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A Story Mapping Intervention to Improve Narrative Comprehension Deficits in Adolescents with ADHD

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Abstract

The current study examined the effects of an 8-week Story Mapping Intervention (SMI) to improve narrative comprehension in adolescents with ADHD. Thirty 12 – 16 year-old adolescents with ADHD who were participating in a summer treatment program for adolescents with ADHD received the SMI instruction ten times and completed SMI homework ten times in a structured environment with teacher feedback. Recall of fables and story creation were assessed before and after the SMI. At post-test, fable recalls included more of the most important events, were more coherent, and included a greater number of plausible inferences than pre-test fable recalls. SMI homework scores accounted for increases in recall of important events and plausible inferences, suggesting that consistent practice and feedback with story mapping could contribute to important recall gains. In contrast, the inclusion of goal-based events and the rated coherence of created stories did not improve, suggesting that more explicit instruction in applying story mapping to story creation may be required.

Keywords

ADHD; adolescence; story recall; comprehension; story map

ADHD is one of the most commonly diagnosed childhood behavioral disorders with prevalence rates as high as 10% (Barkley, 2006). It is well documented that children with ADHD have academic difficulties, and that these difficulties are compounded over time

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(Barbaresi, Katusic, Colligan, Weaver, & Jacobsen, 2007; Kent et al., 2011; Loe & Feldman, 2007). In middle school, individuals with ADHD experience substantially more academic impairment than their peers (Molina et al., 2009; Schultz, Evans, & Serpell, 2009), and by high school, students with ADHD display lower grade point averages (GPAs), are placed in more remedial classes, are more likely to fail classes, and are more likely to drop out of school (Barkley, Fischer, Smallish, & Fletcher, 2006; Kent et al., 2011). These findings are consistent with those found in other longitudinal studies that report grim academic outcomes for secondary school students with ADHD (Barbaresi et al., 2007; Barkley et al., 2006), and these problems are likely contributors to employment issues that arise later in adulthood (Kuriyan et al., 2013). Because these academic problems do not appear to self-correct over time and have long-term consequences, intervention for specific academic deficits could be of tremendous benefit for adolescents with ADHD.

Children and adolescents with ADHD exhibit a broad range of academic difficulties, but a notable problem area is narrative comprehension (Flory et al., 2006; Lorch, Berthiaume, Milich, & van den Broek, 2007). Narrative comprehension represents a skill set believed to underlie broad academic functioning relevant to later academic progress, above and beyond other traditional indicators such as word identification, semantic, and syntactic skills (Feagans & Applebaum, 1986; Kendeou et al. 2005). Major theories of narrative comprehension point to skills needed to construct a coherent story representation. For example, story grammar theory (Mandler & Johnson, 1977; Stein & Glenn, 1979) defines categories of story events according to the major role of each event in the story. Of particular importance from this point of view are a principal character's goals (G), attempts to achieve goals (A), and outcomes of these attempts (O). Linking goals, attempts, and outcomes into GAO sequences is critical to building a coherent representation of story events, whether the task is to recall, narrate, or create a story. The causal network model (Trabasso & van den Broek, 1985; Trabasso, van den Broek, & Suh, 1989) incorporates story grammar theory's definition of events but also stresses the causal connections that link antecedent and consequent events. Understanding causal connections between story events is critical to creating an organized representation of a story and in guiding recall of important events. Development of skills in the construction of coherent story representations provides a basis for later comprehension of more complex information and organized writing skills (Low & Durkin, 1998), both undoubtedly necessary for secondary school success.

Youth with ADHD exhibit several related, but distinct deficits in skills implied by these narrative comprehension models, including (1) difficulty making causal connections among story events, (2) difficulty using goal structure to create a coherent story, (3) difficulty identifying important events to guide recall, and (4) difficulty generating inferences (Lorch et al., 2007). Importantly, youth with ADHD often do not differ from comparison peers when recalling discrete, factual story events, but consistently perform more poorly than comparison peers when answering questions testing understanding of causal relations (i.e., 'why' questions; Lorch et al., 1999; Lorch et al., 2000; Lorch et al., 2004). Relatedly, youth with ADHD have shown specific deficits in incorporating and maintaining a goal plan across a variety of storytelling procedures including telling a story (with and without prompts), narrating a wordless picture book, and recalling a story that they have previously

heard or read (Derefinko, Bailey, Lorch, Milich, & Riley, 2009; Flory et al., 2006; Renz et al., 2003). Difficulties understanding causal connections and maintaining goal plans suggest that youth with ADHD construct less coherent story representations whether creating or recalling a story.

Perhaps due to deficits in understanding causal connections and goal structure, youth with ADHD also demonstrate problems in identifying important information within a narrative. Given that goals and events with many causal connections are likely to be important to a narrative (Trabasso & Sperry, 1985), it is not surprising that youth with ADHD are less sensitive to the importance of information than comparison peers. When recalling stories, recall generally increases as event importance increases, but this effect is smaller for individuals with ADHD (Flake, Lorch & Milich, 2007). Unfortunately, these deficits are not eliminated with development (Lorch, Milich, Flake, Ohlendorf, & Little, 2010), and may last into adulthood.

Finally, effective narrative comprehension requires the generation of reasonable inferences. Goals and causal connections between events often are not explicitly stated in stories, but must be inferred from story events (Thurlow & van den Broek, 1997). Although inference generation among adolescents with ADHD has not been studied extensively, recent work suggests that children with ADHD produce fewer inferences that plausibly explain story events but produce more implausible or erroneous inferences (Berthiaume, Lorch, & Milich, 2010). These findings suggest that youth with ADHD struggle to make implicit connections among story events that are vital to the construction of a complete and coherent story representation.

Intervention Strategies

Given the documented deficits in narrative comprehension, it is important to develop intervention strategies to remedy such deficits for individuals with ADHD. However, much research to date has failed to yield promising results in addressing a variety of academic difficulties. Given the frequency with which it is prescribed, the treatment efficacy of stimulant medication in particular has been investigated extensively in youth with ADHD (Barkley, 2006; Loe & Feldman, 2007). Although many treatment studies have suggested that stimulant medication is successful in improving basic academic functioning, such as reducing disruptive behavior, increasing homework completion, and improving quiz grades (Evans et al., 2001; Pelham et al., 2013), longitudinal research has shown that such treatment does not improve academic performance in the long-term (Barkley, 2006; Langberg & Becker, 2012).

