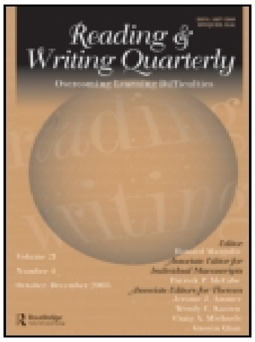

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ACADEMIC INTERVENTIONS FOR STUDENTS WITH ATTENTION-DEFICIT/HYPERACTIVITY DISORDER: A REVIEW OF THE LITERATURE

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Students with attention-deficit hyperactivity disorder (ADHD) frequently underachieve academically and are at risk for poor scholastic outcome. This article reviews empirical studies that have reported the effects of academic interventions with this population. Intervention approaches are reviewed in the general categories of peer tutoring, computer-assisted instruction, task and instructional modifications, and strategy training. Some of these strategies (e.g., peer tutoring, task modifications) appear to enhance both academic performance and attentional behavior. Strategies that directly address the academic difficulties experienced by students with ADHD must be part of the treatment package if educational success is to be achieved. Recommendations for practice and future research efforts are delineated.

Attention-deficit hyperactivity disorder (ADHD) is a psychiatric diagnosis applied to children and adolescents who exhibit developmentally inappropriate levels of inattention or impulsivity–overactivity (American Psychiatric Association, 1994). Approximately 3% to 5% of elementary school-aged children in the United States are diagnosed with this disorder, with boys outnumbering girls at about a 2:1 to 5:1 ratio (Barkley, 1990). Given that most general education classrooms include 20 to 30 students, teachers must address the needs of at least 1 student with ADHD per school year. Typically, ADHD symptoms are first exhibited in early childhood and continue to be present throughout adolescence and adulthood (Weiss & Hechtman, 1993).

Children with ADHD are at a higher than average risk for a variety of behavioral difficulties, including defiance toward authority figures, poor relationships with peers, and antisocial acts such as lying, stealing, and fighting (Barkley, 1990). In addition to these behavioral risks, students with ADHD frequently struggle scholastically, presumably because of their low academic engagement rates and inconsistent work productivity (DuPaul & Stoner, 1994). The results of prospective

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follow-up studies of children with ADHD into adolescence and adulthood indicate significantly higher rates of grade retention, placement in special education classrooms, and dropping out of school relative to their peers (e.g., Barkley, Fischer, Edelbrock, & Smallish, 1990). Furthermore, lower than expected rates of work completion may in part account for the association of ADHD with academic underachievement, because up to 80% of students with this disorder have been found to exhibit academic performance problems (Cantwell & Baker, 1991). Furthermore, a significant minority (i.e., 20–30%) of children with ADHD are classified as "learning disabled" because of deficits in the acquisition of specific academic skills (for a review, see DuPaul & Stoner, 1994, and Semrud-Clikeman et al., 1992).

Given the risk for poor academic outcomes, school professionals must design and implement interventions to address not only the behavioral manifestations of ADHD, but also the academic achievement problems associated with this disorder. Unfortunately, most of the available treatment outcome studies have not been conducted in classroom settings. Those few school-based intervention studies that have been conducted have focused primarily on decreasing disruptive behavior and other symptoms of ADHD (DuPaul & Eckert, 1995). Surprisingly few studies have examined treatment programs that incorporate academic interventions, defined broadly to include any school-based treatment that focuses primarily on manipulating antecedent conditions (e.g., modifications to academic instruction or materials). DuPaul and Eckert found only 8 out of 63 studies of school-based treatment for ADHD (studies conducted between 1971 and 1995 that met criteria for a meta-analytic review) assessed the efficacy of academic interventions, in contrast to 26 studies of contingency management and 29 investigations of cognitive–behavioral strategies.

The two primary interventions for ADHD are psychostimulant medication (e.g., methylphenidate) and contingency management programming (e.g., token reinforcement, response cost). These intervention strategies have been found to enhance rates of academic productivity and accuracy for most study participants (for a review, see Barkley, 1990, and Pelham & Murphy, 1986). Despite their positive effects, these interventions do not comprehensively address all of the academic deficits (i.e., beyond productivity on independent seatwork) that may be exhibited by students with ADHD. Furthermore, approximately 47% of children treated with methylphenidate either show no change or show decrements in academic performance relative to placebo conditions (Rapport, Denney, DuPaul, & Gardner, 1994). Thus, these interventions are necessary for many students with

ADHD, but they are not sufficient for ameliorating academic performance problems.

The purpose of this article is to review empirical studies that have assessed the efficacy of academic interventions for students with ADHD. Intervention approaches are reviewed in the general categories of peer tutoring, computer-assisted instruction, task and instructional modifications, and strategy training (see Table 1 for description of reviewed studies). Recommendations for practice and future research efforts are delineated. In keeping with research in this area, we contend that the complexities and chronicity of ADHD require the long-term use of multiple interventions across classroom and home settings. Strategies that directly address the academic difficulties experienced by students with this disorder must be part of the treatment package if scholastic success is to be achieved.

