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A Preliminary Investigation of the Effectiveness of Homeschool Instructional Environments for Students With Attention-Deficit/Hyperactivity Disorder

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Abstract. An exploratory study that involved two male and two female elementary students with attention-deficit/hyperactivity disorder (ADHD) was carried out in homeschools and public schools. The general purpose of the study was to determine whether parents could provide instructional environments that facilitated the acquisition of their children's basic skills over time. Students were observed using the Mainstream Version of the Code for Instructional Structure and Student Academic Response (MS-CISSAR), an eco-behavioral direct classroom observation instrument that produces information on ecological, teacher, and student behavior processes. Pre and post standardized achievement test scores and rate-based measures were analyzed to determine gains in reading and math for all students. The results indicated that homeschool students were academically engaged about two times as often as public school students and experienced more reading and math gains. The key variable appeared to involve student to teacher ratios that existed between the two settings.

Although estimates of homeschooled students in the United States range from 1,000,000 (Lines, 1998) to 1,230,000 (Ray, 1997), there is little research addressing what occurs during home instruction. Of particular interest to school psychologists is the learning of children with unique challenges in the homeschool population, including those with attention-deficit/hyperactivity disorder (ADHD). Given estimates that 3% to 5% of all school children have this disorder (American Psychiatric Association, *Diagnostic and Statistical Manual of Mental Disorders–Fourth Edition* [DSM-IV], 1994), there could be at least 61,500 children with ADHD being taught at home. With so many children involved, and because homeschool students often return to traditional schools after 2 years of home teaching (Ray, 1997), it is important to investigate whether parents can provide adequate instruc-

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tional settings for these students without the help of professionals.

An increasing number of parents perceive conventional schools as (a) failing to promote traditional values, (b) setting academic standards that are too low, and (c) providing nominal levels of personal attention and hands-on learning for students (Toch, 1991). Because so many parents have responded by educating their children at home, officials often require families to regulate their curricula, instructional hours, and record keeping (Home School Legal Defense Association [HSLDA], 1995). Some states require homeschool families to test students periodically and register with state/local superintendents (HSLDA, 1995). Although it is legal in all 50 states for parents to teach their children at home, local education and social agencies frequently oppose homeschool efforts that involve students with special needs (T. A. Bushnell, Director, National Challenged Homeschoolers, personal communication, January 16, 1998).

Most of the arguments against teaching students at home concern socialization and teacher training. In the former, homeschooling raises concerns about social development because, to some degree, it limits children's interactions with others. However, students from homeschools and traditional schools have been found to attend extrafamilial social activities with the same frequency, belong to the same number of organizations (e.g., scouting and church youth groups), and socialize equally as often with relatives and friends (Groover & Endsley, 1988). With regard to their preparation as teachers, parents have not often been trained and certified as teachers and it has been suggested that this lack of training hinders parents' abilities to be effective, especially with those students who have special needs. However, data have consistently shown that homeschooled children typically score higher than the national average on achievement tests (HSLDA, 1994; Ray, 1997). Furthermore, Duvall, Ward, Delquadri, and Greenwood (1997) found that, to a large degree, noncertified parents engaged in the same teaching behaviors as certified special educators in public schools. However, for students with ADHD, there are little or no data related to the success of parents in structuring an effective homeschool experience.

Related research suggests that parents, when assisted by professionals, can be effective instructors of children with handicaps (e.g., Broden, Beasley, & Hall, 1978; DuPaul & Henningson, 1993; Duvall, Delquadri, Elliott, & Hall, 1992; Gang & Pouche, 1982; Greenwood, Delquadri, & Hall, 1984; Thurston & Dasta, 1990; Waldrop, 1994). For example, Duvall et al. (1992) demonstrated that, after being trained by educators to tutor students with learning disabilities (LD), parents enabled their children to significantly increase their reading scores. Waldrop (1994) showed that parents of children with ADHD were able to assist these children in achieving higher school grades after being trained to use behavioral techniques. DuPaul and Henningson (1993) demonstrated gains in reading achievement for four elementary students with ADHD by increasing their academic engaged time (AET) via parent-tutoring at home. In this study, the students experienced gains in reading at home and school as a result of the increased AET. However, homeschooling is usually carried out by parents without professional assistance, and currently there is little or no research suggesting that these parents can effectively teach students with ADHD on their own.

In their research with parents working independent of professional assistance, Duvall et al. (1997) demonstrated that parents could effectively teach students with LD at home. In this study, the academic gains and instructional environments of 4 homeschool students were compared to that of 4 public school students who were taught in special classes. The homeschool students in this study made more gains, which appeared related to higher levels of engagement on key instructional behaviors. These behaviors included writing, task participation, reading aloud, reading silently, and academic talk, all of which have been shown to result in academic gains (e.g., Delquadri, Greenwood, Whorton, Carta, & Hall, 1986; Duvall et al., 1992; Greenwood et al., 1984; Hall, Delquadri, Greenwood, & Thurston, 1982). However, research on the effectiveness

of instruction when students with ADHD are taught entirely at home is lacking. Knowing how students with ADHD respond to homeschooling is especially important because they frequently exhibit behaviors such as inattentiveness, distractibility, and verbal outbursts (Fowler, Barkley, Reeve, & Zentall, 1992) that could interfere with parents' ability to deliver effective instruction. Consequently, the question of whether parents can provide effective instructional settings for these students needs to be addressed. It is also important to determine the similarities between homeschooling and public school instruction as they relate to children with ADHD.