Three studies have examined the effects of stimulant medication on narrative comprehension and production. Two focused on the effects of stimulant medication on story recall. Francis, Fine, and Tannock (2001) asked 50 children with ADHD to retell stories from memory both on and off stimulant medication. Although children showed some improvement in including the story grammar categories of story characters' internal responses and attempts, stimulants did not improve overall story recall length or accuracy of responses to comprehension questions. In another study of the effects of stimulant medication on free recall of children

with ADHD (Bailey, Derefinko, Milich, Lorch, & Metze, 2011), stimulant medication was associated with increases in the number of events recalled, but had no significant effect on recall of events central to the stories or on the coherence of recalls. A third study (Derefinko et al., 2009) minimized memory demands by investigating the effects of stimulant medication on the inclusion of goal-based story events as children narrated wordless picture books. Children produced a larger number of clauses in the medication condition than in the placebo condition, but there was no significant effect of medication on the inclusion of goal-based story events. Taken together, these studies indicate that stimulant medication leads to little improvement in complex narrative comprehension and production.

A second general approach often employed to improve academic performance for children and adolescents with ADHD is instruction on improving organization of ideas through strategic studying, note-taking, and essay construction. Children with ADHD have difficulty organizing ideas into a coherent representation without instruction, even when given time to study and common study aids to help them (i.e., a highlighter, a piece of paper and a pen; Lorch et al., 2004). Approaches that do provide these children with instruction on organizing information into a coherent representation are not necessarily effective at addressing the deficits specific to comprehension in youth with ADHD. Children who were instructed on the Directed Note-taking Activity (DNA) procedure by Evans, Pelham, and Grudberg (1995) learned how notes should be organized using a format that stressed main ideas. Although adolescents were able to record over 80% of details from a lecture with the DNA instruction, they did not improve in identifying main ideas. One organizational technique that has been utilized successfully to address deficits associated with organizing thoughts into coherent writing is a technique described as self-regulated strategy development (SRSD; Harris & Graham, 1996). SRSD utilizes “instructional strategies” to addresses three deficits that may contribute to writing issues with ADHD, including goal-setting issues, poor self-regulation, and working memory deficits. Children and adolescents with ADHD have shown improvement with this procedure (e.g., Jacobsen & Reid, 2010; De La Paz, 2001). However, few studies have examined the use of SRSD as a stand-alone strategy to improve writing in individuals with ADHD.

Story Maps as a Potential Intervention

It appears that common treatment methods such as stimulant medication, practicing traditional study skills, and broad organizational strategies do not address the narrative comprehension deficits identified in youth with ADHD. However, these treatments were not designed to address these specific deficits. One treatment method, instruction in using the “story map” to guide the construction of a story representation, has been used successfully to address comprehension deficits in single-case design studies, as well as serving as a component of larger-scale interventions with youth with ADHD (DuPaul et al., 2006; Jitendra et al., 2007). Story maps are visual-spatial displays that can be used during instruction to guide attention to important components of narratives using a specific structure (Boulineau, Fore, Hagan- Burke, & Burke, 2004). The map provides readers with a space to record important story grammar categories including: Setting, characters, problem, goals, actions, outcome, and conclusion of the story. The purpose of instruction with a story map is to improve narrative comprehension by helping students to understand the structure

of a coherent story representation, with emphasis on the causal connections between characters' goals, their attempts to achieve goals, and the outcomes of those attempts (Boulineau et al., 2004).

As mentioned, story maps have been effective for struggling readers in both single-technique intervention studies focusing on story mapping, as well as studies examining the combined effects of multiple techniques. In two studies that examined the effect of interventions focusing on story mapping, Idol and Croll (1987) and Boulineau et al. (2004) explicitly instructed struggling readers on story grammar categories and story structure using story maps. Students in both studies received extensive feedback from teachers on correct identification of story grammar elements through story map completion. Participants in Idol and Croll (1987) showed improved comprehension, and most maintained comprehension gains when story maps were removed. Students in Bolineau et al. (2004) improved in the identification of story grammar elements from pre-test to post-test, and accuracy of identification was maintained after removal of instruction. These studies suggest that interventions that focus on story-mapping as a technique may effectively improve comprehension. DuPaul and colleagues (2006) and Jitendra and colleagues (2007) utilized a story mapping technique as one available component among multiple components of a reading intervention package in large scale, long-term, academic intervention studies for children with ADHD. Both studies found evidence of improved comprehension for these struggling readers, although the unique contribution of story mapping instruction cannot be determined. As a whole, these studies suggest that instruction in the use of story maps is a promising technique for improving knowledge of story structure and potentially of narrative comprehension and production.

Current Study

Although improvements among children with learning disabilities as a function of instruction in use of story maps are promising, and story maps have been utilized as one component of multifaceted intervention packages for children with ADHD (DuPaul et al., 2006), use of the story map in instruction to address narrative comprehension deficits has yet to be tested as a specific intervention in individuals with ADHD. The current study investigated the use of a Story Mapping Intervention (SMI) to improve the narrative recall and production of adolescents with ADHD. Utilizing a pre-post test research design, we sought to explore whether the use of the SMI would improve areas of comprehension previously shown to be deficient in youth with ADHD, including using goal structure to create or recall important events, generating or recalling coherent stories, and generating plausible inferences based upon story events. The SMI was designed to target the skills thought to underlie effective narrative comprehension and the construction of a coherent story representation, including attention to characters' goals and the causal connections linking goals, attempts, and outcomes. This intervention was implemented in a group setting ten times over the course of an 8-week summer program. Both before and after the SMI intervention, recall of audiotaped fables and adolescents' independent creation of novel stories was assessed. Given the focus of the SMI on the goal structure of stories and the connections among important events, we evaluated if adolescents with ADHD would show post-test improvement in recalling important events from the fable, in the global coherence

of the fable recall, and in generation of two types of plausible inferences based upon story events. Similarly, for story creation we examined whether adolescents would show post-test improvement in the length of stories created, in the inclusion of goal-based story grammar events, and in the global coherence of stories created. Assuming that extensive practice in story mapping would be important (Boulineau et al., 2004; DuPaul et al., 2006; Idol & Croll, 1987), we evaluated whether story map homework completion would account for any improvements.