PEER TUTORING

Peer tutoring can be defined as any instructional strategy wherein two students work together on an academic activity, with one student providing assistance, instruction, and feedback to the other (Greenwood, Maheady, & Carta, 1991). A number of peer tutoring models have been developed that differ as to instructional focus (acquisition vs. practice), structure (reciprocal vs. nonreciprocal), and procedural components (e.g., number of sessions per week, methods of pairing students, type of reward system used; for a review, see L. S. Fuchs, Fuchs, Phillips, Hamlett, & Karns, 1995). Despite these differences, all models of peer tutoring share instructional characteristics that are known to enhance the sustained attention of students with ADHD. These characteristics include (a) working one-to-one with another individual, (b) instructional pace determined by learner, (c) continuous prompting of academic responses, and (d) frequent and immediate feedback about the quality of the performance (Pfiffner & Barkley, 1990).

Research Studies

One of the earliest investigations of peer tutoring as part of an intervention package for students with ADHD was conducted by Robinson, Newby, and Ganzell (1981). The purpose of this study was to investigate the effects of a classwide token reinforcement program on the academic performance of 18 hyperactive third-grade boys placed in a special education classroom. A single-subject BAB reversal design was

TABLE 1 Empirical Studies of Academic Interventions for Students With ADHD

Study	Type of AI	*N*	Participants	Dependent measures	Results
DuPaul & Henningson (1993)	PT	1	7-year-old boy	Obs. of on-task and activity level; CBM math probes	Increases in on-task; reductions in fidgeting; some improvement in math performance
DuPaul et al. (1995)	PT	19	16 boys, 3 girls (6–11 years old)	Obs. of on- and off-task; weekly posttests	Increases in on-task; decreases in off-task; increases in posttest scores
Locke & Fuchs (1995)	PT	3	11-year-old boys	Obs. of on-task and social interactions	Increases in on-task and positive social interactions
Robinson et al. (1981)	PT	18	3rd grade boys	Vocabulary test scores	Gains in vocabulary test scores
Kleinman et al. (1981)	CAI	18	6–14 years olds	No. of problems completed; no. of problems correct; *M* time between problems; total time working on problems	Increases in the no. of problems completed; increases in the total time spent working on problems
Ford et al. (1993)	CAI	21	18 boys, 3 girls (8–11 years old)	Obs. of on-task behaviors	Increases in on-task behavior
Dunlap et al. (1994)	TM	1*	12-year-old boy	Percentage of task engagement; Percentage of disruptive behavior	Increases in task engagement; decreases in disruptive behavior
Ervin et al. (1996)	TM	2*	boys, 13–14 years old	Obs. of off-task behaviors	Decreases in off-task behaviors
Zentall (1989)	TM	20*	20 boys	No. of commission errors; no. of omission errors; motor activity; verbal activity	Decreases in commission errors; decreases in omission errors; increases in motor activity level
Zentall & Leib (1985)	TM	15*	8–12-year-old boys	Quantity of performance; quality of performance; motor activity	Decreases in motor activity

Dubey & O'Leary (1975)	IM	2	1 boy, 1 girl	No. of comprehension errors	Decreases in comprehension errors
Richardson et al. (1987)	IM	42	7–12-year-olds	Reading grade equivalent	Increases in reading grade equivalent
Skinner et al. (1995)	IM	1*	7-year-old boy	No. of words read correctly; no. of words read correctly per minute; no. of seconds required to read list	Increases in accuracy; increases in rates of accurate reading
Chase & Clement (1985)	ST	6	9–12-year old boys	Counter usage; amount of academic performance; accuracy of academic performance	Increases in amount of academic performance; improvements in accuracy of academic performance
Evans et al. (1995), Exp. 1	ST	16	13 boys, 3 girls	Quality of notes; fraction of main ideas; fraction of details	Increases in quality of notes; increases in recording of details
Evans et al. (1995), Exp. 2	ST	14	13 boys, 1 girl	Obs. of on-task behaviors; obs. of disruptive behaviors; assignment & quiz scores; quality of notes; format of notes rating; fraction of main ideas; fraction of details	Increases in on-task behaviors; improvements in assignment scores

Note. AI = Academic Intervention. PT = Peer Tutoring. CBM = Curriculum-Based Measurement. CAI = Computer-Assisted Instruction. TM = Task Modification. IM = Instructional Modification. ST = Strategy Training. Obs. = observations: No. = number: Exp. = Experiment.

*Denotes studies that included non-ADHD participants; information reported is relevant to participants with ADHD only.

used wherein, during treatment conditions (B phases), students were able to earn token reinforcers for passing vocabulary tests and helping classmates to do the same. Tokens were exchanged for playing time on a video game. The peer tutoring procedure was quite simple and involved students who had passed a given level of the vocabulary test helping a classmate who had not passed that level. The tutor helped the tutee to sound out words, when necessary, and provided verbal feedback (e.g., "That's right" or "That's wrong") in response to the tutee's attempts at constructing sentences using the vocabulary words. The combination of token reinforcement and peer tutoring led to immediate and significant gains in vocabulary performance for most students. In fact, by the end of the study, 13 of the 18 boys had successfully completed the final level of vocabulary achievement. Furthermore, children were able to cooperate with each other in the context of peer tutoring with minimal training, and the teacher was able to implement the program independent of the investigators. The teacher reported that classroom disruptive behavior decreased significantly even though it was not a direct target of the intervention. Unfortunately, the specific effects of peer tutoring cannot be determined because the latter was combined with token reinforcement.

