positive versus negative emotions (e.g., happy or sad to come to preschool); the remaining six vignettes pitted negative versus negative emotions (e.g., angry at or afraid of a sibling's aggression; see Denham, 1986). Children affixed the felt face of their choice to report how the puppet felt. They received two points for correct identification of emotion in any subtest, one point for only identifying correct valence (e.g., picking sad for afraid).

Prior to planned analyses, AKT data were checked for univariate normality. Because understanding of happiness develops earlier compared to some negative emotions (Denham & Couchoud, 1990), 79% of participants correctly identified this emotion's items in expressive, receptive, and stereotypical situation scales, with attendant problematic values for kurtosis and skewness. Hence, these happiness items were excluded from further analyses. *Negative recognition* and *situation knowledge* aggregates were created. Cronbach α s for 6-item negative recognition and 18-item situation knowledge aggregates were .67 and .87, and .63 and .91, at T1 and T2, respectively. T1 to T2 test-retest reliability correlations, controlled for age, gender, and risk, equaled r s (311) .48 and .58, for negative recognition and situation knowledge, respectively, p s < .001.

In terms of validity, AKT scores are related to indices of social-emotional competence across numerous studies (e.g., Cutting & Dunn, 2002; Denham et al., 2003). Regarding early school success, relations have been discovered between AKT scores and 1st grade achievement scores (Rhoades, Warren, Domitrovich, & Greenberg, in press).

Preschool Self-Regulation Assessment (PSRA; Smith-Donald et al., 2007)—

PSRA includes seven structured tasks to tap HEF and CEF. For CEF, three tasks (Pencil Tap, Balance Beam, Tower Turn-Taking) were included. For HEF, four delay tasks (Toy Wrap, Toy Wait, Snack Delay and Tongue Task) were used. The battery was administered by trained, certified research assistants who live-coded latencies or performance levels for each task (see both Smith-Donald et al., 2007 and Denham et al. 2011, for administration and psychometric details). PSRA tasks were internally consistent (for T1 and T2, respectively, HEF (19 items) α = .90 and .94; CEF (6 items) α = .82 and .76). T1 to T2 test-retest reliability correlations, controlled for age, gender, and risk, equaled r s (255) .58 and .46, for HEF and CEF, respectively, p s < .001.

School adjustment: Social Competence and Behavior Evaluation (SCBE-30; LaFreniere & Dumas, 1996, 2002)—SCBE-30 measures socio-emotional competence of 3- to 6-year-olds. Teachers rated children on behaviors such as “easily frustrated” (Angry/Aggressive scale), “avoids new situations” (Anxious/Withdrawn scale), and “comforts or assists children in difficulty” (Sensitive/Cooperative scale). Subscales demonstrated

adequate to very high internal consistency ($\alpha = .77$ to $.94$); T2 to kindergarten stability, controlled for age, gender, and risk, was significant for Angry/Aggressive and Sensitive/Cooperative scales. See LaFreniere and Dumas (2002) for demonstrated construct and convergent validity of the measure.

School adjustment: Early learning behaviors—Teachers rated children’s approaches to learning using Preschool Learning Behaviors Scale (PLBS; McDermott, Leigh, & Perry, 2002), on 29 items regarding children’s specific, observable classroom behaviors. The instrument yields three reliable learning behavior dimensions: (a) competence motivation (i.e., reluctant to tackle new activities); (b) attention/persistence (i.e., tries hard, but concentration soon fades and performance deteriorates); and (c) attitudes toward learning (i.e., doesn’t achieve anything constructive when in sulky moods). Adequate internal consistency estimates were found (α s = $.79$ to $.89$). See McDermott et al. (2002) for psychometric details.