Method

Participants

Participants were 30 adolescents with ADHD between the ages of 12 and 16 years old. The adolescents participated in the Summer Treatment Program-Adolescent (STP-A) at a large university clinic. Participants were required to (a) meet DSM-IV-TR (APA, 2000) diagnostic criteria for ADHD, (b) be at least 12 years of age, (c) have a Verbal IQ higher than 80, and (d) have no conditions that precluded full participation in the STP-A activities. Demographic information is included in Table 1. The STP-A is an intensive behavioral day treatment program for adolescents with ADHD that includes an active parent involvement component (Sibley et al. 2011; Smith et al. 1998). During the STP-A, adolescents receive over 300 hours of treatment focused on improving skills in academic, social, and family domains. In addition, parents participate in 15 hours of behavior management training, 8-weeks of daily practice implementing a home behavioral contract, and ongoing daily support from a trained clinician. The STP-A shows evidence of improving the social behavior and academic functioning of adolescents with ADHD (Sibley et al., 2011, 2012).

Parents and teachers of adolescents completed an application that contained behavioral rating scales, a demographic questionnaire, and a treatment history form. Parents also were administered the Disruptive Behavior Disorders Interview (DBD; Pelham et al., 1992a), a semi-structured interview with supplemental probes for symptom severity and situational variability. Through dual clinician review, participants were accepted to the STP-A if parent and teacher reports indicated the presence of clinically significant symptoms (assessed by the Disruptive Behavior Disorder Rating Scale; Pelham et al., 1992b) and cross-situational impairment (assessed by Impairment Rating Scale; Fabiano et al., 2006) consistent with a diagnosis of ADHD. Adolescents were administered the Wechsler Abbreviated Scale of Intelligence (WASI; Weschler, 1999) to obtain an estimated IQ score and the Word Reading, Spelling, and Mathematics subtests of the Wechsler Individual Achievement Test-II (Wechsler, 2002) to assess achievement. Adolescents were excluded from the program if they qualified for a diagnosis of pervasive developmental disorder, or a psychotic disorder. Parents signed informed consent and adolescents signed youth assent forms prior to treatment.

Materials

Fables—One fable, *The Knight and the Dragon*, was read to the adolescents and recalled during the pre-test and a second fable, *Silly Richard*, was read to the adolescents and recalled during the post-test. The two fables had been used in previous studies for which

each fable had been parsed by trained coders into individual story events. Initial agreement between the coders regarding division of units was 94%; disagreements were revised by consensus to determine the final set of events. Thirty-four adults then rated the importance of events from each fable using a 7-point Likert scale ranging from 1 (not important to the overall meaning of the story) to 7 (extremely important to the overall meaning of the story; Flake et al., 2007). The average ratings were converted to quartiles for each fable, constituting four levels of importance of events. Both fables include a main character who has multiple failed attempts at trying to reach a goal before actually achieving the goal. *Silly Richard* is 618 words long and contains 84 story events. This story concerns a young boy who wants to buy a skateboard. His mother tells him that he has to earn the money. Richard goes through a number of failed attempts before earning enough money. *The Knight and the Dragon* contains 640 words and contains 85 story events. This story is about a king who asks a knight to protect his people from a dragon that lives on a mountain. The knight encounters obstacles on his way to the dragon's cave, but the problem is resolved when the dragon later helps the knight and accompanies him to the kingdom.

Story map—The story map was used as a concrete organizational aid during instruction, and helped to focus adolescents on important story grammar categories with a particular emphasis on goal structure. Blank spaces of the story map included Title, Setting, Characters, Outcome, and Vocabulary. Of particular importance during instruction were the blank spaces for goal structure elements, including the Major Goal, Problem, Sub-goals, Attempts, and Outcomes (see Appendix A).

Procedure

All procedures were approved by the university Institutional Review Board. The STP-A is an 8-week intensive summer treatment program for adolescents with ADHD. The program is fully described in a manual available from the authors (Pelham et al., 2012). Adolescents attended the program from 8:00 am to 5:00 pm each day and participated in modules designed to mimic a secondary school setting. The STP-A teaches academic and organizational skills that are relevant to secondary school (i.e., note-taking, study skills, writing skills, daily planner use, binder organization) to foster generalization of therapeutic gains. STP-A modules also include daily jobs, substance use prevention (i.e., Life Skills Training; Botvin, 2004), and leadership training to teach life skills and prevent maladaptive outcomes such as deviant peer affiliation, substance use, and delinquency. The STP-A behavioral feedback system is sensitive to adolescent social norms. Because ADHD is a heterogeneous disorder, individualized treatment plans and adjunct treatments are used as needed to customize treatment to the unique deficits of each participant. Adolescents were in groups of 9 to 11 similar age peers and each group was staffed by a graduate student counselor and three undergraduate counselors. To promote treatment fidelity, staff members received 60 hours of pre-service training and were required to pass a STP-A procedural test. Staff were supervised by Ph.D.-level mental health professionals and trained fidelity observers. Supervisors and fidelity observers completed standardized dichotomous fidelity checklists and provided daily feedback about adherence to manualized procedures. Across treatment fidelity checklists, average fidelity scores were above 90%. Staff were also required to complete weekly treatment fidelity quizzes on STP-A procedures. If any score

on a treatment fidelity checklist or weekly quiz was below 100 %, it was immediately addressed with remedial procedures.

Pre-test/ Post-test—Adolescents completed pre-test measures on the first day of the program before any instruction occurred, and post-test measures on the final day at the beginning of the Writing class. Pre- and post-test measures consisted of a fable recall task and a story creation task. During both the pre-test and post-test sessions, all adolescents listened to the same fable (pre-test was *The Knight and the Dragon* and post-test was *Silly Richard*) and were instructed to write down what they remembered from beginning to end after the fable was read.

For the story creation task, adolescents were instructed to make up a story that they had never heard before within a 15-minute time limit. They were also instructed to write “The End” when finished. If the adolescent did not have any information written down within the first minute, the teacher would advise the adolescent to write down whatever they had thought up.

Intervention—The Story Mapping Intervention (SMI) took place during the Writing class in the academic portion of the STP-A. The SMI was explained to adolescents at the beginning of the course by the Writing teacher. The Writing teacher was a recruited from the local school system based upon experience in a mental health-related area. She was supervised by a Ph.D.-level mental health professional who attended every class period, completed standardized dichotomous fidelity checklists, and provided daily feedback about adherence to manualized procedures. Fidelity to the story mapping intervention averaged over 95%, and on the rare occasion that the teacher did not complete instruction on an aspect of the story map, the supervisor brought this to her attention immediately so that treatment integrity was maintained.

In the first class, the teacher began by asking adolescents to identify elements of a good story (e.g., organization, setting, characters, plot) and then introduced the story map. The teacher asked the adolescents to suggest definitions for each concept on the story map, with corrections made as necessary. The teacher then guided the adolescents in filling in the story map and using the story map to organize a summary of events, using the Introduction to the collection of stories that served as the material for the class. On later days, the teacher continued to guide the students in filling in story maps and correcting those they had completed as homework (see below). During this instruction, the teacher emphasized identification of the central character’s goals, the attempts motivated by those goals, and outcomes that followed from the attempts.

Story map homework was assigned during every other Writing class (10 total homework assignments). Time to complete homework was provided during camp hours under counselor supervision in a study hall to increase task adherence and concentration. The homework required adolescents to read a designated chapter from the book *ADHD and Me: What I Learned from Lighting Fires at the Dinner Table* (Taylor, 2007), followed by the completion of a story map. Homework was turned in during the next Writing Class. Students who completed an entire story map accurately received a grade of “1”, those who attempted

the story map, but did not complete at least 50% of it (or completed a section of it incorrectly) received a grade of "1/2", and those who did not make an attempt to complete the story map or did not turn in the story map received a grade of "0". The homework scores ranged from a minimum of 36% to a maximum of 100%. Homework was graded while the adolescents worked on an in-class assignment, and was returned immediately. The teacher then lead the class in a discussion of the assigned chapter by utilizing a blank story map on the overhead projector. This discussion served as feedback on the adolescents' story maps as well as additional instruction in story mapping and its relation to goal structure. During the discussion, adolescents corrected their graded story mapping homework at their desk. Homework scores were averaged and used as a covariate in analyses.

Coding

Both fable recall and story creation assessments were transcribed verbatim from the hand written papers of the adolescents by a coder blind to the testing condition.

Fable recall—Fable recall protocols were parsed into individual events in a manner similar to that described for the complete fables (see above). The events in adolescents' recalls were compared to the actual events in the story (determined as described in the Materials section above). Each actual event was scored 0 (not recalled) or 1 (recalled). The percentage recalled for events at each level of importance was calculated. Next, the *global coherence* of fable recall was rated by trained coders on a scale of 1 to 4. Global coherence represents the general logical flow of the entire recall as perceived by adult evaluators (Habermas & de Silveira, 2008), and as such is related to how a teacher might grade an essay. A scoring rubric was derived from Habermas and Silveira (2008), and interrater reliability has been consistently high for previous studies employing this coding system (Flake et al., 2007; Freer et al., 2011; Lorch et al. 2010). A score of "1" indicated that the recall had no clear story line, had many gaps, had many flaws and ambiguities, or had no transitions. A score of "2" indicated that the recall had some story line, but poor transitions and many ambiguities. A score of "3" indicated that the recall had a story line, few ambiguities, and good transitions. A score of "4" indicated that the recall had a good story line, almost no ambiguities, and varied transitions. Finally, fable recalls were coded for 2 types of inferences: *Explanatory* and *elaborative*. Explanatory inferences are essential for narrative comprehension because they fill in causal connections between events or outcomes that have not been explicitly stated within the story. An elaborative inference adds information to the story line, but is not essential for narrative comprehension. Both types of inferences were coded for plausibility (i.e., was an inference reasonably consistent, given the explicit story events). Because implausible inferences were rare, only plausible inferences were utilized in the current study. To estimate the inter-rater reliability, two coders coded all of the stories for inferences and 25% of the stories for recall of events and coherence. The interrater reliability for event coding was $K = .82$ at the level of individual events, $r = .85$ for global coherence ratings, and $r = .92$ for total number of inferences.

Story creation task—The stories adolescents created were parsed into individual events, in a similar manner to that described for recall protocols. Story length was assessed via the

number of events. Events then were coded for whether they fell into goal-based or non-goal based categories.

Goal-based categories included categories that are part of what Stein and Glenn (1979) described as the story's "episode system": goal-initiating events, goals, attempts, and outcomes. *Goal-initiating events* were events that motivated a character's goal. *Goals* were coded as explicit statements of what the main character was trying to complete or attain. *Attempts* were events where the main character was making an effort to achieve goals. *Outcomes* were explanations of whether the attempt succeeded or failed.

Nongoal-based categories included settings, main characters, characters' internal responses, and non-goal-related events (Stein & Glenn, 1979. The *setting* consisted of background information in the study; events such as time and place. The *main character* was coded as the protagonist if he or she caused the actions to occur in a story. An *internal response* was an emotional reaction from the main character. *Nongoal-based events* were actions that took place to move a story along but were not related to goal sequences.

Global coherence of the stories created was coded with the same 1 to 4 scale that was used for the fable recall. In order to estimate inter-rater reliability, two coders coded all of the stories for coherence and 25% of the stories for story grammar categories. The inter-rater reliability for story coherence ratings was $r = .70$. Interrater reliability was > .80 for all story grammar categories, including those related to goal structure.

Planned Analyses

Pre-post test designs were conducted to explore whether performance improved as a result of the SMI. For comparisons that utilized additional variables (e.g., importance of events during recall), ANOVAs were used. In all other instances, planned paired-samples *t*-tests were conducted.

To explore whether improvement was a result of practice in the SMI intervention, SMI homework scores were used as a covariate in analyses, and interaction terms were interpreted accordingly.

Results

Effects of SMI on Fable Recall

Recall as a function of Importance of events—To examine the effects of the Story Mapping Intervention (SMI) on recall of events as a function of importance ratings, a 2 (Tests: pre-test, post-test) X 4 (Importance: 4 levels of rated importance) repeated-measures ANOVA was conducted. As seen in Figure 1, adolescents recalled more events at post-test than at pre-test, $F(1, 24) = 29.54$, $p < .001$, $d = 2.22$, and overall, more important events were recalled more often, $F(3, 72) = 56.03$, $p < .001$, $d = 1.72$. These main effects were qualified by a significant test X importance interaction, $F(3, 24) = 29.93$, $p < .001$, indicating that the slope of the function relating recall to importance was steeper at post-test than at pre-test, $F(1, 24)= 29.93$, $p < .001$. Notably, adolescents recalled only 21.52% of the most important events at pre-test, but 41.72% during the post-test.