Two recent investigations have used ClassWide Peer Tutoring (CWPT; Greenwood, Delquadri, & Carta, 1988) in general education classrooms that included students with ADHD. CWPT has been found to enhance the mathematics, reading, and spelling skills of students of all achievement levels (see Greenwood et al., 1991). This form of peer tutoring includes the following steps: (a) the class is divided into two teams; (b) within each team, classmates form tutoring pairs; (c) students take turns tutoring each other; (d) tutors are provided with academic scripts (e.g., math problems with answers); (e) praise and points are contingent on correct answers; (f) errors are corrected immediately, and an opportunity is provided for practicing the correct answer; (g) teacher monitors tutoring pairs and provides bonus points for pairs that are following prescribed procedures; and (h) points are tallied by each student at the conclusion of each session. Tutoring sessions typically last 20 min, with an additional 5 min for charting progress and putting materials away. At the conclusion of each week, the team with the most points is applauded by the other team. Points are not usually exchanged for any back-up reinforcement.

A controlled case study of CWPT was conducted by DuPaul and Henningson (1993) with a 7-year-old boy with ADHD placed in a second grade general education classroom. A single-subject reversal (ABAB) design was used to evaluate the impact of CWPT relative to baseline conditions (i.e., instruction followed by independent seatwork) on on-task behavior, fidgeting, and math performance as assessed by curriculum-based measurement (CBM) probes. CWPT led to reliable increases in on-task behavior and similarly reliable reductions in fidgeting during math class relative to typical instructional conditions. Less consistent findings were obtained with respect to CBM math probe performance, although the student did appear to make measurable gains during the second CWPT phase. The findings of this study are limited because only a single student was used, minimal data are available regarding changes in academic performance, and no assessment was made regarding the acceptability of this intervention to the teacher.

The results of this controlled case study have been replicated and extended with a larger group of students exhibiting significant ADHD-related behaviors. DuPaul, Hook, Ervin, and Kyle (1995) evaluated the effects of CWPT on the academic performance and behavioral control of 19 students (16 boys, 3 girls; *M* age = 7.5) with ADHD who were placed in first through fifth grade general education classrooms. A within-subject, repeated measures design was used wherein each student participated in two baseline (i.e., typical classroom activities such as the completion of independent seatwork) and two CWPT conditions in an ABAB reversal design format. Dependent measures included direct observations of ADHD-related behavior, teacher ratings, self-report ratings, and weekly pretests and posttests. CWPT was implemented for either math, spelling, or reading depending on the academic area that each teacher identified as weakest for the student with ADHD.

The results of the DuPaul et al. (1995) study indicated that the active engagement of students with ADHD significantly increased from an average of 22% during baseline to an average of 82% when CWPT was implemented. Concomitant reductions in off-task behavior also were obtained. Exemplar data for three children clearly demonstrate the behavioral effects of this intervention and are displayed in Figure 1. In addition, children's weekly posttest scores increased from an average of 55% during baseline to 73% for CWPT conditions, thus indicating that this intervention affected both attentional behavior and academic performance. Similar positive changes in behavior and academic performance were exhibited by randomly selected students without ADHD, confirming the findings of Greenwood and colleagues (1991) that CWPT is helpful for all students, not just those who are experiencing difficulties. It is important to note that participating teachers and students rated CWPT as effective, practical, and highly