School adjustment: Teacher Rating Scale of School Adjustment (TRSSA; Ladd, Kochenderfer, & Coleman, 1997)—This measure was designed to tap several constructs reflective of young children’s behavioral and relational adjustment to classroom settings. Teachers provided ratings for behaviors such as “follows teacher’s directions” (Cooperative Participation), “works independently” (Self-Directedness), “likes going to school” (School Liking), or “initiates conversations with teacher” (Comfort with Teacher). Internal consistency is adequate ($\alpha = .83$ to $.93$ in current sample). T2 to kindergarten stability, controlled for age, gender, and risk, was significant. Subscales have demonstrated validity in socioeconomically-diverse and mixed race samples (Ladd et al. 1997).

School adjustment aggregates—Cross-correlations of T2 teacher-report indices were all significant at $p < .001$, absolute values ranging $.25$ to $.78$; at kindergarten 41 of 45 correlations were significant at the $p < .001$ level, absolute values ranging $-.06$ to $.84$. At both time points, PCAs with varimax rotation showed one factor explaining 60.1 and 63.4 percent of variance in the ratings, respectively. Thus, for school adjustment aggregate scores used in subsequent analyses, standard scores for all SCBE, PLBS, and TRSSA scales were summed, with SCBE anger/aggression and anxiety/withdrawal reversed. Alphas were $.90$ for both T2 and kindergarten.

Academic success: ECLS-K Academic Rating Scale—Kindergarten teachers completed Academic Rating ECLS-K (ARS, U.S. Department of Education, National Center for Education Statistics, 2002–2005), which includes ratings of kindergarteners’ academic level in (1) Language and Literacy (e.g., “reads simple books independently”), (2) General Knowledge (e.g., “forms explanations based on observations and explorations”), and (3) Mathematical Thinking (e.g., “shows an understanding of relationship between quantities”). Teachers compared each child to their same-age peers on 5-point scales, in spring of kindergarten. Internal consistency reliability for scales in this sample ranged from $.85$ to $.92$; Kindergarten Academic Success aggregate was created by summing scales’ standard scores ($\alpha = .96$).

Results

Our goals in this study were to (a) examine short-term developmental change, according to age, gender, and risk, via mixed-method MANOVAs; (b) uncover associations with self-regulation, via zero-order correlations and regressions; (c) predict preschool and kindergarten school adjustment and preacademic skills, via zero-order correlations and regressions, especially considering moderation of these relations by age, gender, and risk.

Goal 1: Developmental Change, Age, Gender and Risk Differences

Three MANOVAs (for T1, T2, and cross-time) were performed; see Table 1 for descriptive data. Age (2), Sex (2), and Risk (2) were between-subject variables in all three analyses, and Wave (2) and Measure (2; recognition and situations) were added within-subject variables in cross-time analysis. Both main and interaction effects are interpreted, and multivariate findings are accompanied by univariate follow-up analyses.

Age and gender differences—Emotion knowledge was more advanced in four-year-olds compared to three-year-olds, T1 $F_{overall}(2, 313) = 26.30$, $F_{recognition}(1, 321) = 39.42$, $F_{situations}(1, 321) = 30.46$, $ps < .001$; T2 $F_{overall}(2, 302) = 11.97$, $F_{recognition}(1, 311) = 17.29$, $F_{situations}(1, 311) = 18.60$, $ps < .001$. Effect sizes (partial eta squared) ranged from .073 to .144. No within-time gender differences were found.

Risk status differences—Within-time risk differences emerged favoring children attending private childcare at both time points, T1 $F_{overall}(2, 313) = 4.44$, $p < .01$, $F_{recognition}(1, 321) = 6.03$, $p < .01$, $F_{situations}(1, 321) = ns$; T2 $F_{overall}(2, 302) = 5.82$, $p < .01$, $F_{recognition}(1, 311) = 11.66$, $p < .001$, $F_{situations}(1, 311) = 3.18$, $p < .05$. Effect sizes ranged from .010 (for T2 situation knowledge) to .037 (for T2 negative recognition). The main effect of Risk at T1 was qualified by an interaction with Age, T1 $F_{overall}(2, 313) = 3.00$, $p < .05$, $F_{recognition}(1, 321) = 2.58$, $p < .10$, $F_{situations}(1, 321) = 5.57$, $p < .05$. Effect sizes ranged from .008 to .019. Risk differences were most pronounced for four-year-olds, who were over-represented in Head Start, $\chi^2(1) = 5.50$, $p < .05$.