The present study was a preliminary investigation of 2 children with ADHD who were being schooled at home. In addressing the above-mentioned homeschool issues, we described (a) students' academic engaged time, (b) parents' instructional behaviors while teaching, (c) the ecological features of homeschooling, and (d) academic gains by students with ADHD as measured by standardized and rate-based measures. To provide a basis for comparison, we included a description of two case studies of students with similar patterns of behavior who were schooled in a general education setting.

Method

Participants

Four students who had been previously diagnosed as having ADHD, Predominantly Inattentive Type, participated in the study. To provide a comparative benchmark for the experiences of homeschool students in relation to general education peers with similar behavioral profiles, students were selected from a pool of 33 local students (10 of whom received their academic instruction at home and 23 at school) with similar diagnoses. A homeschool student was paired with a public school student according to significant scores (i.e., > 97th percentile) on the Children's Attention Profile (Barkley, 1990, 1991), Home Situations Questionnaire—Revised (Barkley, 1990, 1991), and the School Situations Questionnaire—Revised (Barkley, 1990, 1991). Additionally, Table 1 shows how pairs were matched according to score differences of 15 points or less as they related to achievement scores (as indicated by Broad Reading and Broad Math standard scores earned on the Woodcock-Johnson Tests of Achievement—Revised [WJ-R]; Woodcock & Johnson, 1989), rate-based scores in reading and math, IQ (obtained on the Wechsler Intelligence Scale for Children—Third Edition; Wechsler, 1991), grade, sex, and socioeconomic status. We included only those pairings that matched on at least 90% of the variables. Furthermore, to avoid mismatches due to various medical treatments and their effects, we selected students who, because of parental concerns, were not taking prescription medications for ADHD. Table 2 describes each instructor's sex and education.

Setting

The study took place within a 50-mile radius of Kansas City, Kansas, and involved two homes and two public school facilities located in two rural consolidated school districts that were predominantly white (98% compared to a state average of 79%). The percent of economically disadvantaged families in the districts involved generally reflected state averages (32% and 27% compared to a state average of 32%). Student-teacher ratios in homeschools averaged 2.2:1 compared to 20.2:1 in public school classrooms. Observations occurred in homes wherever parents provided instruction (e.g., dining room, 52%; kitchen, 36%) and in general education classrooms in the public schools.

Research Design

Because the independent variable could not be manipulated, a continuous baseline probe design (Duvall et al., 1997) was used to examine how homeschool and public school instruction compared as it related to active academic engagement and achievement gains over time. To investigate various similarities and differences between homeschools and public schools, the following dependent measures were used: (a) Ecobehavioral Assessment Systems Software (EBASS; Juniper Gardens Children's Project, 1993) codes (e.g., academic engagement levels); (b) WJ-R subtest scores; (c) rate-based

Table 1
Characteristics of Students

	Student																
	Homeschool									Public School							
					WISC-III	WJ-R Pretest Scores		Kaufman Pretest Rate-Based Scores						WISC-III	WJ-R Pretest Scores		Kaufman Pretest Rate-Based Scores	
Pair	Race	SES	Grade	Sex	IQ	Reading	Math	Reading	Math	Race	SES	Grade	Sex	IQ	Reading	Math	Reading	Math
1	W	Low	5	F	79	70	82	24	36	W	Mid	5	F	77	80	96	29	43
2	W	Mid	6	M	98	118	88	44	30	W	Mid	6	M	91	90	97	39	45

Note. SES = based on reported income (i.e., low = < 15K; mid = 15 K–55K); WISC-III = Wechsler Intelligence Scale for Children—Third Edition (Mean = 100, *SD* = 15); WJ-R = Woodcock-Johnson Tests of Achievement—Revised (Mean = 100, *SD* = 15).

Table 2
Characteristics of Instructors

Instructors							
Homeschool				Public School			
Student	Instructor	Sex	Highest Degree Earned	Student	Instructor	Sex	Highest Degree Earned
1	Parent	F	GED	3	RE Teacher	F	MS
2	Parent	F	HS	4	RE Teacher	F	MS

Note. GED = General Educational Diploma; RE = regular education; MS = Masters; HS = High School Diploma.

measures derived from items on the Kaufman Tests of Educational Achievement (Kaufman & Kaufman, 1985), and (d) consumer satisfaction questionnaires.

Dependent Measures

The following provides a description of the dependent measures, when they were established, and, when appropriate, how their reliability was determined.

Direct observations of academic engagement. Student behaviors, parent instructional behaviors, and the ecological features of homeschooling were observed through the use of EBASS (Greenwood, Carta, Kamps, & Delquadri, 1993; Greenwood, Carta, Kamps, Terry, & Delquadri, 1994). Observers used laptop computers and a version of the EBASS observation system called the Mainstream Version of the Code for Instructional Structure and Student Academic Response (MS-CISSAR—full system). Response categories, subcategories, and specific behavior codes are provided in the appendix. A complete listing of EBASS definitions can be found in Greenwood et al. (1993).

Once a month between January and May, observations were conducted of each student in his or her instructional setting for 30-45 min for a total of five observations each. To provide temporal continuity, all observations were conducted on school days between 2:00-4:00 p.m. However, no attempts were made to control subject matter during observations to allow for a sampling of instructional environments as they occurred naturally. When observations began in January, we informed homeschool and public school instructors which students were the target of our observations and that we were trying to determine how they responded to teacher conduct and classroom events.

Interobserver reliability checks between the experimenter and a second observer were collected from samples of each student across all conditions. Only one observer attended home sessions; consequently, homeschool students were videotaped as they received instruction so that the sessions could be viewed and scored later by a second observer. During school-based reliability sessions, however, both observers recorded data simultaneously. The duration of all reliability observations was 10 min. The observers scored independently from one another during each reliability session.

Interobserver reliability was determined by calculating the proportion of agreements to the number of intervals times 100. Agreements for each category (e.g., setting, activity, task) were computed separately. Concerning homeschool sessions, mean reliability over all categories was 92.3%, with a range of 60% to 100% agreement (the 60% score occurred once in the "teacher position" category when, during a videotaped session, the observers had difficulty determining a mother's position because she continuously made small adjustments in her position relative to the target student). Mean reliability for public school sessions was 97.7%

with agreements ranging from 80% to 100%. The mean interobserver reliability for all sessions across home and school settings was 95%.

Woodcock-Johnson Tests of Achievement—Revised. One of the research questions concerned the performance of homeschool students on standardized tests compared to that of public school students. For pre- and posttest comparisons, Broad Reading and Broad Math scores were obtained by administering the Letter-Word Identification, Reading Comprehension, Mathematics Calculations, and Applied Math subtests of the WJ-R. Copies of the unscored protocols (n = 8) were scored by an independent observer to check agreement. Calculations for percent of agreement involved dividing the number of agreements by the number of disagreements times 100. The percent of agreement was 100%.

Rate-based measures. In addition to standardized tests, rate-based tests were used to compare academic gains between students. As in the Duvall et al. (1997) study, tests consisted of items derived from reading and math subtests of the Kaufman Test of Educational Achievement (Kaufman & Kaufman, 1985). These tests involved obtaining the rate of accurate responses. The same tests were administered during each assessment session. The tests were given once in January; twice during February, March, and April; and once in May for a total of 16 (8 reading and 8 math) probes per student.

The number of correct words read per minute (CWPM) and correct digits calculated (CDC) in 2 minutes served as dependent measures. For example, in reading, the experimenter instructed the student to read aloud starting with Item 1 in a list of 60 words. The words at the beginning of the list were relatively easy and became increasingly more difficult as the student read down the list. The experimenter tallied errors, counted the words read per minute, and charted the results. To obtain math scores, the students began with the first item and calculated digits for 2 minutes. During each test, students were encouraged to work as quickly as possible and were informed that skipping difficult items was permissible.

To verify the accuracy of these measures, all student probes (n = 64) were scored by a second observer and compared to the experimenter's results. Agreements for reading (n = 32) were 100%, and agreements for math (n = 32) ranged from 96.6% to 100% with a mean of 99.6%.

Social validation of academic change. To determine satisfaction with homeschooling at the end of the study, instructors and students responded to a standard set of questions about reading and math instruction. Each rated his or her agreement on a 5-point scale (1 = *Strongly Disagree* and 5 = *Strongly Agree*) with statements as they related to (a) how student gains in reading and math compared to those made by others in the same grade, (b) whether students received enough opportunities to do the things that were necessary to make substantial progress in these areas, and (c) whether students received adequate one-on-one reading and math assistance.

Results

Direct Observations

In the following section, the student, teacher, and ecological variables are reported. For each composite variable, the percentage of time first for homeschool students versus public school students is reported.

Student behavior. The first research question concerned student AET levels. As shown in Figure 1, the homeschool student of the first pair, compared to her public school counterpart, continually experienced more academic responding as evidenced by AET percentages that ranged from 25 to 55.7 (mean = 43.9) in contrast to a range of 10.5 to 38 (mean = 23.8). However, compared to AET levels measured during the first three observations, the AET demonstrated by the homeschool student generally declined during the last two whereas those of the public school student varied throughout.

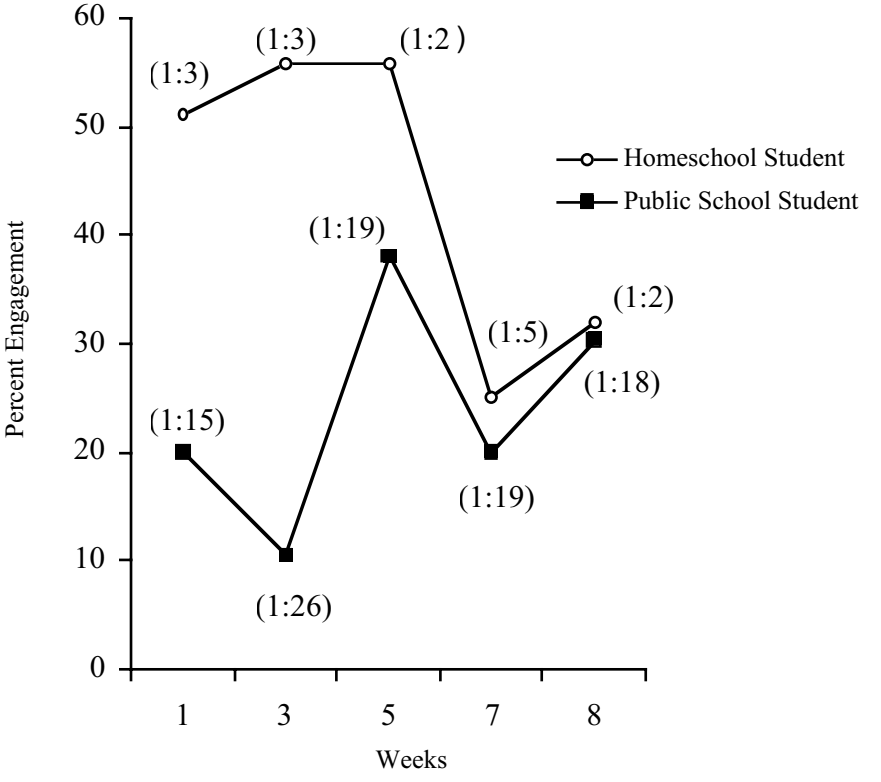
Figure 1 also demonstrates an inverse relationship between AET and student-teacher ratios. For example, during the first observa-

tion, the homeschool student demonstrated AET 51% of the time in an instructional setting in which the student-teacher ratio was 3-to-1. This was in contrast to the public school student's AET level of 20% involving a 15-to-1 ratio. Furthermore, this inverse relationship remained consistent as the weeks progressed.

As seen in Figure 2, observations involving the second pair yielded somewhat similar results as the homeschool student, compared to the public school student, continually displayed higher percentages of AET. This was evidenced by homeschool AET levels that ranged from 48.9 to 80.0 (mean = 59.1) compared to a range of 13.3 to 25.9 (mean = 20.4). Additionally, the AET experienced by the homeschool student varied throughout the semester, whereas that experienced by the public school student remained fairly stable. As with student Pair 1, observations of Pair 2 revealed that the homeschool student, in a setting with low student-teacher ratios, continually experienced higher AET than the public school student who was taught in larger groups.

When combining the results from both pairs, the composite AET, task management, and competing behavior percentages were 52.5 (homeschool) vs. 24.6 (public school), 27.9 vs. 30.1, and 34.0 vs. 52.6, respectively.

Table 3 indicates the values for individual student and teacher behaviors that were observed as well as the instructional variables of each learning environment. The values listed at the top of each category reflect findings that were consistent across pairs, first for homeschool students and then for general education students. The remaining values involve responses that occurred more often by a homeschool student of one pair but not the other. Accordingly, concerning academic engagement, the homeschool



Note. ( ) = Teacher-student ratio during observation

Figure 1. Active academic responding by Pair 1.

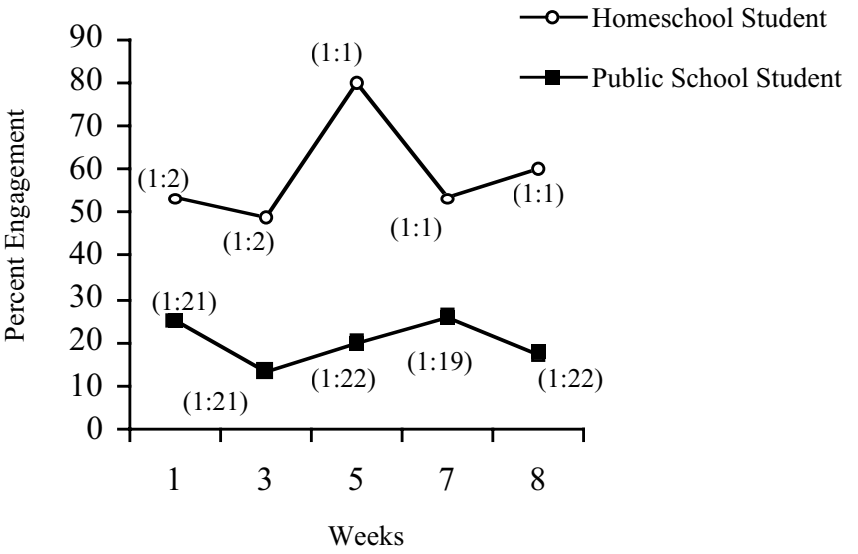
student in each pair engaged in more Writing and Talk Academic responses than his or her general education peer. A similar pattern of academic responding by public school students was not observed, so the remaining values indicate that more Reading Silent, Task Participation, and Reading Aloud responses were demonstrated by the homeschool student of one pair but not the other. Concerning task management behaviors, Table 3 indicates that the homeschool students engaged in more Talk Management and the public school students experienced more Moving. The remaining findings were inconsistent across pairs. Regarding competing behaviors, it can be seen that the homeschool students experienced more Self-Abuse and the public school students more Looking Around.

Teacher behavior. The second question concerned the instructor's teaching behaviors. As can be seen in Table 3, the homeschool and public school instructors showed somewhat similar profiles. The homeschool instructors exhibited some teaching behaviors more frequently across pairs as did the public school instructors. However, the differences appeared small with the exception of more No Response behaviors by homeschool instructors and Talk Management and Talk Academic by public school teachers.

In addition to teacher behavior, EBASS includes codes for teacher focus and position. As seen in Table 3, the homeschool instructors consistently focused more on target students or no one and public school teachers on groups that included target students or other individuals. Concerning teacher position, homeschool teachers were more often located to the side of target students and outside of the room whereas public school instructors spent more time in front of or behind the students.

Instructional ecology. Another research question concerned the ecological and classroom instructional features of homeschools and how they compared to public schools. This involved determining the percentage of time for activities, tasks, physical arrangements, and instructional grouping.

Concerning activities, Table 3 indicates that the homeschool students were observed more often during math and transition activities and that public school students were more often observed during social studies. For tasks, homeschool instruction consistently involved more paper-and-



Note. ( ) = Teacher-student ratio during observation.

Figure 2. Active academic responding by Pair 2.

Table 3
Percent of EBASS Variables Relating to Student, Teacher, and Instructional Categories

	Pair 1			Pair 2		
	HS	PS	Discrepancy	HS	PS	Discrepancy
Student Behaviors						
Academic Engagement						
Writing	29.5	8.8	20.7	27.9	16.2	11.7
Academic Talk	7.4	0.4	7.0	9.0	0.6	8.4
Reading Silently	6.8	9.2	-2.4	11.1	2.2	8.9
Task Participation	1.1	7.5	-6.4	5.8	0.6	5.2
Reading Aloud	1.1	2.5	-1.4	5.3	0.0	5.3
Total AET	45.9	28.4	17.5	59.1	19.6	39.5
Task Management						
Talk About Management	3.2	2.9	0.3	3.7	0.0	3.7
Moving	0.5	6.7	-6.2	0.0	3.4	-3.4
Attention	14.7	19.3	-4.6	19.5	15.6	3.9
Manipulate Materials	10.5	5.9	4.6	3.2	3.9	-0.7
Raising Hand	0.5	0.4	0.1	0.0	0.0	0.0
Total Task Management	29.4	35.2	-5.8	26.4	22.9	3.5
Competing Behaviors						
Self-Abuse	0.5	0.4	0.1	0.5	0.0	0.5
Looking Around	14.7	22.6	-7.9	10.0	24.0	-14.0
Noncompliance	3.7	3.4	0.3	0.5	14.0	-13.5
Inappropriate Talk	6.8	2.9	3.9	2.1	7.3	-5.2
Self-Stimulation	11.6	15.1	-3.5	17.4	16.2	1.2
Disruptive	0.0	0.4	-0.4	0.0	0.0	0.0
Total Competing Behaviors	37.3	44.8	-7.5	30.5	61.5	-31.0
Teacher Behaviors						
No Response	26.3	8.8	17.5	7.9	6.2	1.7
Nonverbal Prompt	7.4	1.3	6.1	2.1	1.1	1.0
Question Academic	11.1	6.3	4.8	7.9	6.2	1.7
Talk Nonacademic	3.2	0.4	2.8	4.7	0.0	4.7
Command Academic	1.6	0.4	1.2	7.4	2.8	4.6
Command Discipline	1.6	0.0	1.6	0.5	0.0	0.5

(Table 3 continues)

(Table 3 continued)

	Pair 1			Pair 2		
	HS	PS	Discrepancy	HS	PS	Discrepancy
Talk Academic	9.0	17.6	-8.6	15.3	31.3	-16.0
Talk Management	7.4	21.8	-14.4	3.7	17.3	-13.6
Question Management	3.2	4.2	-1.0	1.1	2.8	-1.7
Read Aloud	2.6	4.2	-1.6	6.8	7.3	-0.5
Approval	1.6	1.7	-0.1	2.6	3.4	-0.8
Attention	22.6	30.0	-8.3	40.5	24.0	16.5
Disapproval	2.6	4.6	-2.0	2.6	1.1	1.5
Talk Discipline	0.5	2.1	-1.6	1.1	0.0	1.1
Command Management	3.7	1.7	2.0	1.1	1.1	0.0
Question Discipline	0.0	0.4	-0.4	0.0	0.0	0.0
Teacher Focus						
Target Student	37.4	11.3	26.1	53.7	5.6	48.1
Target Plus Others	14.2	39.3	-25.1	18.4	48.0	-29.6
Other	23.2	41.4	-18.2	21.1	41.9	-20.8
No One	25.3	7.1	18.2	6.8	4.5	2.3
Teacher Position						
Side	45.3	30.1	15.2	64.7	38.0	26.7
Out-of-Room	7.4	0.4	7.0	1.6	0.0	1.6
In Front	26.8	41.0	-14.2	18.4	39.7	-21.3
Behind	20.0	20.5	-0.5	13.7	20.7	-7.0
At Teacher's Desk	0.0	4.6	-4.6	0.0	0.0	0.0
Instructional						
Activity						
Math	31.6	12.6	19.0	96.8	82.7	14.1
Transition	4.2	3.4	0.8	3.2	0.6	2.6
Social Studies	0.0	10.5	-10.5	0.0	8.9	-8.9
Language	30.0	0.0	30.0	0.0	7.8	-7.8
Spelling	26.3	0.0	26.3	0.0	0.0	0.0
Handwriting	7.4	0.0	7.4	0.0	0.0	0.0
Science	0.0	41.0	-41.0	0.0	0.0	0.0
Reading	0.0	17.2	-17.2	0.0	0.0	0.0
Arts and Crafts	0.0	11.7	-11.7	0.0	0.0	0.0
Prevocational	0.0	3.4	-3.4	0.0	0.0	0.0

(Table 3 continues)

(Table 3 continued)

	Pair 1			Pair 2		
	HS	PS	Discrepancy	HS	PS	Discrepancy
Other	0.5	0.0	0.5	0.0	0.0	0.0
Business Management	0.0	0.4	-0.4	0.0	0.0	0.0
Task						
Paper and Pencil	24.2	14.2	10.0	59.5	32.4	27.1
Discussion	11.6	1.7	9.9	13.2	2.2	11.0
Listen to Lecture	6.3	26.7	-20.4	8.4	26.3	-17.9
Worksheet	1.1	14.2	-13.1	0.0	8.4	-8.4
Fetch and Put Away	4.7	6.3	-1.6	1.6	8.9	-7.3
Readers	1.6	24.3	-22.7	1.6	0.0	1.6
Other Media	27.9	7.1	20.8	13.7	19.0	-5.3
No Task	2.6	0.8	1.8	2.1	2.8	-0.7
Workbooks	20.0	4.6	15.4	0.0	0.0	0.0
Physical Arrangement						
Individual	22.1	1.3	20.8	52.6	0.0	52.6
Entire Group	25.3	14.2	11.1	47.4	0.0	47.4
Divided Group	52.1	82.9	-30.8	0.0	100.0	-100.0
Instructional Grouping						
One-on-One	29.5	10.0	19.5	44.2	2.2	42.0
Independent	22.6	6.7	15.9	7.9	0.0	7.9
Whole Class	24.2	69.5	-45.3	46.3	92.2	-45.9
Small Group	0.0	9.2	-9.2	0.0	2.8	-2.8
No Instruction	0.0	0.4	-0.4	1.1	2.8	-1.7

pencil and discussion whereas public school instruction included more listen-to-lecture, worksheets, and fetch-and-put-away behaviors.

Concerning physical arrangements, it can be seen in Table 3 that homeschool students were taught more in individual and entire group arrangements whereas public school students were often instructed when part of divided groups. Finally, for instructional grouping, students taught at home were observed in one-and-one and independent groupings whereas students in public schools experienced more whole class, small group, and no instruction arrangements.

Academic Gains

Standardized and rate-based test scores were used to determine student growth in the areas of reading and math. In the following, we report the achievement gains for homeschool students first and follow with those for the public school students.

Woodcock-Johnson—Revised gains. The WJ-R standard score gains for Pair 1 were 11.0 versus 2.0 (Reading) and 2.0 versus 3.0 (Math). Concerning Pair 2, the gains were 13.0 versus 2.0 (Reading) and 2.0 versus -6.0 (Math).

Rate-based gains. In addition to standardized tests, rate-based measures were obtained as an indication of student progress. Concerning Pair 1, it can be seen in Figure 3 that, across time, the homeschool student experienced gains from 36 to 46 CWPM in reading and from 24 to 27 CDC in math. The public school student demonstrated an increase from 43 to 51 CWPM in reading but her math score remained unchanged at 29 CDC. Concerning slope, the homeschool student's biweekly correct scores increased by 1.55 and .51 in reading and math, respectively. By comparison, the public school student made reading and math gains of 1.69 and -.05.

Concerning Pair 2, Figure 4 shows that the homeschool student experienced an increase in reading (from 44 to 57 CWPM), but a decrease from 30 to 25 CDC in math. In contrast, the public school student demonstrated an increase in both reading (from 39 to 41 CWPM) and math (from 45 to 52 CDC). Regarding slope, the homeschool student's biweekly correct scores increased by 1.75 and -0.51 in reading and math, respectively. In comparison, the public school student made reading and math gains of 0.7 and 1.06.

Social Validation of Academic Change

Another purpose of the study was to determine student and parent satisfaction with homeschooling. As can be seen in Table 4, student and instructor ratings (i.e., on a 5-point scale with 1 as *Strongly Disagree* and 5 as *Strongly Agree*) for Pair 1, listing homeschool responses first followed with those made by the public school participant. Satisfaction data for Pair 2 are then similarly reported.

As seen in Table 4, the homeschool student in Pair 1 reported equal or lower satisfaction ratings than her public school peer as they related to issues surrounding achievement and instruction. However, concerning these same issues, the satisfaction ratings by the students in Pair 2 yielded no pattern. Similarly, when asked about the students' progress, no pattern emerged in the responses given by the the instructors in Pair 1, but the homeschool instructor in Pair 2 reported generally lower satisfaction ratings as they related to her child's achievement and instructional experience at home.

Discussion

The measures of classroom ecology and achievement generally showed that two homeschools, when compared to two public school classrooms, provided equal, if not better, instructional environments for two children with ADHD by providing higher levels of academic responding. These outcomes are consistent with the "opportunity-to-respond" para-

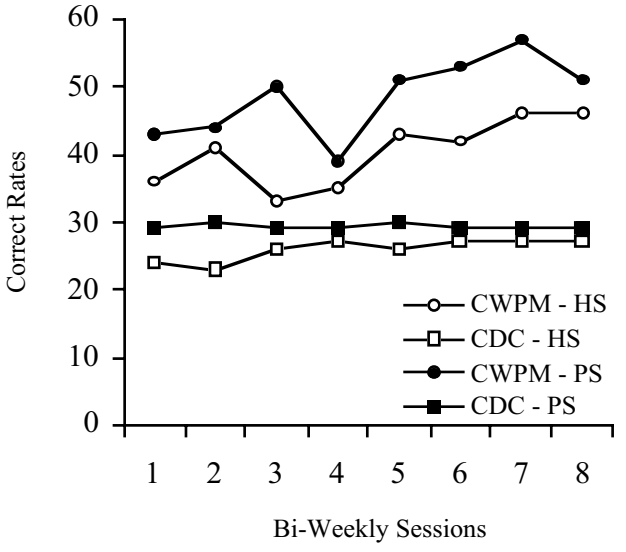


Figure 3. Rate-based gains across sessions by Pair 1.

digm developed at Juniper Gardens Children's Project (e.g., Duvall et al., 1992; Duvall et al., 1997; Greenwood et al., 1984; Greenwood, Delquadri, & Hall, 1989), which indicates that children make larger gains when they spend more time making active academic responses. The results of the present study indicate that, in a situation in which the student-teacher ratio was 10 times lower in homeschools than in public school classrooms, the 2 children in the homeschools generally experienced higher AETs than those in public schools.

During observations, the target children in homeschools received more individualized instruction than students in public schools. For example, EBASS data indicated that five-and-a-half times as much one-on-one instruction was observed in homeschool versus public school settings (i.e., 36.8% vs. 6.7%). This may have been related to homeschool instructional environments having AET levels that were 2.1 times greater than those observed in the public school classrooms, which primarily involved whole class instruction. If so, this finding was consistent with other studies that reported a strong relationship between increased AET and smaller instructional groups (e.g., Duvall, 1997; Greenwood et al., 1989). Furthermore, higher AET in homeschools resulted in less competing behaviors (e.g., inappropriate talk and looking around) that are characteristic of children with ADHD. As analysis of the teacher behaviors showed, public school teachers spent more time dealing with management issues. As was shown, "talk management" by the teachers was very different in the two settings: about 5% for the homeschool parents as compared to over 20% for the public school teachers.

In general, the 2 homeschool students made achievement gains greater than or equal to those experienced by the 2 public school students. For example, the homeschool students made more gains in three of four comparisons on both standardized test scores and rate-based measures. However, a slope analysis of the rate gains indicated that the homeschooled students made more gains in only two of four comparisons. Even so, because the design of the current study used only two children in each schooling condition, generalizing the results to other settings should be done with caution.

An important purpose of the study was to determine whether two parents, who were not certified teachers, could effectively teach

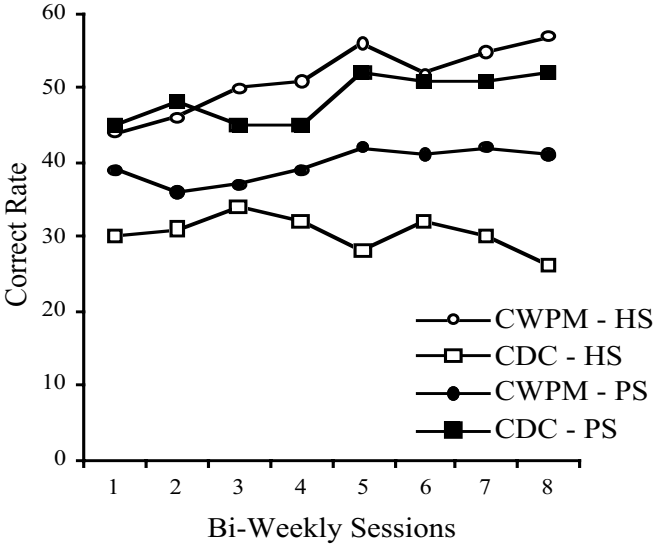


Figure 4. Rate-based gains across sessions by Pair 2.

Table 4
Social Validation Responses by Students and Instructors

	Pair 1		Pair 2	
	HS	PS	HS	PS
Student Response				
Good reading progress relative to peers	3	4	4	3
Good math progress relative to peers	3	4	2	4
Adequate opportunities to make reading gains	3	5	4	4
Adequate opportunities to make math gains	3	5	3	4
Adequate one-on-one opportunities in reading	4	4	4	4
Adequate one-on-one opportunities in math	4	4	5	3
Instructor Response				
Good reading progress relative to peers	3	2	4	1
Good math progress relative to peers	3	2	1	3
Adequate opportunities to make reading gains	4	4	4	5
Adequate opportunities to make math gains	3	4	2	5
Adequate one-on-one opportunities in reading	2	4	2	5
Adequate one-on-one opportunities in math	3	4	2	5

students with ADHD. Some important similarities and differences were discovered between the homeschool and public school instructors. Concerning similarities, we found that teaching behaviors in the homeschools were quite similar to those displayed by public school personnel, a finding that was also documented by Duvall et al. (1997). For example, both demonstrated roughly equivalent levels of attention, academic questioning, and approval. Regarding differences, the parents created instructional settings that generally yielded more AET than those run by public school teachers. This may have been due to the homeschool instructors teaching fewer children, positioning themselves more often beside target students, and providing more one-on-one instructional grouping than the public school instructors.

The results showed that the parents, although not trained to use methods such as direct instruction (Becker, 1977) or mastery learning (Stallings & Stipek, 1986), engaged their students at higher levels of academic responding than the public school instructors achieved with their students. However, instead of using classwide and whole-class management techniques (e.g., classwide peer tutoring) to engage students, the parents accomplished this goal by having only a few students participate in instructional groups. Having few students to engage in the lesson seemed to nullify the need for parents to be knowledgeable of procedures that increase students' academic responding. Consequently, as in the Duvall et al. (1997) study, the low student-teacher ratio in homeschools, and not specialized training, apparently enabled the parents to create effective instructional environments.

Overall, homeschool students, when compared to public school students, expressed

less satisfaction toward their academic progress and in the way they were taught. Among instructors, the parents believed that they were more effective at helping students to improve their skills but expressed less confidence in the way they taught them. However, the results were not consistent across pairs. Even so, it was interesting that the parents in this study expressed less satisfaction than the parents who taught students with LD at home in the Duvall et al. (1997) study. This may indicate that teaching students with ADHD at home is less satisfactory to parents than teaching students with LD, but the low sample sizes and lack of comparative data preclude any conclusion. Studies with higher participant numbers may shed more light on the issue.

To date, researchers have shown that increasing AET improves the academic performance of students who, for example, have learning disabilities (e.g., Delquadri et al., 1986; Duvall et al., 1992; Duvall et al., 1997; Greenwood et al., 1984), emotional disturbances (e.g., Ysseldyke, Thurlow, Christenson, & McVicar, 1988), and mental handicaps (e.g., Ysseldyke, Thurlow, Christenson, & Muyskens, 1991). The current study showed that AET is likely an important consideration for homeschooling students with ADHD.

An interesting implication of the current project was that EBASS, which was developed for observation and quantification of classroom instructional arrangements, teacher and student behaviors, and academic engagement, was easily modified in order to acquire the same data and observe the same variables in homeschools. Because it required only minor adjustments in 2 of the 13 EBASS categories, it was not necessary to rewrite the EBASS software. In the MS-CISSAR taxonomy, EBASS requires observers to code the setting in which instruction is observed. In public schools, the setting options are "regular class," "self-contained special education classroom," "resource room," "Chapter I Lab," "library," etc. During home-based observations, we substituted the various home settings where instruction took place (i.e., "living room," "dining room," "kitchen," "basement classroom," and "bedroom," respectively). The only other issue involved was the "Teacher Definition" category in which the parent was always coded as the regular teacher. By doing so, we were able to achieve a 95% interrater agreement score that allowed comparison of composite scores and individual codes across home and school settings.

Based on the current study, it appears that homeschooling may have certain advantages over public schooling for some children with ADHD. However, the extent to which these results can be generalized across homeschool and public school settings is limited because of the preliminary nature of the study involving a small number of homeschools, the possibility that reactivity effects to researchers may have been stronger in homeschools, and the restricted scope of the behavioral observations. Our findings generally showed increased AET in the homeschool settings and suggested that this discrepancy may contribute to differences in academic performance because they were consistent with those observed in experimental school-based studies (e.g., Greenwood et al., 1984; Greenwood et al., 1989; Hall et al., 1982). Even so, school psychologists should not presume that all homeschools are typically as effective as those observed in this study. Prior to making these types of conclusions, it is necessary to study large numbers of students and homeschools within tightly controlled experimental designs. Homeschooling may be a legitimate alternative to traditional educational and schooling practices, but further research is needed to ensure that professionals make databased decisions in response to homeschooling issues.

The incorporation of EBASS, standardized and rate-based achievement measures, and social validation measures in this study provided important methodological guidelines upon which to build future studies. As in this study, it will be necessary for future researchers to gauge learning outcomes and levels of academic engagement to gain an increased understanding of homeschool effectiveness. Ideally, the present methodology could yield many more conclusions if applied within an experimental study that involved a higher number of participants and instructional environments.

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Appendix

MS-CISSAR Codes

Student Responses

Academic Responses

1. Writing—marking academic task materials while holding a writing instrument in a manner likely to produce written numbers, letters, words, shapes, or forms
2. