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The Impact of Tutoring on Early Reading Achievement for Children With and Without Attention Problems

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Abstract

This study examined whether the benefits of reading tutoring in first grade were moderated by children's level of attention problems. Participants were 581 children from the intervention and control samples of Fast Track, a longitudinal multisite investigation of the development and prevention of conduct problems. Standardized reading achievement measures were administered after kindergarten and 1st grade, and teacher ratings of attention problems were obtained during 1st grade. During 1st grade, intervention participants received three 30-min tutoring sessions per week to promote the development of initial reading skills. Results replicated prior findings that attention problems predict reduced 1st grade reading achievement, even after controlling for IQ and earlier reading ability. Intervention was associated with modest reading achievement benefits for inattentive children without early reading difficulties, and substantial benefits for children with early reading difficulties who were not inattentive. It had no discernible impact, however, for children who were both inattentive and poor early readers. Results underscore the need to develop effective academic interventions for inattentive children, particularly for those with co-occurring reading difficulties.

Keywords

attention problems; tutoring; reading; intervention

Problems with attention to classroom instruction and schoolwork are extremely common among students (DuPaul, Stoner, & O'Reilly, 2002), and a recent survey of teachers indicates that approximately 16% of elementary school children display frequent inattention and/or poor concentration (Wolraich, Hannah, Baumgaertel, & Feurer, 1998). When these problems are severe enough to warrant a diagnosis of Attention Deficit/Hyperactivity Disorder (i.e., AD/HD), the impact on children's educational success is profound: up to 80% of students with AD/HD exhibit academic performance problems (Cantwell & Baker, 1991) and studies of young adults with AD/HD reveal a substantially higher history of grade retention, placement in special

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education, and dropping out of school relative to their peers (Murphy, Barkley, & Bush, 2002; Weiss & Hechtman, 1993).

Recent studies suggest that it is the inattentive symptoms of AD/HD, rather than hyperactive-impulsive symptoms, that are most directly associated with neuropsychological impairment and academic performance/achievement problems. For example, in comparisons of AD/HD subtypes, only children with the inattentive and combined subtypes—both of which are characterized by six or more inattentive symptoms—showed impairment on a variety of neuropsychological measures (Chhabildas, Pennington, & Willcutt, 2001). Children with the hyperactive-impulsive subtype, in contrast, displayed no such deficits. And, although the academic performance of children with the inattentive and combined subtypes of AD/HD is significantly worse than students without AD/HD, this is not necessarily true for children with the hyperactive-impulsive subtype (Graetz, Sawyer, Hazell, Arney, & Baghurst, 2001; Todd et al., 2002).

In addition to the adverse impact of attention problems on academic performance/achievement in children diagnosed with AD/HD, attention problems are also associated with diminished academic success in nondiagnosed children. For example, Merrell and Tymms (2001) reported that teacher ratings of attention problems at the beginning of formal schooling predicted increasing academic difficulties over the next year. Rabiner and Murray (2002), working with a sample of 620 first graders, reported that teacher rated attention problems were the strongest predictor of low academic achievement and that students in the top 15% for teacher ratings of *DSM-IV* (American Psychiatric Association [APA], 1994) inattentive symptoms were four to seven times more likely to be rated below grade level in reading, math, and written language. This was true even after controlling for gender, ethnicity, school, and a variety of other behavioral/emotional problems (i.e., hyperactivity, oppositional behavior, and anxiety).

Rabiner, Coie, and the Conduct Problems Prevention Research Group (Conduct Problems Prevention Research Group [CPPRG], 2000) provided especially compelling findings concerning the contribution of attention problems to the development of academic difficulties. Participants were 387 students comprising the normative sample for the Fast Track project (CPPRG, 1992), a longitudinal multisite investigation on the development and prevention of conduct disorder. Students were followed from kindergarten through the end of fifth grade, and attention problems during first grade predicted the development of reading difficulties that were evident 5 years later, even after controlling for IQ, other behavior problems, and prior reading achievement. The authors hypothesized that because many inattentive first graders had not performed poorly on an assessment of early reading skills conducted after kindergarten, a reading disability was probably not responsible for their reading difficulties that were evident at the end of grade 1. Instead, they hypothesized that inconsistent attention to classroom lessons where early reading skills (i.e., phonetic decoding) were taught accounted for their lower reading achievement at the end of the year. Extra instruction in these skills, particularly in a one-on-one context where children with attention problems are typically able to focus more consistently, would thus presumably be effective in preventing these children from falling significantly behind their peers in the acquisition of early reading skills.

This study was intended to test this hypothesis and to examine whether attention problems moderate the impact of tutoring on early reading development. Participants were children from the intervention and control samples in Fast Track. Among the interventions provided in first grade to children in the treatment group were three 30-min sessions per week of individual reading instruction that emphasized the acquisition of phonetic decoding skills. Measures of reading achievement obtained before and after first grade, and measures of inattentive behavior during first grade, enabled us to examine whether attention problems moderate the impact of tutoring. We were particularly interested in testing Rabiner et al.'s hypothesis (Rabiner et al.,

2000) that tutoring inattentive first graders who did not have substantial early reading difficulties would prevent them from falling behind their peers. We were also interested in whether attention problems moderated the impact of tutoring on children who need it most—that is, those who enter first grade with prereading/reading skills that are significantly below their peers.

