The Association between Self-Regulation and ADHD in First Grade Classrooms

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Background

According to a recent report by the National Assessment of Education Progress (NAEP), only 33% of children read at or above a proficient reading level and this number is even lower for children living in poverty (NAEP, 2007). Proficient reading provides the foundation for academic success (NRP, 2000). It is therefore crucial that we understand all of the malleable sources of influence that are associated with stronger literacy development so that we can develop effective interventions. Aside from classroom-level attributes, such as instruction and teacher quality, there are also a number of child characteristics that can impact literacy achievement and academic success (Duncan et al., 2007; McGee et al., 2002). One child characteristic that has been shown to impact academic achievement is self-regulation. Self-regulation is a broad construct that includes emotional and social interactions, behavior, cognition, and even physiological components. Strong self-regulation skills appear to be important for children to be able to control their thoughts and behaviors so that they can benefit from new learning experiences (Blair, 2002). Research has shown that students who demonstrate more disruptive behaviors and that lack self-control in elementary school are more likely to exhibit academic difficulties later on (Vitaro et al., 2005). Some studies have also indicated that children who have poor self-regulation can disrupt the overall flow of the classroom and make it more difficult for the teacher to deliver effective instruction (Skibbe et al, in review; Vitaro, 2005). Plus, there is emerging evidence that children with attention deficit hyperactivity disorder (ADHD) tend to show poor self regulation. The purpose of this study is to examine whether there is a systematic association between children's level of self regulation and reported symptoms of ADHD.

Self-regulation involves the organization of thought necessary to plan, problem solve, and monitor the effectiveness of these strategies (Blair, 2002). If a child is not able to pay attention to a particular task, this can negatively influence his or her ability to pay attention to their teacher(s) in school. Moreover, if students do not have strong self-regulation skills, this can negatively impact their academic achievement as attention, problem solving, planning, memory, and inhibitory control are crucial skills for academic success. For example, children with lower literacy skills are reportedly more likely to spend more time in off-task behavior during instructional activities compared to students with higher reading abilities (Allington, 1983). Working memory is highly correlated with performance on several academic and language-related tasks, such as vocabulary, reading comprehension, mathematics, and problem solving and is necessary for a wide range of classroom learning situations (Swanson, 1994). Finally, self-regulation has been implicated to be comorbid (Barkly, 1997; Sarkis et al., 2005) or a symptom (Barkley, 1990) of Attention Deficit Hyperactivity Disorder (ADHD), which also has serious implications for students' academic success (American Academy of Pediatrics, 2000).

Although a large body of research has previously examined self-regulation as a predictor of achievement in secondary and college students, much less is known about how children's self-regulation and ADHD relate to each other and how they operate in early elementary classrooms to predict literacy outcomes in younger children (Zimmerman, 1994). In this study, we examine the relation between children's literacy skills and their performance on assessments of self-regulation and ADHD in order to better understand the unique contributions (if any)associations among these constructs with the goal of better understanding malleable sources of influence on students' literacy development

ADHD and Self-Regulation

Attention-deficit/hyperactivity disorder (ADHD) occurs in approximately 3–7% of the childhood population and boys are overrepresented 3:1 (Barkley et al., 1990). Moreover, it is frequently co-morbid with dyslexia (Shanahan et al., 2006; APA, 2000). The disorder persists into adolescence in 50–80% of cases clinically diagnosed in childhood and into adulthood in 30–50% or more of these same cases (Barkley, 1997). While not every person who has poor self-regulation also has ADHD, poor self-regulation has commonly been said to be a core deficit in ADHD (Barkley et al., 1990; Harris et al., 2004). Additionally, many ADHD researchers conceptualize self-regulation as having sub domains such as cognitive control, emotional control, behavioral control, and have focused on deficits in executive functioning which encompasses attention, inhibitory control, and working memory skills (Harris et al, 2004). Persons with the disorder often have difficulty with sustained attention, inhibitory control, and working memory (Sarkis et al, 2005; Willcutt et al., 2005). Therefore, it is arguable that a measure that is commonly used to diagnose ADHD may also be useful for measuring self-regulation skills and vise versa.

Similar to several assessments of self regulation, identification of ADHD typically relies on parent or teacher report. The Conners' Rating Scale-Revised (CRS-R; Conners, 2000) has been widely used to assess skills of attention, inhibitory control, and working memory While the primary use of the CRS-R has been for the assessment of ADHD, the test is divided into subscales: Oppositional Behavior, Cognitive Problems/Inattention, and Hyperactivity. These subscales capture many of the same sets of skills that the HTKS is designed to measure such as inattention and working memory.

In addition to teacher report, there are new direct assessments of self-regulation, which have several advantages, most specifically the reduction of observer bias, especially when student's ethnic backgrounds differ from the teacher's (Cameron et al., 2005; Connor et al., in in press). For this study, we used a measure of self-regulation that taps working memory, attention, and inhibitory control. This measure was adapted from a task described by McCabe and colleagues in 2004. In our study, students completed a complex version of the Head-to-Toes Task (HTT, Cameron et al., in press). The HTT task requires children to remember and use two rules to respond to behavioral commands. The HTT demonstrated validity with teacher ratings of child behavior in 4-year-old children; however it approached ceiling levels in children older than 5 years (Cameron et al., in press). In order to increase task complexity and increase variability in older children, we used an expanded version of this task, the Head-Toes-Knees-Shoulders Task (HTKS). The HTKS uses four behavioral commands: "touch your head" and "touch your toes"; "touch your shoulders" and "touch your knees". Children are instructed to respond with the opposite response (e.g., touch their toes when told to touch their head.). The task is intended to assess self-regulation by requiring the use of three skills: (1) attending to tester's instructions and commands, (2) using working memory to remember instructions while processing new commands, and (3) inhibiting natural response to commands.

Thus, we examine the association between students' scores on the Conners' and the HTKS measure. Finding a strong association might suggest what other observational research has shown: that teacher actions can make independent contributions to child outcomes (Cameron et al., 2005). Moreover, research has also found that teachers' classroom management, organization, and instruction may influence students' literacy learning and self-regulation gains (Connor et al, in press).

Classroom Behavior, Self-regulation, and ADHD

Direct observations of students' behaviors in the classroom, when conducted at the level of the individual child, may help explicate the mechanisms whereby children's self-regulation and sequelae of ADHD may operate during instruction to reduce academic achievement – in our research specifically reading achievement. In this study, we observed each classroom three times throughout the school year during their language arts block in the fall, winter, and spring. Using a model adapted from Connor et al., in press, (see Figure 1), the child and teacher/classroom level behaviors will be examined as they effect students' literacy and self-regulation gains.

Study Objective and Research Question

The principal aim of this study is to examine whether there is a systematic association between children's self-regulation and ADHD and how this might relate to students' negotiation of the classroom environment during reading instruction. We aim to answer the following research questions:
(1) What is the association between self-regulation and ADHD? We predict that students who have poor self-regulation skills will also be more hyperactive and inattentive compared to students who have higher self-regulation skills. Specifically, students who have lower scores on the HTKS will have higher scores on the hyperactivity and cognitive problems/inattention scales of the Connors' Rating Scale.
(2) In what ways might the classroom behavior differ comparing children with weak, typical, and poor self-regulation. We anticipate that students' time on task and time in transitions will be greater and their time in meaningful reading instruction less as their self-regulation skills are weaker.

Setting

Children from two school districts in Florida participated in this study. In the first district, student participants were recruited through backpack mailings in forty-six classrooms in a mid-sized southern city. In the second district, students were recruited through backpack mailings in 33 classrooms at 5 schools.

Participants

In the first district, consent was obtained from 75% of the children. Of this sample, a sub-sample was randomly chosen and each classroom was divided into thirds with 4 students from top third group of readers in the class, 4 from the middle third, and 4 from the bottom third were selected. The final sample size was 459 students with classroom observations. In four of the schools 82% or more of the children qualified for free and reduced priced lunch. Forty-five percent of the students were African American, 35% were Caucasian, 8% other ethnicities including Hispanic and Asian, and 12% unknown. Forty-nine teachers out of 52 teachers volunteered to participate in the study. Teachers taught literacy using one of two core reading curricula (Open Court & Reading Mastery) during a 120-minute block of time dedicated to literacy instruction.

In the second district, students were recruited through backpack mailings in 33 classrooms at 5 schools. At these schools, approximately 38% of the students qualified for free

or reduced-price lunch. For this study, we examined only students whose teachers completed the Connors' Rating Scale, which brought our sample size to 276 students in 28 classrooms. Classrooms were divided into thirds the same way in which we described above. Eighty-Four percent of the children were white, 5% were African American, and 11% percent of the students were of other ethnicities including Asian and Hispanic.

Program

Children were assessed on the HTKS two times during the school year in the fall and spring. The HTKS takes about 7-10 minutes to administer. The Conners' Rating Scale was also given as a measure of ADHD (CRS-R; Conners, 2000). Teachers filled out the surveys for the priority children in their classroom towards the end of the fall semester after they had a few months to get to know each of the students in their classroom. The CRS-R is commonly used as a screening measure for symptoms of ADHD. The teacher short form includes 28 questions that are answered in a likert-scale format.

The letter-word reading sub-test of the *Woodcock Johnson Achievement Tests*-III (WJ-III; Mather & Woodcock, 2001) was used to assess children's word reading skills in the fall, winter, and spring.. The letter-word reading task asks children to identify and name letters and words, and then asks them to read progressively more unfamiliar words from lists. The total duration for the letter-word sub-test is approximately 10 minutes.

Research Design

This study is a part of a large-scale randomized-controlled field trial, the Individualizing Student Instruction Project (ISI). The aim of the ISI study is to help teachers better organize and manage instruction by using a software program that tells teachers how much and what types of reading instruction each child in their classroom needs based on initial fall reading scores. Classroom management is a specific topic of the professional development participating teachers receive.

Data Collection and Analysis

The association will first be examined using HLM where children's Connors' score is the predicted outcome (Y_{ij}) as a function of fall HTKS score (see Equation 1). Hypothesizing that HTKS-Conners correlations may differ for children who score at the extreme ends of the continuum, quantile regression (Catts et al., 2008) will be used. Then, items on the Conners' and how they relate to students' scores on the fall HTKS will be assessed to see which items seem to be most highly related to the construct of self-regulation captured by the HTKS using multilevel multivariate models (Raudenbush & Bryk, 2002). Finally, HLM, with Spring HTKS as the outcome (see model below), will be used to examine the relative predictive value of the Conners as compared to the fall HTKS for spring HTKS.

$$Y_{ij} = \beta_{0j} + \beta_{1j}*X_i + e_0 \tag{1}$$

$$\beta_{0j} = \gamma_{00} + \gamma_{10}*SchoolSES + r_{00}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}*SchoolSES + r_{10}$$

Where Y_{ij} is the predicted amount of children's spring HTKS growth as a function of their fall HTKS scores and their scores on the measure of ADHD (X_i). Using dominance analysis (Azen & Budescu, 2003; Budescu, 1993), HTKS scores and Conners' Rating Scale scores will be compared to see which measure is a better predictor for spring literacy outcomes. The R^2 values will be examined for HTKS and the Conners' Rating Scale for all possible subset regression models. An advantage of using dominance analysis to compare predictors rather than other methods is that it measures relative importance in a pairwise fashion.

In the last analysis, we compare the amount of time (in minutes) off-task, in transitions, and in small group and whole class instruction children receive as a function of their score on the HTKS or Conners. In three models, similar to those described above, with each of the observed classroom activities as the outcome.

Findings/Results

Although we do not yet have full results to report, we do have some preliminary findings to share. There is a total of 40 possible points on the HTKS, in the fall the average was 34 and in the spring, the average was 37. W scores were used to measure growth on the letter-word test. The W-scale is a special transformation of the Rasch ability scale and each test is centered on a score of 500. W scores provide a common scale of equal-interval measurement that represents both a person's ability and the task difficulty (Woodcock & Mather, 2000). All descriptive information is presented in Table 1.

Correlations can be found on Table 2. Spring HTKS is significantly and positively associated with spring scores on the letter-word (LW) sub-test indicating that students with higher self-regulation skills perform better on the letter-word sub-test. Correlations were also examined for each scale on the Conners' Rating Scale (CRS). Overall, the Cognitive Problems and Inattention scale was the only scale that was significantly related to spring LW scores. The relationship appears to be negative: children who had higher scores on the Cognitive Problems/Inattention scale also had lower scores on the LW sub-test in the spring. There appears to be no relationship between the HTKS and Conners' Rating Scale.

Conclusions

Although further analysis is needed in order to adequately answer our research question, correlations demonstrate that there is no significant systematic association between childrens' scores on the the Conners' Rating Scale and the HTKS. The Cognitive Problems/Inattention scale was the only part of the Conners' Rating Scale that appears to be predicative of spring reading performance. In contrast, fall and spring scores on the HTKS significantly predicted spring reading outcomes (i.e., residualized change). The Hyperactivity Scale did not predict spring scores as was hypothesized. Though HTKS scores and the Conners were not significantly related, it does appear that attention and working memory (which are both assessed on both our behavioral measures) predict spring reading outcomes. These preliminary results indicate that self-regulation and ADHD may represent different constructs that each impact students' reading gains. Problems of inattention and cognitive difficulties (i.e. working memory) associated with ADHD appear to be predicative skills of spring reading outcomes.

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Table 1

Descriptives

	N	Min.	Max.	Mean	S.D.
Fall WJ Letter-Word W Score	450	339	509	419.50	27.022
Spring WJ Letter-Word W Score	439	392	523	461.99	21.694
Fall HTKS Total	457	0	40	33.68	7.609
Spring HTKS Total	434	0	40	37.22	3.813
Conners' Oppositional Scale t-score	263	45	91	51.79	10.900
Conners' Cognitive Problems/Inattention Scale t-score	263	42	85	51.48	10.225
Conner's Hyperactivity Scale t-score	263	43	91	53.19	11.127
Conners' ADHD Index Scale t-score	263	41	89	53.37	10.966
Valid N (listwise)	244				