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STUDENT BEHAVIORS AS PREDICTORS OF LATER ACADEMIC ACHIEVEMENT: SCHOOL ENTRY THROUGH FIFTH GRADE

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Abstract

The purpose of this study was to examine the relationships between student behaviors and academic achievement at various academic time periods, ranging from kindergarten entry through fifth grade. Student behaviors included academically-related behaviors (i.e., approaches to learning), social behaviors (i.e., prosocial behaviors), and problem behaviors (i.e., externalizing and internalizing). It was hypothesized that approaches to learning would demonstrate a moderate relationship with later academic achievement, whereas prosocial skills were expected to demonstrate a small relationship with achievement. Externalizing and internalizing behaviors were hypothesized to have small relationships with achievement. Data from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K) were used. Multiple regression analyses were utilized to test the relationships between student behaviors and achievement. Results indicated that student background characteristics, including prior academic achievement and cognitive skills, had the strongest relationship with academic achievement. Approaches to learning had the most significant relationship with academic achievement when compared with the other behaviors of interest, although this relationship was small. The relationships between prosocial skills, internalizing problem behaviors, and externalizing problem behaviors and later academic achievement were negligible, although these relationships became stronger as students progressed academically. Implications for practice and directions for future research are discussed.

Table of Contents

List of Tables

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Student Behaviors as Predictors of Later Academic Achievement: School Entry Through Fifth Grade

Recent educational research has examined the relationships between student classroom behaviors and learning in school (DiPerna, Lei, & Reid, 2007; Zins, Weissberg, Wang, & Walberg, 2004). Specifically, researchers have hypothesized that approaches to learning, interpersonal skills, and externalizing and internalizing problem behaviors, play important roles in the academic success of students (e.g., McClelland, Morrison, & Holmes, 2000; McClelland. Acock, & Morrison, 2006; Bodovoski & Farkas, 2007). As a result of these studies, researchers and practitioners alike have begun to promote the importance of social emotional learning (SEL) in schools.

The purpose of SEL is to foster the academic, social, and emotional growth of children. According to Zins et al. (2004), SEL is "the process through which we learn to recognize and manage emotions, care about others, make good decisions, behave ethically and responsibly, develop positive relationships, and avoid negative behaviors" (p. 4). Although many educational stakeholders believe that students should have appropriate social and emotional skills as part of being well-rounded individuals, most researchers also have suggested that students need to possess a base of such skills in order to maximize their academic achievement (Zins et al., 2004). Developing such a foundation places additional responsibilities on teachers and other school personnel to promote the development of positive behaviors and maximize appropriate approaches to learning in students while also minimizing the impact of negative behaviors. A growing number of intervention and prevention programs have been developed and implemented in an effort to promote social and emotional learning in schools (see Catalano, Berglund,

Ryan, Lonczak, & Hawkins, 2002; O'Donnell, Hawkins, Catalano, Abbott, & Day, 1995).

Although there is growing interest in SEL, the exact relationships between student behaviors and academic achievement remain unclear. Research in this area began more than three decades ago and continues today, but there is a lack of consensus on the magnitude of the relationships between various student behaviors and academic achievement (e.g., Bodovoski & Farkas, 2007; Duncan et al., 2007; Wentzel, 1993). Moreover, studies are fraught with methodological and analytic differences, thus making it nearly impossible to draw any definitive conclusions. For example, some studies indicated that other student variables (e.g., past achievement, demographic characteristics) may account for a significant amount of shared variance between student behaviors and academic achievement (e.g., DiPerna et al., 2007; Schaefer & McDermott, 1999), whereas other studies did not include covariates in their models (e.g., Agostin & Bain, 1997; Miles & Stipek, 2006). Furthermore, a number of researchers examined the longitudinal relationships between student behaviors and later student achievement (e.g., DiPerna et al., 2007), whereas others only explored concurrent relationships (e.g., Howse, Lange, Farran, & Boyles, 2003b).

The purpose of this study was to examine the unique relationships between specific student behaviors and academic achievement at different academic time periods, ranging from kindergarten entry through fifth grade. Student behaviors included approaches to learning, social skills, and externalizing and internalizing problem behaviors. Participants were drawn from the Early Childhood Longitudinal Study – Kindergarten Cohort (ECLS-K). This database includes a nationally-representative

sample of children who have been followed longitudinally since their kindergarten year. Multiple regression analyses were used to examine the relationships between student behaviors and academic achievement at kindergarten entry, primary school (i.e., third grade), and intermediate school (i.e., fifth grade).

Literature Review

The purpose of this synthesis was to review the published literature on learning behaviors and their relationships with academic achievement. Research has indicated that academically-related (DiPerna, Lei, & Reid, 2007), social (DiPerna, Volpe, & Elliott, 2001; Greenwood, Horton, & Utley, 2002; Wentzel, 1991), and negative behaviors (Hinshaw, 1992; Spira & Fischel, 2005) may play a unique role in explaining differences in academic achievement. For purposes of this synthesis, academically-related behaviors included approaches to learning, social behaviors included prosocial skills, and negative behaviors included externalizing, internalizing, and inattentive behaviors.

Search Strategies and Yield

Studies were identified by searching ERIC and PsycINFO using key descriptors for academic achievement and target student behaviors. Key behavior descriptors or root form of descriptors (social skills, interpersonal skills, social competence, prosocial, extern*, intern*, depress* anx*, conduct, hyperact*, inattent*, aggress*, problem behaviors, engagement, self-regulation, goals, approaches to learning) were used in combination with key academic descriptors or root form of descriptors (academic achievement, achieve*, reading, math) to identify possible articles.

To be included in the final sample of articles, a study had to meet the following criteria: (a) the study was published in a peer-reviewed journal; (b) participants in the study included children in preschool, elementary, or middle school; (c) predictor variables included the identified student behaviors; (d) academic achievement was identified as an outcome variable and measured through either standardized, curriculum-

based, or criterion-referenced achievement tests, report card grades, or teacher ratings of academic competence; and (e) no interventions were implemented during the study.

A total of 67 studies met inclusion criteria for the review. These studies were then classified based on the particular behaviors included in the study. Academically-related behaviors included approaches to learning (i.e., engagement, regulated behavior, motivation, and goal-directed behavior). Social behaviors included prosocial skills (i.e., social skills, interpersonal skills, and academic competence). Negative behaviors included externalizing problem behaviors (i.e., hyperactivity, conduct problems, and aggression), internalizing problem behaviors (i.e., anxiety and depression), inattention, and unspecified problem behaviors (i.e., composites of problem behaviors and Attention-Deficit/Hyperactivity Disorder diagnoses that did not specify the specific subtype under examination). A total of 24 studies examined approaches to learning, 17 studies examined prosocial skills, 25 investigated externalizing behaviors, 24 explored internalizing behaviors, 9 evaluated inattention, and 11 investigated general behavior problems. (Because studies often included multiple predictors, 31 studies fell in one or more categories.)

Retained studies were coded on the following characteristics: (a) participants; (b) behaviors identified as academically-related, social, or negative; studies that included documented disorders (e.g., conduct disorder) as the identified behavior were included in this synthesis; (c) achievement domain (e.g., reading, math); (d) achievement measure (e.g., standardized achievement test, report card grades); (e) longitudinal versus concurrent data analyses; (f) covariates (e.g., cognitive skills, prior achievement); and (g) outcomes (e.g., positive, negative, mixed, or nonsignificant results). Information on each

study's characteristics, including participants, targeted behaviors, achievement domain and measure, and covariates is presented in Appendix A.

This synthesis presents literature that pertains to student behaviors and their relationships with academic achievement. Results from the literature review are presented according to behavior types and achievement domains. The discussion within each academic domain distinguishes between studies that utilized longitudinal and concurrent designs as well as studies that included covariates in their analyses. A summary of the literature for each behavior type is included at the end of each section. Finally, the synthesis concludes with a discussion of the limitations of extant research and the rationale for the current study.

Academically-Related Behaviors

Approaches to Learning

Reading. All of the longitudinal studies that used reading as an outcome variable also controlled for various child (e.g., cognitive skills and age), family, and neighborhood characteristics (Alexander, Entwisle, & Dauber, 1993; Howse, Calkins, Anastopoulos, Keane, & Shelton. 2003a; Hughes, Leo, Kwok, & Loyd, 2008; McClelland et al., 2006; McClelland et al., 2000; Wilson & Shulha, 1995). Howse et al. (2003a) reported that preschoolers who were able to self-regulate their emotions and behavior had higher pre-literacy skills in kindergarten, accounting for 8% to 16% shared variance. Hughes and colleagues indicated that student engagement in first grade accounted for 10% variance in reading achievement in fourth grade. Other studies indicated that more global measures of learning behaviors, including following directions, persisting on work, being considerate of others, and working independently, were significantly related to later

achievement in samples of primary (McClelland et al., 2000) and middle school students (Wilson & Shulha, 1995). In contrast, McClelland et al. (2006) indicated that although these behaviors predicted both concurrent reading achievement and achievement through second and sixth grade, they only predicted growth through second grade. Results from another study concluded that second and fourth grade reading performance was predicted by first grade interest and participation behaviors, but not by cooperative and compliant behaviors (Alexander et al., 1993).

All of the concurrent studies that examined self-regulatory behaviors and controlled for various student characteristics indicated significant relationships with early literacy (Fantuzzo et al., 2007; Howse et al., 2003b; McClelland et al., 2007) and reading skills in second grade (Howse et al.). Fantuzzo and colleagues also indicated that children with academically disengaged behavior performed lower on early reading indicators (sharing 5% to 12% variance) when compared with children with self-regulated behaviors (sharing 6% to 17% variance). Finn et al. (1995) found that effort and initiative and reading achievement shared 16% to 35% variance after controlling for race and gender, and also concluded that a compliant group of fourth graders scored significantly higher in reading than the non-compliant group (Cohen's d = .60 - .72).

Kohn and Rosman (1974) reported that although 41% of the variance in reading achievement was explained by cognitive skills, their measures of approaches to learning (i.e., apathy-interest, anger-cooperation, and task orientation) still accounted for 22% of the variance in reading. Similarly, Schaefer and McDermott (1999) explored the relationships between reading achievement and learning behaviors, including competence, motivation, attitudes toward learning, attention/persistence, and

strategy/flexibility, and concluded that cognitive ability explained the most amount of variance in reading achievement, but learning behaviors did demonstrate positive relationships with reading. Furthermore, when comparing grades with standardized achievement tests, Schaefer and McDermott suggested that learning behaviors explained more variance for grades (25%) than achievement tests (8%) in reading, whereas intelligence explained less variance for grades (12%) and more for achievement tests (21%). These results suggest that teacher-assigned grades may factor in a child's learning-related behaviors when determining a mark on a report card, whereas achievement tests only measure a child's academic performance.

Mathematics. The majority of studies that evaluated the longitudinal relationship between approaches to learning and math achievement also controlled for possible confounding variables (Alexander et al., 1993; DiPerna et al., 2007, McClelland et al., 2000; McClelland et al., 2006; Perry, Guidubaldi, & Kehle., 1979; Wilson & Shulha, 1995). Based on the results of longitudinal growth modeling, DiPerna et al. suggested that approaches to learning was the second largest predictor for math growth from kindergarten through third grade ($\beta = .19$ for initial status, .10 for growth rate), next to cognitive skills ($\beta = .53$ for initial status, .32 for growth rate). Similarly, McClelland et al. (2000) concluded that kindergarten work-related skills predicted math in second grade ($\beta = .04$). Another study slightly contradicted these results, suggesting that kindergarten learning-related skills predicted later achievement through third ($\beta = .19$) and sixth grade ($\beta = .24$), but only predicted growth through second grade and not from third through sixth grade (McClelland et al., 2006).

Perry et al. (1979) and Alexander et al. (1993) examined constructs similar to approaches to learning (i.e., interest-participation, cooperation-compliance, and attention span-restless). Perry and colleagues indicated that approaches to learning in kindergarten predicted third grade math, and that the two constructs shared 8% to 42% variance. Conversely, Alexander et al. suggested that only interest-participation predicted fourth grade performance on a standardized math achievement test ($\beta = .28$) and attention span-restless behavior in first grade predicted fourth grade report card grades ($\beta = .18$) and achievement test outcomes ($\beta = .31$). Wilson and Shulha (1995), however, indicated that approaches to learning was significantly related to report card grades in math ($\beta = .12$ - .25). Of the remaining longitudinal studies that did not use covariates, Bodovoski and Farkas (2007) analyzed data from a nationally representative sample and concluded that kindergarten engagement significantly predicted growth in math in kindergarten ($\beta =$ .17), first ($\beta = .13$), and third ($\beta = .13$) grade. Similarly, Hughes et al. (2008) reported that first grade effortful engagement accounted for 10% variance in math achievement 2 years later.

All studies that examined the concurrent relationship between self-regulation and math achievement reported positive results, even when controlling for child and family characteristics (Fantuzzo et al., 2007; Howse et al., 2003a; McClelland et al., 2007). Finn et al. (1995) found that math performance shared a significant amount of variance with effort (35%) and initiative (32%). Singh, Granville, and Dika (2002) concluded that the constructs of motivation, attitude/interest, and engagement explained 46% of the variance in math achievement, but these authors did not use covariates in their analyses. Wolters (2004) indicated that although prior math achievement accounted for 22% variance,

mastery goal orientations (i.e., learning for the purpose of increasing levels of competence or overcoming a challenge) and self-efficacy increased the percent variance explained in math achievement by 18%. Kohn and Rosman (1974) also suggested that a significant amount of variance in math achievement was accounted for by cognitive ability (41%) and demographic variables (19% – 22%), but the relationship between approaches to learning and math was still substantial, accounting for 16% variance. Schaefer and McDermott (1999) reported that although cognitive ability accounted for the most amount of variance (24%), learning behaviors accounted for a significant amount of variance (7%) in math achievement on a standardized test. This relationship was reversed with grades, however, with ability accounting for 12% variance and learning behaviors accounting for 18% variance in math grades.

General achievement. Most of the studies that examined the relationship between approaches to learning and general academic achievement used concurrent analyses and reported significant relationships between the two. The exception to this was the study conducted by Dermitzaki and Kiosseoglou (2004), which had mixed results but failed to include covariates.

Yen et al. (2005) defined approaches to learning as including various learning behaviors, such as competence, motivation, attitudes toward learning, attention/persistence, and strategy/flexibility. These authors concluded that cognitive ability accounted for the most variance on a standardized achievement measure ($\beta = .68$), but learning-related behaviors still accounted for a significant amount of variance in achievement ($\beta = .13$). Similarly, two studies found that approaches to learning behaviors accounted for between 10% to 40% variance in academic performance over and above

student and family characteristics (Durbrow et al., 2000; McWayne et al., 2004). Valiente et al. (2008) reported that effortful control (i.e., controlling one's attention and behavior) and social competence shared 10% to 27% variance with achievement as measured by report card grades. Dermitzaki and Kiosseogou (2004), however, found that the relationship between self-regulation and exam grades was nonsignificant.

Summary. Nearly all of the studies that examined reading, math, and composites of achievement reported a positive relationship with approaches to learning. These relationships were documented regardless of the inclusion of other student predictors. Although factors such as prior achievement may be the best predictors of future achievement, approaches to learning behaviors appear to add 8% to 40% variance in achievement. Based on the review of literature, however, it is evident that controlling for student characteristics and demographic variables reduces the variance explained by approaches to learning.

Social Behaviors

Prosocial skills

Reading. Five studies utilized longitudinal designs in their examination of the relationship between prosocial skills and reading (Agostin & Bain, 1997; Duncan et al., 2007; Feshbach & Feshbach, 1987; Malecki & Elliott, 2002; Miles & Stipek, 2006). Duncan et al. were the only researchers to control for student characteristics in their analyses, and they concluded that prosocial skills were not a significant predictor of reading. In contrast, three of the remaining studies that omitted covariates indicated that prosocial skills had both a positive and significant longitudinal relationship with reading achievement (Agostin & Bain, 1997; Malecki & Elliott, 2002; Miles & Stipek, 2006). For

example, Agostin and Bain concluded that cooperation in kindergarten accounted for approximately 35% of the variance in reading 2 years later. Feshbach and Feshbach (1987) reported that young girls who scored high on a measure of empathy had significantly higher achievement in reading 2 years later, accounting for roughly 18% shared variance. This relationship was not significant for boys, however.

The remaining studies examined concurrent relationships (Bramlett, Scott, & Rowell, 2000; Ray & Elliott, 2006), and neither of these studies used covariates in their analyses. Ray and Elliott reported a positive relationship, indicating that prosocial skills accounted for 19% shared variance in reading achievement. Furthermore, these authors suggested that social skills had an indirect effect on achievement through their direct effect on social adjustment. The results of Bramlett et al. did not find that prosocial skills accounted for a significant amount of variance in reading achievement.

Mathematics. Five researchers reported longitudinal results for the relationship between math achievement and prosocial skills (Agostin & Bain, 1997; DiPerna et al., 2007; Duncan et al., 2007; Feshbach & Feshbach, 1987; Malecki & Elliott, 2002). Malecki and Elliott concluded that both teacher and student rated social skills accounted for 9% to 25% shared variance in math and that social skills significantly predicted math achievement a year later ($\beta = .55$). Agostin and Bain reported similar results, indicating that prosocial skills accounted for 35% variance in math. Conversely, although Feshbach and Feshbach (1987) found that prosocial skills accounted for a significant amount of variance in future reading achievement for girls, this relationship was not observed in math for either gender.

None of the studies indicating a positive longitudinal relationship between prosocial skills and math included covariates in their models (Agostin & Bain, 1997; Feshbach & Feshbach, 1987; Malecki & Elliott, 2002). Research that did utilize covariates indicated that prosocial skills did not contribute a significant amount of variance in math achievement for children in kindergarten through fifth grade (DiPerna et al., 2007; Duncan et al., 2007). Furthermore, DiPerna and colleagues observed that prosocial behaviors actually had a very small negative relationship with growth in math after controlling for various covariates. The authors hypothesized that this may be due to the amount of common variance shared between prosocial behaviors and approaches to learning, as the relationship between prosocial behaviors and growth in math was slightly positive when approaches to learning was omitted from the model.

The remaining studies only examined concurrent relationships (Bramlett et al., 2000; Feshbach & Feshbach, 1987; Ray & Elliott, 2006), and none of these studies included covariates in their analyses. Ray and Elliott (2006) reported that social skills were positively related to math, accounting for 19% shared variance in a sample of fourth and eighth graders. Conversely, Bramlett et al. (2000) indicated that social skills did not predict math achievement over and above the contribution of temperament, including persistence.

General achievement. The remaining studies investigated the relationship between prosocial skills and composites of several academic domains, and all concluded that such relationships were significant. Only the studies conducted by Caprara, Barbaranelli, Pastorelli, Bandura, and Zimbardo (2000) and Chen, Rubin, and Li. (1997) used longitudinal designs. Caprara et al. indicated that prosocial skills accounted for 32%

variance in academic achievement after controlling for prior achievement. Chen and colleagues concluded that prosocial skills predicted future achievement (β = .11 - .27) and achievement predicted future prosocial skills (β = .14 - .32). Although the model reported by Ladd, Birch, and Buhs (1999) was significant, prosocial skills only accounted for 3% of the variance in academic achievement after controlling for various child and family characteristics. Wentzel (1993) included similar covariates and reported that social skills accounted for 17% variance in achievement. Green, Forehand, Beck, and Vosk (1980) also concluded that social skills and achievement shared 11% to 17% variance.

All of the studies that used report card grades as an outcome measure reported a significant and positive relationship with prosocial skills (Normandeau & Guay, 1998; Valiente et al., 2008; Welsh et al., 2001; Wentzel, 1993; Zsolnai, 2002). Normandeau and Guay reported that, after controlling for child background characteristics, prosocial skills had an indirect relationship with future achievement (β = .17) through the mediational effect of cognitive self-control (β = .52). Welsh et al. indicated that social competence predicted academic achievement from first grade to second grade (β = .22) and from second grade to third grade (β = .25). Similar concurrent results were reported by Wentzel for prosocial behaviors (β = .22) and by Valiente and colleagues for social competence (β = .20) after controlling for student characteristics. Finally, Zsolnai indicated that friendliness and report card grades shared approximately 9% variance in a sample of adolescents.

Summary. The results of the literature that examined the relationship between prosocial skills and academic achievement are mixed. Although there is some evidence to support the predictive power of prosocial skills and reading and math achievement, these

relationships appear to diminish after controlling for other skills and abilities (e.g., DiPerna et al., 2007; Duncan et al., 2007). As such, there is little evidence to support a significant relationship between prosocial skills and the domains of reading or math. Conversely, the reviewed research does support a significant relationship between prosocial skills and general measures of achievement. One possible explanation for these inconsistencies could be that a composite of general achievement may measure a child's overall academic ability, and it is possible that children with well-developed prosocial skills tend to have better developed cognitive skills as well. Furthermore, the positive relationship between report card grades and prosocial behaviors could be due to the fact that prosocial behaviors were almost always rated by teachers in the reported studies (e.g., Caprara et al., 2000; Wentzel, 1993). As such, it is possible that these two may have a high amount of shared variance due to teachers' roles in each assessment. Furthermore, teachers may intentionally factor a child's prosocial behaviors into consideration when assigning course grades (e.g., citizenship in the classroom).

Negative Behaviors

Externalizing Problem Behaviors

Reading. Two studies investigated the longitudinal relationship between externalizing problem behaviors and reading while controlling for student and demographic characteristics (Duncan et al., 2007; Massetti et al., 2008). Neither of these studies reported a significant relationship between reading achievement and externalizing behaviors (Duncan et al., 2007) or the hyperactive-impulsive behaviors identified in a sample of children with Attention-Deficit/Hyperactivity Disorder (ADHD; Massetti et al., 2008).

Of the longitudinal studies that did not account for other student characteristics, Agostin and Bain (1997), Feshbach and Feshbach (1987), and Montague, Enders, and Castro (2005) did not report a significant relationship between externalizing behaviors and skills in reading. Feshbach and Feshbach, however, did suggest that aggression at ages 8 and 9 was negatively related to concurrent reading achievement, sharing approximately 10% variance. Similarly, Agostin and Bain (1997) found that the relationship between hyperactivity and underachievement in reading accounted for 6% shared variance. Miles and Stipek (2006) also indicated that aggressive behavior was concurrently related to reading achievement and that this association grew stronger over time (sharing 5% to 7% variance). Moreover, longitudinal analyses revealed that low literacy significantly predicted future aggression ($\beta = -.17$ to $-.21$), but high aggression did not significantly predict future underachievement in literacy. In contrast, Giannopulu, Escolano, Cusin, Citeau, and Deliatolas (2008) did not find a significant relationship between externalizing behaviors (i.e., conduct problems and hyperactivity) or unsociability and concurrent pre-literacy skills in preschool, but did indicate that first grade reading comprehension was significantly predicted by preschool externalizing behaviors, accounting for 0.9% to 11.5% variance.

Of the studies that examined the concurrent relationship between externalizing behaviors and reading achievement on a standardized test, three controlled for student characteristics and demographic variables (Finn et al., 2002; Hodges & Plow, 1990; Nelson, Benner, Lane, & Smith, 2004). Hodges and colleagues reported that children diagnosed with conduct or oppositional disorders did not exhibit significant underachievement in reading. Other authors indicated that underachievement in reading

shared 3% to 27% variance with disruptive behaviors (Finn et al.) and 14% variance with externalizing behaviors (Nelson et al.). Moreover, Nelson and colleagues reported that 83% of students in their sample scored below the norm sample on measures of achievement. Fuerst and Rourke (1993) indicated that children identified as exhibiting externalizing behavior problems actually achieved significantly higher in reading when compared with a composite of students who exhibited normal, conduct disorder, and somatic concern behaviors. All of the remaining studies reported negative relationships between reading achievement and externalizing problem behaviors (Barriga et al., 2002; Gresham, Lane, MacMillan, & Bocian., 1999), aggression (Barriga et al., 2002), or conduct problems (Vaughn, Hogan, Lancelotta, Shapiro, & Walker, 1992).

Mathematics. The studies that used longitudinal data and controlled for various student characteristics did not find a significant relationship between math achievement and externalizing behaviors (DiPerna et al., 2007; Duncan et al., 2007) or ADHD-hyperactive-impulsive subtypes (Massetti et al., 2008). Similarly, the three studies that excluded covariates did not indicate that the variance in math achievement was significantly accounted for by aggression and externalizing behaviors (Agostin & Bain, 1997; Feshbach & Feshbach, 1987; Montague et al., 2005). The concurrent analyses conducted by Agostin and Bain suggested that the relationship between math and hyperactivity accounted for 4% to 6% shared variance; however, externalizing behaviors were not significantly related to math.

The three concurrent studies reported results consistent with reading achievement (Finn et al., 1995; Hodges & Plow, 1990; Nelson et al., 2004). Externalizing problem behaviors accounted for 14% variance in math achievement for children with diagnosed

emotional/behavioral disorders (Nelson et al.), whereas disruptive behaviors were related to 3% to 27% shared variance in math (Finn et al.). However, a sample of children who were hospitalized for a diagnosis of conduct disorder did not evidence significant underachievement in math (Hodges & Plow, 1990). The remaining concurrent studies without covariates also yielded contradictory results with one reporting a significant negative relationship between externalizing problems and math achievement (Gresham et al., 1999) and two indicating a nonsignificant relationship between conduct problems and externalizing behaviors and math (Barriga et al., 2002; Fuerst and Rourke, 1993).

General achievement. Of the studies that examined the relationship between externalizing behaviors and standardized achievement as an outcome variable, two included longitudinal analyses (Bub, McCartney, & Willett, 2007; Chen et al., 1997). Chen and colleagues found that negative behaviors significantly predicted future underachievement (β = .14 to .32). In addition, Bub and colleagues reported that first grade achievement had a negative relationship with previous externalizing behaviors over and above the effects of student characteristics (β = -.23). Ladd et al. (1999) indicated that antisocial behaviors in kindergarten had a direct effect on peer and teacher relationships, which in turn influenced achievement through the mediational role of classroom participation. Similarly, another study reported that students diagnosed with conduct disorder achieved significantly lower than expected given their cognitive ability (Frick et al., 1991). Comparable results were reported for disruptive and externalizing behaviors (accounting for 12% to 14% shared variance; Arnold, 1997) and negative social skills and hyperactivity (accounting for 4% to 19% shared variance; Green et al., 1980), but not for conduct disorder (Green et al.).

Caprara et al. (2000) and Normandeau and Guay (1998) examined the longitudinal relationship between externalizing problem behaviors and report card grades; whereas Johnson, McGue, and Iacono (2005) and Aluja and Blanch (2004) investigated concurrent relationships. Caprara and colleagues reported that aggression did not demonstrate a relationship with future achievement. Conversely, Normandeau and Guay found that kindergarten aggressive behavior predicted first grade achievement (β = -.46) through the mediational effect of cognitive self-control (β = .52). Other authors concluded that social maladjustment (β = -.47 - -.62; Aluja & Blanch, 2004) and disruptive behavior (16% to 59% shared variance; Johnson et al., 2005) were related to academic achievement in adolescent samples.

Both Henricsson and Rydell (2006) and Gresham et al. (1999) concluded that children with greater externalizing behaviors subsequently had significantly lower ratings of academic competence when compared with control groups. Rabiner, Murray, Schmid, and Malone (2005) reported that adding the covariates of gender and ethnicity diminished the relationship between oppositional and hyperactive behaviors and academic competence.

Summary. An examination of the literature on reading and math and externalizing problem behaviors indicates that the relationship between the variables typically is nonsignificant when other variables are controlled. There were only two exceptions to this finding, but these studies only controlled for the age of onset of emotional/behavioral disorders (Nelson et al., 2004) and race and gender (Finn et al., 1995) rather than other variables, such as cognitive ability or academic achievement. Furthermore, there does not appear to be a clear difference between students with diagnoses and students without

diagnoses, as one study that included participants with documented disorders reported significant results (Nelson et al., 2004) and two did not (Hodges & Plow, 1990; Massetti et al., 2008).

In contrast to the results in reading and math, it is evident that results from the general achievement studies indicated a negative relationship between externalizing behaviors and academic achievement. These general measures of performance included composites of several academic domains, including math, reading, science, and writing. As mentioned previously, it is possible that such composites measure overall academic ability, rather than academic achievement. Furthermore, externalizing behaviors may have a greater relationship with such ability rather than with specific domains of achievement.

Internalizing Problem Behaviors

Reading. Three longitudinal studies indicated that internalizing problem behaviors did not account for a significant amount of variance in reading achievement (Duncan et al., 2007; Nelson et al., 2004; Rapport, Denney, Chung, & Hustace, 2001). Although Rapport et al. did not find a direct relationship between anxiety/depression and withdrawal and reading achievement, they did conclude that internalizing problems had a direct impact on various classroom behaviors (β = -.01 to -.24) and cognitive functioning (β = -.19), which in turn had a significant relationship with achievement (β = .50). In contrast, Feshbach and Feshbach (1987) reported negative correlations for concurrent reading achievement in girls and boys (accounting for 13% to 25% shared variance), but their longitudinal analyses indicated that internalizing behaviors only had a negative impact on reading for girls (accounting for 27% shared variance). Another study also

found a concurrent relationship between internalizing behaviors and reading achievement that accounted for 3% to 6% shared variance, but this association was not evident in the authors' longitudinal analyses (Agostin & Bain, 1997).

The only concurrent investigation controlling for possible covariates found that although depressive symptoms were significantly related to reading achievement, depression only accounted for 2.5% more variance explained in the model (Stringer & Heath, 2006). Of the remaining studies, only two did not indicate that internalizing behaviors as measured by a diagnosis of depression (Hodges & Plow, 1990) or the identification of withdrawn behaviors or anxiety/depression (Barriga et al., 2002) were at least partially related to reading achievement. Similar to their results with externalizing behaviors, Fuerst and Rourke (1993) concluded that participants with internalizing behavior problems actually had significantly higher reading achievement when compared with children with conduct disorder, somatic concerns, and a control group. However, other studies indicated that depressive symptoms accounted for 5.3% variance in reading (Tesiny, Lefkowitz, & Gordon, 1980) and internalizing problem behaviors were significantly related to reading achievement (Gresham et al., 1999; Vaughn et al., 1999) in elementary samples.

Mathematics. Only one longitudinal study indicated a negative relationship between math and internalizing problems (Feshbach & Feshbach, 1987). This study found that depressive symptoms at ages 8 and 9 shared 13% to 24% variance with concurrent underachievement in math, and also shared 24% variance with achievement at ages 10 and 11 (for boys only). The longitudinal analyses conducted by Agostin and Bain (1997) did not indicate that externalizing problems in kindergarten significantly predicted

first grade math achievement; although there was a negative relationship between concurrent internalizing symptoms and math (accounting for 3% to 6% shared variance). Both Duncan et al. (2007) and DiPerna et al. (2007) used large, longitudinal samples to determine that internalizing behaviors did not account for a significant amount of variance in math achievement after controlling for several student and demographic characteristics. The remaining studies used cross-sectional samples to conclude that math was not related to anxiety/depression or withdrawal (Rapport et al., 2001) or internalizing problems in a sample of children with emotional and behavioral disabilities (Nelson et al., 2004).