Developmental change—Children's AKT scores increased from T1 to T2, $F_{overall}(1, 276) = 102.44$, $p < .001$ (effect size = .271), with interactions indicating greater change for three-year-olds, $F_{time \times age}(1, 276) = 13.09$, $p < .001$ (effect size = .045), especially those attending private childcare, $F_{time \times age \times risk}(1, 276) = 3.60$, $p < .05$ (effect size = .013), and marginally greater change for girls, $F_{time \times gender}(1, 276) = 2.99$, $p < .10$ (effect size = .011). Between-subjects effects within T1 to T2 repeated measures analyses largely mirrored those noted for T1 and T2 MANOVAs.

Goal 2: Prediction by Self-regulation

We examined the zero-order correlations of emotion knowledge and both CEF and HEF, and then performed hierarchical multiple regressions with age, gender, and risk controlled on step 1, both aspects of self-regulation entered on step two, and interactions of self-regulation with age, gender, and risk entered on step three (see Table 3). All variables were centered to minimize multicollinearity between main effect and subsequent interaction terms. β s significant at $p < .10$ or better are followed up by post-hoc probing to pinpoint locus of effects (Holmbeck, 2002). For ease of reporting and interpretation, representative moderation findings from these post-hoc probings are depicted in Figure 1.

Zero-Order Correlations—Emotion knowledge indices were correlated within and across time, as were indices of self-regulation. Emotion knowledge and self-regulation were related at both T1 and T2; correlations were strongest for CEF with aspects of emotion knowledge and situation knowledge with aspects of self-regulation, but these differences were not significant. Regression results are shown in the upper half of Table 3.

Regression results: Negative recognition predicted by self-regulation—T1 recognition was predicted only by T1 CEF, although T1 HEF is also correlated with T1 recognition. Moderation term's probing showed that CEF predicted recognition especially for older children. Both T1 and T2 CEF predicted T2 negative recognition. Moderation results showed that T1 CEF was associated with concurrent negative recognition for older

children and those in private childcare (T2 negative recognition also was predicted by older children's T2 HEF, and by Head Start attendees' T2 CEF). Overall, self-regulation was related to both types emotion knowledge for older children and those in private childcare.

Regression results: Situation knowledge predicted by self-regulation—Both CEF and HEF (measured at T1) predicted T1 and T2 situation knowledge (relation with HEF was, however, borderline). Moderation results showed that T1 CEF predicted T2 situation knowledge for children in private childcare, and younger children.

Bidirectionality—To examine cross-time dependencies amongst self-regulation and emotion knowledge, subsidiary regression equations were calculated; age, gender, risk, and time 1 pre-measure of the criterion variable were entered in step 1, and corresponding T2 self-regulation scores (for AKT criterion variables) or AKT scores (for self-regulation criterion variables) were entered in step 2. In these analyses, T2 CEF predicted T2 negative recognition, $\beta = .172$, $p < .01$, even with age, gender, center type/risk status and T1 negative recognition partialled. However, no such contribution was found for T2 situation knowledge, nor did any index of emotion knowledge predict T2 self-regulation after T1 premeasures were entered, suggesting that direction of contribution is stronger from self-regulation to emotion knowledge.

Prediction of School adjustment and Kindergarten Academic Success—Zero-order correlations in Table 2 show that T1 emotion knowledge indices were related to school adjustment or preacademic success (and that these school-related measures were also related). Regression analyses similar to those for contributions of self-regulation were computed. T1 situation knowledge predicted T2 school adjustment. T1 Negative recognition predicted school adjustment in kindergarten. Finally, kindergarten academic success was predicted by both T1 negative recognition and T1 situation knowledge.

Regarding moderation, T1 negative recognition predicted T2 school adjustment and kindergarten academic success, especially for children at great risk (and more so for older children's kindergarten school adjustment). Similarly, T1 negative recognition predicted kindergarten school adjustment, especially for boys.

Discussion

Aims of this study were to address the following areas regarding preschoolers' emotion knowledge: (a) short-term developmental change and stability, according age, gender, and risk; (b) concurrent and cross-time associations with self-regulation; (c) prediction of preschool and kindergarten school success; and (d) moderation of these associations by age, gender, and risk. Our main take-home messages were that preschool children at risk lag in their emotion knowledge, with the emotion knowledge of those at low risk appearing to profit most from their self-regulation; at the same time, emotion knowledge undergirds early success in school. We now discuss results of these aims, their meaning and importance, as well as limitations and next steps.

In terms of developmental change and stability, cross-sectional and longitudinal analyses told similar stories. In cross-sectional analyses, abilities were, not surprisingly, more advanced in older preschoolers at both times of measurement. Change over time (and thus increased age within individuals) was associated with increased AKT scores, especially for relatively younger children in private settings who were "catching" up to older participants. Like Pons and Harris (2005), with older children, we did not uncover any main effects of gender, although girls' AKT scores increased marginally more than boys from T1 to T2.

Although girls are expected to excel in emotion knowledge, findings are often equivocal and effect sizes small.

Little earlier research has specifically confirmed that low income children trail their more advantaged counterparts in the development of emotion knowledge (Garner & Waajid, 2008). We found that risk differences emerged in both cross-sectional (for all measures at both time points) and longitudinal analyses. Findings tended to be stronger for four-year-olds (who are over-represented in Head Start). Children's experiences with the world impact their understanding and decoding of emotions.

We also explored potential self-regulation foundations of emotion knowledge, fully acknowledging that emotion and cognition are involved in both emotion knowledge and self-regulation. Bidirectional influences are evident at the neural level between emotion and cognition, through connectivity among brain structures. Thus, reciprocal developmental influence may exist between emotion knowledge and self-regulation, where competency in one domain fosters (or hinders) development in the other. We found evidence of such bidirectionality in our zero-order correlations, but subsidiary regressions showed that it is not complete; more evidence was found for the self-regulation to emotion knowledge trajectory than the converse.

In regression analyses, CEF predicted negative recognition, and both aspects of self-regulation predicted situation knowledge, even with important demographic characteristics held constant. These contributions to negative recognition and situation knowledge fit our predictions; AKT involves puppets and child participation in pretend play, so that HEF, despite its moderate correlation with CEF, may be involved in suspending one's own mild arousal while considering emotion situations, to pick the correct face. CEF may be involved in both tasks due to their cognitive nature and attentional requirements. Thus, children with low CEF may misperceive emotional expressions, and miss key emotional situation information; those with low CEF *and* low HEF may provoke negative emotional reactions from socializers, disrupting their acquisition of normative emotion situation knowledge (Schultz et al., 2001).

In terms of moderation, aspects of self-regulation contributed to emotion knowledge of children differing age and level of risk. Self-regulation of older children concurrently (and younger children predictively, when they were around the same age older children had been at T1), and of those not at risk, contributed to emotion knowledge. Perhaps older children's greater self-regulation helps them concentrate in order to identify emotional expressions, and younger children's individual differences in self-regulation come into play when they, too, are older. Children not at risk may have more practice applying this regulatory ability to cognitive tasks.

Current results corroborate recent reports that developmentally appropriate levels of emotion knowledge are associated with success in social/pre-academic worlds of preschool and kindergarten, even with important demographic characteristics held constant (Garner & Waajid, 2008; Leerkes et al., 2008). Both aspects of emotion knowledge show unique prediction of school adjustment/academic aggregates in regression analyses, and moderation analyses showed that emotion knowledge may be particularly important for the school success of boys, relatively older preschoolers, and children at economic risk. Discovery of groups who benefit most from preschool emotion knowledge holds important implications for maximizing school readiness.