METHOD

Participants

Participants were 581 children who comprised the treatment and control samples from cohorts 2 ($n = 321$) and 3 ($n = 260$) of Fast Track, a longitudinal multisite investigation of the development and prevention of conduct problems (CPPRG, 1992; Lochman & CPPRG, 1995). Cohort 1 participants in Fast Track were excluded from our sample because the assessment of early reading ability used with these children was not sufficiently sensitive to change; this issue is discussed below. Sites included Durham, North Carolina; Nashville, Tennessee; Seattle, Washington; and rural central Pennsylvania. Schools at each site were randomly assigned to intervention or control groups.

During the spring semester of kindergarten in three consecutive years, teachers provided behavior ratings for all children enrolled in these schools using the 10-item Authority Acceptance Scale of the Teacher Observation of Classroom Adaptation—Revised (TOCA-R; Werthamer-Larsson, Kellam, & Wheeler, 1991). The parents of children who scored in the top 40% of the sample at each site were then contacted by telephone or in person and rated the frequency of child behavior problems at home using 24 items from the Aggression scales of the Child Behavior Checklist/4–18 (CBCL; Achenbach, 1991), the Revised Problem Behavior Checklist (Quay & Peterson, 1987), and other items generated by the investigators (for further details, see Lochman & CPPRG, 1995).

Children's scores on the parent and teacher screening measures were averaged and those who fell in the top 10% at each site on the combined screen were invited to participate in the Fast Track study. The average age of the high-risk children at the time of screening (Spring of the kindergarten year) was 5.7 years ($SD = 0.44$). Sixty-seven percent (67%) of the children in the sample are boys, and 55% have a minority ethnic background (52% African American and 3% other).

Measures

Reading Achievement—The measure used to assess reading achievement at the end of kindergarten and first grade changed mid-way through the Fast Track study. Initially, the Letter–Word Identification subtest from the Woodcock–Johnson Psychoeducational Battery (Woodcock & Johnson, 1989), an assessment of single-word reading skills, was used to assess early reading ability. This measure was the only reading measure used at the end of kindergarten and first grade for cohort 1 participants, and at the end of kindergarten for cohort 2 participants. However, this test proved to be too difficult for many Fast Track participants and was not a sensitive indicator of initial reading skills that were developing over late kindergarten and grade 1 (CPPRG, 1999). For this reason, it was replaced with the word-attack sub-test from the Diagnostic Reading Scales (Spache, 1981), a task in which children are required to sound out and recognize initial and final consonants rather than read single words. This subtest was administered to Cohort 2 at the end of first grade and to Cohort 3 at the end of both kindergarten and first grade. In a previous analysis of Fast Track data, this scale was found to have a coefficient alpha of .94 (CPPRG, 1999).

Because the early reading measure we analyzed differed for cohorts 2 and 3 (i.e., Woodcock–Johnson letter–word identification for cohort 2 and DRS word attack subtest for cohort 3), we were concerned that the association between early and end of grade 1 reading scores might differ substantially between the cohorts, and thus make combining them problematic. To test for this possibility, standardized scores were calculated within cohort and grade level on the administered reading test, and the correlations between the kindergarten and grade 1 reading scores were computed. These correlations were comparable in the control sample (0.44 for cohort 2 with different measures and 0.54 for cohort 3 with constant measures, a nonsignificant difference, $t(182379) < 1$), and the standardized scores were therefore combined across cohorts. This resulted in a single metric for each grade, with the untested assumption that they are equivalent measures for this purposes. To mitigate the limitations imposed by this strategy (i.e., the assumed equivalence of the measures), cohort membership was tested as a moderating factor in all analyses. We believe this to be the best compromise available to retain the power afforded by the two-cohort sample while accommodating the change in the early reading measure given to each cohort.

Attention—During the spring of kindergarten and first grade, children’s inattentive behavior was assessed using the AD/HD Rating Scale (DuPaul, 1991), a 14-item measure consisting of the 14 AD/HD symptoms from *DSM-III-R* (American Psychiatric Association, 1987). Items are rated on a 4-point scale where 0 = *child never displays the behavior* and a rating of 3 = *behavior is displayed “very much.”* An attention problems score was computed for each child by summing six items comprising an inattention factor (DuPaul identified eight items in an “inattention” factor, two of which were also part of the “impulsivity/hyperactivity” factor; we omitted those two items). The coefficient alpha for this factor was found to be .93 in this data. As would be expected in a high-risk sample, the average attention problems score in our sample was approximately one half a standard deviation above the average score in DuPaul’s normative sample. Thus, as a group, participants in this study had greater attention problems than the general population.

Intelligence—In addition to these primary measures, IQ was estimated by averaging children’s scaled scores on the Vocabulary and Block Design subtests from the WISC-R. These subtests were selected because they show the highest correlations with the Verbal and Performance IQ scales, respectively (Wechsler, 1974). The average scaled score in this sample was 8.42, which is below the expected average scaled score of 10 and not surprising given the high-risk nature of the sample.

Procedure

Data collection for the instruments included began in the summer following kindergarten; trained members of the research staff individually administered the WISC-R, WJ, and DRS subtests as part of a larger battery of measures. In the discussion below, this postkindergarten measure of reading achievement is referred to as early reading ability or kindergarten reading ability. Inattention was measured by teacher report in the spring of the first grade year, and reflected teachers’ perceptions of students’ inattentive behavior over the course of first grade. The final assessment of reading achievement occurred during the summer following first grade and is referred to below as grade 1 reading. Although staff members were blind to the ratings of attention problems that participants had received from their teachers, because the Fast Track intervention was so extensive, and parents were interviewed during the same visit, it was not possible for interviewers to remain blind to children’s intervention status.

Tutoring Intervention—Tutoring was provided by paraprofessional tutors who had received 40 hr of training in the Wallach and Wallach (1976) tutoring program prior to the intervention. The program was designed for low-readiness children from disadvantaged

backgrounds and emphasized a phonics-based, mastery-oriented approach to the development of initial reading skills. Tutoring began with an individual assessment of children's skill development and progressed according to each child's ability to master the skills that were taught. Throughout first grade, tutors worked with children individually three times each week for 30-min sessions. Two of these sessions occurred during school hours and one occurred during the parent-child groups described below. Over 70% of participants received over 50% of scheduled tutoring sessions during the year.

Other Intervention Components—Tutoring in reading was only one component of a comprehensive array of interventions designed to prevent the development of serious conduct problems in high-risk youth (CPPRG, 1999). A brief description of these components is provided below.

Universal Intervention—For the school-based component of the intervention, grade 1 classroom teachers were trained to deliver an adapted version of the PATHS curriculum (Kusche & Greenberg, 1994). PATHS lessons covered four domains of skills: (a) skills for emotional understanding and communication (i.e., recognizing and labeling emotions); (b) friendship skills (i.e., participation, cooperation, fair play, and negotiation); (c) self-control skills (i.e., behavioral inhibition and arousal modulation; and (d) social problem-solving skills (i.e., problem identification, response generation, response evaluation, and anticipatory planning). Teachers implemented this classroom-level program throughout the year, teaching an average of two to three lessons per week (see Bierman, Greenberg, & CPPRG, 1996, for further details).

Selective Interventions—Parents and children in the high-risk intervention condition were also offered parent groups and child social skills training groups during a weekly 2-hr enrichment program held at their child's school on Saturdays or weekday evenings. During the first hour of this enrichment program, high-risk children met in groups of 5–6 in "friendship groups" led by project staff. In these groups, discussions, modeling stories and films, and role-play activities were used to illustrate and promote skill concepts while cooperative activities provided opportunities for skill practice and performance feedback. Sessions focused on reviewing and practicing the skills covered in the PATHS program. Ninety-eight percent of children attended at least one friendship group; the average attendance among those who attended at least one session was 78%.

Primary content areas of the parent group curriculum included (a) establishing a positive family-school relationship and supporting child adjustment to school, (b) building parental self-control, (c) promoting developmentally appropriate expectations for the child's behavior, and (d) improving parenting skills to improve parent-child interaction and decrease disruptive behavior (see McMahon, Slough, & CPPRG, 1996, for further details about the parent-focused intervention components). Ninety-six percent (96%) of parents attended at least one parent group; of those who attended, the average attendance was 71%.

After the parent and child groups, parent-child pairs spent 30 min together participating in positive cooperative activities and practicing positive parenting skills with staff support. During the last 30 min of each session, children worked with their tutor on their reading skills while parents observed.

As this overview of intervention components makes clear, tutoring was provided as part of a comprehensive program that included other important components. For this reason, it is important to emphasize that the specific impact of tutoring on children's reading achievement cannot be disentangled from the overall array of services that children received. None of the

intervention components described above were implemented in the control schools where only data collection activities occurred.

RESULTS

Preliminary Analyses

Missing Data—Missing data were accommodated by multiple imputation. Ten imputations were generated using a multivariate normal model in PROC MI in SAS v 8.2 (SAS Institute, 2001); this number should be more than sufficient for the modest amount of missing data (the only variables that were missing for more than 5% of participants were kindergarten ratings on the ADHD Rating Scale; these ratings were not part of the primary analysis reported below). Data were imputed separately by cohort (to allow for changes in measurement) and treatment status (to allow for interactions between treatment status and other variables). The imputation datasets included the variables described above; dummy variables for race (African American vs. non-African American), sex, and study site; and six additional measures of kindergarten and grade 1 behavior and attention problems. Autocorrelation plots of the worst linear functions indicated no problems in the imputations. Note that the degrees of freedom for tests of parameter estimates based on multiple imputation are not simple functions of sample size, but rather depend on the between- and within-imputation variance estimates; they can be interpreted as a general guide to precision of estimation.

Descriptive Statistics—Descriptive statistics based on the imputed data for intervention and control children combined across cohort are shown in Table I. As can be seen, IQ scores for both groups are below the average scaled score of 10. The externalizing problems variable represents the standardized composite of the parent and teacher ratings used to screen students to identify the high-risk sample. Because students were selected for Fast Track based on high levels of externalizing problems, it is substantially above the population mean in both groups. Standardized scores for kindergarten reading achievement approximate the population mean in both groups; the difference in standardized first grade reading achievement scores for intervention and control participants reflects the significant intervention effect reported below. The entry for attention problems in kindergarten and first grade represent the average score on attention problem items from the ADHD Rating Scale. As previously noted, these items were rated on a 4-point scale and the average item score in both groups falls between points corresponding to the behavior being displayed *just a little* and *pretty much*. This is above the average item score reported by DuPaul (1991) and is consistent with the high-risk nature of our sample. Kindergarten attention problem ratings were significantly higher among intervention participants, $t(29) = 3.35, p < .03$; this difference was not evident during first grade, $t < 1$.

Table II displays the correlations between these variables for imputed data combined across cohort and intervention status. As expected, there was a modest positive correlation between IQ and reading achievement during kindergarten and grade 1, a modest negative relationship between IQ and attention problems during each year, and moderate year-to-year stability in children's reading achievement and teacher-rated attention problems. The limited association between externalizing problems and the other variables is expected given that participants were selected based on high levels of externalizing behavior and the range in this variable is thus severely restricted.

Endogeneity Analyses—The Fast Track intervention began during the grade 1 school year. Although child attention problems were not a target of the intervention, intervention effects on attention problems would affect its use as an independent variable. A multiple regression modeling attention problems from treatment status, early reading ability, their interaction, and

IQ, sex, race, and site as covariates showed no main effect or interaction of treatment on grade 1 attention problems ($t_s < 1$), nor were the effects significantly moderated by cohort (omnibus test of cohort interactions, $F(3, 12761) = 1.19, p > .20$). There was significant prediction of grade 1 attention problems from kindergarten reading ability, $b = -.26, SE = .04, t(10601) = 6.02, p < .0001$. The grade 1 attention problem variable was treated as exogenous in further analyses.

Analysis of Treatment Effects—To examine whether attention problems moderated the impact of the Fast Track intervention on grade 1 reading outcomes, we conducted a multiple regression analysis with main effects and all interactions of treatment, early reading, attention problems, and cohort, covarying IQ, race, sex, and site.

Main effects of treatment, early reading ability, and attention problems were all significant (i.e., $p_s < .05$), as were all three two-way interactions (i.e., treatment by early reading; treatment by attention problems; and early reading ability by attention problems). The three-way interaction (i.e., early reading by treatment by attention problems) was not, $t(659) = 1.41, p > .15$. In addition, there was a marginally significant main effect of cohort, $t(3739) = 1.95, p < .06$, and interaction between cohort and early reading ability, $t(14760) = 2.04, p < .05$; these effects are not surprising given the difference in early reading ability tests across cohort (i.e., that the early reading measure for cohort 2 was the Woodcock–Johnson whereas for cohort 3 it was the DRS). There were no other significant interactions with cohort membership, $t_s < 1$.

Main Effects—The main effects analysis indicated a significant beneficial effect of treatment, $b = .31, SE = .07, t(2369) = 4.18, p < .0001$; the expected significant effect of early reading ability, $b = .37, SE = .04, t(2230) = 9.37, p < .0001$; and a significant adverse effect of grade 1 attention problems, $b = -.19, SE = 0.04, t(2693) = 4.94, p < .0001$.

Interactions Between Attention Problems, Treatment, and Early Reading Ability—The significant two-way interaction between treatment and early reading indicated that treatment was of greater benefit to students with early reading difficulties than those without, $b = -.21, SE = .07, t(4051) = 2.88, p < .005$. This interaction is plotted in Fig. 1, and shows the expected values of reading ability at the end of grade 1 based on representative values of the predictors (collapsed across cohort). As seen in Fig. 1, when children had early reading scores that fell a standard deviation below the sample mean, the predicted standardized reading scores at the end of first grade were substantially higher for those who received tutoring -0.07 versus -0.59 . As children's early reading scores increased, the beneficial effects of tutoring progressively diminished, such that for children scoring one standard deviation above the mean on early reading, there was no discernible impact of tutoring on grade 1 reading scores (i.e., predicted values for treatment and control participants of 0.45 and 0.36, respectively).

The interaction between attention problems and treatment was significant, $b = -.16, SE = .07, t(3310) = 2.21, p < .03$, and is plotted in Fig. 2. As seen in Fig. 2, the impact of tutoring on grade 1 reading achievement was greatest for children with low attention problem scores, where the predicted values for standardized grade 1 reading achievement for treatment and control participants were 0.46 and -0.01 , respectively. For children whose attention problems approach a clinically significant level (i.e., one standard deviation above the sample mean), however, the impact of tutoring on reading achievement was smaller (expected grade 1 reading scores for treatment and control participants of -0.08 and -0.22 respectively).

Finally, attention problems were especially likely to be associated with poor grade 1 reading achievement among poor early readers, $b = .10, SE = .04, t(1434) = 2.76, p < .006$. This interaction is plotted in Fig. 3. As seen in Fig. 3, among good early readers (i.e., those with standardized early reading scores at least one standard deviation above the sample mean), the

difference in grade 1 reading achievement for children with and without attention problems is smaller (0.32 vs. 0.50) than it is among poor early readers (−0.62 vs. −0.04).⁴

Categorical Analysis—The regression analysis described above is well suited for examining the relationship between tutoring, reading ability, and attention problems across the entire range of the sample data. However, we had two specific questions about subgroups in the Fast Track sample for which this analysis is not ideal: Does tutoring prevent inattentive children without evidence of early reading problems from falling behind their peers, and do attention problems moderate the impact of tutoring for children who show signs of early reading difficulties? To better address these questions, early reading problems (at least one standard deviation below the mean on early reading ability) were crossed with attention problems (at least one standard deviation above the mean on grade 1 attention problems) to classify students into one of four mutually exclusive groups: no early reading difficulties and no attention problems ($n = 384$); early reading difficulties without attention problems ($n = 64$); attention problems without early reading difficulties ($n = 93$); and early reading difficulties with attention problems ($n = 40$). We then tested for group differences in grade 1 reading achievement using a Treatment \times Reading problem \times Attention problem \times Cohort ANCOVA (covarying sex, race, site, and IQ). The three-way interaction between treatment, early reading problems, and attention problems, was significant, $t(1283) = 2.27, p < .03$.⁵

The adjusted means for this interaction are graphed in Fig. 4. As seen in Fig. 4, among children without pronounced early reading difficulties, students benefited from tutoring by roughly comparable amounts regardless of whether substantial attention problems were present (i.e., the treatment vs. control difference in standardized grade 1 reading achievement was 0.21 for children without attention problems and 0.26 for children with attention problems). Although children with attention problems had lower grade 1 reading scores than other children, even when tutoring was provided, modest support was found for our prediction that tutoring would prevent inattentive children without early reading problems from falling significantly behind their peers. Specifically, for intervention children with these characteristics, the grade 1 reading score was somewhat lower, but not significantly so, than grade 1 reading for control children with neither attention problems nor early reading difficulty (−0.13 vs. 0.14; $F(1, 530) = 2.28, p < .14$).⁶ Among control children with these characteristics, however, grade 1 reading achievement was significantly lower (−0.39 vs. 0.14; $b = -.53, SE = .14, t(4197) = 3.79, p < .0003$). We should also note, however, that the difference between intervention and control participants with attention problems but not early reading problems did not reach significance (−0.13 vs. −0.39; $b = .26, SE = 0.18, t(5574) = 1.44, p > .15$).

The results just discussed suggest that tutoring provided modest benefits to inattentive children who did not have substantial early reading difficulties. What about the benefits of tutoring for

⁴We repeated the regression analysis with the inclusion of additional substantive covariates: grade 1 internalizing and externalizing behavior problems as measured by the Teacher Report Form (TRF; Achenbach, 1991) and grade 1 impulsivity/hyperactivity as measured by the AD/HD Rating Scale. These variables were not included in the primary analysis because their range is restricted given the high-risk nature of our sample, and because their substantial shared variance with attention problems might obscure effects legitimately attributable to attention problems. No substantive differences from those reported in the text were found: The only effect that changed significance level relative to the .05 threshold was the Treatment \times Attention problems interaction, which remained in the same range ($p < .06$).

⁵In this analysis, all three substantive main effects—that is, treatment, reading problems, attention problems—were significant in the directions previously shown, $ps < .0003$. None of the specific two-way interactions were significant in the context of the three-way interaction, $ps < .09$; this difference from the continuous-predictor models is not surprising, given the presence of a higher-order interaction, which by definition implies that the two-way interactions differ in nature or degree at different levels of the third variable. There was also a marginally significant Treatment \times Attention problems \times Cohort interaction, $t(693) = 1.94, p < .06$, but the Treatment \times Attention problems interaction was not significant within either cohort. The four-way interaction with cohort was not significant, $t < 1$, nor were other main effects or interactions for cohort, $ps > .18$.

⁶Because test statistics to evaluate this contrast were not available to evaluate using SAS PROC MIANALYZE, the significance level for all contrasts reported for the categorical analysis is based on nonimputed data.

children who began first grade with evidence of substantial early difficulties? For these children, their level of attention problems was clearly an important moderator. As seen in Fig. 4, in the absence of attention problems, tutoring was extremely helpful to children who were poor early readers—that is, grade 1 reading achievement for poor early readers without attention problems was -0.13 versus -0.94 for intervention and control participants respectively, $b = .81$, $SE = .26$, $t(2708) = 3.11$, $p < .002$. When early reading difficulties were accompanied by attention problems, however, there was no evidence that tutoring provided any benefit—that is, grade 1 reading achievement was -0.87 for intervention participants and -0.74 for control participants.

The Relationship Between Attention Problems and Children’s Participation in Tutoring—One possible explanation for why attention problems appeared to mitigate the benefits of tutoring is that inattentive students may have been less likely to attend the tutoring sessions, reducing the potential impact of intervention. To test for this possibility, we regressed the number of sessions attended on grade 1 inattention, controlling for sex, race, site, and cohort. No significant effect of inattention was found, $t(719) < 1$, suggesting that this is an unlikely explanation for the results reported above. It is also possible that children with attention problems benefited less from tutoring because they did not attend adequately during the tutoring sessions themselves. Unfortunately, information on children’s attention and behavior during the tutoring sessions is not available.

DISCUSSION

Our overall objective was to examine whether attention problems moderate the impact of tutoring on the development of children’s early reading skills. In the context of this general question, we planned to examine two issues of particular interest. First, we wanted to test Rabiner et al.’s hypothesis (Rabiner et al., 2000) that tutoring inattentive first graders who did not have substantial early reading difficulties would prevent them from falling significantly behind their peers. Second, we were interested in whether attention problems moderated the impact of tutoring on children who need it most—that is, those who enter first grade with prereading/reading skills that are significantly below their peers.

Results from the current study both replicate and extend prior findings on the relationship between attention problems and early reading achievement. Similar to findings by Rabiner et al. (2000), attention problems predicted diminished reading achievement scores at the end of grade 1, even after controlling for IQ, prior reading scores, and a variety of demographic factors. In the current study, this was found in a sample of children at high-risk for the development of serious conduct problems. Replication of this finding in a high-risk sample highlights the need to develop effective educational strategies for inattentive students regardless of whether they carry a formal diagnosis of AD/HD, or what other externalizing difficulties are present.