Two investigations indicated that depressive symptoms had a small relationship with math, explaining 2.3% variance after controlling for student characteristics (Stringer & Heath, 2006) and 7.3% variance (Tesiny et al., 1980). Gresham et al. (1999) observed that students with internalizing behaviors had similar math achievement as students with externalizing behaviors, but both were significantly lower than a control group. Interestingly, students with internalizing behaviors rated their own academic self-competence significantly lower than both children with externalizing behaviors and the control group. Although the results reported by Hodges and Plow (1999) did not suggest that anxiety or depression significantly predicted math achievement in a clinical sample, post hoc analyses indicated that depressed children scored significantly lower in math when compared with students with other behavior disorders (e.g., conduct disorder). The remaining studies did not report that math underachievement was significantly related to internalizing behaviors, including withdrawal, depression, or anxiety (Barriga et al., 2002; Fuerst & Rourke, 1993).

General achievement. Bub et al. (2007) concluded that, after controlling for student background, internalizing behaviors in preschool significantly predicted first grade achievement (β = -.23). Other authors, however, did not report a significant relationship between performance on a standardized achievement test and child-reported anxiety and depression in a sample of children with ADHD (Kartustis et al., 2000). In contrast, Durbrow et al. (2000) indicated that anxiety explained 31% variance in academic achievement on a curriculum-based measure, but these results did not include covariates. Another study suggested that withdrawal explained considerably less variance (4%) in academic achievement (Green et al., 1980).

Using report card grades as the outcome measure, Normandeau and Guay (1998) found that anxious-withdrawn behavior in kindergarten significantly predicted first grade achievement (β = -.14). Shahar et al. (2006) indicated that self-criticism mediated the relationship between depressive symptoms and academic achievement. More specifically, boys who had high levels of self-criticism and depressive symptoms had lower grades (β = -.19), whereas girls with low levels of self-criticism and depressive effects had lower grades (β = -.23). Two concurrent studies indicated that school performance was significantly related to internalizing problems, including depressive symptoms (accounting for 4% shared variance; Preiss & Franova, 2006) and anxiety on both standardized test scores and report card grades (Durbrow et al., 2000). In contrast, Aluja and Blanch (2004) and Hamilton et al. (1996) did not find a significant relationship between depression and achievement.

Although Rabiner et al. (2004) indicated a significant relationship between anxious/shy behaviors and teacher ratings of academic competence, the addition of

gender and ethnicity caused the relationship between internalizing behaviors and competence to be nonsignificant. Similarly, Karustis et al. (2000) reported that, after controlling for student characteristics, anxious and depressive symptoms were not correlated with academic competence in a sample of children with ADHD. The only studies that found that internalizing behaviors were significantly related to academic competence did not used covariates in their analyses (Gresham et al., 1999; Henricsson & Rydell, 2006).

Summary. Although the results for internalizing problem behaviors and achievement were mixed, some conclusions can be drawn. It appears that internalizing behaviors are not related to reading or math achievement over time, as most of the longitudinal studies did not report a significant and negative relationship. Furthermore, after controlling for various covariates, the relationship between reading or math and internalizing behaviors was either nonsignificant or extremely small. Although some concurrent studies found a significant relationship, internalizing problems generally only accounted for a negligible amount of variance in reading and math achievement. It also does not appear that a diagnosis of a specific internalizing disorder (e.g., depression) has a negative impact on specific achievement domains. This suggests that perhaps the severity of the behavior is not related to the severity of the achievement deficit. Similar to the relationship between externalizing behaviors and general academic achievement, it appears that many more studies support a negative relationship between internalizing behaviors and general achievement when compared to reading and math. However, this relationship appears to diminish after including covariates in the analyses.

Inattention

Reading. Two studies that examined the longitudinal relationship between inattention and reading included covariates in the analyses (Duncan et al., 2007; Massetti et al., 2008). Massetti and colleagues indicated that reading underachievement was associated with symptoms of ADHD-inattentive type (Cohen's *d* = -1.16), but not with ADHD-hyperactive-impulsive or ADHD-combined subtypes. Another study found that attention was the best predictor of later achievement (accounting for 10% variance) after previous math and reading achievement (Duncan et al., 2007). Giannopulu et al. (2008) reported that inattention explained a significant amount of variance in pre-literacy skills in preschool and early reading skills in first grade. Additionally, inattention in preschool explained 2.4% to 4.1% of the variance in first grade reading achievement. Using concurrent analyses, Finn et al. (1995) indicated that students with inattentive behaviors scored lower on measures of achievement than students in both the disruptive and prosocial groups (Cohen's *d* = .28 - .69). Similar results were found in samples of kindergarten students (Vaughn et al., 1992) and adolescents (Barriga et al.; 2002).

Mathematics. Duncan et al. (2007) concluded that attention skills accounted for approximately 10% variance in math achievement. Other authors also found that young children diagnosed with ADHD-inattentive subtype evidenced significant underachievement several years later (Cohen's *d* = -1.3; Massetti et al., 2008). Similar relationships indicating significant math achievement deficits for children with attention problems were reported in an adolescent sample by Barriga et al. (2002) and in a sample of fourth graders by Finn et al. (1995).

General achievement. All of the studies that examined general achievement as an outcome of inattentive behaviors reported a negative relationship (Arnold, 1997; Johnson et al., 2005; Rabiner et al., 2004). Using measures of standardized achievement, Arnold found that students with greater attention skills also exhibited higher achievement, sharing approximately 10% variance. In contrast, students with behavior problems experienced underachievement that became worse over time. Johnson et al. reported that inattention was significantly related to grades, and the relationship was stronger for boys than for girls. Rabiner and colleagues indicated that children with more severe inattentive behaviors also had significantly lower academic competence as rated by teachers (β = -.69).

Summary. Research indicates that there is a strong relationship between inattention and achievement for both the specific domains of reading and math and for composites of achievement. In general, higher levels of inattentive behaviors are associated with lower levels of achievement. This relationship held true with both longitudinal and concurrent analyses.

Problem Behaviors: Unspecified

Reading. All of the investigations that examined the relationship between general behavior problems and literacy indicated that literacy was significantly and negatively related to behavior (Barkley, Anastopoulos, Guevremont, & Fletcher, 1991; Barry, Lyman, & Klinger, 2002; Blackman, Ostrander, & Herman, 2005; Clark, Prior, & Kinsella, 2002; DuPaul et al., 2004; Eisenberg & Schneider, 2007; Volpe et al., 2006). Volpe et al. proposed a model in which past achievement and various academic enablers (i.e., interpersonal skills, motivation, study skills, and engagement) mediated the

relationship between ADHD and reading, thus causing an indirect effect. Three studies indicated that students with ADHD achieved significantly lower on tests of achievement when compared with a control group (Barkley et al., 1991; Barry et al., 2002; Clark et al., 2002). For example, Barry and colleagues concluded that ADHD symptoms accounted for 12% variance in reading achievement. Similarly, DuPaul et al. (2004) reported that a control group had significantly higher academic achievement on both a standardized reading achievement measure and report card grades (Cohen's $d = 1.48$).

On ratings of academic competence, children with ADHD were perceived by parents, teachers, and students to have poorer achievement when compared with a control group (Eisenberg and Schneider, 2007). Blackman et al. (2005) compared children with ADHD, comorbid ADHD and depression, and a control group and indicated that the ADHD group performed significantly lower on reading achievement than the control group, but there was no difference between children with ADHD and depression and children only with ADHD.

Mathematics. The results for general behavior problems and math were similar to those for reading, and all of the studies that included participants diagnosed with ADHD reported a significant relationship between symptoms of the disorder and academic achievement (Barkley et al., 1991; Barry et al., 2002; DuPaul et al., 2004; Eisenberg & Schneider, 2007; Volpe et al., 2006). Volpe et al. indicated that ADHD symptoms had an indirect effect on math achievement through the mediational role of past achievement and academic enablers. Other studies found that children with ADHD had significant underachievement in math when compared to a control group on both standardized tests of achievement (Barkley et al., 1991; Barry et al., 2002; DuPaul et al., 2004) and report

card grades (Cohen's *d* = 1.83; DuPaul et al., 2004). In ratings of academic competence, children with ADHD were perceived by students, parents, and teachers to have significantly lower academic competence; however, after controlling for achievement and other confounding variables, this relationship was only apparent for girls and not for boys (Eisenberg & Schneider, 2007).

General achievement. Two studies examined the relationship between achievement on standardized tests and problem behaviors (Green et al., 1980; Malecki & Elliott, 2002). Malecki and Elliott reported that problem behaviors, including externalizing and internalizing behavior problems as well as hyperactivity, were negatively related to concurrent achievement, but did not significantly predict future achievement. Other authors also found a significant concurrent relationship between achievement and a composite of problem behaviors, including inattention, hyperactivity, anxiety, and unsociability (Green et al., 1980). Diamantopoulou et al. (2007) reported that ADHD had a longitudinal relationship with academic performance as measured by teacher ratings ($\beta = -.25$). Frick et al. (1991) indicated that students with ADHD evidenced significant underachievement on a standardized test based on predictions from IQ scores. Furthermore, when controlling for a dual diagnosis of ADHD and conduct disorder, only ADHD emerged as having a negative and significant relationship with academic achievement.

Summary. General problem behaviors have a negative relationship with achievement, including reading, math, and overall composites. However, like other student behaviors, it is likely that including pertinent child and demographic characteristics in the analyses may diminish the relationship between problem behaviors

and achievement. Furthermore, general problem behaviors may have a more significant relationship with achievement than specific problem behaviors (i.e., externalizing and internalizing problems). It is possible that such composites of problem behaviors result in more severe academic impairment.

Conclusions and Rationale for Current Study

Several conclusions can be drawn from this synthesis. The effects of all of the targeted student behaviors on achievement are reduced after controlling for key student skills (e.g., cognitive ability, previous achievement). Students who demonstrated prosocial skills had higher achievement as measured by general composites, but not by reading or math domains. Similarly, students who had greater externalizing or internalizing problem behaviors performed significantly lower on general composites of achievement, but this relationship was not apparent for reading or math. The studies on prosocial skills, externalizing problems, and internalizing problems yielded mixed results and included many different methodology and analyses. As such, the relationship between these three behaviors and academic achievement is not totally clear.

Stronger evidence supports the relationship between approaches to learning and achievement. Research suggests that students with greater approaches to learning skills (e.g., self-regulated behavior) experienced significantly higher academic achievement. Conversely, students with greater inattention had greater deficits in academic achievement. A similar relationship was found for composites of problem behaviors and academic achievement.

There are several limitations to the research reviewed in this synthesis that were addressed in the current study. First, most of the studies used extremely small sample

sizes. With such small samples, generalizability of the results is limited. Second, most of the studies examined either concurrent relationships or data that were collected in consecutive years. Very few examined the relationships between student behaviors and achievement over time, thus making it difficult to determine if such behaviors have lasting effects on achievement. Only 5 of the 67 studies reviewed examined academic growth over time (Bodovoski & Farkas, 2007; Bub et al., 2007; DiPerna et al., 2007; McClelland et al., 2006; McClelland et al., 2007).

Third, most of the investigations examined only a small number of behaviors as predictors of achievement. The only study that did include the same behaviors as the current study was DiPerna et al. (2007), although these authors only examined the relationship with math. Finally, many of the studies did not control for key child characteristics and background variables in their analyses. Failure to include key confounding variables could falsely inflate the relationships between achievement and behaviors.

Purpose and Hypotheses of Current Study

The purpose of the current study was to examine the relationships between various student behaviors with academic achievement from kindergarten entry through fifth grade. Specially, approaches to learning, prosocial behaviors, and externalizing and internalizing problem behaviors were examined. The targeted academic domains were reading and math. The following major research question was addressed: Are there relationships between various student behaviors and later academic achievement in reading and math when controlling for student skills and background characteristics (e.g., cognitive skills)? Based on past research, Hypothesis 1 predicted that approaches to

learning would have a moderate relationship with subsequent reading and math achievement (e.g., DiPerna et al., 2007; McClelland et al., 2000; Schaefer & McDermott, 1999). Although the research is somewhat mixed, Hypothesis 2 indicated that prosocial behaviors would have a small relationship with achievement. Hypothesis 3 indicated that externalizing problem behaviors would have a small relationship with achievement. Similarly, Hypothesis 4 predicted that internalizing problem behaviors would also have a small relationship with future achievement. According to Cohen, Cohen, West and Aiken, (2003), a small relationship was defined as explaining up to 9% variance, a medium effect would explain between 10% to 24% variance, and a large effect would explain upwards of 25% variance.

Method

Participants

Participants in this study were drawn from the Early Childhood Longitudinal Study – Kindergarten Class of 1998-1999 (ECLS-K). The ECLS-K is a national study conducted by the National Center for Education Statistics (NCES) and provides information on children's cognitive, social, and physical development from kindergarten through the eighth grade. The total sample of the ECLS-K includes 17,487 children who were in kindergarten in 1998-1999. Demographic information for the initial kindergarten sample is presented in Table 1 (West, Denton, & Germino-Hausken, 2000). This study used data from kindergarten, third grade, and fifth grade.

Table 1. Demographic Characteristics of Participants in the Kindergarten Cohort

Characteristic	*n*	%
Gender		
Male	8,659	51
Female	8,564	49
Child's age at entry		
6 years, 0 months – 6 years, 6 months	657	4
5 years, 6 months – 5 years, 11 months	4,019	24
5 years, 0 months – 5 years, 5 months	5,449	32
4 years, 6 months – 4 years, 11 months	5,441	32
4 years, 0 months – 4 years, 5 months	1,600	9

(table continues)

Table 1 (continued)

Characteristic	*n*	%
Mother's education		
Less than high school	2, 233	14
High school diploma or equivalent	5,041	30
Some college	5,432	31
Bachelor's degree or higher	4,070	22
Family type		
Single mother	*3,547*	21
Single father	*303*	2
Two parent	*13,071*	75
Primary language spoken in home		
Non-English	1,678	9
English	15,499	91
Race/Ethnicity		
White	9,819	58
Black/African American	2,473	15
Hispanic	3,019	19
Asian	939	3
Native Hawaiian/Pacific Islander	197	1
American Indian/Alaska Native	292	2
More than One Race, Non-Hispanic	460	2

Measures

Parent Interview

Demographic information included in the present study was collected from parent interviews in the fall of kindergarten (1998). The term "parent" included anyone who acted as the child's primary caretaker in the home. For purposes of the current study, information from parent interviews included any background or demographic characteristics needed for the analyses. Specifically, child's gender, race, and socioeconomic status (measured by parent income, education level, and participation in government assistance programs) were used as covariates in all multiple regression analyses.

Behavior Rating Scales

Teachers provided indirect ratings of student performance on a number of behavioral ratings using the brief teacher rating scale (TRS) that was part of the assessment battery used in the ECLS-K. For purposes of this study, The Social Rating Scale (SRS) adapted from the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) was used as a measure of student behaviors. A total of 24 items were used for all time points. Two additional items were added in the third and fifth grade versions. Although the SRS included five scales, only four were used in this study, including Approaches to Learning (five items for kindergarten, six items for Grades 3 and 5), Interpersonal Skills (five items), Externalizing Problem Behaviors (five items for kindergarten, six items for Grades 3 and 5), and Internalizing Problem Behaviors (four items). Teachers responded to each item using a Likert-type scale ranging from 1 (*never*) to 4 (*very often*).

