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Observed Emotional and Behavioral Indicators of Motivation Predict School Readiness in Head Start Graduates

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Abstract

Emotions and behaviors observed during challenging tasks are hypothesized to be valuable indicators of young children's motivation, the assessment of which may be particularly important for children at risk for school failure. The current study demonstrated reliability and concurrent validity of a new observational assessment of motivation in young children. Head Start graduates completed challenging puzzle and trivia tasks during their kindergarten year. Children's emotion expression and task engagement were assessed based on their observed facial and verbal expressions and behavioral cues. Hierarchical regression analyses revealed that observed persistence and shame predicted teacher ratings of children's academic achievement, whereas interest, anxiety, pride, shame, and persistence predicted children's social skills and learning-related behaviors. Children's emotional and behavioral responses to challenge thus appeared to be important indicators of school success. Observation of such responses may be a useful and valid alternative to self-report measures of motivation at this age.

Children's motivation has been an important topic of psychological research for many years. What is it that pushes children to succeed? Why do some children persist in the face of challenge while others simply give up? Motivation has been studied in relation to a wide range of outcomes relevant for learning, including interest, excitement, and expectations for success in activities, as well as greater performance, persistence, creativity, self-esteem, and general well-being (Bandura, 1997; Deci & Ryan, 1985, 2000; Wigfield, Eccles, Schiefele, Roeser, & Davis-Kean, 2006). Understanding the cognitive and emotional processes that underlie children's motivation is critical for parents, educators, and psychologists. It is particularly important to study motivation in relation to early schooling experience for children at-risk for low achievement, as understanding how aspects of motivation relate to early school adjustment and learning behaviors may inform avenues for intervention. There is a dearth of research on motivation in young children (Stipek & Greene, 2001), however, which may be due to difficulties in assessing motivation in this age group. In the current

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investigation, we present the development of a method to assess observed motivation in young children (specifically emotions and task-focused behavior during challenging tasks), and examine concurrent validity of this measure with regard to teacher-rated school readiness outcomes in a sample of Head Start graduates.

Developing an Observational Measure of Motivation

Assessing motivation in young children

Motivation is defined here as "the process whereby goal-directed behavior is energized and sustained" (Pintrich & Schunk, 2002, p. 49). That is, motivation is that which activates and directs behavior towards certain goals. To assess motivation, researchers have often focused on self-reports of task-related beliefs (e.g., efficacy beliefs, outcome attributions, expectations for success, task value, perceived control, goals, strategies, and internal emotional experiences) as important aspects of motivation (see Elliot & Dweck, 2005, and Wigfield et al., 2006). Among school-age children, for example, perceived competence beliefs have been shown to predict children's valuation of academic domains (Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002) and interest, participation, and achievement in reading (Wigfield & Guthrie, 1997). The survey- and interview-based methods traditionally used to assess these constructs are not as useful for young children, however, due to young children's less-developed capacity to incorporate information about outcomes and task difficulty when rating their own abilities and affect (Ruble, Parsons, & Ross, 1976). Researchers who have attempted to assess task-related beliefs in preschool and kindergarten-age children have often found ceiling effects in the data, leading some to believe that young children consistently show high levels of motivation in the face of failure (see Stipek & Greene, 2001, for a review).

Research using behavior-based assessments with young children, such as observing children's exploratory behavior with objects and whether they prefer challenging or easy tasks, has shown that preschool-age children show individual differences in interests and pursuits (Krapp, Hidi, & Renninger, 1992), attention (Robinson, Burns, & Davis, 2009) and responses to failure (Chang & Burns, 2005; Smiley & Dweck, 1994), all of which are important indicators of motivation. Extensive research on mastery motivation in toddlers has also examined children's observed task-related behaviors such as persistence (e.g., Yarrow et al., 1983) as well as mastery pleasure and task performance (e.g., Morgan, Busch-Rossnagel, Maslin-Cole, & Harmon, 1992). Finally, some researchers have used children's verbal reports, coding motivational beliefs from children's utterances (e.g., endorsing learning or performance goals; Smiley & Dweck, 1994). This may be a less ideal approach to use for assessing motivation in children with less well-developed language skills, however, which may be the case in high-risk samples such as children growing up in poverty (Feagans & Farran, 1982). Given the relative success of behavioral observation methods, we focused on observed task-related behavior during an academic challenge to assess motivation in our sample of Head Start graduates.

Motivation and emotion

In addition to the methodological limitations of the above approaches to assessing task-related aspects of motivation in young children, it is also critical to note that motivation consists of more than task-related behaviors and beliefs. Specifically, emotion experiences can induce and modulate motivation and task engagement for both children and adults (Csikszentmihalyi, 1975; Pekrun, 2006). Emotion state and task engagement have been examined as key components of motivation across developmental periods (Bandura, 1997; Connell & Wellborn, 1991; Smiley & Dweck, 1994). It is therefore vital to consider emotion expression, in addition to task-related behaviors, when evaluating motivation in young

children, although relatively little research has done so (Pekrun, Goetz, Titz, & Perry, 2002). Emotions can suggest the direction of behavior, and emotions and cognition equally drive thought and behavior (Gray, Braver, & Raichle, 2002). In particular, self-evaluative emotions, which involve comparing one's actions in response to standards, rules, and goals, may motivate behavior and promote competence (Alessandri & Lewis, 1993; Lewis & Sullivan, 2005). Children may work hard to experience pride and behave well to avoid feeling shame. For example, even by age two, children were shown to seek approval from adults after successful mastery attempts and turn away after failure (Kelley, Brownell, & Campbell, 2000; Stipek, Recchia, & McClintic, 1992).

Primary emotions also direct behavioral goals and induce motivation (Barrett & Morgan, 1995; Izard & Ackerman, 2000; Pintrich, 2000), with positive emotions associated with more self-reported intrinsic motivation among older children, and negative emotions such as sadness, shame, and fear associated with decreased intrinsic motivation (Linnenbrink & Pintrich, 2000; Pekrun, Elliot, & Maier, 2006). Interest has been hypothesized as a particularly important emotion for motivation and self-regulation (Sansone & Thoman, 2005; Silvia, 2008), and has also been associated with self-reported intrinsic motivation in school-age children and adults (Deci & Ryan, 2000; Harter, 1981; Reeve & Nix, 1997; Renninger, 2000). Additionally, anger is associated with efforts to overcome obstacles to goals; displays of anger and frustration can indicate goal-directed behavior (He et al., 2009; Lewis & Sullivan, 2005), although anger may also indicate less intrinsic motivation (Patrick, Skinner, & Connell, 1993; Pekrun et al., 2006). Anxiety has also been consistently associated with less intrinsic motivation, at least among older children (e.g., Gottfried, 1990).