Significant interactions between early reading, attention problems, and treatment were also evident. Tutoring provided greater benefits to children who entered first grade with less developed reading skills, although the negative association between attention problems and first grade reading achievement was stronger among these children. The former result is not surprising; the latter is consistent with a recent study in which students with co-occurring reading and attention problems were more impaired on a variety of measures than children with either difficulty alone (Willcutt et al., 2001). Of particular interest to us is that attention problems were found to moderate the impact of the intervention. Specifically, as children’s level of attention problems increased, the benefits associated with tutoring diminished. In fact, as attention problems approached a clinically elevated range, differences in first grade reading achievement for intervention and control participants were negligible.

Results from the categorical analysis add significantly to our understanding of the relationship between early reading ability, attention problems, and intervention, and bear most directly on our questions of special interest. We had hypothesized that tutoring inattentive students who lacked substantial early reading problems would help them keep pace with their peers. Mixed support for this hypothesis was found. As predicted, when children with these characteristics received tutoring, their reading score at the end of first grade was not significantly lower than those obtained by children without attention problems or early reading difficulties. When tutoring was not provided, however, these children ended first grade with reading scores significantly below their peers. We should also note, however, that the difference in first grade reading achievement among tutored and nontutored children with attention problems—although in the expected direction—was not significant. Thus, the extent to which tutoring benefited inattentive students without substantial early reading difficulties is somewhat unclear. In subsequent work, it will be important to examine the trajectory of reading achievement in these children across elementary school to learn whether intervention versus control differences that showed signs of emerging during first grade become stronger over time. It will also be interesting to learn whether inattentive children who continue to receive tutoring are able to keep pace with their peers, or whether they fall behind despite this ongoing academic support.

Results from the categorical analysis also indicate that although tutoring may provide modest benefits to inattentive children without co-occurring reading difficulties, and is clearly helpful to children with early reading problems who are not inattentive, the situation is quite different for children with both attention problems and early reading difficulties. In fact, there was no indication that poor readers with co-occurring attention problems derived any benefit whatsoever. This is a striking result given that multiple weekly sessions were conducted over the entire first year, and highlights how difficult it may be to help these children who are in greatest need.

It is unclear why tutoring provided no discernible benefit to inattentive children with substantial early reading problems, even though it was helpful to children with either of these difficulties alone. One plausible explanation is that the intervention was not intensive enough for students with co-occurring reading and attention problems. Three 30-min sessions per week—and many students did not consistently receive all sessions—may not have been sufficient for these students. Even if additional tutoring were to yield a more positive impact, however, it would be difficult for public schools to provide this, particularly if children did not qualify for special educational services because they lacked a formal diagnosis of either AD/HD or a specific learning disability. Unfortunately, diagnostic information on our participants during first grade is not available, so it is unclear how many would have qualified for special services because of these disorders.

Another reason why inattentive students with early reading difficulties may not have benefited from tutoring is that the intervention did not simultaneously address their reading difficulties and attention problems. The Wallach and Wallach (1976) reading program was not designed specifically for inattentive children, and staff who provided tutoring had not received special training for working with inattentive students. Research suggests, however, that specialized instructional practices are necessary to promote academic success among students with high levels of inattentive behavior (DuPaul & Eckert, 1998), and our findings highlight that this may be especially important when primary academic difficulties are also present. For instance, it is possible that students with both attention problems and early reading difficulties were more difficult to consistently engage during tutoring than children with either problem alone, and thus derived less benefit from their participation. Unfortunately, information on children's level of engagement in the tutoring sessions that would enable us to examine this hypothesis is not available.

Although results from this study provide evidence that attention problems mitigate the benefits of tutoring on children's reading development, particularly for children with early reading difficulties, there are several limitations that should be acknowledged. First, as noted above, tutoring was embedded in a comprehensive set of interventions intended to prevent the development of serious conduct problems in high-risk children. Thus, it is not possible to discern whether the results reported for tutoring were affected by the other interventions provided. Second, because our sample was selected for high levels of externalizing problems, the extent to which these findings would generalize to inattentive children without these co-occurring difficulties is unclear.

In summary, results from this study replicate prior work in highlighting the role of attention problems in the development of academic difficulties. This finding has important implications because the association between attention problems and diminished academic achievement may grow stronger over time, both because children who have difficulty attending to classroom instruction may fail to acquire a wide array of academic skills and knowledge, and because the demands for sustained attention increase as students move to higher grades.

Our results also extend prior work by suggesting that the combination of attention problems and early reading difficulties is likely to substantially diminish the benefits of traditional academic interventions such as tutoring. When these difficulties co-occur, interventions designed to specifically address children's attention difficulties may be required as well. For many children with AD/HD, stimulant medication treatment and contingency management programs have been found to enhance rates of academic productivity and accuracy (Barkley, 1998), and recent results from the Multimodal Treatment Study for AD/HD (MTA Study; MTA Cooperative Group, 1999) suggest that the combination of these approaches may promote gains in reading achievement. Peer tutoring and computer-assisted instruction have also shown promise as interventions to enhance academic success in students with attention problems (DuPaul & Eckert, 1998). Whether these approaches would be helpful to students with co-occurring attention and reading problems has not been examined, however, and would be important to pursue in subsequent research.