One important issue to address in future research is by what mechanism emotion knowledge confers benefits reflected in early school success. Representational processes, by which the child interprets, organizes, and stores in memory all interpersonal and academic

interchanges, figure as key mechanisms in emotion knowledge-readiness connections. Dynamically changing knowledge of the plentiful emotions within early childhood classrooms may impact school success via construction of emotion knowledge structures that accompany children in everything they do.

Accordingly, children who do not understand others' emotions would enter the classroom sphere of learning at distinct disadvantages with teacher and peers alike. Conversely, many classroom learning tasks are made easier for those who have age-appropriate emotion knowledge. For these children, classroom social interactions are replete with emotional information about self and other. They are more likely to have friends and well-running social relations (giving and getting information from peers, sharing resources with peers, and modeling peers' learning skills), more personal resources to focus on learning, and more useful teacher feedback.

Despite the strength of findings reported here, several limitations deserve mention. Our data met several criteria for power to detect moderation involving categorical variables (e.g., fairly equal gender/risk groups, equivalent error variances across groups) and continuous variables (e.g., internal consistency). However, we note the notorious difficulty with power to detect moderation – given R^2 s and β s similar in magnitude to those reported here for moderation terms in analyses for self-regulation and T2 school adjustment, we needed up to 900 participants to detect moderation terms with power = .975; for kindergarten analyses, our n of 100, with greater R^2 s and β s, was actually sufficient (Champoux & Peters, 1987).

Another limitation was our inability to assess children's verbal/cognitive ability, in order to partial their contribution prior to examining self-regulation's contributions to emotion knowledge, or those of emotion knowledge to school adjustment. Verbal ability or IQ does routinely predict preschoolers' emotion knowledge (Cutting & Dunn, 2002; Schultz et al., 2001). However, Izard and colleagues (2001; see also Ensor & Hughes, 2011) have shown that verbal ability predicts emotion knowledge, which *then* predicts academic competence independently, suggesting that our analyses are on solid ground conceptually. Further, regression analyses including maternal education as proxy for child cognitive ability (Sameroff, Seifer, Baldwin, & Baldwin, 1993) were almost identical to those presented here. Nonetheless, because links uncovered in this study between emotion knowledge and both self-regulation and school success may be partially accounted for by cognitive ability, such a measure should be included in future research.

In sum, although additional research is needed to determine the mechanisms that link these factors, results confirm important links between emotion knowledge and both self-regulation and pre-academic school success in preschool and kindergarten, even after controlling for demographic characteristics. Moreover, groups for whom self-regulation is particularly important as a foundation for emotion knowledge, and for whom emotion knowledge is important for school readiness, were delineated.

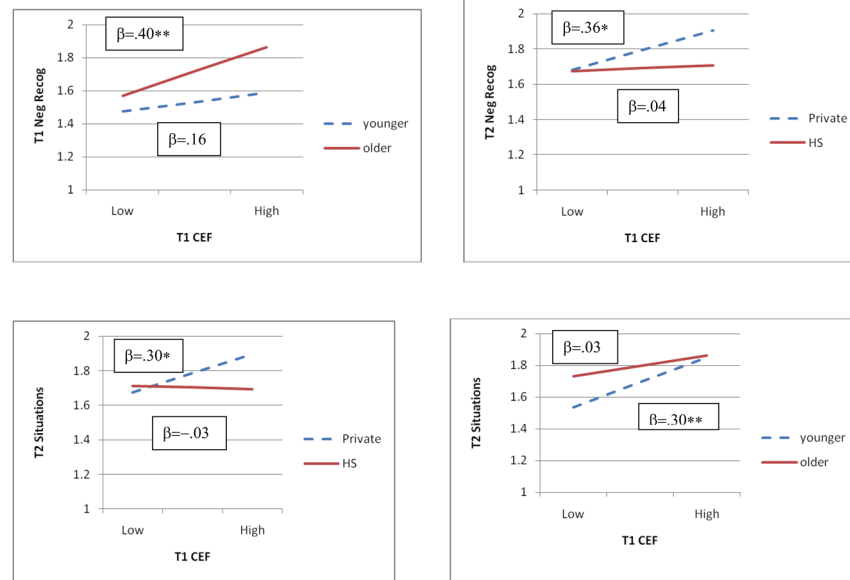
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(a) Moderation of Self-Regulation Contributions to Emotion Knowledge