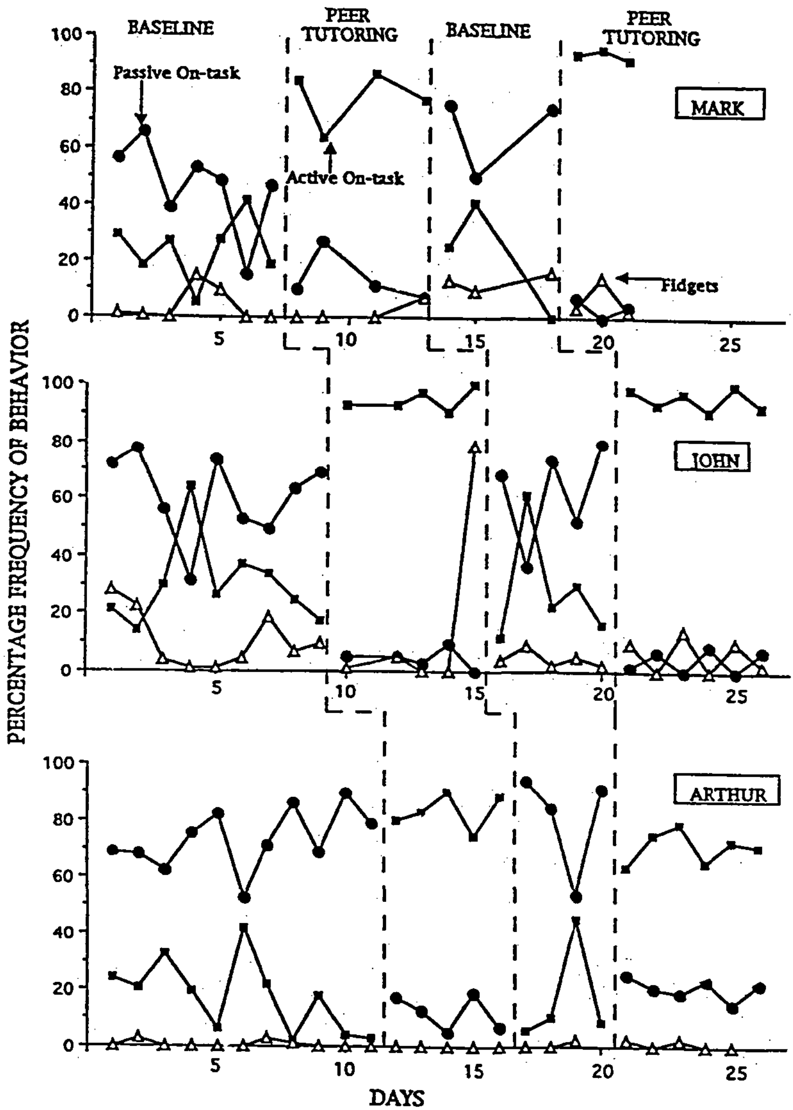

FIGURE 1 Rates of task engagement and off-task behavior for three children with attention-deficit hyperactivity disorder as a function of baseline and ClassWidePeer Tutoring conditions. From "Effects of ClassWide Peer Tutoring on Students With Attention Deficit Hyperactivity Disorder" by G. J. DuPaul, C. L. Hook, R. A. Ervin, and K. Kyle, 1995, presented at 103rd Annual Convention of the American Psychological Association, New York.

acceptable. Because this study did not include any follow-up assessment, the durability of CWPT effects on behavior and academics in this population is unknown.

Locke and Fuchs (1995) investigated the effects of a peer-mediated reading instruction strategy (PMI; D. Fuchs, Mathes, & Fuchs, 1993) on the attentional behavior and peer interactions of three boys identified as having attention deficits on their individualized education plans. The participants were 11 years old and were placed in a self-contained classroom for students with behavior disorders. They all were reported to be in the borderline range of intellectual functioning. An ABAB reversal design was used to contrast typical instruction (i.e., teacher-led activities followed by independent seatwork) with PMI in reading. The specific PMI strategy used was partner reading wherein the higher performing reader read for the initial 5 min while the other member of the dyad monitored reading performance and corrected errors. The partners switched roles for the next 5 min. Direct observations of on-task behavior and social interactions were conducted during reading group activities across all conditions.

Consistent with the results of previous studies of peer tutoring with this population, Locke and Fuchs (1995) found a substantial increase in on-task behavior associated with PMI. During typical instruction conditions the three boys were observed to be on-task approximately 52% of the time, whereas during PMI the average on-task rate was 88%. In addition, there was very little overlap in the range of data across phases, indicating that PMI led to immediate and consistent differences in academic engagement. Even though PMI was implemented to enhance reading performance, increases in positive social interactions also were obtained. Specifically, the average rate of positive social interaction was 4% during typical instruction and 18% with PMI. Again, there was very little overlap in social interaction data across phases. Unfortunately, Locke and Fuchs did not present any data to document treatment effects on reading performance. Thus, more comprehensive investigations of this form of peer tutoring with this population are needed.

Benefits and Limitations of Peer Tutoring

Research studies have provided consistent evidence that peer tutoring enhances the active engagement, academic performance, and, possibly, the social interactions of a wide variety of students, including those with ADHD. Given that students with ADHD have significant problems when asked to complete independent assignments, peer tutoring provides an alternative mode for the practice and refinement of academic skills. Peer tutoring is not meant to take the place of other forms of instruction (e.g., teacher-led lesson, group discussion). Furthermore, in the studies reviewed above, the behavioral changes elicited during peer tutoring did not carry over to other classroom activities. Although Greenwood, Terry, Utley, Montagna, and Walker (1993) have found positive, long-term effects associated with CWPT, studies of this intervention for students with ADHD have been relatively brief (i.e., carried out over several weeks) and have not included follow-up assessment. Therefore, the most prudent conclusion is that peer tutoring can be an effective intervention to enhance academic engagement and scholastic performance, at least over the short term, especially when combined with other treatment strategies.

COMPUTER-ASSISTED INSTRUCTION

The use of computer-assisted instruction (CAI) has been recommended for increasing the on-task and work production behaviors of students with ADHD. It has been suggested that the instructional features of CAI allow students with ADHD to focus their attention on academic stimuli (Lillie, Hannun, & Stuck, 1989; Torgesen & Young, 1983). Although not always the case, CAI presents specific instructional objectives, provides highlighting of essential material (e.g., large print, color), uses multiple sensory modalities, divides content material into smaller bits of information, and provides immediate feedback about response accuracy. In addition, CAI limits the presentation of nonessential features that may be distracting (e.g., sound effects, animation). Despite these contentions, only two empirical studies have examined the effects of CAI with students diagnosed with ADHD.

Kleiman, Humphrey, and Lindsay (1981) examined the effects of a CAI drill and practice mathematics program on the attending behaviors of 18 children diagnosed as hyperactive or having attention deficit disorder (ADD). The CAI program consisted of several key features: individual instructional levels, easily readable display format, self-paced work completion, and motivational features. A within-subjects group design was used to examine whether CAI resulted in improvements in work completion and accuracy when compared with a paper-and-pencil drill and practice task. The results of this study indicated that the students completed almost twice as many problems in the CAI condition than in the paper-and-pencil condition. In addition, students spent significantly more time working on problems in the CAI condition than the paper-and-pencil condition. Limitations of this study include incomplete participant and procedural information and a lack of assessment of interobserver agreement and treatment integrity. In addition, the study was short in duration and follow-up data were not collected.

Ford, Poe, and Cox (1993) examined the efficacy of various computer instructional programs on the attending behavior of children with ADHD. Twenty-one elementary school children (18 boys, 3 girls) diagnosed with ADHD received CAI in the areas of math and reading across a 4-week period. Using a within-subjects group design, participants were instructed with each of the following CAI software programs: (a) math drill and practice, (b) math instructional game, (c) reading drill and practice, and (d) reading tutorial. Each program included a game and nongame format for comparison. The results of this study indicated that participants were significantly more attentive when the CAI included a game format with animation. Significantly more nonattending behaviors were observed when the CAI included only drill and practice or tutorial instruction. In the drill and practice format, nonattending behaviors increased when the CAI material was too easy or too difficult. No increase in nonattending behaviors was observed when the CAI material was presented in a game format. A number of methodological difficulties associated with this study limit the conclusions that can be drawn. For example, no attempt was made to control for carryover effects of the instructional procedures. In addition, interobserver agreement was not reported for the observational data.

The results of these two studies provide preliminary evidence that CAI may be an effective instructional alternative for at least some children with ADHD. Allowing students to receive CAI may result in improvements in work completion and attending behaviors. However, characteristics of the software packages may affect the attending behaviors of students with ADHD. Software packages that include game formats and animation may be more effective than drill and practice or tutorial programs. Clearly, there is a pressing need for continued research on CAI for students with this disorder.

TASK AND INSTRUCTIONAL MODIFICATIONS

Task Modifications

Another type of academic intervention that can be used to improve the academic performance of students diagnosed with ADHD is task modification (TM). TM involves revising the curriculum or attributes of the curriculum in an attempt to reduce problem behaviors and increase appropriate classroom behaviors. In addition, TM is a proactive strategy, because changes are made before the curriculum is presented to the student. It has been advocated that this type of positive academic modification is more responsive to the individual needs of the student (Meyer & Evans, 1989).

One type of TM, choice making, requires the student to choose activities from two or more concurrently presented stimuli. Previous studies examining the effects of choice making on students with developmental disabilities have demonstrated increases in social behavior and decreases in levels of disruptive behavior (Dyer, Dunlap, & Winterling, 1990; Koegel, Dyer, & Bell, 1987). The effects of choice making in classrooms were recently examined in a study conducted by Dunlap et al. (1994). In this study, researchers examined effects of choice making on the task engagement and disruptive behaviors of three students with emotional and behavioral disorders. Of these three students, one 12-year-old boy was identified as having ADHD. In the context of an ABAB reversal design, he was provided with a menu of academic tasks in English and Spelling from which to choose. The results of the study indicated that choice making led to reliable and consistent increases in task engagement with concomitant reductions in disruptive behavior. Therefore, choice making may be a valuable TM for students with ADHD. Not only does allowing students to choose their assignments reduce disruptive behaviors and improve task engagement, it also promotes student initiative and independence. However, the Dunlap et al. study did not assess effects on academic performance. Therefore, it is not clear whether this type of TM would result in improvements in academic performance. Other limitations associated with the study included a limited number of students, short intervention period, and lack of follow-up data. Treatment integrity measures and consumer satisfaction data were not obtained.

On the premise that children with ADHD have a greater need for cognitive stimulation, a few TM studies have investigated the effects of modifying intratask stimulation (Zentall, 1989; Zentall & Leib, 1985). In one study conducted in a classroom setting, Zentall and Leib (1985) investigated the effects of added structure on the activity levels and performance of children using a repeated-measures design. Eight boys identified as hyperactive were randomly assigned to one of two experimental art conditions in which the structure of the task requirement was manipulated (explicit instructions combined with task materials vs. nonspecific instructions without task materials). The results of the study indicated significant decreases in activity level of the participants, suggesting that modifying task requirements may affect activity levels of children identified as hyperactive. However, the lack of a control group and the inability to control for the participants' ability level limits the findings of the study. In addition, interobserver agreement, treatment integrity measures, and consumer satisfaction information were not examined.

In another classroom study, Zentall (1989) examined whether adding color to relevant cues in a spelling task improved the performance of children diagnosed as hyperactive. Using a within-subjects group design, 20 hyperactive and 26 comparison boys were pre-assessed on spelling achievement and randomly assigned to one of two condition-order groups. Results of this study indicated that the participants identified as hyperactive demonstrated better performance than the comparison participants when relevant color was added to spelling tasks. Interestingly, the addition of color to irrelevant aspects of the task resulted in decreases in spelling performance. The educational implications of these results suggest that adding color to relevant components of a task may increase attention to detail and improve the academic performance of children with ADHD. However, the highly controlled spelling task and limited measures of academic achievement reduces the degree to which these findings can be generalized to classroom settings.