The Approaches to Learning subscale measured a child's ability to benefit from the learning environment (NCES, 2004). Items on this scale reflected attentiveness, task persistence, eagerness to learn, learning independence, flexibility, and organization. The Interpersonal Skills subscale assessed a child's ability to interact appropriately with his or her peers and included items regarding the child's capacity to form and maintain friendships, get along with others, comfort or help others, appropriately express feelings, and show sensitivity to others. The Externalizing Problem Behavior scale measured acting-out behaviors through items that assessed the frequency with which a child argues, fights, gets angry, acts impulsively, and disturbs ongoing activities. The Internalizing Problem Behavior scale assessed negative affect by rating the presence of anxiety, loneliness, low self-esteem, and sadness. Reliability estimates for each of the scales were adequate in each grade, ranging from .77 to .91 (NCES, 2006). Content validity was established by content experts and teachers who evaluated the appropriateness of each item on the SRS (Rock & Pollack, 2002). Furthermore, structural validity for this scale was evidenced through factor analysis of ECLS-K data indicating that the hypothesized factor structure including the five subscales was supported.

Academic Measures

Reading. Reading was assessed in all grades in three major areas, including basic skills, vocabulary, and comprehension (NCES, 2006). Basic skills measured print familiarity, letter knowledge, letter-sound relationships, and sight-words. Vocabulary included items that measured receptive vocabulary by asking the child to point to a picture that represented a word provided by the examiner. More difficult in-context vocabulary items required the child to choose a word from a list that best fit a target word

provided in a reading passage. Finally, reading comprehension items included listening, initial understanding, developing interpretation, personal reflection, and critical stance. Children were required to draw conclusions based on cues provided in the text, use both cues in the text and personal background information to understand homonyms, understand the author's purpose and relate such ideas to similar life problems, and critically evaluate non-fiction by comparing and contrasting details of the text. Split-half reliability estimates for reading scores across each wave of data collection were adequate, ranging from .91 to .96.

Mathematics. The ECLS-K mathematics assessment measured number sense and properties; measurement; geometry and spatial relations; data analysis, statistics, and probability; and patterns, algebra, and functions (NCES, 2006). Items for each of these areas were designed to measure basic through advanced skills. More specifically, children were asked to identify numbers (both single digit and two-digit numbers), recognize patterns and shapes, count aloud, and compare the length of objects. Questions on basic addition and subtraction and more advanced multiplication and division were also included. More advanced items included understanding place values to the hundreds place in integers, using measurement and rate to solve word problems, understanding fractional parts, and solving word problems on area and volume. Split-half reliability estimates for math scores across each wave of data collection were adequate, ranging from .89 to .94.

General Knowledge. Based on NCES recommendations (as cited in DiPerna et al., 2007), the achievement domain of general knowledge was used in the current study as a measure of cognitive skills (NCES, 2002). This domain measured knowledge of the

social (i.e., history, government, culture, geography, and economics) and physical (i.e., earth, life, physical science) worlds. For purposes of the present study, general knowledge performance in the fall of kindergarten was entered into all analyses as a covariate. The split-half reliability estimate for the general knowledge scores in the fall of kindergarten was adequate (.88).

Procedure

Description of ECLS-K

The ECLS-K is a data set that followed a nationally representative cohort of children from kindergarten through eighth grade, beginning in the 1998-1999 school year (NCES, 2002). There are several major elements of the ECLS-K, including (a) the study of achievement in elementary school; (b) assessment of key developmental factors through the elementary years; (c) cross-sectional studies of kindergarten programs; and (d) an examination of the interrelationships of family, preschool, and school experiences on a child's academic and behavioral development from kindergarten entry through middle school. Thus, the ECLS-K provides a multi-method data set that is ideal for studying the educational experiences of children in the United States.

Data Collection

Data were collected beginning in the fall of the participants' kindergarten year in 1998 through the spring of their eighth grade year in 2007. There were seven rounds of data collection, including fall of kindergarten (Round 1), spring of kindergarten (Round 2), fall of first grade (Round 3), spring of first grade (Round 4), spring of third grade (Round 5), spring of fifth grade (Round 6), and spring of eighth grade (Round 7). Both direct (e.g., achievement tests) and indirect (e.g., teacher ratings) measures were collected

at all rounds of data collection. Children were individually administered the direct assessments, teachers completed the questionnaires, and parents participated in interviews.

Academic measures. All child assessments were untimed and individually administered by trained assessors (West et al., 2000). Direct child assessments collected information on reading and math skills in all grades (i.e., kindergarten and Grades 1, 3, 5, and 8). Additionally, general knowledge in science and social studies was collected in kindergarten and first grade, and a separate science assessment was collected in third and fifth grade. In kindergarten and first grade, the child assessments were administered using an easel with pictures, letters, words, short sentences, and numbers or number problems. Children responded orally to each item and responses were recorded by the examiner on a computer. Beginning in third grade, individual workbooks were added to the assessments. In math, workbook questions required computations and written responses whereas reading questions in the booklet allowed for longer reading passages.

The cognitive measures of the ECLS-K used a two-stage adaptive administration technique (NCES; 2000). Such methods are employed to minimize the overall administration time. In the first stage, each domain has a set of items that spanned a wide range of difficulty levels. For example, in kindergarten, there are 20 routing items for reading, 16 items for math, and 12 items for general knowledge. Based on individual performance on the routing items, each child was administered an appropriate skill level for that domain and given credit for the preceding levels. Item response theory (IRT) was then used to estimate a child's performance on the exam if all items on the test had been administered. IRT takes into account the pattern of correct, incorrect, and omitted

responses on administered items while also taking into consideration question difficulty and guessing. Such scores provide a criterion-referenced measure of the child's performance.

Behavior rating scales. Each teacher was asked to complete a Teacher Rating Scale packet for each of the students from their class who were also included in the ECLS-K (NCES, 2002). The packets included a cover letter, information regarding the ECLS-K, and the teacher questionnaires. Due to the sample of students, most teachers rated more than one student, with the number of rated students ranging from 1 to 20 per teacher. Information collected from teacher questionnaires included data regarding the child's academic competence, behaviors, the presence of an Individualized Education Plan (IEP) and special education services, and the child's primary language spoken in the home.

Parent interviews. The 45-50 minute parent interviews were conducted by trained interviewers over the phone. If a child's family did not have a telephone, the interview was conducted in person. Furthermore, the parent interview was translated to Spanish to maximize the inclusion of all families in the study. Parents who were not proficient in English or Spanish were provided with translators for the interview portion of the assessments. More specific details of all data collection procedures can be found in the ECLS-K Technical Manual (NCES, 2002; NCES, 2004; NCES, 2006).

Data, Design, & Analysis

The purpose of this study was to examine the relationships between student behaviors and subsequent reading and math achievement across several academic years. The present study utilized data collected in kindergarten (Round 1), third grade (Round

5), and fifth grade (Round 6). These waves of data collection were chosen because they correspond with major time periods in formal schooling during the elementary years: school entry, primary grades, and intermediate grades.

Academic achievement was predicted by prior student behaviors as measured by teachers. Specifically, kindergarten behaviors were used to predict third grade achievement and third grade behaviors were used to predict fifth grade achievement. This allowed inferences to be drawn about whether or not classroom behaviors were more salient across different time periods in elementary school.

The design of this study was non-experimental. As such, hierarchical multiple regression analyses were used to evaluate the relationships between student behaviors and student achievement. Hierarchical regression was chosen over stepwise approaches because the latter does not allow for the incremental contribution of each variable to be estimated, whereas hierarchical regression portions out the unique variance explained by each variable (Cohen et al., 2003). Furthermore, hierarchical regression allows variables to be entered into the equation in an order that is driven by theory and prior research.

All multiple regression analyses were conducted using the methods outlined by Keith (2006). Three models were tested for each grade and achievement domain combination. Appendix B includes a full description of each of the equations that were tested in this study.

Model 1 included the identified covariates (i.e., cognitive ability, socioeconomic status, race, and sex) prior to entering the behavior variables of interest. The order of the covariates was determined based on theory. The general equation of Model 1 was as follows:

$$ACH = \beta_1 + \beta_2(COG) + \beta_3(SES) + \beta_4(RACE) + \beta_5(SEX) + \beta_6(ATL) + \beta_7(PRO) + \beta_8(EXT) + \beta_9(INT) + e$$

Where ACH was reading or math achievement in third or fifth grade; COG was the general knowledge measure at school entry; SES was family socioeconomic status measured by parent income level, education level, and participation in government assistance programs; RACE was student race; SEX was student gender; ATL was prior approaches to learning; PRO was prior prosocial skills; EXT was prior externalizing problem behaviors; INT was prior internalizing problem behaviors; and *e* was the error term.

Some researchers (e.g., McClelland et al., 2007; Shahar et al., 2006; Volpe et al., 2006) included prior student achievement as a covariate when examining the relationship between student behaviors and academic achievement to account for the relationship between prior and future achievement. Model 2 added prior student achievement in reading or math as the first covariate to the equation used for Model 1. The equation for Model 2 was as follows:

$$ACH = \beta_1 + \beta_2(PACH) + \beta_3(COG) + \beta_4(SES) + \beta_5(RACE) + \beta_6(SEX) + \beta_7(ATL) + \beta_8(PRO) + \beta_9(EXT) + \beta_{10}(INT) + e$$

Where PACH was student prior achievement in reading or math.

After conducting the initial proposed analyses, a reduced model was tested based on the results of Model 1. This model included cognitive skills, socioeconomic status, and prior approaches to learning. The equation for Model 3 was as follows:

$$ACH = \beta_1 + \beta_2(COG) + \beta_3(SES) + \beta_4(ATL) + e$$

The specific interest for the present study was in estimating the R-square for the behavior variables for each equation. However, based on previous studies, the possible confounding effects of demographic variables and cognitive skills were factored out first to control for any common variance shared with the targeted outcome variables. Specifically, because it was hypothesized that approaches to learning would have the most salient relationship with future achievement, this specific behavior was chosen as the first variable to be entered into the equation. The subsequent variables were then entered in their hypothesized order of importance. The change in R^2 value was calculated to determine the percent variance accounted for by each independent variable (Cohen et al., 2003). Regression coefficients with a *p*-value of .05 or less were considered statistically significant.

Testing of Assumptions

As recommended by Cohen, Cohen, West, and Aiken (2003), several assumptions were tested prior to completing the regression analyses. First, linearity between the criterion variables and predictor variables was examined using bivariate scatterplots. Linearity also was tested by plotting the standardized residuals against predicted values to indicate whether the variables were randomly distributed around zero. Second, the assumption of random error was inspected by examining residual boxplots for each of the predictor and criterion variables. Uncorrelated errors were indicated if examination of these plots revealed relative uniformity of the variable medians around zero. Third, independence of errors were inspected through a scatterplot of residuals against each of the predictor variables, thus indicating whether or not the variance was evenly distributed around zero for each of the predictors. Fourth, inspection of histograms

and p-p plots provided insight regarding normal distribution of residuals. Finally, multicollinearity was evaluated by examining the tolerance values for the independent variables (Keith, 2006). Tolerance is "a measure of the degree to which each variable is independent of the other independent variables" (Keith, 2006, p. 201). Tolerance values of 0 indicate that no independence exists among the variables; whereas tolerance values of 1 indicate that the variables are completely independent of each other. Conservatively, tolerance values above .40 are considered to be acceptable.

Results

Data Preparation and Preliminary Analyses

Sampling weights. The data of the ECLS-K is designed to be nationally representative of children who entered kindergarten in 1998 in the United States (National Center for Educational Statistics, NCES, 2007). However, the ECLS-K has a complex sample design, thus indicating that only a subsample of kindergarten students in 1998 were included in the study. Additionally, problems with the data, including potential biases, may occur from issues such as non-response or attrition. If each case is counted equally in the analyses, the results may not be generalizable to the target (U. S.) population. To account for this potential problem, sampling weights must be employed so that each case is included relative to its representation in the population. As recommended by the National Center for Education Statistics (2007), sampling weights were employed in all analyses.

When analyzing the ECLS-K data, there are two important issues to consider in relation to the standard errors (NCES, 2007). Standard errors are used in hypothesis testing and to generalize results to a population. When sampling weights are employed, the standard errors are changed to reflect the population size rather than the actual sample size. These inaccurate standard errors could lead to results that may be determined (incorrectly) to be significant or nonsignificant. As such, the weights must be normalized to allow for the standard errors to be based on the sample size. Additionally, the ECLS-K employs a complex sample design rather than a simple sample design. Because most statistical software is designed to be used with simple sample design, the standard errors are often underestimated when analyzing data with a complex sample design. A design

effect is used to correct for these potential issues associated with a complex sample design. A design effect is "the ratio of variance of the dependent variable produced by specialized software that accounts for the complex design to the variance of the same dependent variable" (NCES, 2007).

In the present study, these potential issues with standard errors were accounted for by first calculating a normalized weight to adjust the population size to the actual sample size. The National Center for Education Statistics (2007) provided the following formula to calculate the normalized weights:

Normalized Weights = Sampling Weight to be Normalized * (n/N)

Where "n" is the sample size and "N" is the population size, or the sum of the weights that were used in the analyses. The sampling weights were provided in the data set of the ECLS-K. A new variable was computed to include these new normalized weights.

After calculating the normalized weight, a design effect was obtained to adjust for issues with complex design. NCES (2007) provided design effects for each of the sample weights. A "design effect-adjusted weight" was then calculated to allow the standard errors to be more accurate. The following equation was used to calculate the design effect-adjusted weight (NCES, 2007):

Design Effect-Adjusted Weight = Normalized Weight/ Design Effects

The design effect-adjusted weight was used for all analyses in the current study.

Assumptions. Statistical analyses were conducted using SPSS 13.0 for Windows. Prior to completing the multiple regression analyses, data were examined to determine whether they met underlying assumptions for multiple regression analyses. According to Tabachnick and Fidell (2001), multiple regression analyses require a large number of observations ($N \geq 50 + 8\ m$, with m equaling the number of independent variables). All analyses conducted for each wave of data met this requirement. Additionally, a power analysis indicated that the sample sizes used in this study met the minimum sample size requirement (Erdfelder, Faul, & Buchner, 1996).

Linearity was tested by plotting the criterion and predictor variables on bivariate scatterplots. Additionally, the standardized residuals were plotted against predicted values to indicate whether the variables were randomly distributed around zero. Inspection of these plots indicated a linear relationship between the criterion and the predictor variables. Random error was inspected by examining the residual boxplots for each of the predictor and criterion variables. There were 72 cases (.5% of the total) and 41 cases (.2%) greater than three standard deviations from the mean for the Grades K-3 and 3-5 samples, respectively. Analyses were conducted both with and without these outliers and did not reveal significant differences. As such, the outliers were retained in the analyses.

Independence of errors was tested by examining a scatterplot of the residuals against each of the predictor variables. This indicated that the variance was evenly distributed around zero, and thus the assumption of independence of errors was not violated. The residuals appeared to be normally distributed by an examination of the histograms and p-p plots. The data also were examined for multicollinearity. The

tolerance values for both samples were greater than or equal to .45 indicating that multicollinearity for the variables was not apparent.

Multiple Regression Analyses

Regression analyses were conducted for each time period and outcome variable of interest: kindergarten behaviors predicting third grade reading, kindergarten behaviors predicting third grade math, third grade behaviors predicting fifth grade reading, and third grade behaviors predicting fifth grade math. Model 1 controlled for cognitive skills and student demographic variables prior to entering prior approaches to learning, prosocial skills, externalizing problem behaviors, and internalizing problem behaviors. Model 2 controlled for prior achievement, cognitive skills, and student demographic variables before entering the prior student behavior variables. Model 3 was a reduced version of Model 1 and only included cognitive skills, socioeconomic status, and approaches to learning.

Third Grade Achievement

Descriptive statistics for the predictors of third grade achievement outcomes are presented in Table 2. The correlations for prior and future achievement were large. The correlations for the covariates were large for cognitive skills; medium for socioeconomic status and race; and small for sex. Later achievement had a large relationship with approaches to learning, whereas later achievement had small relationships with prosocial skills, externalizing problems, and internalizing problems.

Table 2. Means, Standard Deviations, and Correlations of Predictor Variables with Third Grade Achievement Outcomes

			Third Grade Achievement	
Kindergarten Predictor Variable	*M*	*SD*	Reading (*r*)	Math (*r*)
Reading	50.12	10.00	.62	.67
Math	50.11	10.00	.58	.71
Cognitive Skills	50.56	9.83	.62	.59
Socioeconomic Status	3.10	1.38	.45	.43
Race	.63	.48	.30	.30
Sex	.51	.50	-.09	.08
Approaches to Learning	3.01	.68	.40	.40
Prosocial Skills	3.00	.63	.28	.25
Externalizing Problem Behaviors	1.62	.63	-.19	-.16
Internalizing Problem Behaviors	1.52	.51	-.16	-.17

Note. N = 12,558. All correlation coefficients are significant at $p < .01$.

Reading

Model 1. Results of the multiple regression analyses for kindergarten behaviors predicting third grade reading achievement for Model 1 are presented in Table 3. Cognitive skills, as measured by the general knowledge scale, was significant, indicating that children who scored higher on this measure in kindergarten also scored higher in reading in third grade. Similarly, children with higher socioeconomic status in kindergarten demonstrated higher reading achievement in third grade. The results for race indicated no difference in reading achievement for children of majority status versus

children of minority status. There were small differences in sex suggesting that girls had higher reading achievement than boys.

The relationship between approaches to learning in kindergarten and reading achievement in third grade was positive. Although the relationship between prosocial skills in kindergarten and third grade math achievement was negative, the strength of this relationship was negligible. Kindergarten externalizing and internalizing problems both had a nonsignificant relationship with third grade reading achievement.

Table 3. Results of Model 1 Multiple Regression Analyses for Third Grade Reading

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.60	58.33	<.001	.37	.37
SES	.19	16.67	<.001	.39	.03
Race	.001	.06	.95	.39	<.001
Sex	-0.11	-10.97	<.001	.41	.01
Approaches to Learning	.18	16.73	<.001	.43	.03
Prosocial Skills	-0.04	-2.76	.006	.43	.001
Externalizing Behaviors	-0.01	-0.70	.48	.43	<.001
Internalizing Behaviors	-0.02	-1.50	.13	.43	<.001

Note. N = 12,558. SES = Socioeconomic Status.

Model 2. Prior reading explained the majority of variance when entered into the equation (Table 4). Cognitive skills explained a small amount of variance (9%). Although the relationships between socioeconomic status, approaches to learning and later reading achievement were significant, these variables only explained 1% of the variance in third grade reading, respectively.

Table 4. Results of Model 2 Multiple Regression Analyses for Third Grade Reading

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Prior Reading	.62	60.71	<.001	.38	.38
Cognitive Skills	.37	31.25	<.001	.47	.09
SES	.11	10.57	<.001	.48	.01
Race	.01	1.18	.24	.48	<.001
Sex	-0.07	-7.90	<.001	.49	.005
Approaches to Learning	.12	11.02	<.001	.50	.01
Prosocial Skills	-0.02	-1.12	.26	.50	<.001
Externalizing Behaviors	-003	-2.80	.005	.50	.001
Internalizing Behaviors	-0.01	-0.86	.39	.50	<.001

Note. *N* = 12,558. *SES* = Socioeconomic Status.

Model 3. The reduced equation indicated that cognitive skills had the strongest positive relationship with later reading achievement (Table 5). Socioeconomic status and approaches to learning explained a small amount of variance.

Table 5. Results of Model 3 Multiple Regression Analyses for Third Grade Reading

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.61	60.99	<.001	.37	.37
SES	.19	17.33	<.001	.40	.03
Approaches to Learning	.20	19.40	<.001	.43	.03

Note. N = 12,558. SES = Socioeconomic Status.

Mathematics

Model 1. Similar to the results for the outcomes in reading, cognitive skills had the strongest positive relationship with later math achievement (Table 6). Additionally, children with higher socioeconomic status in kindergarten scored higher in math in third grade. The relationships between race and math achievement and between sex and math achievement were negligible.

Kindergarten approaches to learning demonstrated a small positive relationship with third grade math achievement. The relationship between prosocial skills in kindergarten and third grade math achievement was negative but negligible in size. Kindergarten externalizing problems had a nonsignificant relationship with third grade mathematics. Kindergarten internalizing problems had a negative relationship with third grade math, but this relationship was very small.

Table 6. Results of Model 1 Multiple Regression Analyses for Third Grade Math

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.58	59.95	<.001	.34	.34
SES	.20	17.26	<.001	.37	.03
Race	.04	3.15	.002	.37	.001
Sex	.07	6.95	<.001	.37	.005
Approaches to Learning	.23	20.87	<.001	.42	.04
Prosocial Skills	-0.07	-5.20	<.001	.42	.003
Externalizing Behaviors	.002	.15	.88	.42	<.001
Internalizing Behaviors	-0.02	-2.09	.04	.42	<.001

Note. *N* = 12,558. *SES* = Socioeconomic Status.

Model 2. Adding prior math achievement into the regression equation resulted in prior math explaining the greatest amount of variance (Table 7). Cognitive skills had a small positive relationship with later math achievement and the strength of the relationship of all the other variables was negligible.

Table 7. Results of Model 2 Multiple Regression Analyses for Third Grade Math

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Prior Math	.72	79.13	<.001	.51	.51
Cognitive Skills	.20	17.23	<.001	.54	.02
SES	.10	10.04	<.001	.54	.008
Race	.04	4.11	<.001	.55	.001
Sex	.08	0.06	<.001	.55	.006
Approaches to Learning	.10	10.17	<.001	.56	.008
Prosocial Skills	-0.03	-2.28	.02	.56	<.001
Externalizing Behaviors	-0.02	-2.15	.03	.56	<.001
Internalizing Behaviors	-0.01	-0.65	.52	.56	<.001

Note. N = 12,558. *SES* = Socioeconomic Status.

Model 3. The reduced equation indicated that cognitive skills had the strongest positive relationship with later math achievement (Table 8). Socioeconomic status and approaches to learning had a small relationship with later math achievement.

Table 8. Results of Model 3 Multiple Regression Analyses for Third Grade Math

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.59	57.72	<.001	.35	.35
SES	.20	17.72	<.001	.37	.03
Approaches to Learning	.19	18.44	<.001	.41	.03

Note. N = 12,558. SES = Socioeconomic Status.

Fifth Grade Achievement

Table 9 presents descriptive statistics for the fifth grade achievement outcomes. There was a large relationship between prior and future reading achievement and prior and future math achievement. There were also strong relationships between fifth grade achievement and cognitive skills and socioeconomic status, whereas later achievement had small relationships with race and sex. All of the behavior variables had small relationships with later achievement, including approaches to learning, prosocial skills, and externalizing problems. The exception to this was internalizing problems, which had a medium to large relationship with later achievement.

Table 9. Means, Standard Deviations, and Correlations of Predictor Variables with Fifth Grade Achievement Outcomes

			Fifth Grade Achievement	
Predictor Variable	*M*	*SD*	Reading (*r*)	Math (*r*)
Reading	49.91	10.10	.87	.73
Math	49.87	9.97	.71	.88
Cognitive Skills	51.01	9.88	.50	.42
Socioeconomic Status	3.27	1.36	.46	.43
Race	.67	.47	-0.17	-0.12
Sex	.51	.50	.07	-0.10
Approaches to Learning	3.00	.70	.28	.26
Prosocial Skills	3.06	.66	.13	.12
Externalizing Problem Behaviors	1.75	.63	-0.10	-0.10
Internalizing Problem Behaviors	1.66	.55	-0.47	-0.59

Note. N = 11,136. All coefficients are significant at $p < .01$.

Reading

Model 1. Cognitive skills demonstrated a large positive relationship with fifth grade reading achievement (Table 10). There was a small positive relationship between socioeconomic status and later achievement. Similar to the third grade analyses, the relationship between race and later reading indicated no significant differences, and girls had slightly higher reading achievement than boys.

There was a small positive relationship between approaches to learning in third grade and reading achievement in fifth grade. The relationship between prosocial skills in

third grade and later reading achievement was negligible. Third grade externalizing and internalizing problems demonstrated no relationship with fifth grade reading achievement.

Table 10. Results of Model 1 Multiple Regression Analyses for Fifth Grade Reading

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.61	29.61	<.001	.38	.38
SES	.21	9.60	<.001	.41	.04
Race	-0.03	-1.55	.12	.41	.001
Sex	-0.09	-4.64	<.001	.42	.009
Approaches to Learning	.26	12.17	<.001	.48	.05
Prosocial Skills	-0.10	-3.62	<.001	.48	.005
Externalizing Behaviors	.01	.49	.63	.48	<.001
Internalizing Behaviors	-0.02	-0.72	.47	.48	<.001

Note. *N* = 11,136. *SES* = Socioeconomic Status.

Model 2. Third grade reading achievement explained the majority of variance in fifth grade reading achievement (Table 11). Cognitive skills was the only other variable that contributed any variance of meaning, but this relationship was small.

Table 11. Results of Model 2 Multiple Regression Analyses for Fifth Grade Reading

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Prior Reading	.86	63.12	<.001	.73	.73
Cognitive Skills	.15	8.69	<.001	.75	.01
SES	.06	4.13	<.001	.75	.003
Race	-0.01	-0.36	.72	.75	<.001
Sex	-0.01	-1.07	.28	.75	<.001
Approaches to Learning	.06	3.97	<.001	.75	.003
Prosocial Skills	-0.02	-0.99	.32	.75	<.001
Externalizing Behaviors	.004	.23	.82	.75	<.001
Internalizing Behaviors	-0.005	-0.32	.75	.75	<.001

Note. *N* = 11,136. *SES* = Socioeconomic Status.

Model 3. The results for the reduced equation for fifth grade reading were similar to those for third grade reading. Cognitive skills had the strongest positive relationship with later reading achievement (Table 12). Socioeconomic status and approaches to learning were also positively related to later reading, but these relationships were small.

Table 12. Results of Model 3 Multiple Regression Analyses for Fifth Grade Reading

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.62	30.65	<.001	.39	.39
SES	.21	9.71	<.001	.42	.04
Approaches to Learning	.26	13.37	<.001	.48	.06

Note. *N* = 11,136. SES = Socioeconomic Status.

Mathematics

Model 1. Similar to each of the prior analyses for Model 1, cognitive skills had the strongest positive relationship with later math achievement (Table 13). Children with higher socioeconomic status in third grade scored higher in math in fifth grade. Race had a nonsignificant relationship with later achievement and the relationship between sex and later achievement was very small and therefore negligible.

Third grade approaches to learning demonstrated a small relationship with later achievement. Third grade prosocial skills and externalizing and internalizing problems had negligible relationships with fifth grade math achievement.

Table 13. Results of Model 1 Multiple Regression Analyses for Fifth Grade Math

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.56	25.74	<.001	.31	.31
SES	.25	11.09	<.001	.37	.05
Race	-0.01	-0.24	.81	.36	<.001
Sex	0.10	4.58	<.001	.37	.009
Approaches to Learning	.27	12.31	<.001	.43	.06
Prosocial Skills	-0.12	-4.17	<.001	.44	.007
Externalizing Behaviors	.41	-0.51	.61	.44	<.001
Internalizing Behaviors	-0.04	-1.86	.06	.44	.001

Note. *N* = 11,136. *SES* = Socioeconomic Status.

Model 2. Prior math explained the majority of variance upon its entry into the model (Table 14). As a result, the strength of the relationship of all the other variables was negligible.

Table 14. Results of Model 2 Multiple Regression Analyses for Fifth Grade Math

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Prior Math	.88	69.48	<.001	.77	.77
Cognitive Skills	.08	5.76	<.001	.77	.005
SES	.06	4.55	<.001	.78	.003
Race	-0.02	-1.47	.14	.78	<.001
Sex	.03	2.18	.03	.78	.001
Approaches to Learning	.05	3.30	.001	.78	.002
Prosocial Skills	-0.01	-0.64	.52	.78	<.001
Externalizing Behaviors	-0.03	-1.54	.12	.78	<.001
Internalizing Behaviors	.003	.20	.84	.78	<.001

Note. *N* = 11,136. SES = Socioeconomic Status.

Model 3. Consistent with previous analyses, cognitive skills had a large positive relationship with later math achievement in the reduced equation (Table 15). Socioeconomic status and approaches to learning had small positive relationships with later achievement.

Table 15. Results of Model 3 Multiple Regression Analyses for Fifth Grade Math

Predictor Variables	Beta (β)	*t*	*p*-value	R^2	ΔR^2
Cognitive Skills	.56	26.23	<.001	.31	.31
SES	.26	11.36	<.001	.37	.05
Approaches to Learning	.22	10.67	<.001	.41	.05

Note. *N* = 11,136. SES = Socioeconomic Status.

Follow-up Analyses: Reversal of Variable Entry

As recommended by Cohen et al. (2004), the order of variable entry was reversed for each of the four sets of equations to determine the amount of variance accounted for by the predictor variables prior to entering the identified covariates. The results of these analyses are reported in Appendices C through N. The student behavior variables consistently explained more variance when the variance contributed by cognitive skills and other demographic variables was not accounted for in the model. Internalizing and externalizing problem behaviors had small negative relationships with later achievement (sharing up to 6% variance). Prosocial skills had a small positive relationship with later achievement (sharing up to 3% variance). The relationship between approaches to learning was positive and ranged from small to medium (8% to 20% variance).

Student sex generally shared a negligible amount of variance with later achievement, but for some equations the relationship was small. Similar results were indicated for student race. Socioeconomic status had a small to medium relationship with later achievement (8% to 12% variance). Student cognitive skills, although entered into the equation last or next to last, consistently demonstrated a moderate relationship with later achievement (10% to 16% variance). Prior achievement demonstrated a small to large relationship with later achievement, and this relationship became stronger in the intermediate grades (7% to 34% variance).

Discussion

The purpose of this study was to examine the relationships between student behaviors and later academic achievement. Student behaviors included approaches to learning (i.e., engagement, regulated behavior, motivation, and goal-directed behaviors), prosocial skills (i.e., social skills, interpersonal skills, and academic competence), externalizing problem behaviors (i.e., hyperactivity, conduct problems, and aggression), and internalizing problem behaviors (i.e., anxiety, depression, and inattention). These behaviors were used to predict reading and math achievement in third and fifth grade.

Three models were tested for each of the achievement outcomes. Model 1 controlled for cognitive skills as measured by kindergarten performance on a general knowledge measure and student demographic variables (race, sex, and socioeconomic status) and then introduced the four behavior variables (approaches to learning, prosocial skills, externalizing problem behaviors, and internalizing problem behaviors). Model 2 was composed of the same variables as Model 1, but included prior achievement as the first predictor in the model. Model 3 was a reduced model of the most salient predictors from Model 1, including cognitive skills, socioeconomic status, and approaches to learning.

It was hypothesized that approaches to learning would have a moderate relationship with later academic achievement; whereas prosocial skills were expected to have a small relationship with achievement. Externalizing and internalizing problem behaviors were hypothesized to have small relationships with achievement. Multiple regression analyses were utilized to test the relationships between student behaviors and

achievement. Nationally representative data from the ECLS-K were used to test each hypothesis.

Multiple Regression Analyses

Appendix O provides a summary of the percent variance explained by each predictor variable for reading and math achievement in third and fifth grade for each of the three models. For each of the models, the results were similar regardless of grade or achievement domain. When included in the model, prior achievement always explained the most variance in the equation and accounted for 38% – 77% of the total variance. Cognitive skills accounted for .9% – 39% variance and explained the most variance when the equations did not include prior achievement.

Socioeconomic status was the most significant demographic predictor in each of the models and accounted for .30% to 9% variance. Race was only significant in Model 1 for third grade math achievement, but the amount of variance explained in this model was negligible (.10% variance). Similarly, sex never accounted for a substantial amount of variance. Approaches to learning always emerged as the most salient behavior variable, accounting for .20% to 11% variance. Prosocial skills, externalizing problem behaviors, and internalizing problem behaviors consistently accounted for a negligible amount of variance.

One possible explanation for the strong relationship between prior and later achievement could be the measures that were used. Though adaptive tests were used during each wave of ECLS-K data collection, it is possible that students were exposed to some of the same items at different data collection time points. Bivariate correlations indicated that the relationship between prior reading and math achievement in

kindergarten was strongly related to third grade reading and math achievement (*r*s = .62 and .71, respectively). The correlations between third grade reading and math and fifth grade reading and math achievement were even stronger (*r*s = .87 and .88, respectively). These high intercorrelations and the content of items that were presented to the students indicate that the measures used for prior and later achievement were highly related. This is especially true at the older grades. As such, using prior achievement as a predictor may result in falsely inflating the relationship between prior and future achievement, thus masking the relationship between other variables of interest and later achievement.

With the exception of prior achievement, cognitive skills consistently explained the most amount of variance in the models. Socioeconomic status was the only student demographic variable and approaches to learning was the only behavior variable of interest that contributed consistently meaningful variance for all of the models tested. Based on this study, it is evident that cognitive skills, socioeconomic status, and approaches to learning are the three variables that contribute the most variance in explaining future academic achievement.

The differences in the strength of the relationships between the predictor and criterion variables in the original models versus the reversed analyses highlight the importance of the order and presence of key variables in the model. The relationship between the targeted student behavior variables and later academic achievement was stronger when cognitive skills and the student demographic variables were not included in the model. This suggests that failure to include key covariates may result in falsely inflating the relationship between student behaviors and academic achievement.

Hypotheses

Covariates

As noted in the previous section, student race and sex did not emerge as contributing a significant amount of variance to later achievement in the present study. However, students from families with lower socioeconomic status in kindergarten and third grade demonstrated slightly lower achievement in reading and math at third and fifth grade. Of note, student race was not a significant predictor of later achievement after the variance contributed by socioeconomic status was taken into account. Prior research also supports this achievement gap that is present among students with different socioeconomic backgrounds (Sirin, 2005). The results of this study also indicated that students with high cognitive skills had higher future achievement. Research also supports the concept that beyond prior academic achievement, students' cognitive skills are the single best predictor of academic achievement (e.g., Watkins, Lei, & Canivez, 2007).

Student Behaviors

Approaches to learning. Hypothesis 1 indicated that approaches to learning would have a moderate relationship with future academic achievement. Approaches to learning consistently explained the most amount of variance when compared with the other behavior variables across grade levels and academic achievement domains. However, this relationship ranged from being negligible (Model 2) to small (Models 1 and 3). It appears that the relationship between approaches to learning and achievement may become more salient as students become older -- third grade approaches to learning explained more variance in fifth grade achievement when compared to kindergarten approaches to learning and third grade achievement.

Results of prior studies (Alexander et al., 1993; DiPerna et al., 2007; Howse et al., 2003a; Hughes et al., 2008; McClelland et al., 2006; McClelland et al., 2000; Perry et al., 1979; Wilson & Shulha, 1995) have indicated a positive relationship between approaches to learning and achievement. The current results are consistent with prior studies indicating that approaches to learning skills had the most significant relationship with academic achievement when compared with the other behaviors of interest (DiPerna et al., 2007; Schaefer & McDermott, 1999).

Although approaches to learning explained the most variance among the classroom behavior predictors, the strength of this relationship was weaker than predicted. Past studies have indicated a moderate amount of variance explained for the predictive relationship between self-regulation (Howse et al., 2003a), student engagement, (Hughes et al., 2008) and reading achievement. Similarly, the present results indicated a weaker relationship between student behavior and future math achievement when compared to the moderate relationship reported in other studies (e.g., Perry et al., 1979).

Prosocial skills. Hypothesis 2 indicated that prosocial skills would have a positive relationship with future academic achievement. This hypothesis was not supported by the majority of the models that were tested. Although prosocial skills were significantly related to later achievement in the reversed analyses, this relationship was very small and only explained a maximum of 3% variance.

Past research that has examined the relationship between prosocial skills and academic achievement has indicated mixed results. Duncan et al. (2007) indicated that prosocial skills were not a significant predictor of reading or math achievement. DiPerna

et al. (2007) observed a negative relationship between prosocial skills and math achievement in their study using the ECLS-K data, although this relationship was not significant. The only longitudinal studies that indicated a significant positive relationship between prosocial skills and reading or math achievement did not include covariates in their analyses (Agostin & Bain, 1997; Malecki & Elliott, 2002; Miles & Stipek, 2006).

In contrast, studies that examined general achievement indicated a more salient relationship between prosocial skills and achievement. For example, Caprara et al. (2000) indicated that prosocial skills accounted for 32% of variance in academic achievement after controlling for prior achievement. Ladd et al. (1999) reported a significant relationship after controlling for child and family background characteristics; however, prosocial skills only accounted for 3% variance with later achievement. It is possible that there is a stronger relationship between prosocial skills and general achievement when compared to specific subject areas. As noted by DiPerna et al. (2007), it is also possible that there may be a large amount of common variance shared between approaches to learning and prosocial skills for the measures used on the ECLS-K, thus indicating that the two are measuring highly related constructs. DiPerna and colleagues also noted that the measures used by the ECLS-K to assess prosocial skills and approaches to learning may have limited construct specificity.

Externalizing behaviors. Hypothesis 3 indicated that externalizing problem behaviors would have a small relationship with achievement in reading and math, but this prediction was not supported. These results are similar to the past studies that have included covariates and examined the longitudinal relationship between reading and/or math achievement and externalizing problem behaviors (DiPerna et al., 2007; Duncan et

al., 2007) and hyperactive-impulsive behaviors (Massetti et al., 2008). Even longitudinal studies that omitted covariates in their analyses have not yielded a significant relationship between externalizing problem behaviors and later achievement (Agostin & Bain, 1997; Feshbach & Feshbach, 1987; Montegue et al., 2005). Conversely, Giannopulu et al. (2008) indicated that preschool externalizing problem behaviors were significantly related to first grade reading comprehension. Longitudinal studies that included general measures of achievement reported significant relationships between externalizing problem behaviors and later achievement (Chen et al., 1997), even when controlling for various student characteristics, such as sex and socioeconomic status (Bub et al., 2007).

Internalizing behaviors. The fourth hypothesis that internalizing problem behaviors would have a small relationship with later achievement was not supported. Several studies are consistent with these findings in reading (Duncan et al.,2007; Nelson et al., 2004; Rapport et al., 2001) and math achievement (DiPerna et al., 2007; Duncan et al., 2007; Nelson et al., 2004). Similar results were noted in a study that examined the relationship between anxiety and depression and a general measure of academic achievement (Kartusis et al., 2000). Feshbach and Feshbach (1987) and Agostin and Bain (1997) both suggested that internalizing behaviors were negatively associated with concurrent reading achievement, but this relationship was not significant in the authors' longitudinal analyses.

Other studies have reported a significant relationship between internalizing behaviors and achievement, even when using covariates in their analyses (Bub et al., 2007; Durbrow et al., 2000). There were some methodological differences between these studies and the present study. For example, the sample utilized by Durbrow and

colleagues included children from a Caribbean village and it is likely that the background characteristics of those children were fairly homogeneous compared to those of the children used in the nationally representative database for the present study.

Potential Explanations for Inconsistency with Past Research

There are several inconsistencies between the results of the present study and those of past studies. One possible explanation for the inconsistency of results in the studies that examined the relationships between student behaviors and academic achievement could be the use of covariates in the analyses. As was noted in the Literature Review, failing to include key covariates could change or even falsely inflate the strength of the relationship between student behaviors and achievement. For the present study, the percent variance explained by each behavior variable was greater when the achievement, cognitive, and demographic variables were included in the regression model after student behaviors. In addition, the results indicated that the covariates, particularly prior achievement and cognitive skills, accounted for the most variance in future reading and math achievement.

A second potential explanation is that researchers have defined student behaviors in different ways. For example, Schaefer and McDermott (1999) defined approaches to learning as including competence, motivation, attitudes toward learning, attention/persistence, and strategy/flexibility. Conversely, Finn et al. (1995) defined approaches to learning as effort, initiative, and compliance. The different types of student behaviors also have been measured using various methods. Some studies used standardized teacher and/or parent ratings of behaviors, whereas others used teacher information as noted on report cards. The present study used an adapted version of the

Social Skills Rating System (SSRS; Gresham & Elliott, 1990) that was developed for the ECLS-K. It is possible that this version may have limited construct specificity relative to the original SSRS. These differences in the definitions and measurement of student behaviors make it difficult to directly compare results across studies.

Student achievement has also been measured differently across studies. The majority of studies used standardized achievement measures (Duncan et al,. 2007; Feshbach & Feshbach, 1987; Vaughn et al., 1992). Other studies used teacher or parent ratings of academic competence (Dermitzaki et al., 2004; Eisenberg & Schneider, 2007). A third set of studies used report card grades as measures of academic achievement (Hamilton et al., 1997; Normandeau & Guay, 1998). Similarly, different academic subjects have been featured across studies. Many included reading and math (Duncan et al., 2007; McClelland et al., 2007; Volpe et al., 2006), others only examined math (DiPerna et al., 2007; Singh et al., 2002; Wolters, 2004) or reading (Howse et al., 2003b; Miles & Stipek, 2006; Vaughn et al., 1992), and others explored general measures of achievement (Chen et al., 1997; Rabiner et al., 2004; Schaefer & McDermott, 1999). Similar to the behavior measures, it is difficult to compare results across studies that define and measure academic achievement using different methods. However, results can be compared across different studies that examine the same achievement domain using similar measures. For example, the results of the present study were most consistent with past research that has also included standardized achievement measures for specific achievement domains (DiPerna et al., 2007; Duncan et al., 2007).

Implications for Practice

There are several prospective implications for practice resulting from this study. A new focus in education has been on fostering social emotional learning (SEL) in addition to the traditional emphasis on academic skills (Zins et al., 2004). The purpose of social emotional learning is twofold. First, educators argue that one goal of education is to produce well-rounded individuals who possess both the academic education and social behaviors that are necessary to be successful citizens (Zins et al., 2004). Second, some students may be less successful in school because curricula do not focus on teaching students the necessary behaviors to be academically successful (Adelman & Taylor, 2000).

The current results suggest that attention should be paid to students' approaches to learning behaviors. Specifically, implementing a curriculum designed to foster the growth of approaches to learning may assist students with becoming more academically successful. Because significant results were present even for behaviors identified in kindergarten, targeting these behaviors at a young age and explicitly teaching them as a child progresses through the education system may be beneficial. These behaviors include, but are not limited to, student engagement, regulated behavior, motivation, goal-directed behavior, following directions, and cooperation. The Collaborative for Social Emotional Learning (CASEL; www.casel.org) provides information regarding several empirically-based programs that are available to educators that include lessons specifically designed to target approaches to learning behaviors.

Although the present study did not yield meaningful relationships between achievement, prosocial skills, and problem behaviors, these behaviors cannot be ignored.

For example, Ladd (1999) found that children who displayed better developed social skills were more likely to have positive peer relationships throughout their formal schooling, whereas children with poor social skills were more likely to be rejected by their peers (Ladd, 1999; Rubin, Hymel, & Mills, 1989). Ladd also concluded that children who did not have friends had a history of both poorly developed social skills and demonstrating problem behaviors, which, in turn, hindered their ability to form and maintain positive relationships.

Externalizing and internalizing problem behaviors also have been associated with other negative life outcomes, including future stressful life events and delinquent behaviors (see Kim, Conger, Elder, & Lorenz, 2003). As such, teachers, psychologists, and other professionals in school settings should intervene with students who display externalizing or internalizing problem behaviors to help promote positive mental health and prevent future problems. Educators also should help promote students' development of prosocial skills to assist them with engaging and maintaining appropriate peer relationships.

Limitations

There are several limitations of this study that should be taken into consideration. One limitation involves the measures used for the student behavior variables. Student behavior was measured through teachers via a questionnaire. There were no direct measures (e.g., direct observations) of student behavior, and it is therefore not possible to determine the validity of teacher responses. It is possible that there is some bias involved in the teacher responses. Although there is research to indicate that teachers are generally accurate predictors of student achievement (Hoge & Coladarci, 1989), even when taking

into account student behaviors (McGinnis, 2007; Hecht & Greenfield, 2002), it is possible that teachers may be more likely to provide favorable behavioral ratings of students who have better academic performance in the classroom. Because approaches to learning in the present study was measured using teacher ratings, it is possible that teachers rated children with higher achievement as displaying more sophisticated and active learning behaviors. Another potential source of bias is social desirability (Gall, Borg, & Gall, 1996). Teachers may rate students with more desirable behaviors than they actually portray in an attempt to respond in a manner that will be viewed as being more favorable. However, the developers of the ECLS-K indicated that there may be a smaller risk of social desirability bias in teacher responses due to the use of mail surveys for data collection, rather than face-to-face assessments (NCES, 2007).

A second limitation includes the abbreviated measures that were used to measure the behavior constructs in the study. Due to the large scope of the ECLS-K, the developers of the study scaled-back the length of individual measures to allow for more manageable data collection. As a result of abbreviating measures, there may be problems with restricted construct representation for the behavior measures. There is some reliability evidence for these abbreviated measures to indicate consistency in the scores. However, there is little published data available to evaluate the adequacy of the construct validity of these measures.

A third limitation is the use of the general knowledge measure as a proxy for cognitive skills in the present analyses. The general knowledge assessment was designed to measure a child's knowledge of basic information, science, and social studies. The ECLS-K did not gather information regarding the general intelligence of participants, and

as such, past researchers have used general knowledge as an estimate of cognitive skills (DiPerna et al., 2007). However, it is possible that this actually measures acquired knowledge rather than cognitive skills. There is considerable debate regarding the differences between intelligence tests and achievement tests, as many indicate that they have similar items and measure similar constructs (Flanagan, Andrews, & Genshaft, 1997). However, there is empirical evidence indicating intelligence and achievement tests measure two separate constructs (Watkins et al., 2007). As such, it would have been preferable to use an actual cognitive ability measure rather than general knowledge.

Future Research

In addition to conducting studies that address the aforementioned limitations, there are several considerations for future research. For example, the longitudinal relationships between student behaviors and future academic achievement should be examined across different levels of the educational system (preschool through college). Particular attention should be made to the identification of early behaviors and their relationships with achievement throughout a child's academic career to assist with the development of intervention programs to prevent problem behaviors from occurring and to foster the growth of positive behaviors.

Future research also should use multiple methods of measuring achievement, including standardized or criterion-referenced assessments, teacher or parent judgments of academic competence, and report card grades. This will allow for the determination of whether the method of measuring achievement influences the relationship with student behaviors. Similarly, researchers should examine the influence of student behaviors on other academic domains, including science, social studies, and writing.

The present study only examined the relationships of four student behaviors in predicting academic achievement. Future research should examine the relationships of other variables that may predict academic success. Additional student characteristics may be important to examine (see McClelland et al., 2007). The present study included inattention as an internalizing behavior and hyperactivity as an externalizing behavior. However, it is possible that these behaviors may be more typical of symptoms associated with Attention-Deficit/Hyperactivity Disorder (ADHD), thus indicating that it may be more appropriate to examine their relationship with later achievement independent of other externalizing or internalizing behavior problems (see Barry et al., 2002; Blackman et al., 2005; Eisenberg & Schneider, 2007). Family characteristics, including parent involvement and parent marital status, may also be important areas to target (see Duncan et al., 2007; McWayne et al., 2004). Another area to consider is teacher characteristics, including the number of years of teaching experience, and whether or not the teacher characteristics (i.e., sex and race) match those of their students (see Wentzel et al., 1993).

Finally, an examination of the reciprocal relationship between student behavior and academic achievement is also needed. The results from Miles and Stipek (2006) indicated that aggression did not predict future underachievement in reading, but underachievement in reading did predict future aggression. It is unclear whether students develop problem behaviors due to experiencing academic difficulties, or whether students experience academic difficulties because they exhibit problem behaviors. Understanding the nature of this relationship will provide insight to educators to help them determine if they should focus on academic skills or behaviors for students who are at-risk.

Conclusion

Understanding the relationships between student classroom behaviors and academic achievement is an important consideration in education. Prior to this study, the empirical literature in this area demonstrated mixed results. This study attempted to determine the relationships between student behaviors, including approaches to learning, prosocial skills, and internalizing and externalizing problem behaviors, and later academic achievement. Cognitive skills consistently contributed the most amount of variance to future academic achievement. Additionally, socioeconomic status was the only student demographic variable that contributed meaningful variance to later achievement. The results also indicated that, of the behavioral variables, approaches to learning had the most salient relationship with future academic achievement. As such, it appears that behaviors such as engagement, motivation, and regulated classroom behaviors contribute to academic achievement. Conversely, prosocial skills, externalizing problem behaviors, and internalizing problem behaviors do not contribute a meaningful amount of variance to later academic achievement when other variables are considered. These results lend support to implementing interventions that target student approaches to learning behaviors as early as kindergarten, thus assisting students with developing and utilizing these behaviors.

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Appendix A

Studies that explore the relationships between student behaviors and academic achievement

Study	Sample	Targeted behaviors	Academic area	Covariates
Agostin & Bain (1997)	*N* = 184; Grade K, followed two years	Social skills and problem behaviors	Reading and math on standardized achievement test	None
Alexander, Entwisle, & Dauber (1993)	*N* = 790; Grade 1 followed 4 years	Interest-participation, cooperation-compliance, and attention span-restless	Reading and math on standardized achievement test and report cards	Race, gender, parent education, SES
Aluja & Blanch (2004)	*N* = 678, 11 to 15-years-old	Depressive symptoms and social maladjustment	Report card grades	None
Arnold (1997)	*N* = 74 boys; 3 to 6-years-old	Externalizing behaviors and attention	Report card grades	None
Barriga et al. (2002)	*N* = 58; 11 to 19-years-old	Internalizing behaviors, externalizing behaviors, and attention	Reading and math on standardized achievement test	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Barry, Lyman, & Klinger (2002)	*N* = 66; 8 to 14-years-old	ADHD and non-ADHD control group	Reading and math on a standardized achievement test	None
Blackman, Ostrander, & Herman (2005)	*N* = 453; 6 to 11-years-old	ADHD, ADHD and depression, and control group	Reading on a standardized test and teacher ratings scales	None
Bodovoski & Farkas (2007)	*N* = 13,043; Grades K, 1, and 3	Engagement	Math on standardized achievement test	None
Bramlett, Scott, & Rowell (2000)	*N* = 104; Grade 1	Social skills	Reading and math on standardized achievement test	None
Bub, McCartney, & Willett (2007)	*N* = 882; 24, 26, 54 months, grades K and 1	Internalizing and externalizing behavior problems	Reading and math on standardized achievement test	Gender and SES
Caprara et al. (2000)	*N* = 294; Grade 3, followed 5 years	Prosocial behaviors and aggression	Report card grades	Prior achievement
Chen, Rubin, & Li (1997)	*N* = 230; Grades 4 and 6	Prosocial and negative behaviors	Achievement based on school test scores	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Clark, Prior, & Kinsella (2002)	*N* = 110; 12 to 15-years-old	ADHD, ADHD and ODD/CD, ODD/CD, control group	Reading on standardized test	None
Dermitzaki & Kiosseoglou (2004)	*N* = 311; Grade 2	Self-regulation and goal orientation	Reading and math exam grades	None
Diamantopoulou et al. (2007)	*N* = 112; 5 to 10-years-old	ADHD	Teacher ratings of achievement	Cognitive ability and gender
DiPerna, Lei, & Reid (2007)	*N* = 6,905; Grade K, followed through Grade 3	Prosocial behaviors, approaches to learning, externalizing and internalizing problems	Math achievement on standardized test	General knowledge (cognitive skills) and age
Duncan et al. (2007)	6 longitudinal data sets; preschool to age 10	Attention, social skills, externalizing and internalizing problems	Reading and math achievement on standardized test	Attention, socioemotional skills, cognitive skills, family background

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Durbrow, Schaefer, & Jimerson (2000)	*N* = 61; 5 through 12-years-old	Behavior problems and learning behaviors	Reading and math report card grades and on a curriculum-based exam	Cognitive skills and family background
Eisenberg & Schneider (2007)	*N* = 9,062; Grade 3	ADHD and control group	Student, teacher, and parent perceptions of academic competence	Age, race, family background, and SES
Fantuzzo et al. (2007)	*N* = 1,764; preschool	Regulated and academically disengaged behavior	Literacy and numeracy through child observation; math on standardized test	Age and gender
Feshbach & Feshbach (1987)	*N* = 227; 8 through 11-years-old	Empathy, depressive symptoms, self-concept, and aggression	Reading and math on standardized achievement test	None
Finn, Pannozzo, & Voelkl (1995)	*N* = 1,013; Grade 4	Prosocial and disruptive behaviors	Norm- and criterion-referenced achievement test	Race and gender

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Frick et al. (1991)	*N* = 177; 7 to 12-years-old	ADHD and conduct disorder	Reading and math on standardized test	Age
Fuerst & Rourke (1993)	*N* = 500; 6 through 12-years-old	Conduct disorder, mild anxiety, internalizing and externalizing problems	Reading and math on standardized achievement test	None
Giannopulu et al. (2008)	*N* = 940; preschool and Grade 1	Hyperactivity, inattention, conduct problems, and unsociability	Early literacy skills for preschool; reading tasks for Grade 1	None
Green, Forehand, Beck, & Vosk (1980)	*N* = 116; Grade 3	Social skills, anxiety, conduct problems, withdrawal, inattention, and hyperactivity	Standardized achievement test	None
Gresham, Lane, MacMillan, & Bocian (1999)	*N* = 181; Grade 3	Externalizing and internalizing problem behaviors, control group	Reading and math on standardized achievement test, teacher perceptions of competence	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Hamilton, Asarnow, & Tompson (1997)	*N* = 49; 7 to 14-years-old	Depression and control group	Report card grades and achievement test scores	None
Henricsson & Rydell (2006)	*N* = 91; Grade 1, followed to Grades 3 and 6	Externalizing and internalizing behavior problems	Teacher ratings of achievement	None
Hodges & Plow (1990)	*N* = 76; 6 to 13-years-old	Anxiety, depression, conduct disorder, and oppositional disorder	Reading and math on standardized achievement test	None
Howse et al. (2003a)	*N* = 122; preschool and Grade K	Emotion and behavior regulation	Reading and math on standardized achievement test	Maternal education and cognitive skills
Howse, Lange, Farran, & Boyles (2003b)	*N* = 129; Grades K and 2	Self-regulation	Reading on standardized achievement test	Vocabulary skills
Hughes, Luo, Kwok, & Loyd (2008)	*N* = 671; Grade 1, followed for 3 years	Effortful engagement and conduct engagement (prosocial and antisocial)	Reading and math on standardized achievement test	Sex and ethnicity

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Johnson, McGue, & Iacono (2005)	*N* = 800 pairs of twins; 11 years-old	Inattention and disruptive behavior	School grades	None
Karustis et al. (2000)	*N* = 125; 7 to 12-years-old	ADHD with depression and anxiety	Math and reading achievement, teacher and parent ratings	Cognitive skills and age
Kohn & Rosman (1974)	*N* = 209 boys; Grade 2	Social emotional functioning	Reading and math on standardized achievement test	Race, SES, family background characteristics
Ladd, Birch, & Buhs (1999)	*N* = Study 1: 200 Study 2: 199; Grade K	Prosocial and antisocial behaviors, classroom participation	Performance on standardized achievement test	Gender, cognitive maturity, family background characteristics
Malecki & Elliott (2002)	*N* = 139; Grade 3 and 4	Social skills and problem behaviors	Reading and math on standardized achievement test	None
Massetti et al. (2008)	*N* = 255; 4 to 6-years-old; followed 8 years	ADHD and non-ADHD control group	Reading and math on standardized achievement test	Cognitive skills, demographic variables, and child characteristics

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
McClelland, Acock, & Morrison (2006)	*N* = 260; Grade K; followed through Grade 6	Learning-related skills (self-regulation, responsibility, independent, cooperation)	Reading and math on standardized achievement tests and curriculum-based tests	Cognitive skills, age, race, and maternal education
McClelland et al. (2007)	*N* = 310; preschool	Behavior regulation	Literacy, vocabulary, and math on standardized achievement test	Gender, age, and previous achievement
McClelland, Morrison, & Holmes (2000)	*N*= 82; Grade K, followed until Grade 2	Approaches to learning	Reading and math on standardized achievement test	Cognitive skills, age, preschool experience, family background
McWayne, Fantuzzo, & McDermott (2004)	*N* = 195; preschool	Classroom competencies, approaches to learning, classroom behaviors	Performance on developmental screener	Age, gender, neighborhood variables, family environment
Miles & Stipek (2006)	*N* = 377; Grade K or 1, followed through Grades 3 and 5	Aggressive and prosocial behaviors	Literacy on standardized achievement test	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Montague, Enders, & Castro (2005)	*N* = 226; middle school	Externalizing and internalizing behaviors	Reading and math on standardized achievement test	None
Nelson et al. (2004)	*N* = 155; Grades K through 12	Emotional/ behavioral disorders; externalizing and internalizing behaviorsInattention and disruptive behavior	Reading and math, on standardized achievement test	Age of onset
Normandeau & Guay (1998)	*N* = 291; Grades K and 1	Aggression, prosocial, and anxious-withdrawn behaviors	Report card grades	Cognitive skills
Perry, Guidubaldi, & Kehle (1979)	*N* = 186; Grades K through 3	Social competence	Reading and math on standardized achievement test	Cognitive skills
Preiss & Franova (2006)	*N* = 635; 9 to 11-years-old	Depressive symptoms	Grade point average from report cards	None
Rabiner et al. (2004)	*N* = 621; Grade 1	Inattention and behavior problems	Teacher ratings of academic achievement	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Rapport et al. (2001)	*N* = 325; 7 to 15-years-old	Internalizing behaviors (withdrawal and anxiety/ depression)	Reading and math on standardized achievement measures	None
Ray & Elliott (2006)	*N* = 77; Grade 4 and 8	Social skills	Reading and math on standardized achievement test	None
Schaefer & McDermott (1999)	*N* = 1,100; 6 to 17-years-old	Learning behaviors (i.e., competence, motivation, attitude toward learning, strategy/flexibility, and attention/persistence	Report card grades and standardized achievement test	None
Shahar et al. (2006)	*N* = 460; Grades 7 and 8	Depressive symptoms and self-criticism	Grade point average on report cards	Gender, previous grade point average
Singh, Granville, & Dika (2002)	*N* = 3,227; Grade8	Attitude/interest and engagement	Math report card grades and standardized achievement scores	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Stringer & Heath (2006)	*N* = 155; Grades 4 and 5	Depressive symptoms	Reading and math on standardized achievement test	Age, cognitive skills
Tesiny, Lefkowitz, & Gordon (1980)	*N* = 944; Grades 4 and 5	Depressive symptoms	Reading and math on standardized test and teacher ratings	None
Valiente et al. (2008)	*N* = 264; 7 to 12-years-old	Effortful control and social competence	Report card grades	Gender, SES
Vaughn et al. (1992)	*N* = 372; Grade K	Attention, conduct problems, social skills, and anxious/withdrawn	Reading on standardized achievement test	None
Volpe et al. (2006)	*N* = 146; Grades 1 through 4	ADHD and control group	Reading and math on standardized test and report card grades	Prior achievement
Welsh et al. (2001)	*N* = 163; Grade 1, followed for two years	Positive and negative social behaviors	Report card grades	None

(table continues)

(Table continued)

Study	Sample	Targeted behaviors	Academic area	Covariates
Wentzel (1993)	*N* = 423; Grade 6 and 7	Prosocial and antisocial behavior	Report card grades and standardized achievement test	Gender, ethnicity, cognitive skills, family background, days absent, teacher preferences
Wilson & Shulha (1995)	*N* = 86; Grade 9, followed 1 year	Learning behaviors	Report card grades	None
Wolters (2004)	*N* = 525; Grades 7 and 8	Personal achievement goals, motivation	Math achievement on course grades and state achievement test	Prior achievement and gender
Yen, Konold, & McDermott (2004)	*N* = 1, 304; 6 to 17-years-old	Learning behaviors	Reading and math on standardized achievement test	Cognitive skills
Zsolnai (2002)	*N* = 438; 12 to 16-years-old	Social competence	Report card grades	None

Appendix B

Multiple Regression Equations

Regression Equations for Proposed Analyses

Kindergarten Behaviors Predicting Third Grade Reading:

Model 1:

$$READ_3 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_K) + \beta_4(RACE) + \beta_5(SEX) + \beta_6(ATL_K) + \beta_7(PRO_K) + \beta_8(EXT_K) + \beta_9(INT_K) + e$$

Model 2:

$$READ_3 = \beta_1 + \beta_2(READ_K) + \beta_3(COG_K) + \beta_4(SES_K) + \beta_5(RACE) + \beta_6(SEX) + \beta_7(ATL_K) + \beta_8(PRO_K) + \beta_9(EXT_K) + \beta_{10}(INT_K) + e$$

Model 3:

$$READ_3 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_K) + \beta_4(ATL_K) + e$$

Kindergarten Behaviors Predicting Third Grade Math:

Model 1:

$$MATH_3 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_K) + \beta_4(RACE) + \beta_5(SEX) + \beta_6(ATL_K) + \beta_7(PRO_K) + \beta_8(EXT_K) + \beta_9(INT_K) + e$$

Model 2:

$$MATH_3 = \beta_1 + \beta_2(MATH_K) + \beta_3(COG_K) + \beta_4(SES_K) + \beta_5(RACE) + \beta_6(SEX) + \beta_7(ATL_K) + \beta_8(PRO_K) + \beta_9(EXT_K) + \beta_{10}(INT_K) + e$$

Model 3:

$$MATH_3 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_K) + \beta_4(ATL_K) + e$$

Where $READ_3$ is third grade reading achievement; $MATH_3$ is third grade math achievement; $READ_K$ is kindergarten reading achievement; $MATH_K$ is kindergarten math achievement; COG_K is the General Knowledge measure at school entry; SES_K is family socioeconomic status in kindergarten; RACE is student race; SEX is student gender; ATL_K is kindergarten Approaches to Learning; PRO_K is kindergarten Prosocial Skills; EXT_K is kindergarten Externalizing Problem Behaviors; INT_K is kindergarten Internalizing Problem Behaviors; and *e* is the error term.

Regression Equations for Proposed Analyses Continued

Third Grade Behaviors Predicting Fifth Grade Reading:

Model 1:

$$READ_5 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_3) + \beta_4(RACE) + \beta_5(SEX) + \beta_6(ATL_3) + \beta_7(PRO_3) + \beta_8(EXT_3) + \beta_9(INT_3) + e$$

Model 2:

$$READ_5 = \beta_1 + \beta_2(READ_3) + \beta_3(COG_K) + \beta_4(SES_3) + \beta_5(RACE) + \beta_6(SEX) + \beta_7(ATL_3) + \beta_8(PRO_3) + \beta_9(EXT_3) + \beta_{10}(INT_3) + e$$

Model 3:

$$READ_5 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_3) + \beta_4(ATL_3) + e$$

Third Grade Behaviors Predicting Fifth Grade Math:

Model 1:

$$MATH_5 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_3) + \beta_4(RACE) + \beta_5(SEX) + \beta_6(ATL_3) + \beta_7(PRO_3) + \beta_8(EXT_3) + \beta_9(INT_3) + e$$

Model 2:

$$MATH_5 = \beta_1 + \beta_2(MATH_3) + \beta_3(COG_K) + \beta_4(SES_K) + \beta_5(RACE) + \beta_6(SEX) + \beta_7(ATL_3) + \beta_8(PRO_3) + \beta_9(EXT_3) + \beta_{10}(INT_3) + e$$

Model 3:

$$MATH_5 = \beta_1 + \beta_2(COG_K) + \beta_3(SES_3) + \beta_4(ATL_3) + e$$

Where $READ_5$ is fifth grade reading achievement; $MATH_5$ is fifth grade math achievement; $READ_3$ is third grade reading achievement; $MATH_3$ is third grade math achievement; COG_K is the General Knowledge measure at school entry; SES_3 is family socioeconomic status in third grade; RACE is student race; SEX is student gender; ATL_3 is third grade Approaches to Learning; PRO_3 is third grade Prosocial Skills; EXT_3 is third grade Externalizing Problem Behaviors; INT_3 is third grade Internalizing Problem Behaviors; and *e* is the error term.

Regression Equations for Reversed Analyses

Kindergarten Behaviors Predicting Third Grade Reading:

Model 1:

$$READ_3 = \beta_1 + \beta_2 (INT_K) + \beta_3(EXT_K) + \beta_4(PRO_K) + \beta_5(ATL_K) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_K) + \beta_9(COG_K) + e$$

Model 2:

$$READ_3 = \beta_1 + \beta_2 (INT_K) + \beta_3(EXT_K) + \beta_4(PRO_K) + \beta_5(ATL_K) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_K) + \beta_9(COG_K) + \beta_{10}(READ_K) + e$$

Model 3:

$$READ_3 = \beta_1 + \beta_2(ATL_K) + \beta_3(SES_K) + \beta_4(COG_K) + e$$

Kindergarten Behaviors Predicting Third Grade Math:

Model 1:

$$MATH_3 = \beta_1 + \beta_2 (INT_K) + \beta_3(EXT_K) + \beta_4(PRO_K) + \beta_5(ATL_K) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_K) + \beta_9(COG_K) + e$$

Model 2:

$$MATH_3 = \beta_1 + \beta_2 (INT_K) + \beta_3(EXT_K) + \beta_4(PRO_K) + \beta_5(ATL_K) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_K) + \beta_9(COG_K) + \beta_{10}(MATH_K) + e$$

Model 3:

$$MATH_3 = \beta_1 + \beta_2(ATL_K) + \beta_3(SES_K) + \beta_4(COG_K) + e$$

Where $READ_3$ is third grade reading achievement; $MATH_3$ is third grade math achievement; $READ_K$ is kindergarten reading achievement; $MATH_K$ is kindergarten math achievement; COG_K is the General Knowledge measure at school entry; SES_K is family socioeconomic status in kindergarten; RACE is student race; SEX is student gender; ATL_K is kindergarten Approaches to Learning; PRO_K is kindergarten Prosocial Skills; EXT_K is kindergarten Externalizing Problem Behaviors; INT_K is kindergarten Internalizing Problem Behaviors; and *e* is the error term.

Regression Equations for Reversed Analyses Continued

Third Grade Behaviors Predicting Fifth Grade Reading:

Model 1:

$$READ_5 = \beta_1 + \beta_2 (INT_3) + \beta_3(EXT_3) + \beta_4(PRO_3) + \beta_5(ATL_3) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_3) + \beta_9(COG_K) + e$$

Model 2:

$$READ_5 = \beta_1 + \beta_2 (INT_3) + \beta_3(EXT_3) + \beta_4(PRO_3) + \beta_5(ATL_3) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_3) + \beta_9(COG_K) + \beta_{10}(READ_3) + e$$

Model 3:

$$READ_5 = \beta_1 + \beta_2(ATL_3) + \beta_3(SES_3) + \beta_4(COG_K) + e$$

Third Grade Behaviors Predicting Fifth Grade Math:

Model 1:

$$MATH_3 = \beta_1 + \beta_2 (INT_K) + \beta_3(EXT_K) + \beta_4(PRO_K) + \beta_5(ATL_K) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_K) + \beta_9(COG_K) + e$$

Model 2:

$$MATH_3 = \beta_1 + \beta_2 (INT_K) + \beta_3(EXT_K) + \beta_4(PRO_K) + \beta_5(ATL_K) + \beta_6(SEX) + \beta_7(RACE) + \beta_8(SES_K) + \beta_9(COG_K) + \beta_{10}(MATH_K) + e$$

Model 3:

$$MATH_3 = \beta_1 + \beta_2(ATL_K) + \beta_3(SES_K) + \beta_4(COG_K) + e$$

Where $READ_5$ is fifth grade reading achievement; $MATH_5$ is fifth grade math achievement; $READ_3$ is third grade reading achievement; $MATH_3$ is third grade math achievement; COG_K is the General Knowledge measure at school entry; SES_3 is family socioeconomic status in third grade; RACE is student race; SEX is student gender; ATL_3 is third grade Approaches to Learning; PRO_3 is third grade Prosocial Skills; EXT_3 is third grade Externalizing Problem Behaviors; INT_3 is third grade Internalizing Problem Behaviors; and *e* is the error term.

Appendix C

Results of Reversed Model 1 Multiple Regression Analyses for Third Grade Reading

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.16	-12.38	<.001	.03	.03
Externalizing Behaviors	-0.17	-13.02	<.001	.05	.03
Prosocial Skills	.22	14.17	<.001	.08	.03
Approaches to Learning	.42	23.56	<.001	.16	.08
Sex	-0.02	-1.50	.13	.16	<.001
Race	.21	18.32	<.001	.21	.05
SES	.31	27.01	<.001	.30	.09
Cognitive Skills	.46	38.07	<.001	.43	.14

Note. N = 12,558. SES = Socioeconomic Status.

Appendix D

Results of Reversed Model 2 Multiple Regression Analyses for Third Grade Reading

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.16	-12.33	<.001	.03	.03
Externalizing Behaviors	-0.17	-13.07	<.001	.05	.03
Prosocial Skills	.22	14.13	<.001	.08	.03
Approaches to Learning	.42	23.50	<.001	.16	.08
Sex	-0.02	-1.39	.14	.16	<.001
Race	.21	18.36	<.001	.21	.05
SES	.31	27.00	<.001	.29	.09
Cognitive Skills	.46	38.01	<.001	.43	.14
Prior Reading	.34	27.57	<.001	.50	.07

Note. N = 12,558. SES = Socioeconomic Status.

Appendix E

Results of Reversed Model 3 Multiple Regression Analyses for Third Grade Reading

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Approaches to Learning	.41	35.41	<.001	.17	.17
SES	.35	31.71	<.001	.28	.12
Cognitive Skills	.46	41.23	<.001	.43	.15

Note. N = 12,558. SES = Socioeconomic Status.

Appendix F

Results of Reversed Model 1 Multiple Regression Analyses for Third Grade Math

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.17	-12.92	<.001	.03	.03
Externalizing Behaviors	-0.13	-10.20	<.001	.04	.02
Prosocial Skills	.21	13.14	<.001	.07	.03
Approaches to Learning	.45	25.17	<.001	.16	.09
Sex	.17	.13.75	<.001	.19	.03
Race	.23	20.18	<.001	.24	.05
SES	.30	26.52	<.001	.32	.08
Cognitive Skills	.39	32.20	<.001	.42	.10

Note. N = 12,558. SES = Socioeconomic Status.

Appendix G

Results of Reversed Model 2 Multiple Regression Analyses for Third Grade Math

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.17	-12.92	<.001	.03	.03
Externalizing Behaviors	-0.13	-10.21	<.001	.04	.02
Prosocial Skills	.21	13.13	<.001	.07	.03
Approaches to Learning	.45	25.16	<.001	.16	.09
Sex	.17	13.75	<.001	.19	.03
Race	.23	20.18	<.001	.24	.05
SES	.30	26.52	<.001	.32	.08
Cognitive Skills	.39	32.20	<.001	.42	.10
Prior Math	.53	43.38	<.001	.56	.14

Note. N = 12,558. SES = Socioeconomic Status.

Appendix H

Results of Reversed Model 3 Multiple Regression Analyses for Third Grade Math

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Approaches to Learning	.40	34.54	<.001	.16	.16
SES	.35	31.38	<.001	.27	.11
Cognitive Skills	.43	38.08	<.001	.41	.14

Note. N = 12,558. SES = Socioeconomic Status.

Appendix I

Results of Reversed Model 1 Multiple Regression Analyses for Fifth Grade Reading

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.24	-9.39	<.001	.06	.06
Externalizing Behaviors	-0.18	-6.72	<.001	.09	.03
Prosocial Skills	.16	4.64	<.001	.10	.01
Approaches to Learning	.49	13.85	<.001	.20	.11
Sex	.03	1.16	.25	.20	.001
Race	.19	8.32	<.001	.24	.04
SES	.31	13.12	<.001	.32	.08
Cognitive Skills	.48	21.12	<.001	.48	.16

Note. N = 11,136. SES = Socioeconomic Status.

Appendix J

Results of Reversed Model 2 Multiple Regression Analyses for Fifth Grade Reading

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.23	-9.06	<.001	.05	.05
Externalizing Behaviors	-0.16	-5.98	<.001	.08	.02
Prosocial Skills	.15	4.50	<.001	.09	.01
Approaches to Learning	.50	13.59	<.001	.19	.10
Sex	.03	1.26	.21	.19	.001
Race	.20	8.42	<.001	.23	.04
SES	.30	12.78	<.001	.31	.08
Cognitive Skills	.48	21.01	<.001	.47	.16
Prior Reading	.73	30.48	<.001	.75	.28

Note. N = 11,136. SES = Socioeconomic Status.

Appendix K

Results of Reversed Model 3 Multiple Regression Analyses for Fifth Grade Reading

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Approaches to Learning	.45	19.33	<.001	.20	.20
SES	.34	15.13	<.001	.31	.11
Cognitive Skills	.48	22.69	<.001	.48	.18

Note. N = 11,136. SES = Socioeconomic Status.

Appendix L

Results of Reversed Model 1 Multiple Regression Analyses for Fifth Grade Math

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.24	-9.40	<.001	.06	.06
Externalizing Behaviors	-0.15	-5.47	<.001	.08	.02
Prosocial Skills	.10	3.04	<.01	.08	.006
Approaches to Learning	.45	12.36	<.001	.17	.09
Sex	.21	8.84	<.001	.21	.04
Race	.20	8.60	<.001	.25	.04
SES	.32	13.84	<.001	.33	.09
Cognitive Skills	.39	16.52	<.001	.44	.12

Note. N = 11,136. SES = Socioeconomic Status.

Appendix M

Results of Reversed Model 2 Multiple Regression Analyses for Fifth Grade Math

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Internalizing Behaviors	-0.24	-9.39	<.001	.06	.06
Externalizing Behaviors	-0.14	-5.34	<.001	.08	.02
Prosocial Skills	.10	3.01	.003	.08	.01
Approaches to Learning	.45	12.34	<.001	.17	.09
Sex	.22	8.88	<.001	.21	.04
Race	.20	8.72	<.001	.25	.04
SES	.32	13.73	<.001	.34	.09
Cognitive Skills	.38	16.43	<.001	.44	.10
Prior Math	.80	47.23	<.001	.78	.34

Note. N = 11,136. SES = Socioeconomic Status.

Appendix N

Results of Reversed Model 3 Multiple Regression Analyses for Fifth Grade Math

Predictor Variables	Beta (β)	*T*	*p*-value	R^2	ΔR^2
Approaches to Learning	.40	16.97	<.001	.16	.16
SES	.37	16.13	<.001	.28	.12
Cognitive Skills	.40	18.11	<.001	.31	.13

Note. N = 11,136. SES = Socioeconomic Status.

Appendix O

Percentage of Reading and Math Variance Accounted for in Each Model

	Prior	COG	SES	RACE	SEX	ATL	PRO	EXT	INT
Read K-3									
Model 1	–	37	3	NS	1	3	.10	NS	NS
Model 2	–	14	9	5	NS	8	3	3	3
Model 3	–	37	3	–	–	3	–	–	–
Model 4	38	9	1	NS	.50	1	NS	.10	NS
Read 3-5									
Model 1	–	38	4	NS	.90	5	.50	NS	NS
Model 2	–	16	8	4	NS	11	1	3	6
Model 3	–	39	4	–	–	6	–	–	–
Model 4	73	1	.30	NS	NS	.30	NS	NS	NS
Math K-3									
Model 1	–	34	3	.10	.50	4	.30	NS	<.10
Model 2	–	10	8	5	3	9	3	2	3
Model 3	–	35	3	–	–	3	–	–	–
Model 4	51	2	.80	.10	.60	.80	<.10	<.10	NS
Math 3-5									
Model 1	–	31	5	NS	.90	6	.70	NS	NS
Model 2	–	12	9	4	4	9	.60	2	6
Model 3	–	31	5	–	–	5	–	–	–
Model 4	77	.50	.30	NS	.10	.20	NS	NS	NS

Note. Prior = prior reading achievement; COG = cognitive skills; SES = socioeconomic status; ATL = approaches to learning; PRO = prosocial skills; EXT = externalizing problem behaviors; INT = internalizing problem behaviors; NS = Nonsignificant predictor

Curriculum Vita

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Work Experience:

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Reid, E., Miller, A., **McGinnis, A. M**., Goffreda, C., Hahn, K., Reid, M., Meyer, E., Freberg, M., & Culler, E. (2009, February). *Construct validity of the Woodcock- Johnson III Tests of Cognitive Abilities among adjudicated adolescents*. Poster presented at the annual convention of the National Association of School Psychologists, Boston, MA.

McGinnis, A. M., DiPerna, J. C., Morgan, P., Lei, P., Reid, E., & Wu, Q. (2008, August). *Sex differences in progress-monitoring performance in preschool students.* Poster presented at the annual convention of the American Psychological Association, Boston, MA.

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