Furthermore, emotions can also influence processes associated with learning and performance (Pekrun, 2006). Positive affect can support attention, memory, and problem solving (Campos & Barrett, 1985; Carver & Scheier, 2000), whereas negative affect increases cognitive load, impairs working memory, and is related to less deep strategy use (Forgas, 2000; Linnenbrink & Pintrich, 2000; Turner, Thorpe, & Meyer, 1998). Finally, emotions, effort, and persistence have been linked to self-perceptions of ability, learning goals, and learning strategies (Bandura, 1997; Zimmerman, 2000). In the current study, we examined emotions during a challenging task, in addition to more traditional behaviors (e.g., persistence), as indicators of motivation. Specifically, we considered displays of positive affect, interest/arousal, sadness, confusion, worry/anxiety, anger, hostility, frustration, and shame.

Theoretical Framework

We sought to describe aspects of motivation that could be assessed observationally in young children. We began with the definition of motivation as a “process whereby goal-directed activity is energized and sustained” (Pintrich & Schunk, 2002, p. 49), and sought theoretical frames that both fit this definition and described observable behaviors indicative of greater or less motivation. We began with concepts measured in studies of toddlers' mastery motivation, given the demonstrated reliability of these assessments (see MacTurk, Morgan, & Jennings, 1995). This led to the coding of persistence, mastery pleasure (pride), and performance. Next, we looked to expectancy-value theory (Wigfield & Eccles, 2000), a widely used theory in studies of older children's achievement motivation, for indicators of motivation that can be observed. In addition to persistence and performance, expectancy-value theory predicts greater strategy use by children with greater motivation (Pintrich & De Groot, 1990). We chose to focus on help-seeking behavior, given that some researchers believe that help-seeking develops as an adaptive strategy of self-regulated learning and indicates greater motivation (Newman, 2000). Notably, other researchers (Harter, 1981; Lepola, 2004) consider independent effort an indicator of motivation and might consider

help-seeking indicative of dependence on adults. Thus, we were interested to see whether help-seeking would be positively or negatively related to our school readiness indicators. Because our videotapes of the task were primarily focused on children's faces, we were not able to code other aspects of task-focused problem-solving strategies (e.g., starting with the edge pieces of a puzzle). Finally, we explored the role of emotions in young children's motivation, which we coded through observation of facial movements (Izard, 1971).

Based on these theoretical grounds, we considered the following as indicators of motivation: mastery motivation behaviors (persistence, pride, and competence), strategy use (help-seeking), and emotion expression (positive affect, interest/arousal, sadness, confusion, anxiety, anger, frustration, hostility, and shame) as observed during a challenging task (see Figure 1 for our conceptual model). We had directional hypotheses for some, but not all of the different emotions (e.g., positive affect as indicating greater motivation; sad or anxious affect as indicating less motivation), given that the relatively scant literature in this area is mixed. Goals of the current study were twofold: one, to examine relations between observed mastery motivation behaviors, strategy use, and emotion expression; and two, to demonstrate concurrent validity by examining associations between these observational indicators of motivation and other independently-assessed school readiness variables theoretically related to motivation, including student-teacher relationship quality (Deci & Ryan, 1985, 2000), learning-related behaviors (e.g., self-regulation, behavioral engagement; Little, 1998; Skinner, Wellborn, & Connell, 1990; Stipek, Newton, & Chudgar, 2010), and academic competence (Bandura, 1997; Wigfield & Eccles, 2000). We did so in a sample of low-income kindergarten children. Each construct and hypothesized links to motivation is reviewed below (and see Figure 1).

Motivation-Related School Readiness Constructs: Student-Teacher Relationships, Learning-Related Behaviors, and Academic Competence

Nurturing relationships are critically important for encouraging motivation (Pintrich & Schunk, 2002). A sense of belongingness or relatedness is a necessary condition for intrinsic motivation and self-regulated engagement (Deci & Ryan, 2000; Skinner et al., 1990). High-quality relationships with mothers and friends are related to motivation and engagement in school (Buhs, Ladd, & Herald, 2006; Frodi, Bridges, & Grolnick, 1985; Ladd, 2006; Moss & St. Laurent, 2001). Teacher-reported involvement with children strongly predicts emotional engagement and motivation in school (Skinner & Belmont, 1993), perhaps because children with close relationships to their teachers are motivated to please them (Urdan & Maehr, 1995). Finally, Hughes and Kwok (2007) demonstrated that the quality of teacher-student relationships mediated associations between child background characteristics and teacher-rated school engagement. Therefore, we examined how well our observational indicators of motivation predicted the quality of student-teacher relationships (specifically closeness and conflict).

Motivation and learning-related behaviors in the classroom are also theoretically interrelated. However, researchers have not often examined associations between these constructs in young children. School-age children who report more intrinsic motivation show high levels of behavioral engagement, whereas disengagement is related to inattention and low persistence (Reeve, 2006; Skinner et al., 1990). Motivation and self-regulation are also consistently associated in school-age children (e.g., Boekaerts, 2006; Pintrich & De Groot, 1990). In preschoolers, components of motivation including attention, persistence, and positive attitude toward learning as reported by teachers are negatively related to aggression, inattention, and hyperactivity, which can translate into classroom difficulty (Fantuzzo, Bulotsky-Shearer, Fusco, & McWayne, 2005). Behavioral engagement may be a mechanism through which motivation affects performance (Deci & Ryan, 2000). Indeed,

Ladd, Birch, and Buhs (1999) found that school-age children who engage and cooperate with classroom demands show higher achievement. We examined whether our observational indices of motivation in a challenging lab-type task would be associated with teacher ratings of learning-related behaviors, specifically social competence, (lack of) hyperactivity, interpersonal skills, work-related skills, and self-regulation in kindergarteners.

Motivation is also related to academic achievement, even when controlling for IQ (Skinner, Zimmer-Gembeck, & Connell, 1998). Higher motivation, characterized by more persistence, effort, and attention, should lead to greater academic competence as children develop successful strategies and engage in deep conceptual learning (Barrett & Morgan, 1995; Deci & Ryan, 2000; Skinner & Belmont, 1993). Simply put, motivation can lead children to pursue opportunities to learn and therefore results in more learning. A measure of general motivation should therefore predict academic competence. In the current study, we expected that the emotions and behaviors indicating high or low motivation as observed in our challenge task would be related to teachers' reports children's competence in literacy and math.