Results from this study also support the need to develop interventions designed to directly enhance children's attention. A review of the attention training literature shows remarkably little work in this area, although promising results have been reported for students with AD/HD (Kerns, Eso, & Thomson, 1999) using an adaptation of the attention process-training model developed by Sohlberg and Mateer (1987). Promising results of EEG biofeedback in reducing inattentive symptoms among AD/HD children have also been recently reported (Fuchs, Birbaumer, Lutzenberger, Gruzelier, & Kaiser, 2003; Monastra, Monastra, & George, 2001). Additional research on interventions to enhance attention, and to examine whether such interventions promote gains in academic achievement for inattentive students, is another important avenue to pursue.

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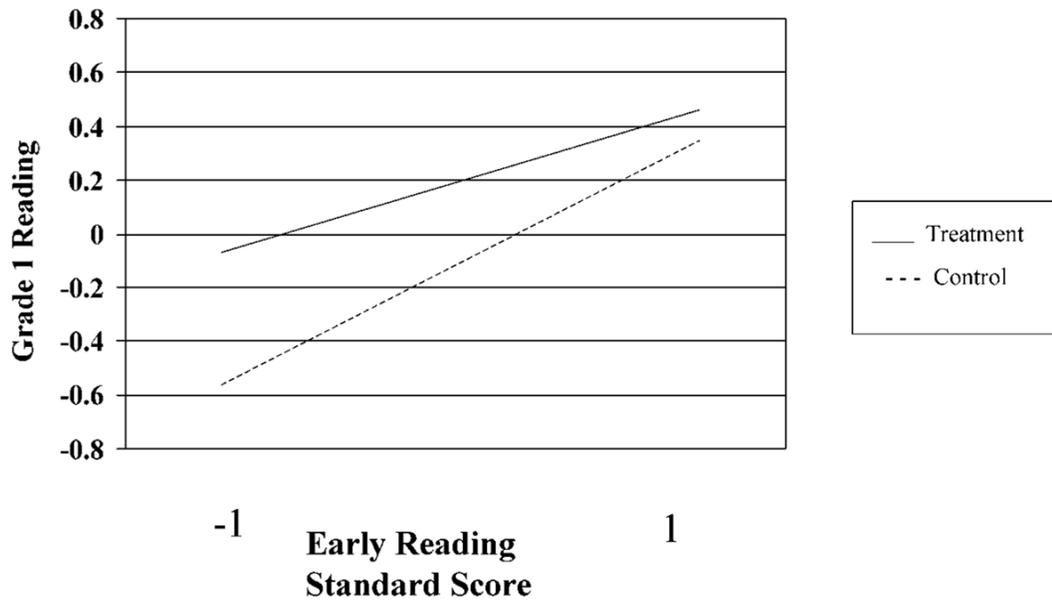


Fig. 1. Grade 1 reading achievement as a function of early reading achievement and intervention status.

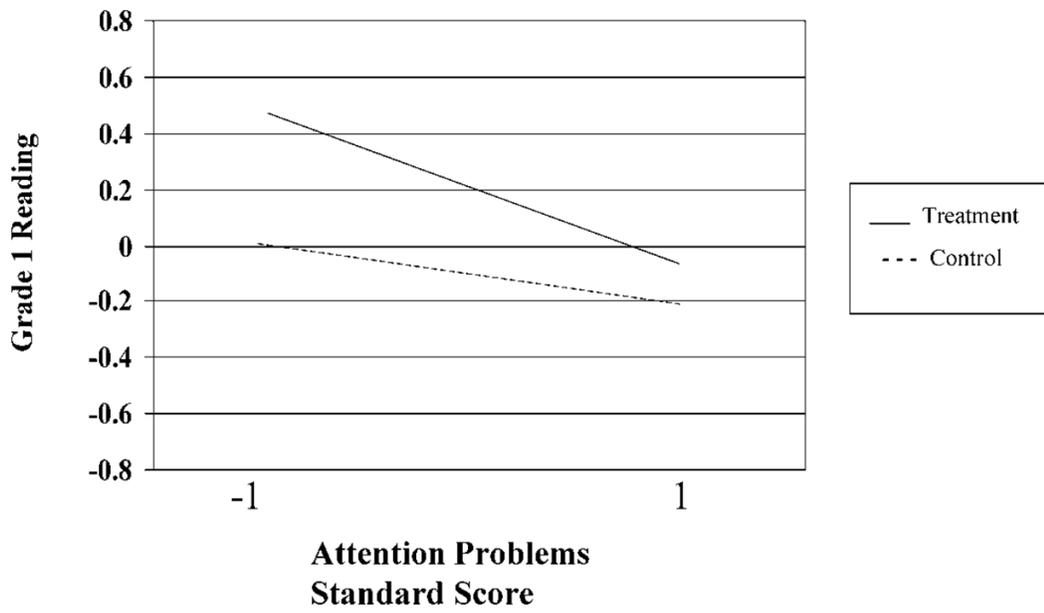


Fig. 2. Grade 1 reading achievement as a function of first grade attention problems and intervention status.