When story map homework scores were included in these analyses as a covariate, this accounted for significant variance in test (pre, post), $F(1, 23) = 6.92$, $p < .05$, and in the test X importance interaction, $F(1, 23) = 10.49$, $p < .01$. In addition, when homework scores were controlled for, the main effect of test (pre, post) and the test X importance interaction were no longer significant ($F(1, 23) = 0.61$, *ns*, and $F(1, 23) = 1.55$, *ns*, respectively). This suggests that the higher the quality of homework, the greater the effect of the SMI.

Global coherence—To examine the effects of the SMI on global coherence of recall, a paired-samples *t*-test compared rated coherence at the pre-test and the post-test. Recall was significantly more coherent during the post-test, $M = 2.80$, than the pre-test, $M = 2.04$, $t(24) = 3.37$, $p < .01$, $d = 1.37$, but homework score was not a significant covariate, $F(1, 23) = 0.38$, *ns*.

Inferences—To examine the effects of the SMI on the generation of *explanatory* and *elaborative* inferences, paired-samples *t*-tests were used to compare the number of these inferences generated at the pre-test and the post-test (see Figure 2). Adolescents generated more explanatory inferences during the post-test, $M = 2.81$, than during the pre-test, $M = 1.81$, $t(23) = 2.61$, $p < .05$, $d = 1.07$. When homework scores were controlled for, the covariate effect was significant, $F(1, 22) = 4.95$, $p < .05$, and the effect of the test was no longer significant, $F(1, 22) = 1.89$, *ns*, indicating that improvement in explanatory inferences is accounted for by accurate homework completion. Adolescents also made a greater number of elaborative inferences during the post-test, $M = 2.83$, than during the pre-test, $M = 1.33$, $t(23) = 3.85$, $p < .01$, $d = 1.57$, but homework score was not a significant covariate, $F(1, 22) = 1.02$, *ns*.

Effects of SMI on Story Creation

Events—A paired-samples *t*-test was conducted to examine the number of events in the stories at pre and post test. Adolescents created stories with a greater number of events in the post-test condition, $t(22) = 5.26$, $p = .001$, indicating that stories were longer after the SMI.

Goal-based categories—A paired-samples *t*-test was conducted for each goal-based story grammar category, including goal-based events, goals, attempts, or outcomes. There were no significant improvements in the inclusion of any goal-based categories from pre-test to post-test, all *p*s > .05.

Nongoal-based categories—A paired-samples *t*-test was conducted for each nongoal-based story grammar category. Adolescents included a greater number of nongoal-based events in their stories during the post-test, $t(22) = 5.26$, $p < .001$, and a greater number of settings in their stories during the post-test, $t(22) = 2.64$, $p < .02$, but there were no significant increases in main characters or internal responses, *p*s > .10.

Global coherence—Raters scored the global coherence of stories created with the same 1 to 4 scale previously used for the coherence of fable recall. A paired-samples *t*-test (pre-test, post-test) indicated that rated coherence did not significantly improve between pre-test and

post-test sessions, $t(22) = .30$, *ns*. During the pre-test, coherence ratings averaged 2.91, whereas ratings averaged 2.98 during the post-test.

Discussion

The current study represents preliminary work in the use of a Story Mapping Intervention (SMI) to improve specific narrative comprehension skills in adolescents with ADHD. Within the context of a broader clinic-based program, adolescents received ten sessions of the SMI and completed associated homework assignments. Pre-post test comparisons utilizing a fable recall and a story creation task were made to examine whether adolescents with ADHD improved on recall of important events, global coherence of recall, generation of inferences during recall, story creation events, goal and nongoal-based categories of story creation, and global coherence of story creation after repeated instruction and practice with the use of a story map.

Results indicated significant improvement in a number of narrative comprehension skills during the fable recall task. Specifically, adolescents demonstrated improvements in recall of important events of a verbally-presented fable and in the global coherence of their written recall, suggesting that they were attending to story events and processing these events in a way that helped them structure important information for future use. In addition, adolescents generated a significantly greater number of explanatory and elaborative inferences during recall of the post-test fable than during recall of the pre-test fable. The increase in the number of explanatory and elaborative inferences created during the post-test session suggests that the SMI assisted adolescents in making appropriate and reasonable implicit connections among story events that are vital to comprehension. Finally, when included as a covariate in analyses, story mapping homework scores accounted for significant variance in recall of story events and generation of explanatory inferences. These findings suggest that those who performed well in completing the story map homework made more significant improvements on pre-post assessments of narration skills. Although this was not a randomized controlled trial, these pilot results are very encouraging.

It is possible that these improvements in narrative comprehension skills are due to two important components of the current work: The visual-organizational component of the story maps and the repeated, guided teacher feedback with the story map during the intervention. The story map is a visual display of the story components. The teacher could use the story map to direct attention towards goal-structure categories with the purpose of improving attention to important information and organizing this information for later retrieval. In addition to the story map itself, this protocol provided repeated practice of skills and feedback on completed story maps across ten sessions, thereby ensuring that adolescents recognized and corrected errors in their use of the story map at regular intervals. Combined use of this strategy and reinforcement of skills over time may have worked together to promote gains.

In contrast to improvements in recall, adolescents did not show the same improvements in their creation of a story without use of a prompt. This is not surprising, given that free writing of a story without prompts is considered a challenging task for individuals with

ADHD (Freer et al., 2011). Although stories improved in length (significantly more events and nongoal-based events from pre- to post-test), they were not improved in ways that suggest a stronger adherence to the goal structure of a story. This may be due to the fact that the SMI was better adapted to the demands of a recall task. That is, the teachers discussed how using story maps could help the adolescents remember information and structure essays about existing stories. Although adolescents completed regular writing assignments, teachers had fewer opportunities to address how to create a story based upon character's goal. Despite non-significant results, development of the story map intervention could be better adapted to serve story creation. For instance, like the self-regulated strategy development (SRSD) model (Harris & Graham, 1996), the story map could be provided prior to writing and used as a development tool for the generation of story ideas. After the story is "mapped," the adolescent can begin writing. Although exploratory, such tailoring of interventions could be very useful for task-specific skills.

It may also be the case that the SMI should be provided for a longer duration or with greater intensity for story creation gains to be achieved. The literature has consistently indicated that the intensity and duration of treatment for ADHD should reflect the chronic nature of the disorder (Pelham & Fabiano, 2008); limits on the effectiveness of the intervention may reflect the deep-seated nature of the narrative comprehension deficits for individuals with ADHD. Narrative comprehension deficits have been found at young ages in those with ADHD (Berthiaume et al., 2010), with some evidence that the gap between individuals with ADHD and their non-ADHD peers may widen over time (Bailey, Lorch, Milich, & Charnigo, 2009). By adolescence, long-standing narrative comprehension deficits are unlikely to be completely remedied with brief treatment.

One of the strengths of the current study is the use of an intervention directed at improving goal-based narrative comprehension in a population known to exhibit specific deficits in narrative comprehension. Previous interventions that have used a story map as a means to improve recall have shown promising results for children with specific learning problems (Boulineau et al., 2004; Idol & Croll, 1987), and the story map has shown evidence of being a potentially useful contribution to efficacious reading treatment programs in the school system (DuPaul et al., 2006). This is the first study to demonstrate that critical elements of recall may be improved among adolescents with ADHD by instruction and practice in the use of a story map as an organizational tool. The current results are particularly notable given what previous research has indicated about the typical effectiveness of interventions for those with ADHD. Though effective for some academic indices (Evans et al., 2001; Pelham et al., 2013; Sibley et al., 2011), typical treatments for ADHD such as stimulant medication or studying and note-taking skills interventions appear ineffective for improving goal-based narrative comprehension (Bailey et al., 2011; Derefinko et al., 2009; Evans et al., 1995; Lorch et al., 2004). Typical treatments seem to help children and adolescents with ADHD produce *more* information, but have not specifically improved goal-based narrative comprehension. Results from this study suggest that the SMI may help those with ADHD to build a coherent story representation, thus improving recall of important events, generation of inferences, and coherence of recalls. All of these improvements have promise for facilitating academic success.

Limitations and Future Directions

There were several limitations of the current study. First, due to the fact that this study was conducted within the context of a broader treatment program, there was an unavoidable sacrifice of experimental control. Because all participants were a part of this clinic-based program and the SMI was conducted as a mandatory part of the program, it was not possible to include a no-treatment comparison group. Therefore, although adolescents with ADHD demonstrated significant improvements in fable recall across tests, we were unable to compare these results with adolescents with ADHD who had received the intensive clinic-based program but had not received the SMI intervention, or with adolescents with ADHD who had received neither of these interventions. Future work should include comparison groups to better understand the magnitude of these gains over and above gains made by the summer treatment program, and gains made by simple maturation.

Relatedly, another notable limitation of the current work is that it is difficult to evaluate whether the SMI or the summer treatment program was responsible for improvements in narrative comprehension. For example, the summer treatment program for adolescents with ADHD included behavioral modification to improve attention and reduce classroom-incompatible behavior. It is possible that the other forms of intervention adolescents received may have had a cumulative positive effect on story narration; however, this was partly controlled for in analyses utilizing SMI homework grades. Further study in this area would benefit from utilizing the SMI in isolation (e.g., not as a part of a clinic-based program), or in other structured settings, such as an addition to the school curriculum, to determine the true effect of this treatment and possible cumulative effects of this treatment when combined with other intervention strategies.

The fact that the SMI was conducted in the context of a broader treatment program also limited the amount of experimental control over study factors such as the counterbalancing of study measures and additional interventions that were provided as a standard part of the summer program. Because classroom placement in the treatment program was based upon age and gender of the adolescents, counterbalancing measures could not occur without introducing other study confounds. Thus, one fable was used for baseline assessment and the other was used following the intervention. Future studies of the SMI should address this issue to ensure that the characteristics of a specific story were not responsible for gains. However, in the current study, the fables were very similar to those used in past research in which the effect of importance levels on recall did not differ as a function of the specific fables (Bailey et al., 2011). Thus, it is unlikely that fable effects are responsible for the pattern of recall improvements.

In addition, the nature of this program allowed 8 weeks for the intervention, a considerable period given typical resources. Future work in this area could explore whether an SMI could be implemented in a setting where adolescents typically spend substantial amounts of time (e.g., school or after-school programs), or whether the effectiveness of the SMI could be maintained when much less time is available (e.g., as part of outpatient treatment or tutoring). These preliminary results suggest that 10 practice sessions was enough to make significant gains, but exploration of whether these gains can be achieved in fewer session

would be valuable to understanding how and where this form of intervention should be offered.

It is also important to address narrative comprehension deficits among other age groups with ADHD. The current exploratory work evidenced improvements for adolescents aged 12–16, but introducing this type of intervention at younger ages may have the potential to ameliorate narrative comprehension deficits before they have incremental impacts on academic functioning. Alternatively, utilization of similar techniques for individuals entering college may be an important addition to their writing skills that will promote coherence in written assignments. To accomplish this, future work would do well to develop age-appropriate story maps and evaluate of the effectiveness of these maps in a broad range of age groups.

Conclusion

This study explored the use of a story mapping intervention to reduce narrative comprehension deficits in adolescents with ADHD in the context of an intensive, clinic-based treatment program for ADHD. The story mapping intervention improved several aspects of adolescents' recall of a fable, including the number of events recalled, coherence, and the generation of inferences, and covariate analyses with homework scores suggest that these improvements were related to higher story map homework scores. Although preliminary, these results are encouraging, given the chronic nature of ADHD and the long-standing nature of ADHD-related academic deficits. Despite gains in recall skills, narrative comprehension improvements did not generalize to story creation. However, this intervention could be more effectively tailored to promote the focus of goal-based events in writing assignments by having adolescents develop ideas utilizing the story map as a guide before writing. Based upon the design of this study, it appears possible to use the story mapping intervention as an effective part of a writing class in a secondary-school setting, and future work would do well to use this intervention in more traditional education settings where this type of intervention is likely to be implemented as a part of special services for individuals with ADHD.