Current Investigation and Hypotheses

Thus, although assessments of motivation in older children have focused on self-reports, it is vital to consider outwardly observable indicators of motivation for younger children who may be less reliable reporters. Kindergarten is a critical academic transition particularly for children at risk for low achievement; we examined whether externally observable indicators of motivation at this age relate to school readiness outcomes. We rated emotional and behavioral indicators of motivation during a challenging task, and examined associations with theoretically important areas of child functioning relevant for school readiness as rated by teachers, in a sample of low-income kindergarten-age children. We viewed mastery motivation variables (persistence, pride, and competence) and strategy use (help-seeking) as positive indicators of motivation. We also considered positive affect and interest/arousal as indicating greater motivation (e.g., Deci & Ryan, 1985; Harter, 1981; Lewis & Sullivan, 2005; Pekrun et al., 2006; Reeve & Nix, 1997), and sadness, anxiety, and shame as indicating less motivation (e.g., Patrick et al., 1993; Pekrun et al., 2006). Given that anger and frustration may serve motivating (e.g., Carver & Harmon-Jones, 2009) as well as dysregulating functions (e.g., Cole, Michel, & Teti, 1994), we hypothesized that frequent displays of these emotions would likely indicate less motivation, but that occasional displays of such emotions in our challenge task could indicate greater motivation. Similarly, confusion, which is a metacognitive signal that the mind needs more information, may signal that a shift in strategy or increase in effort is needed and increase engagement, but it may also motivate withdrawing, avoiding, or shifting tasks (Silvia, 2009). Thus, we theorized that low to moderate levels of confusion would be motivating and high levels of confusion would indicate less motivation. We expected that children with greater observed motivation would be rated as having closer student-teacher relationships, better learning-related behaviors, and greater academic competence.

Method

Participants

Participants were 131 families enrolled in a study of preschool emotional competence and kindergarten transition in an urban/suburban area in New England. Children were all Head Start graduates; their kindergartens had a range of 13–22% of students receiving free or reduced-price lunch. Reflecting the demographic characteristics of the region, children's racial identities, as reported by parents, were 8.2% African-American and 70.9% Caucasian (ethnicity: 21% Latino/a). Mean family income was $25,480 for a mean family size of 4.6

individuals (median, $21,300; range, $2,160–70,000). Kindergarteners had a mean age of 5.73 years (*SD* = 0.31), and the sample was 56.5% female.

Procedure

All of the data in the present study were collected on-site in children's kindergarten schools by BA-level research assistants whom the children knew from previous years of data collection. Data collection occurred in rooms that were not in use (e.g., library, administrative, office areas). Children were interviewed on three separate days in the fall of their kindergarten year. Motivation assessment sessions (see below) were completed at school on Day 3. Verbal assent was obtained before assessment and children were debriefed afterwards. Teachers were given a questionnaire packet to complete, and were paid $20.00 per child for completing the packet. Ninety percent of teachers completed questionnaires, typically by Day 3.

Assessments and Measures

Motivation assessment: Challenge tasks and observational coding

Our challenge tasks were adapted from work conducted by Smiley and Dweck (1994), and included five puzzle tasks and a trivia game. Children were given two minutes each to attempt to solve three puzzles designed to be impossible (puzzle pieces removed), and two puzzles that were solvable but not easy in the time allotted. The trivia game (Brown, 2006) was designed to give failure feedback by asking the child to identify one of three objects using difficult vocabulary clues (e.g., ”which one is the lepidoptera?”). Regardless of their answer, children were told that they answered incorrectly and were given the chance to stop or to continue. Afterwards, the experimenter told the child that she had made a mistake and given him/her the “adult questions;” the child ended the session by answering the “kid questions” successfully. IRB approval was given, and parent consent obtained, for all tasks. Children were debriefed and soothed if they became upset during the activity. All tasks were videotaped for later coding.

Emotion (adapted from the AFFEX coding system; Izard, Dougherty, & Hembree, 1989) and task behavior states (a coding system developed for this project) were coded independently by student coding teams using The Observer XT software system (Noldus Information Technology, 2005). Facial, vocal, and behavioral cues were used to indicate emotions (e.g., triangular brows for sadness, smile for positive) and task behaviors (e.g., intently pushing puzzle pieces together). Children were continuously coded as being in one of seven mutually exclusive emotion states (neutral, positive, interest/arousal, sadness, confusion, anxiety, anger) and as showing discrete emotion events (pride, shame, frustration, experimenter-directed hostility). They were also coded as being in one of three mutually exclusive task behavior states, reflecting mastery motivation (with on-task/persistence indicating greater mastery motivation; off-task and on-task/socializing, which was conceptualized and coded as children “multitasking” by talking with the experimenter while doing the task, and as indicating less mastery motivation). Help-seeking (indicating strategy use) and puzzle completion for the difficult yet solvable puzzle (indicating competence) were coded as discrete task events. Note that although pride was coded in the `emotion event' behavior stream, we considered it a mastery motivation variable.

Continuously coded emotion and task behavior states yielded raw scores of total times that the child was in that state (e.g., number of seconds the child was sad, number of seconds the child was on-task/persistent). These scores were divided by the total time the child spent on the lab tasks, as administration times varied between children. The final scores used in analyses were therefore percentage of time in each mutually exclusive emotion state and percentage of time in each mutually exclusive task behavior state. Emotion and task

behavior events (e.g., help-seeking, pride) were counted and these counts were used in analyses. Intraclass correlations (ICCs) were used to determine reliability between coders in fourteen tapes (10%) using procedures outlined by Shrout and Fleiss (1979) for multiple raters producing continuous data (see Table 1 for code descriptions and reliability statistics). Coding disagreements were resolved by group consensus. In addition, rare events such as shame and hostility were coded by group consensus; these items did not occur with sufficient frequency to be included in reliability analyses.

School readiness variables

Teachers reported on their perceptions of the quality of their relationship with the student, students' learning-related behaviors, and students' academic competence. Student-teacher relationship quality was measured with the Student-Teacher Relationship Scale (STRS; Pianta & Nimetz, 1991), with Closeness (11 items), and Conflict (12 items) subscales included (Dependence subscale was excluded due to low reliability). Closeness (α = .84) and conflict (α = .93) subscales were both highly reliable in this sample. Mean scores were 3.91 (*SD* = 0.64) for closeness and 1.57 (*SD* = 0.74) for conflict.

Hyperactivity was measured using the 7-item Hyperactivity subscale (α = .95) from the Conners Teacher Rating Scale-Revised (Conners, 1997). The mean hyperactivity score was 3.92 (*SD* = 5.43). Three subscales were created from the Cooper-Farran Behavioral Rating Scales (CFBRS; Cooper & Farran, 1991) to reflect Self-Regulation (e.g., running in school building, listening to teacher; 11 items, α = .93), Work-Related Skills (e.g., behavior during work time and discussions; 8 items, α = .84) and Interpersonal Skills (e.g., positive response to criticism, conflict resolution skills; 18 items, α = .93). Mean scores were 4.90 (*SD* = 1.30) for Self-Regulation, 4.90 (*SD* = 1.03) for Work-Related Skills, and 5.72 (*SD* = 0.94) for Interpersonal Skills. Social competence was assessed using two items (α = .89) from the Academic and Social Competence scales (ASC; Valeski & Stipek, 2001), which ask teachers to rate student competence in the areas of math, reading, and social skills on a scale ranging from 1 (“well below children this age”) to 5 (“well above children this age”). The mean score was 2.89 (*SD* = 0.69).