In one of the first studies to use classroom-based functional assessment procedures, Ervin, DuPaul, Kern, and Friman (1996) examined the effect of TM on the academic performance of children with ADHD. Based on the results of descriptive analyses and hypothesis development, they purported that the task engagement of two male students diagnosed with ADHD would improve with a TM. Using a brief reversal design, the effects of an alternative writing method were examined with one student. This method included peer discussion, brainstorming of ideas, and the use of a computer for journal writing. Allowing the participant to modify his written assignments resulted in clinically significant decreases in off-task behavior. Specifically, the percentage of intervals in which off-task behavior was not observed was greater when the participant was able to use the computer (M = 97%) than when the participant completed the written task by hand (M = 65%). For the second male student diagnosed with ADHD, it was hypothesized that allowing him to take notes during a lecture would result in less frequent off-task behaviors than if he passively listened to the lecture. The results of a brief reversal indicated that the percentage of intervals without off-task behavior was consistently higher when the notetaking strategy was used (M = 98%) than when it was not used (M = 55%). The results of this study are limited by the brief intervention period, absence of academic performance data, limited number of collected data points, and the limited generality to general education settings.

Instructional Modifications

Similar to TM, specific instructional modifications (IMs) can be implemented to improve the academic environments of students experiencing difficulties with inattention, impulsivity, or hyperactivity. By modifying the content or delivery of instruction, students diagnosed with ADHD may improve their academic achievement (DuPaul & Stoner, 1994). Very few studies have examined this form of intervention with students displaying ADHD-related behaviors.

The use of an IM to improve reading comprehension with students identified as hyperactive was examined in a study conducted by Dubey and O'Leary (1975). They hypothesized that allowing the participants to respond orally to written material would improve their academic performance, a hypothesis supported by a few empirical studies demonstrating that verbalizations led to improved academic performance (Lovitt & Curtiss, 1968; Palkes, Stewart, & Freedman, 1972). Using a single-subject design, they compared systematically the number of comprehension errors emitted by 2 third-grade students (1 boy, 1 girl) identified as hyperactive across silent and oral reading conditions. The results of this study indicated that oral reading produced fewer comprehension errors than silent reading for both students. The findings of this study are limited because only two students participated, a detailed description of the experimental procedures is lacking, and carryover effects across experimental conditions were possible. Furthermore, interobserver agreement data, treatment integrity measures, and social validity assessments were not reported.

In another study investigating the effects of IM in reading, Skinner, Johnson, Larkin, Lessley, and Glowacki (1995) examined the influence of two taped-words interventions, fast-taped words (FTW) and slow-taped words (STW), on word reading list performance using an alternating treatment design. Of the three participating students, one boy was identified as having ADHD. The accuracy and rates of accurate reading increased relative to baseline conditions using both the FTW and STW procedures. Relatively higher reading accuracy and rates of accurate reading were demonstrated on STW. The implications of this study are that taped-words interventions are effective procedures for improving reading accuracy and rate of reading accuracy. It is important to note that differences in the accuracy and rates of accurate reading were observed for the two participants who were not diagnosed as having ADHD. For these two students, greater improvements were obtained using the FTW procedure. It is not clear whether these differences were due to the varying reading levels of the participants or other variables. Additional limitations associated with this study include the use of an "artificial" classroom setting and lack of intervention acceptability data.

Richardson, Kupietz, and Maitinsky (1987) examined the efficacy of IM and medication treatment on the reading achievement of 42 students diagnosed with ADHD. This study used the integrated skills model (ISM; Richardson, 1984) as an IM for improving reading performance. ISM allows the teacher to modify the instructional strategy used (i.e., sight-word processing, phonic–linguistic processing) depending on the student's individual learning style. Results of this study demonstrated that children's reading achievement greatly improved as a result of the ISM and medication treatment. Unfortunately, the investigators did not provide a description of the design method used or statistical information pertaining to the specific treatment effects. Therefore, it is impossible to determine whether the observed effects were due to the implementation of the intervention or to extraneous variables.

Benefits and Limitations of TMs and IMs

A number of studies have documented the benefits of conducting task and instructional modifications in classroom settings with students with ADHD. The results of these studies suggested that modifications resulted in decreased disruptive behavior, increased task engagement, and increased academic performance. However, these studies have only measured immediate academic and behavioral effects in the areas of reading and writing. It is unclear whether TM and IM result in long-term effects in other academic domains. Despite these limitations, TM and IM have been found to be effective in improving the immediate academic and behavioral performance of students with ADHD. Furthermore, these types of modifications can occur within the context of the daily classroom routine, requiring minimal teacher preparation.

The majority of TM studies have focused on improving task engagement, whereas all of the IM studies have concentrated on improving academic performance. It appears that combining both approaches would improve the academic and behavioral needs of students with ADHD. In addition, the work of Ervin et al. (1996) demonstrated the importance of conducting school-based functional assessments prior to implementing modifications. This allows school personnel to obtain valuable student information that can be used in developing unique IMs or TMs.

STRATEGY TRAINING

Another type of academic intervention for improving students' academic classroom performance involves training students in the use of specific classroom strategies. Strategy training (ST) involves teaching students to use a set of procedures or strategies that specifically address the demands of an academic situation. This type of intervention may be particularly beneficial for students diagnosed with ADHD because it permits students to become responsible for monitoring their behavior. Unfortunately, as was the case for other intervention categories, very few empirical investigations have examined the use of ST in this population.

One ST procedure for improving students' academic performance is the use of self-regulation or self-reinforcement. This procedure involves encouraging students to administer reinforcement independently once academic or behavioral goals are met. Specifically, students determine a daily academic or behavioral goal, develop a contract highlighting the goal and associated contingencies, self-observe and self-monitor performance, and ascertain whether the goal was achieved. If the contracted goals are satisfied, the students administer the identified reinforcer. Chase and Clement (1985) examined the effects of self-reinforcement and stimulant medication on the academic performance of six male students identified as having ADD. Using a single-subject, ACACABAB design, the effects of medication, self-reinforcement, and medication plus self-reinforcement were examined. Results of this study indicated that self-reinforcement resulted in greater improvement in the academic performance of five of the participants than medication alone. However, combining self-reinforcement with medication resulted in the greatest academic gains for all of the participants. The external validity of this study is limited given the use of a small sample size and of an "experimental" public school classroom. The medication dosage was not experimentally controlled; this was determined on an individual basis. In addition, follow-up results were not assessed.

ST and Adolescents

Few ST procedures have been examined for adolescents with ADHD. At the secondary school level, students with ADHD may exhibit inferior organization and study skills, thereby increasing the risk for poor scholastic achievement (Shapiro, DuPaul, Bradley, & Bailey, 1996). For example, students with this disorder may have difficulty attending to classroom instruction and taking organized notes for later review. It is possible that improving the notetaking strategies of adolescents with ADHD may enhance their academic and behavioral performance in the classroom. One such notetaking strategy is directed notetaking activity (DNA; Spires & Stone, 1989). This procedure allows students to learn the strategy through teacher-instructed lectures and prompts in an attempt to increase students' on-task behavior, improve comprehension of classroom materials, and reduce the frequency of disruptive behaviors. Specifically, the teacher instructs the students on the notetaking process by illustrating how to outline notes based on main ideas and details. The number of teacher prompts is slowly faded until students are able independently to form an outline of the presented lecture material.

Evans, Pelham, and Grudberg (1995) examined the effects of DNA with adolescents diagnosed with ADHD. In the first experiment, 16 adolescents with ADHD (13 boys, 3 girls) attending a summer treatment program received DNA instruction during their classroom period. The summer treatment program included both academic and recreational activities. Students attended the program on a voluntary basis. Each week of the intervention, the amount of teacher instruction and prompts provided in notetaking were reduced from a teacher-provided outline of lecture material to a blank page for taking notes. Using a pre–post design, the participants demonstrated significant improvements in the quality of notes over time. In addition, significant increases in the recording of details were observed. These results suggested that adolescents with ADHD may improve their notetaking skills with the DNA instruction procedure.

In Experiment 2 of the study, Evans et al. (1995) examined the efficacy of the DNA procedure on the process and product of notetaking. Fourteen adolescents (13 boys, 1 girl) participating in a summer treatment program received DNA instruction for 3 weeks. Using a within-subjects group design, the researchers assessed the participants' proficiency in using the notetaking strategy across four experimental conditions. Results of this experiment indicated that the notetaking intervention significantly improved the on-task behavior and daily assignment performance of the participants. However, the notetaking strategy did not significantly improve quiz scores or reduce disruptive behaviors. When participants took high-quality notes, on-task behavior increased, disruptive behavior decreased, and comprehension of material increased. The quality of notes taken also predicted work assignment performance, with higher quality notes resulting in improved work assignment scores. The implications of this study are that notetaking strategies can enhance the on-task behavior and academic performance of adolescents with ADHD in the classroom. In addition, the greater the quality and organization of the notes, the fewer disruptive behaviors are displayed. Some limitations associated with the study included small sample size and variations in notetaking demands across participants. Moreover, the study was conducted in an analog classroom setting under controlled conditions, so it is questionable whether the obtained results can be generalized to public school classrooms with larger class sizes and less time available for the teacher to implement the DNA strategy.

Benefits and Limitations of ST

Only a few studies have examined the effects of strategy training on the academic and behavioral performance of students with ADHD. Because of the limited number of studies in this area, only tentative conclusions can be drawn regarding the impact of ST. Students with ADHD appear to learn and apply newly acquired strategies to school-based tasks. In addition, these strategies can result in short-term improvements in academic performance and task engagement. ST also appears to promote independent responsibility for academic outcomes, which may be an important goal for this population of students.

IMPLICATIONS FOR PRACTICE AND RESEARCH

It is unclear to what degree academic interventions, in general, enhance the scholastic performance of students with ADHD. Many of the studies reviewed did not include measures of academic outcome, thus limiting conclusions about intervention effects on this important area of functioning. Alternatively, although the reviewed treatment strategies did not directly target disruptive behavior, reductions in the latter were found in conjunction with the implementation of some academic interventions (e.g., peer tutoring). In fact, DuPaul and Eckert (1995) found that academic interventions were as effective as contingency management strategies in improving ADHD-related behaviors. This result should not be surprising because academic behaviors (e.g., completion of seatwork, participating in class discussions) usually are incompatible with inappropriate classroom activities. Thus, academic interventions actually may be preferred over contingency-based approaches (e.g., token reinforcement). Behavioral changes associated with contingency management do not necessarily translate into improvements in academic performance.

Without direct empirical comparisons, it is difficult to assert which category or categories of academic intervention optimally address the classroom needs of students with ADHD. In fact, the four categories of intervention reviewed herein appeared to enhance on-task behavior, reduce disruptive activity, and, in some cases, improve academic productivity or accuracy. Until investigations are conducted that directly compare the effects of various forms of academic intervention, the school practitioner is left to choose treatment strategies on the basis of idiosyncratic factors (e.g., severity of child's ADHD-related behaviors, teacher acceptability of treatment, availability of resources such as computers). Functional assessment data, as used by Ervin et al. (1996), should be used to facilitate intervention planning at an individual level. It is fortunate that school professionals have a number of choices as to specific intervention strategies given the promising findings obtained to date.

In addition to the salutary behavioral effects of academic interventions, several other factors support the use of these strategies. First, interventions such as CAI and peer tutoring may be easier to implement in general education classrooms than are treatment approaches involving the manipulation of consequences (e.g., token reinforcement programs). Ultimately, academic interventions may be more acceptable to teachers than are contingency management systems given greater time efficiency or possible philosophical objections to behavioral procedures. High teacher acceptability may ultimately enhance the fidelity with which interventions are implemented over the long term. A second factor supporting the utility of academic interventions is that these may enhance student-managed behaviors in the completion of classroom responsibilities. For example, providing students with task choices may promote responsible decision making. Similarly, providing students with strategies to improve notetaking could eventually lead to greater levels of independence from teacher support. Thus, academic interventions have the potential to promote maintenance of treatment gains as teacher support is gradually withdrawn. In addition, these strategies have the potential to foster generalization of behavior change to other situations and academic subject areas. Of course, these statements must be considered speculative until supportive empirical data becomes available.

It is encouraging that the academic interventions studied thus far have been found to be at least moderately effective in enhancing the school performance of students with ADHD. Given that so few studies have examined academic interventions, future research efforts need to address the following areas. First, more comprehensive measures of academic outcome should be used because prior studies have almost exclusively relied on classwork productivity data or measures of academic engagement. CBM probes and teacher-made tests should be included in outcome investigations, because these may be more sensitive to intervention effects than more traditional indices. Expansion of dependent measures is particularly important if the performance of secondary school students is being assessed. Second, investigators need to go beyond prescribing treatment programs based on diagnosis. Research on interventions derived from individual functional assessments needs to be conducted (Ervin et al., 1996; see Reid & Maag, this issue) as students with ADHD have divergent needs and typically exhibit idiosyncratic responses to interventions (see Barkley, 1990).

A relatively narrow range of academic interventions has been studied to date. Thus, there is a glaring need to expand the types of strategies to enhance academic performance among students with ADHD. Nowhere is this more evident than among secondary school students; with the exception of the directed notetaking activity, the strategies discussed above would most likely be impractical for use with older students. DuPaul and Eckert (1995) were able to locate only two studies of school-based intervention that specifically targeted the performance of students with ADHD over the age of 13 years. Given the problems that secondary students with ADHD encounter with respect to organization, study skills, and test taking, this is perhaps the most important area for future investigation.

Too few studies have examined the social validity of academic interventions for ADHD. The social validity of a treatment can be examined in at least two ways: evaluating the acceptability of procedures and assessing the degree to which treatment leads to normalization of performance (Kazdin, 1988). For example, DuPaul et al. (1995) asked teachers and students to complete a brief consumer satisfaction rating following the implementation of CWPT. Both respondent groups reported a high degree of satisfaction with peer tutoring strategies, especially in relation to more typical contingency management approaches or stimulant medication. Unfortunately, the acceptability of other interventions examined in the present review is unknown. Furthermore, none of the studies included herein assessed whether academic interventions lead to classroom performance similar to that of non-ADHD classmates.

All of the reviewed studies reported intervention outcomes over a short time period. Given the lack of follow-up data, it was unclear whether treatment gains were maintained over the course of a school year or across school years. Another methodological shortcoming of investigations conducted to date was the lack of assessment of treatment integrity. With the exception of the DuPaul et al. (1995) study, the reader cannot discern whether interventions were implemented as intended. Because these investigations were conducted in classrooms rather than the controlled conditions of a laboratory setting, determining whether the independent variable (i.e., treatment) was manipulated as designed is a particularly critical issue.

For more severe forms of ADHD, academic interventions, in isolation, are unlikely to address sufficiently all of the problems facing students with this disorder. Thus, researchers need to determine how academic interventions can be combined with other school-based strategies (e.g., contingency management) to optimize classroom functioning. Furthermore, the interaction between academic strategies and stimulant medication (e.g., Ritalin) should be examined. For instance, can students be placed on lower doses of Ritalin (or removed entirely from drug regimens) if effective academic interventions are implemented? Finally, how effective are academic interventions over the long term, either in isolation or in combination with other treatments? Ultimately, these are the questions that are most pressing for educators as opposed to determining the effects of an isolated treatment approach implemented for a short period of time.

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