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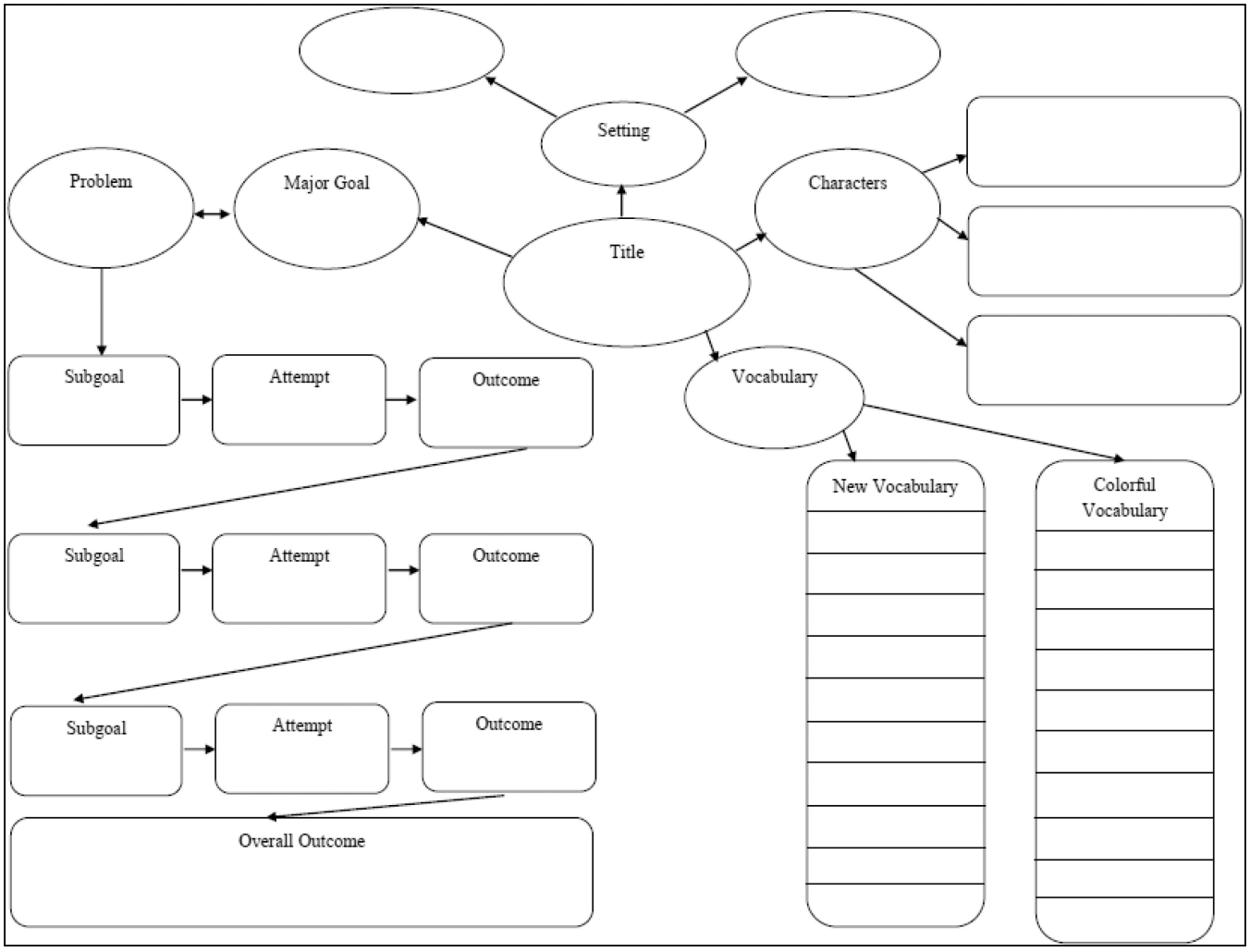
Appendix A. Story map using goal-based categories