Student academic competence was also measured using the ASC (Valeski & Stipek, 2001). Teachers rated two items to indicate student competence in reading (α = .89) and math (α = .84): “Please rate the child's reading/math-related skills” and “How well do you expect the child to do next year in reading/math?” Mean scores were 2.84 (*SD* = 0.80) in reading and 2.85 (*SD* = 0.69) in math. Teacher ratings of reading and math achievement in kindergarten have been shown to have good concurrent and predictive validity up through 3rd grade (Stevenson, Parker, Wilkinson, Hegion, & Fish, 1976).

Results

Age and Gender Differences

Independent samples t-tests revealed that females displayed more positive emotion than males (means of 11.0% and 6.5%, respectively; t (129) = −3.57, $p < 0.01$. There was no relation between age and any of our indicators of motivation. We conducted our regression analyses with and without including age as a covariate, and found no differences in the pattern of significance or results, so age was excluded for parsimony. There were no gender or age differences on outcome measures.

Intercorrelations among Observed Indicators of Motivation (Emotions and Task Behavior)

Intercorrelations among observed emotions and behaviors are presented in Table 2. Significant correlations ($p < .05$) are as follows: persistence was negatively correlated with

sadness, confusion, anxiety, anger, hostility, frustration, help-seeking and pride. Persistence did not relate to competence. Frustration, confusion, anger, and anxiety were positively associated with off-task behavior. Help-seeking, pride, positive affect, hostility, and frustration were all positively correlated with on-task/socializing behavior, characteristic of children who had more interaction with the experimenter.

Among the task codes, persistence was negatively related to on-task/socializing and off-task behavior, as expected, whereas off-task and on-task/socializing were weakly correlated. Emotion events were generally associated with expected emotion states: hostility was positively correlated with anger, frustration was positively related to both sadness and anger, and pride was positively associated with positive emotion expression. Among emotion states, anxiety was correlated with less positive affect and more sadness and confusion, and anger and sadness were positively correlated. Shame and sadness were not significantly associated, although shame was associated with confusion.

Intercorrelations among School Readiness Variables

Intercorrelations among teacher-rated variables are presented in Table 3. As expected, teacher-reported student-teacher relationship quality, learning-related behaviors, and academic competence were moderately intercorrelated.

Intercorrelations among Observed Indicators of Motivation and School Readiness

Correlations between observed indicators of motivation and teacher-reported school readiness outcomes are presented in Table 4. Significant correlations ($p < .05$) are noted below.

Student-teacher relationship quality—Student-teacher closeness was positively related to pride. Student-teacher conflict was negatively related to persistence, and positively related to on-task/socializing, hostility, and competence (see Table 4).

Learning-related behaviors—Social competence was negatively related to interest/arousal, confusion, anxiety, hostility, on-task/socializing, and off-task behavior, and positively related to shame and persistence. Hyperactivity was positively related to interest/arousal, sadness, anxiety, anger, hostility, pride, help-seeking, on-task/socializing and off-task behavior, and negatively related to persistence. Interpersonal skills were positively related to persistence, and negatively related to hostility, frustration, help-seeking, pride, and on-task/socializing behavior. Work-related skills were negatively related to anxiety, on-task/socializing, and off-task behavior and positively related to shame and persistence. Finally, self-regulation skills were positively related to persistence and negatively related to anxiety, hostility, on-task/socializing, off-task behavior, and help-seeking (see Table 4).

Academic competence—Both reading and math competence were positively related to persistence and shame, and negatively related to off-task behavior. Math competence was also negatively related to anxiety (see Table 4).

Regression Analyses: Observed Indicators of Motivation Predicting School Readiness

Data were collected from 20 schools over a period of 4 years, and teacher report data came from 45 teachers across 77 classrooms. Most classrooms had only one child in the study (at most, any given class had 3 children), and so our analyses are not nested within classrooms. A series of hierarchical OLS regression analyses was conducted to examine the contributions of observed indicators of motivation (emotions and task behavior) to teacher-rated school readiness. In the interest of examining the most parsimonious models and focusing on observed motivation variables most relevant for school readiness, only the

variables that were significantly associated with teacher-rated outcomes at the zero-order level were entered into analyses. Variables that explained unique variance in one or more school readiness measures were retained for all analyses. Note that we coded two different types of on-task behavior, on-task/persistence and on-task/socializing. Given that these two variables were highly negatively correlated ($r = -.89$, $p < .01$), and given the negative correlations of on-task/socializing with school readiness outcomes, we did not combine them into a single variable but instead chose the more traditional positive indicator of motivation, persistence, to include in regression analyses. For all models, mastery motivation variables were entered first, then strategy use (help-seeking), then emotions in the third step. In this way, we could see the independent contributions of emotions over and above task behavior. Results are presented in Tables 5–7.

Student-teacher relationships—Observed emotion and task behaviors did not predict student-teacher closeness ($R^2 = .07$). Mastery motivation components contributed to the explanation of a moderate amount of variance in student-teacher relationship conflict scores ($R^2 = .19$). Specifically, less persistence predicted greater conflict while greater task competence and more interest/arousal predicted greater conflict (see Table 5).

Learning-related behaviors—Task behavior and emotion expressions each contributed significantly to predicting most teacher-rated learning-related behaviors, with a moderate amount of variance in such skills explained by these observed indicators of motivation (R^2 range: .22–.30; see Table 6). Increased task persistence predicted greater social competence, interpersonal and work-related skills, self-regulation, and less hyperactivity. Pride also positively contributed to the prediction of greater social competence. In contrast, help-seeking was unrelated to these outcomes. Adding emotion expressions to the model significantly increased the predictive power ($R^2\Delta$ =.02–.11). Specifically, expressions of interest/arousal predicted less social competence and more hyperactivity. Expressions of anxiety predicted lower work-related and self-regulation skills. Shame expressions predicted greater social competence and work-related skills.

Academic competence—Finally, observed indicators of motivation also each contributed to predicting a moderate amount of the variance in teacher-rated academic competence ($R^2 = .17$ for reading; $R^2 = .20$ for math; see Table 7). High persistence in the task predicted higher math and reading skills; competence, pride, and help-seeking were not significantly related to academic skills. While emotion expressions as a group did not increase the predictive power of the model at the $p < .05$ level, more shame expressions predicted greater math and reading skills.

Follow Up Analyses: Negative Emotion Expressions, Interest/Arousal, and Confusion

Because anger and hostility occurred infrequently, we conducted additional analyses to examine outcomes for children who showed high levels of these negative externalizing emotions (defined as those in the top quartile for anger or frustration, and any child showing hostility to the experimenter; $N = 43$) compared with their peers ($N = 74$). Children who showed high levels of negative externalizing emotion expressions were rated by their teachers as less socially competent (t (114) = −2.08, $p < 0.05$), more hyperactive (t (115) = 2.40, $p < 0.05$), and as having poorer interpersonal (t (113) = −2.55, $p < 0.05$) and poorer self-regulatory skills (t (115) = −2.74, $p < 0.01$) than children who showed lower levels of negative externalizing emotions during the task.

We also conducted follow up analyses in order to examine our interest/arousal variable in more detail. Given prominent theories of motivation and arousal (e.g., Yerkes & Dodson, 1908) suggesting that moderate levels of arousal are optimal for performance, we compared

the school readiness outcomes of children in the bottom, middle, and top third of the interest/arousal distribution. Children in the top third of the distribution were rated by teachers as less socially competent than those in the middle and bottom third (t (114) = −2.70, $p < 0.01$). In contrast, children in the top and middle thirds of the interest/arousal distribution were rated by teachers as more hyperactive (t (114) = 3.04, $p < 0.01$), and as having poorer interpersonal (t (113) = −2.60, $p < 0.01$) and self-regulatory (t (115) = −2.53, $p < 0.05$) skills than those in the bottom third.

Because previous research did not suggest a directional hypothesis for confusion, we considered whether moderate levels of confusion were similarly optimal for motivation – enough to signal the need to seek more information or a new strategy, but not enough to motivate task withdrawal (Silvia, 2009). No relations were found between level of confusion and school readiness outcomes.

Discussion

Results suggest that rating observed emotional and behavioral responses to a challenging task is a valid way to assess motivation in young children. We established inter-rater reliability with our observational coding system and captured considerable variance in young children's observed task behavior and emotional responses to our challenging laboratory-type task. Further, behaviors observed in this task were meaningfully associated with learning-related classroom behaviors as reported by teachers, demonstrating concurrent validity. We discuss below our results and implications for the study of motivation in young children.

Gender Differences

Girls displayed nearly twice as much positive affect as boys during the challenging tasks. However, given that displays of positive affect were not related to any of the teacher-rated school readiness outcomes, such gender differences in positive emotion displays may not in fact reflect differences in motivation, but more likely just gender differences in the base rates of positive emotion that have been found to exist even in early childhood (e.g., Garner, Robertson, & Smith, 1997).

Associations among Task Behavior and Emotions in Challenge Task

Our assessment of on-task/socializing behavior as distinct from persistence and off-task behavior appeared to capture children's different approaches to the task. Distinguishing on-task/socializing behavior from on-task persistence likely improved the sensitivity of the persistence measure for predicting school-readiness outcomes. On-task/persistence required focused attention, thus capturing cognitive as well as behavioral engagement (see Fredricks, Blumenfeld, & Paris, 2004), whereas on-task/socializing captured behavioral engagement but also a state of divided attention, perhaps indicating less engagement. On-task/socializing also had more equivocal implications for motivation and school readiness, whereas persistence was consistently associated with positive school readiness outcomes. It is also important to note however that our coding of persistence (i.e., requiring children to maintain focused on the task, and not engage with the experimenter) likely also resulted in negative associations with pride and help-seeking, because help-seeking requires social interaction with the experimenter, and expressions of pride often do as well (e.g., “Look at what I did!”). Persistence was thus less correlated with other indicators of motivation than it might otherwise have been. Conceptualizing on-task/socializing behavior as distinct from off-task behavior was also important, because it allowed off-task behavior to be more distinctive. Off-task behavior occurred relatively infrequently, yet was highly correlated with negative emotion expressions (anxiety, anger). In sum, we found a useful way to categorize task-

related behavior during a challenging task, and it may help illustrate (e.g., for teachers of young children) the different emotional experiences of children who approach a challenging task in a more socially focused versus a more non-social, task-focused (or off-task) manner.

With regard to the role of emotions in challenging task contexts, Campos, Campos, and Barrett (1989) note that affect can support processes of attention, self-regulation, problem-solving, and optimal functioning, but that affective experiences can also compete or interfere with the cognitive demands of a particular setting. If children are overaroused or emotionally dysregulated, they may not be able to fully engage with the task at hand (Cole et al., 1994). Because our laboratory task was designed to be somewhat frustrating by inducing failure, students with better emotion regulation skills should have better experiences in this context. Indeed, we found that although positive affect was unrelated to persistence, anxiety, anger, and frustration were negatively related to persistence. This suggests that negative affective experience may interfere with the demands of this type of challenging task, and may be related to a decrease in persistence.

Associations of Observed Indicators of Motivation with Teacher-Rated School Readiness

Observed task behaviors (primarily persistence) and emotion expressions both contributed to the prediction of teacher-rated school readiness variables, particularly learning-related behaviors and reading and math skills. Children who were more persistent appeared to be functioning more effectively in the classroom context, which makes sense because our task was designed as an academic challenge (attempting a difficult puzzle, answering questions). This association between motivated behavior in the task and classroom contexts suggests a further link between motivation and performance: children who can persist in the face of challenge are more likely to conduct themselves in accordance with the expectations of the classroom and are therefore more likely and easily able to engage in classroom activities and work with peers (Pomerantz, Wang, & Ng, 2005). Further, children who are more motivated for challenge may seek out further challenging situations, resulting in more practice of difficult material, increased skill development, and ultimately greater performance (Bandura, 1997; Dweck, 1999). Thus, an early assessment of children's persistent response to challenge may help teachers identify children who may need more support in the classroom to learn and perform at optimum levels.

From a methodological perspective, it is clear that including persistence as a positive indicator of motivation is essential. On-task/socializing, however, was correlated −0.89 with persistence and accordingly negatively related to school readiness outcomes. This “multi-tasking” state of engaging the experimenter socially while working on the puzzle may be best interpreted as superficial compliance with the task while not fully engaging with it. Such multi-tasking is increasingly frequent in our society, and there is much debate about the effectiveness and potential negative impact of this behavior (Hayles, 2007; Rosen, 2008). Indeed, consistently seeking new stimuli (versus sustained attention to a single task) is a hallmark of attention problems (Manly et al., 2001). Furthermore, on-task socializing was negatively related to teacher-rated interpersonal skills and social competence, suggesting that children who engage in this behavior are also not building positive relations with their peers. We may need to pay particular attention to children who display such behavior as they may be at greater risk for school failure than their “on-task/persistent” peers.

Although some consider competence a part of mastery motivation (e.g., Morgan et al., 1992), we found that students who completed the challenging block puzzle were more likely to be in conflict with teachers, which ran counter to our hypothesis. It is not clear why this was the case; perhaps children who are more adept at complex tasks such as this are bored in the classroom and getting into trouble when they complete their assigned work. Although

we could not test this hypothesis in the current study, this could be a possibility. Also, competence was not related to persistence. This may be due to the difficulty of the task for which we measured competence. Indeed, only 23 children solved the final puzzle. This may have led to inadequate variability in the measure of competence and prevented us from seeing the true relation between persistence and competence. A finer measure of competence might help us determine whether we were seeing goal-directed persistence or simply compliance.

Pride is also related to mastery motivation in young children (Lewis & Sullivan, 2005) and to enhanced adult performance (Herrald & Tomaka, 2002). Pride predicted the more socially-oriented outcomes we examined, but not work-related or academic skills. Pride is a very social emotion (Tracy & Robins, 2007). Observing pride in naturally occurring settings (e.g., classrooms) and social situations (e.g., peer interactions) versus in a laboratory-type task may thus be highly instructive in explicating the role of pride in motivation. Given that antecedents of pride are seen early in development (Lagatutta & Thompson, 2007), it may also be useful to examine associations between expressions of pride and motivation-related outcomes as they develop over time.

We had conceptualized help-seeking as an important adaptive learning strategy that develops with increasingly self-regulated learning in childhood (Newman, 2000), and predicted that it would positively predict school readiness. However, it was negatively correlated with self-regulation and interpersonal skills, and not associated with academic skills. It may be that kindergarten is too early to identify relations between help-seeking and academic achievement, as this skill is just beginning to develop. It may also be that help-seeking in this context may represent a lack of independent mastery (e.g., Harter, 1981). Assessing the nature and purpose of help-seeking behavior may be important (e.g., Karabenick, 2004). That is, it may not be the number of times children seek help but the reasons for seeking help (getting a quick answer versus trying to understand a math problem, for example) that are important. Distinguishing between strategic help-seeking (“Can you help me find this piece?”) and helplessness (“I need help, I can't do this”) may help address this question.

With regard to emotions, we found associations between kindergarteners' expressions of anxiety in our challenge task and teacher-rated hyperactivity, as well as (poor) work-related and self-regulation skills. Performance anxiety has often been studied in older children as an example of an emotion that can impede motivation and achievement, while other emotions have been less-widely studied (Pekrun et al., 2002). Kindergarten-age children may not be as aware of the potential academically evaluative nature of these challenging tasks as older children, so the role of anxiety in this context, or at this age, with respect to academic performance or skill level may be less clear. It may also be that the indicators of anxiety that we saw in this context (e.g., jittery body; eyes shifting back and forth, worried brows) may have less to do with children's worry about being academically evaluated, but may reflect an inability to focus and concentrate on the task. Future work could focus on the development of associations between “performance anxiety” and school achievement by using longitudinal designs.

Our findings regarding other emotions that are theoretically important for motivation – specifically, interest/arousal and shame – also bear discussion. Because we cannot capture internal emotion states using observational measures, we coded the actions, verbalizations, and expressions that we saw (e.g., grabbing the picture of the puzzle to look more closely). In previous studies relating interest/arousal and self-reported interest, only facial movements (e.g., a widened mouth) were used to indicate interest (Reeve & Nix, 1997). In the current study, children were also coded as interested if they exclaimed about new ideas or quickly

started a new part of the task. Although one might expect such actions to indicate high motivation and/or engagement in the face of challenge, resulting in greater academic achievement, interest/arousal was not related to academic skills. Instead, it was positively associated with hyperactivity. Thus, it seems that in addition to capturing arousal and interest, we may have captured over-arousal as well. Although moderate levels of arousal lead to high levels of performance, high levels of arousal lead to decreasing performance (Yerkes & Dodson, 1908). Related to this, a child's propensity to react physiologically to challenging situations, and to regulate these reactions, can also have implications for his or her readiness for school (Blair, 2002). Effective emotion regulation is important in maintaining the moderate level of arousal necessary for optimum motivation and performance (Little, 1998; Schutz & Davis, 2000). Directly assessing children's physiological states and use of emotion regulation strategies (e.g., self-talk; deep breathing) during a challenging task might elucidate the process by which emotion regulation can help a child stay focused and interested, yet not over-aroused or anxious.

We also found that children in the upper third of the interest/arousal distribution were rated as less socially competent than their peers. These children may also tend to comply less well with group (or adult/experimenter) norms, instead following their own pursuits, which may result in strained peer relationships. Teachers may find it more difficult to work with them, particularly during whole-group activities. Children with moderate to high levels of interest/arousal were also rated as more hyperactive and as having weak interpersonal and self-regulation skills. This may, in part, reflect some of the increased demands on teachers and students in the early school years to maintain highly self-regulated behavior in the classroom in order to meet curriculum demands. This can be extremely challenging for many children, particularly those who are experiencing stressful home environments, as may be the case in our sample of Head Start graduates (Randolph, Koblinsky, Beemer, Roberts, & Letiecq, 2000).

Only 15% of children displayed shame during the challenge tasks. These children had higher social and academic competence as well as better work-related skills. Given few failure experiences in school, these children may have been aware of their failure in these tasks, and judged themselves negatively on the basis of this failure. Interviewing children who do and do not show shame in the face of failure may help us learn more about the attributions they make about their failure in these situations. For example, children displaying shame may attribute their failure to being “bad” (e.g., Heyman, Dweck, & Cain, 1992), and might experience diminished self-worth. Competent children who do not show shame may be better able to attribute their failure to the nature of the task. Interview data might also allow us to predict when, or for which children, such experiences of shame – which is typically an intensely negative emotional experience (Keltner & Harker, 1998) – result in avoidance of further challenge, and when, or for which children, such shame experiences motivate children to work harder. Self-conscious emotions can be important motivators of socially appropriate behavior at different ages (Beer, Heerey, Keltner, Scabini, & Knight, 2003; Lewis & Sullivan, 2005). Children who experience shame following poor performance might be motivated to succeed in the future, but might also be more conscious of the outcome and how it looks (a performance orientation) than of the learning process and acquiring new skills (a learning orientation; Smiley & Dweck, 1994).

The lack of association between observed behavior in our tasks and positive student-teacher relationships suggests that the effect of relational support on motivation and affective engagement (Connell & Wellborn, 1991) may be context-specific. That is, relationships may best support motivation in contexts where those relationships are salient. In a decontextualized laboratory situation, then, we might not expect student-teacher relationships to influence motivation to perform a challenging task with a relatively

unknown experimenter. We did find, however, that greater interest/arousal and diminished persistence were related to a more conflictual relationship with the teacher. These child behaviors may be consistent across multiple contexts, which could lead to conflict in a classroom situation where children's activities are directed by the teacher. Including observations of children in their classrooms in future research could greatly elucidate these patterns.

Implications and Future Research

Our ability to elicit and reliably observe emotions and behaviors related to motivation in a laboratory-type task, and make inferences about children's school readiness in the classroom has several implications. First, using observational approaches like this one provide an alternative to self- and teacher-reports of motivation, which may not be highly reliable (especially self-reports from younger children). Second, using an observational method could provide us with the opportunity to assess children's motivation over the course of early childhood as well during the schooling years, because behavior during a challenging task could be assessed across different ages. This would facilitate the longitudinal research that is critically needed in this field. Third, the fact that we can observe children and make inferences about their motivated behavior suggests that teachers may be doing the same. It may be instructive to guide teachers to consider the implications of multiple aspects of task behavior, as well as emotional responses, when working with young children on challenging material. For example, knowing that children who appear to be engaged but “multitasking” have poorer school readiness outcomes may lead teachers to provide additional support or a different form of instruction to those students. Receiving information about the kinds of behaviors and emotions that may signal high or low motivation may be helpful for teachers who can then watch for and assess these behaviors in their students.

From a broader educational and policy perspective, an overall goal of this research is to help us better understand young children's responses to early academic struggles. It can make a significant contribution to the rapidly expanding literature on emotion and self-regulation in connection with classroom behaviors and learning outcomes (e.g., Denham, 2006; McClelland et al., 2007). Many effective interventions for struggling students include substantial affective components as well as skill-based training, for example (Greenberg, Kusche, Cook, & Quamma, 1995). If we are to develop strong early childhood education programs, it is imperative that we understand how children develop differences in achievement motivation at a young age, how to measure such motivation in very young children, and how to use this information to promote academic and motivational growth for all, especially for children at risk.

Study Limitations

As with all research studies, there are several limitations that should be considered. One limitation of the current study is our measurement of persistence. We considered continued on-task behavior to indicate persistence, but without a way to gauge children's effort, we may have captured primarily compliance. It would be interesting to compare these results to other approaches to assessing persistence and to measure effort versus compliance in future work. Also, although children's choice of activities is an observable indicator of their motivation, we did not measure children's preference for challenging puzzles due to time constraints in our laboratory session. Future research would benefit from the inclusion of such a measure. Additionally, our sample included low-income Head Start graduates after the transition to kindergarten. It is unclear whether children who have not had any preschool experiences would respond differently in the challenging task situation. Furthermore, our Head Start population was relatively affluent. It is possible that students from very low-, middle-, and upper-class backgrounds might respond differently. Future research should

include a wider socio-economically representative sample of children. The laboratory-type assessment provides an additional constraint on the validity of this study. Coding emotions and task behaviors in similarly challenging tasks in the naturalistic context of children's own classrooms would provide an interesting additional way to evaluate the validity of this type of approach, as well as examine associations between early indicators of motivation and student-teacher relationships in the early years. Another potential limitation is the reliance on teacher report data for our school readiness outcomes. Observational data or other school readiness assessments would greatly strengthen future work. Finally, as our study encompasses only the transition to kindergarten, we cannot assess the long-term effects of kindergarten motivation or the use of this measure with older children.

Conclusions

Emotional and behavioral indicators of motivation as observed during challenging tasks appear to be good predictors of school readiness in Head Start graduates. Although persistence was the single greatest predictor of positive school readiness outcomes, considering a child's emotional reaction to academic challenge may also be instructive for educators and psychologists seeking to promote optimal educational outcomes for children at risk.

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Figure 1.
Conceptual model: Observed indicators of motivation and associations with school readiness outcomes, including learning-related behaviors, student-teacher relationship quality, and academic competence.

Table 1

Descriptions, Interrater Reliabilities, Descriptive Statistics, and Frequencies for Emotion and Task Behavior Codes

	Code Description	Interrater Rel. (ICC)	M	SD	Min.	Max.	% Displaying
Emotion States (% duration)							
Neutral	no discernible expression	.93	75.92	10.86	44.56	96.16	100
Positive	laughs/giggles, verbal remarks, grins, smiles	.94	9.04	7.75	0	39.77	99.24
Interest/Arousal	highly alert, attentive, engaged with the experimenter or task	.82	11.04	7.44	0.21	42.25	100
Sadness	droopy posture; tears up; frowns; lip pouts	.88	0.87	1.32	0	5.76	72.52
Confusion	quizzical, puzzled; scratches head, furrowed brows, narrowed eyes	.73	1.38	1.53	0	9.22	87.02
Anxiety	`frozen' expression, wide eyes, mouth twitches, fidgets, brows together	.66	1.19	2.14	0	20.28	82.44
Anger	brows drawn down and together; tense mouth	.82	0.22	0.52	0	3.62	38.93
Emotion Events (# observed)							
Pride	pleasure in accomplishment; e.g. calls attention to puzzle, tall posture	.78	4.47	4.04	0	17	86.26
Frustration	exasperated/negative affect toward task, in response to inability to solve it	.91	6.27	6.23	0	32	90.84
Hostility	rolls eyes, sneers, refuses to answer experimenter or follow directions	~	0.21	1.45	0	16	7.63
Shame	gaze avoidance, hunched body; face hidden, looks like wants to escape	~	0.21	0.55	0	3	15.27
Task Behavior States (% duration)							
Persistence	follows instructions, visual/behavioral focus on task	.91	89.58	8.37	63.69	100.0	100
Socializing	chats about other topics but still follows instructions, visual/behavioral focus is on task	.97	6.94	6.14	0	27.62	92.37
Off-Task	visual/behavioral focus on object/event other than task for >3 seconds	.84	2.10	3.44	0	24.69	62.60
Task Behavior Events (# observed)							
Help-Seeking	verbally directly and explicitly asks for help with task	.83	0.86	1.40	0	15	31.30
Competence	completes block puzzle	1.0	0.18	0.38	0	1	17.60

Note. $N = 131$

~reliability not calculated for events occurring in less than 20% of children.

Table 2

Correlations among Observed Emotion Expressions and Task Behaviors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Positive (1)	---														
Interest/arousal (2)	−.13	---													
Sadness (3)	−.09	.07	---												
Confusion (4)	−.11	.30*	.01	---											
Anxiety (5)	−.18*	.10	.21*	.46*	---										
Anger (6)	.08	.09	.24*	.11	.04	---									
Hostility (7)	−.07	.10	.11	.01	−.05	.54*	---								
Frustration (8)	.08	.17t	.35*	.15t	.08	.43*	.17t	---							
Pride (9)	.45*	.09	.05	.06	−.04	.09	.01	.25*	---						
Shame (10)	.01	.03	.13	.17*	.08	−.04	−.04	.14	.00	---					
Persistence (11)	−.13	−.11	−.21*	−.20*	−.22*	−.23*	−.24*	−.44*	−.43*	.03	---				
Socializing (12)	.20*	.17t	.17t	.12	.01	.14	.22*	.39*	.50*	.00	−.89*	---			
Off-Task (13)	−.03	−.06	.12	.23*	.48*	.25*	.13	.26*	.05	−.09	−.62*	.23*	---		
Help-Seeking (14)	.15t	.03	.13	−.05	.02	.10	.10	.34*	.29*	−.05	−.49*	.53*	.15t	---	
Competence (15)	−.01	−.05	−.13	−.02	−.01	−.14	−.05	−.12	.06	.02	.09	−.09	−.03	−.09	---

Note. *N*=131.

t *p*<.10

* *p* < .05.

Table 3

Correlations among Teacher-Rated School Readiness Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
STRS Closeness (1)	---							
STRS Conflict (2)	−0.37*	---						
Social Competence (3)	0.29*	−0.65*	---					
Hyperactivity (4)	0.01	0.74*	−0.52*	---				
Interpersonal Skills (5)	0.19*	−0.85*	0.62*	−0.81*	---			
Work-Related Skills (6)	0.39*	−0.66*	0.67*	−0.53*	0.63*	---		
Self-Regulation (7)	0.16	−0.71*	0.67*	−0.79*	0.79*	0.81*	---	
Reading Skill (8)	0.13	−0.25*	0.41*	−0.17t	0.15	0.55*	0.44*	---
Math Skill (9)	0.13	−0.35*	0.48*	−0.25*	0.25*	0.59*	0.49*	0.90*

Note.*N*=118.

t *p*<.10

* *p*<.05.

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Table 4

Correlations among Observed Emotion Expressions, Task Behaviors, and Teacher-Rated School Readiness Variables

	Student-Teacher Relationships		Learning-Related Behaviors					Academic Competence	
	Closeness	**Conflict**	**Social Comp.**	**Hyper-activity**	**Interpers. Skills**	**Work-Rel. Skills**	**Self-Regul.**	**Reading**	**Math**
Mastery Motivation Variables									
Persistence	−0.08	−0.26*	0.32*	−0.43*	0.40*	0.35*	0.48*	0.21*	0.27*
Socializing	0.10	0.24*	−0.28*	0.41*	−0.39*	−0.24*	−0.44*	−0.11	−0.16t
Off-Task	−0.01	0.13	−0.22*	0.20*	−0.17t	−0.33*	−0.27*	−0.28*	−0.31*
Pride	0.21*	0.02	0.04	0.26*	−0.20*	0.03	−0.18t	0.06	0.06
Competence	−0.06	0.22*	0.02	0.09	−0.14	−0.02	−0.05	0.14	0.17t
Strategy Use									
Help-Seeking	−0.03	0.10	−0.07	0.22*	−0.19*	−0.12	−0.23*	0.04	0.01
Emotion Variables									
Neutral	−0.09	−0.12	0.15	−0.23*	0.11	0.01	0.16	0.03	0.04
Positive	0.09	−0.08	0.16t	−0.04	0.04	0.05	0.04	0.08	0.05
Interest/arousal	−0.02	0.17t	−0.25*	0.23*	−0.12	0.05	−0.13	−0.05	−0.04
Sadness	0.13	0.11	−0.11	0.19*	−0.17t	−0.09	−0.17t	0.02	0.03
Confusion	−0.04	0.13	−0.19*	0.14	−0.11	−0.08	−0.10	−0.12	−0.10
Anxiety	−0.05	0.16t	−0.22*	0.25*	−0.14	−0.25*	−0.29*	−0.17t	−0.19*
Anger	0.07	0.13	−0.10	0.19*	−0.15	−0.06	−0.08	−0.06	−0.07
Hostility	0.07	0.29*	−0.21*	0.30*	−0.30*	−0.17t	−0.18*	−0.03	−0.04
Frustration	0.07	0.09	−0.09	0.18t	−0.20*	−0.06	−0.12	−0.01	−0.03
Shame	−0.02	−0.04	0.19*	−0.01	0.08	0.21*	0.13	0.22*	0.20*

Note. *N*=118.

$^{t}p<.10$

$^{*}p<.05$.

Table 5

Hierarchical Regression Results: Child Age, Task Behavior, Emotions Predicting Student-Teacher Relationship Quality

Variable	Final Model *F* (*df*)	Final β	R^2 Δ
STRS Closeness	*F*(7,102)=1.10		Model R^2=.07
Mastery Motivation			.05
Pride		.25*	
Persistence		−.03	
Competence		−.11	
Strategy Use			.01
Help-Seeking		−.14	
Emotions			.00
Interest/arousal		−.02	
Anxiety		−.05	
Shame		−.03	
STRS Conflict	*F* (7,102)=3.43*		Model R^2=.19
Mastery Motivation			.15*
Pride		−.14	
Persistence		−.32*	
Competence		.27*	
Strategy Use			.00
Help-Seeking		.00	
Emotions			.04
Interest/arousal		.17*	
Anxiety		.08	
Shame		−.05	

Note. *N* = 109 due to missing data.

Betas listed are from final step.

^{t}p<.10

$^{*}p$<.05.

Table 6

Hierarchical Regression Results: Child Age, Task Behavior, Emotions Predicting Learning-Related Behaviors

Variable	Final Model F (df)	Final β	R^2 Δ
Social Competence	F (7,108)=5.58*		Model R^2=.27
Mastery Motivation			.16*
Pride		.20*	
Persistence		.41*	
Competence		−.09	
Strategy Use			.01
Help-Seeking		.08	
Emotions			.11*
Interest/arousal		−.24*	
Anxiety		−.12	
Shame		.21*	
Hyperactivity	F (7,109)=5.76*		Model R^2=.27
Mastery Motivation			.21*
Pride		.10	
Persistence		−.33*	
Competence		.11	
Strategy Use			.00
Help-Seeking		.03	
Emotions			.07*
Interest/arousal		.19*	
Anxiety		.16t	
Shame		−.03	
Interpersonal Skills	F (7,106)=4.29*		Model R^2=.22
Mastery Motivation			.20*
Pride		−.01	
Persistence		.38*	
Competence		−.20*	
Strategy Use			.00
Help-Seeking		−.01	
Emotions			.02
Interest/arousal		−.11	
Anxiety		−.07	
Shame		.08	

Variable	Final Model F (df)	Final β	R^2 Δ
Work-Related Skills	F (7,107)=4.75*		Model R^2=.24
Mastery Motivation			.17*
Pride		.19t	
Persistence		.41*	
Competence		−.07	
Strategy Use			.00
Help-Seeking		.03	
Emotions			.07*
Interest/arousal		.08	
Anxiety		−.18*	
Shame		.21*	
Self-Regulation	F (7,108)=6.66*		Model R^2=.30
Mastery Motivation			.24*
Pride		.02	
Persistence		.43*	
Competence		−.10	
Strategy Use			.00
Help-Seeking		−.02	
Emotions			.06*
Interest/arousal		−.08	
Anxiety		−.20*	
Shame		.14t	

Note. *N* ranges from 113–116 due to missing data.

Betas listed are from final step.

t p<.10

* p<.05.

Table 7

Hierarchical Regression Results: Motivation, Help-Seeking, and Emotions Predicting Academic Skills

Variable	Final Model *F* (*df*)	Final β	R^2 Δ
Math Skills	*F* (7,108)=3.93*		Model R^2=.20
Mastery Motivation			.13*
Pride		.15	
Persistence		.39*	
Competence		.14	
Strategy Use			.02t
Help-Seeking		.18	
Emotions			.05t
Interest/arousal		−.02	
Anxiety		−.12	
Shame		.20*	
Reading Skills	F (7,108)=3.14*		Model R^2=.17
Mastery Motivation			.09*
Pride		.12	
Persistence		.31*	
Competence		.12	
Strategy Use			.03t
Help-Seeking		.19t	
Emotions			.06t
Interest/arousal		−.04	
Anxiety		−.12	
Shame		.23*	

Note. N = 115 due to missing data.

Betas listed are from final step.

t *p*<.10

* *p*<.05.