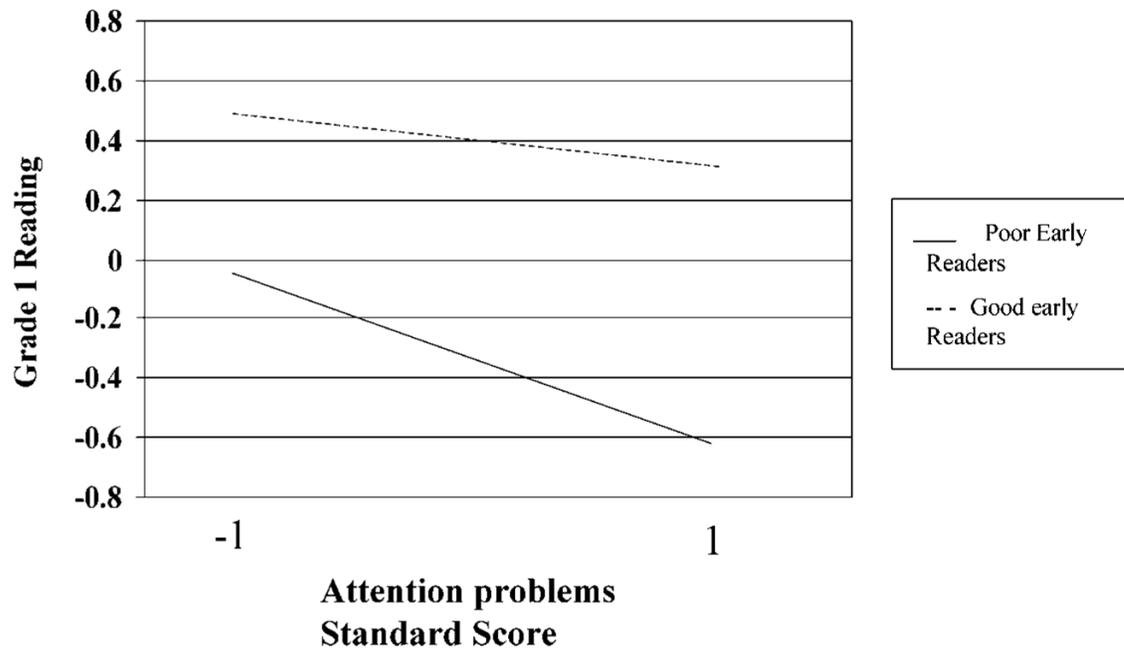


Fig. 3. Grade 1 reading achievement as a function of early reading achievement and first grade attention problems.

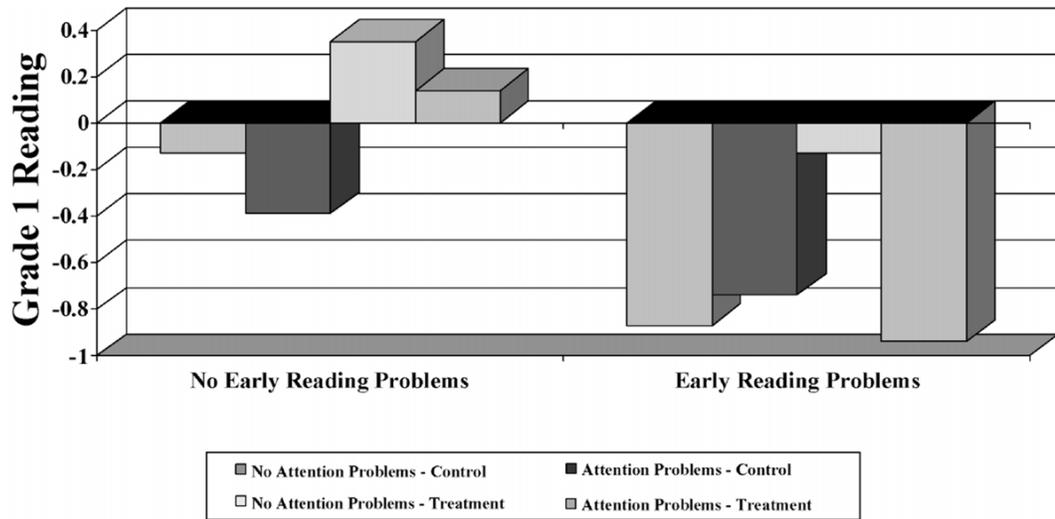


Fig. 4. Grade 1 reading achievement as a function of early reading achievement, attention problems, and intervention status.

Table I

Means and Standard Deviation for Intervention and Control Participants

Variable	Intervention group	Control group
IQ	8.45/2.63	8.38/2.41
Externalizing problems	0.91/0.75	0.90/0.75
Kindergarten reading achievement	0.05/1.03	-0.05/0.97
1st grade reading* achievement	0.15/0.73	-0.14/0.97
K indergarten attention problems*	1.81/0.90	1.43/0.91
1st grade attention problems	1.55/0.86	1.59/0.94

Note. Entries for reading achievement and externalizing problems are standard scores. IQ is scaled score where a score of 10 represents the 50th percentile. Attention problems score reflect average score on a 0–3 scale with higher scores reflecting more inattentive behavior.

* Significant intervention versus control differences were indicated at $p < .05$.

Table II
Correlations Between Reading Achievement, Attention Problems, and IQ

	ReadK	ReadI	AP-K	AP-I	Ext
IQ	.37	.35	-.15	-.27	-.04
ReadK	—	.48	-.11	-.33	-.06
ReadI	—	—	-.10	-.36	-.05
AP-K	—	—	—	.31	.13
AP-I	—	—	—	—	.07

ReadK = standardized reading achievement score after kindergarten; ReadI = standardized reading achievement score after first grade; AP-K = teacher ratings of attention problems in kindergarten; AP-I = teacher ratings of attention problems in first grade; Ext = standard score on screening measure of externalizing problems.

Note. Correlations based on imputed data. All correlations $> .09$ or $< -.09$ are significant at $p < .05$ based on nominal N of 581.