(b) Moderation of Emotion Knowledge Contribution to Preschool and Kindergarten School Success

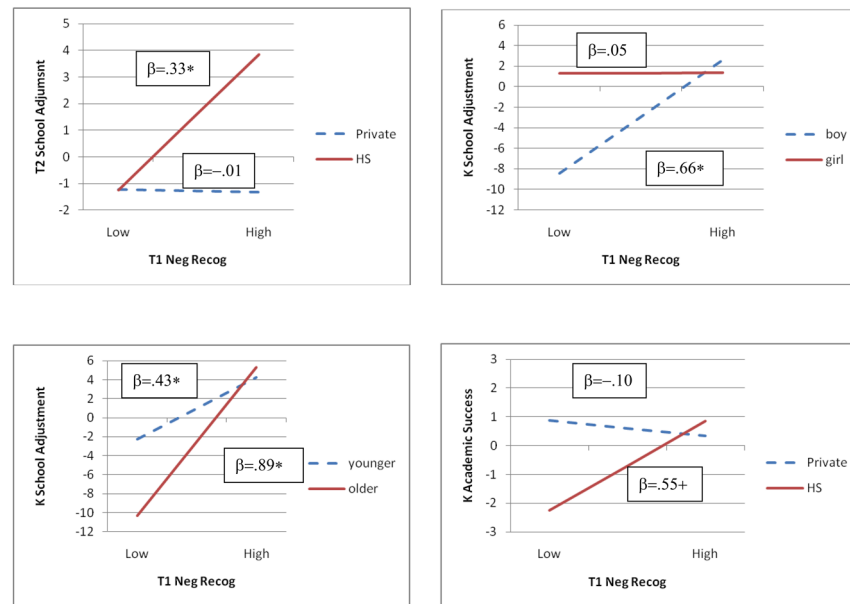


Figure 1. Moderation Results for (a) Contributions of Self-Regulation to Emotion Knowledge and (b) Emotion Knowledge to Early School Success

Table 1

Descriptive statistics for AKT at T1 and T2

	Total	Age				Gender			Risk	
		M (SD)	3-yr	4-yr	Boys	Girls	Private	Head Start		
T1										
Negative Recognition	1.62(.35)	1.46 (.36)	1.70(.28)	1.65(.34)	1.59(.35)	1.65(.36)	1.58(.33)			
Situations	1.68(.34)	1.46(.36)	1.70(.29)	1.65(.31)	1.59(.36)	1.61(.36)	1.63(.31)			
T2										
Negative Recognition	1.75(.29)	1.67(.32)	1.80(.27)	1.76 (.30)	1.75(.28)	1.80(.28)	1.71(.29)			
Situations	1.74(.35)	1.63(.40)	1.80(.30)	1.75(.42)	1.73(.36)	1.77(.32)	1.71(.38)			

Note. Total T1 = 322, M3-year-olds T1 = 111, M4-year-olds T1 = 211, Nboys T1 = 158, Ngirls T1 = 164, Mprivate childcare T1 = 176, MHead Start T1 = 146, Mtotal T2 = 311, M3-year-olds T2 = 110, M4-year-olds T2 = 201, Nboys T2 = 152, Ngirls T2 = 159, Mprivate childcare T2 = 165, MHead Start T2 = 146.