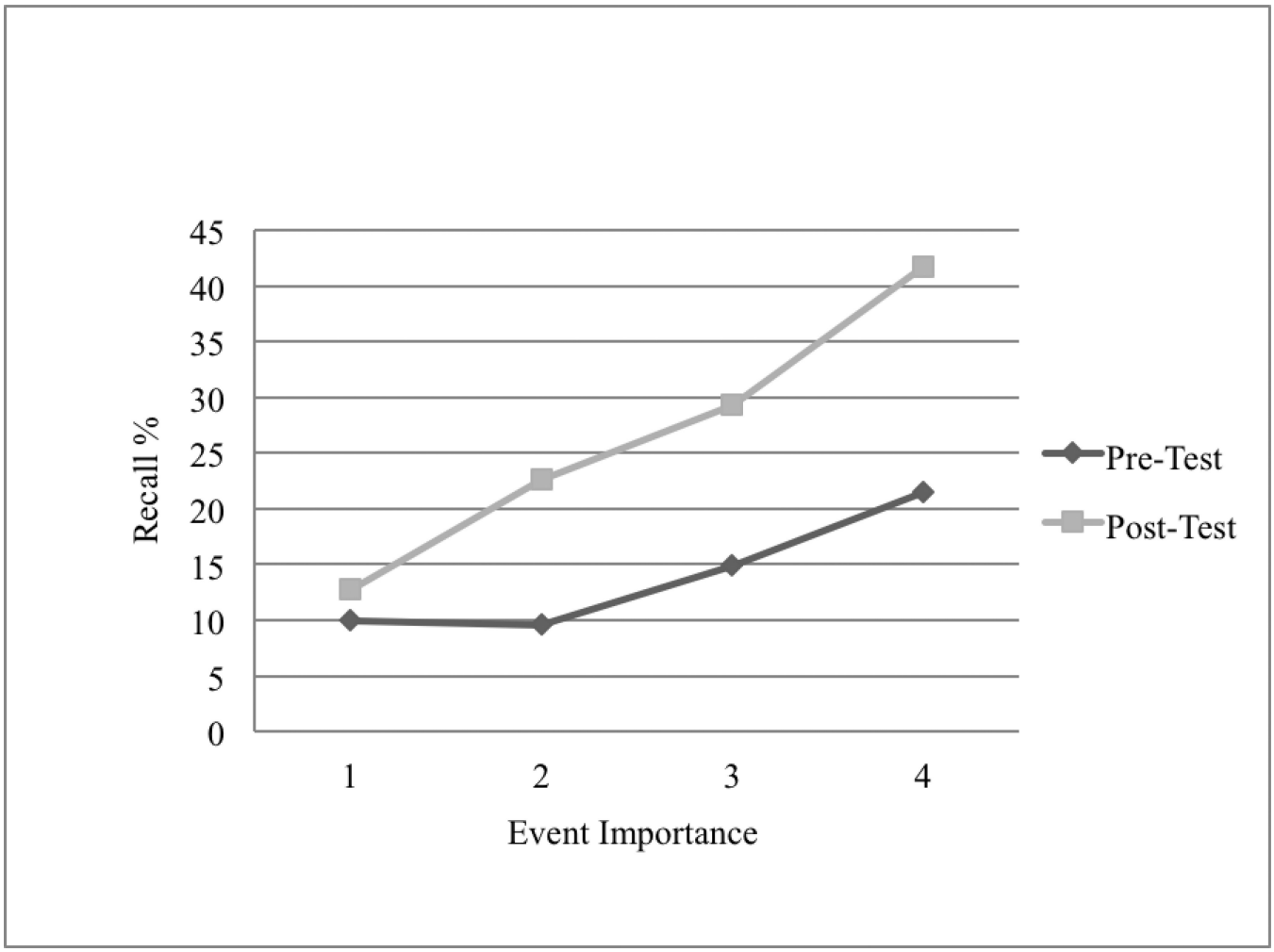


Figure 1.
Fable recall as a function of event importance.

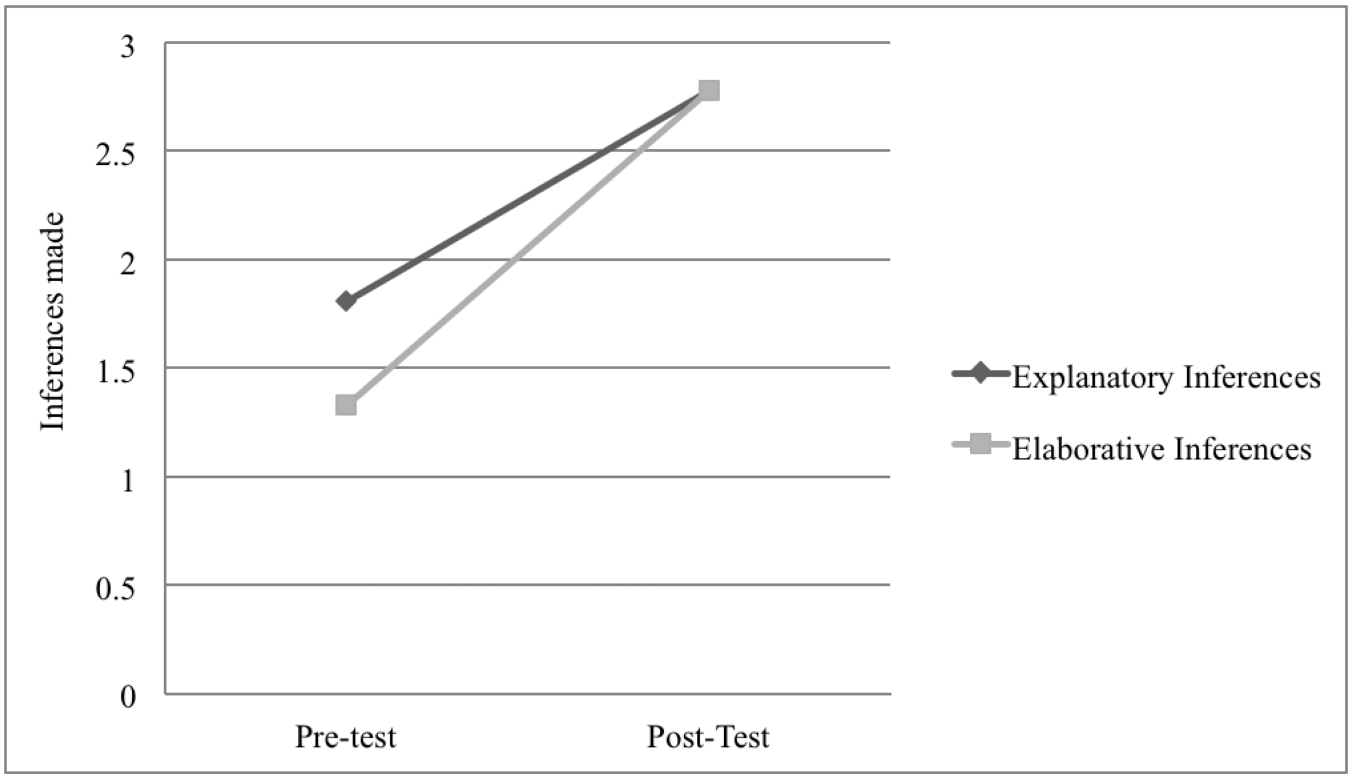


Figure 2.
Fable recall: Mean values of inferences made.

Table 1

Demographic information

Variable	Mean	SD	Range	Percent
Age	13.79	1.33	11.9–16.8	
WASI Full Scale IQ	105.41	11.53	78–133	
WIAT Math	102.90	14.98	65–125	
WIAT Reading	104.03	13.01	75–127	
WIAT Spelling	103.46	14.90	70–133	
DBD ADHD Inattentive symptoms	7.62	2.19	2–10	
DBD ADHD Hyperactive Symptoms	5.17	2.62	0–10	
DBD ODD symptoms	3.96	2.81	0–9	
DBD CD symptoms	0.72	0.88	0–3	
Single Parent Household				21.4
History of Special Services in School				33.3
Race				
Caucasian				61.9
Black				4.8
Asian				4.8
Ethnicity				
Latina/o				50.0
History of Stimulant Medication Use				38.1
Current Stimulant Medication Use				35.7

Note. $N = 30$. WASI = Wechsler Abbreviated Scale of Intelligence WIAT = Wechsler Individual Achievement Test 3rd edition. DBD = Disruptive Behavior Disorder rating scale. ADHD = Attention-Deficit Hyperactivity Disorder. ODD = Oppositional Defiant Disorder. CD = Conduct Disorder.