Table 2

Descriptive Data and Intercorrelations for All Study Variables

	<i>M</i>	<i>SD</i>	1	2	3	4	5	6	7	8	9	10	
1. T1 Neg. Recog.	1.62	0.34	1										
2. T1 Situations	1.62	0.34	.49***	1									
3. T2 Neg. Recog.	1.75	0.29	.53***	.50***	1								
4. T2 Situations	1.74	0.35	.44***	.63***	.52***	1							
5. T1 CEF	.00	2.19	.33***	.45***	.37***	.39***	1						
6. T1 HEF	.00	2.21	.25***	.33***	.24***	.32***	.46***	1					
7. T2 CEF	.00	2.18	.39***	.46***	.35***	.36***	.62***	.38***	1				
8. T2 HEF	-.01	1.98	.14*	.26***	.15**	.24***	.40***	.51***	.36***	1			
9. T2 School Adjustment	.00	7.77	.02	.13*	.06	.08	.13*	.25***	.23***	.29**	1		
10. K School Adjustment	.00	7.73	.35***	.16 ⁺	.14	.10	.25*	.11	.20*	.20*	.37***	1	
11. K Academic Success	.00	2.78	.39***	.35***	.17 ⁺	.15	.44***	.18 ⁺	.43***	.18 ⁺	.23*	.52***	1

Table 3

Summary of Hierarchical Regression Analyses for Contributions of Self-Regulation to Emotion Knowledge and Emotion Knowledge to School Adjustment and Kindergarten Academic Success

	T1 Neg. Recog.				T1 Situations				T2 Neg. Recog.				T2 Situations			
	B	SE	β	R ^{2a}	B	SE	β	R ²	B	SE	β	R ²	B	SE	β	R ²
<i>Block 1</i>				.161***				.165***				.102***				.149***
Gender	-.042	.039	-.059		-.045	.037	-.066		.004	.038	.006		-.011	.043	-.015	
Age	.019	.003	.376***		.020	.003	.401***		.012	.003	.284***		.019	.003	.380***	
Risk	-.141	.040	-.196***		-.017	.038	-.025		-.120	.038	-.193**		-.093	.043	-.133*	
<i>Block 2</i>				.200***				.285***				.188***				.231***
T1 CEF	.029	.010	.182**		.051	.009	.329***		.026	.011	.184*		.027	.012	.163*	
T1 HEF	.012	.010	.073		.016	.009	.102 ⁺		.011	.011	.077		.020	.013	.115	
T2 CEF	--	--	--		--	--	--		.023	.011	.165*		.018	.012	.111	
T2 HEF	--	--	--		--	--	--		-.005	.011	-.034		.007	.013	.038	
				T2 School Adjustment				K School Adjustment				K Academic Success				
	B	SE	β	R ²	B	SE	β	R ²	B	SE	β	R ²	B	SE	β	R ²
<i>Block 1</i>				.113***				.106**				.120**				.120**
Gender	4.565	.890	.294***		3.551	1.588	.223*		-.003	.565	-.001					
Age	.049	.065	.044		-.041	.125	-.033		.112	.044	.258*					
Risk	2.127	.908	.137*		-4.207	1.633	-.263*		-1.675	.583	-.295**					
<i>Block 2</i>				.149*				.209*				.225*				
T1 Neg. Recog.	.894	1.628	.040		8.952	3.153	.342**		2.029	1.106	.221 ⁺					
T1 Situations	4.536	1.880	.193*		2.370	2.771	.102		2.147	.972	.265*					
T2 Neg. Recog.	-.111	1.993	-.004		-1.593	3.825	-.051		-.055	1.382	-.005					
T2 Situations	-.143	1.737	-.006		-6.16	2.698	-.028		-1.091	.951	-.142					

Note. Total R² significant at p < .001 through step 3 for all equations.

⁺ p < .10.

* $p < .05$.

** $p < .01$.

$p < .001$. $N_{\text{self-regulation T1}} = 300$, $N_{\text{self-regulation T2}} = 272$. $N_{\text{school adjustment T2}} = 302$. $N_{\text{kindergarten academic success}} = 100$.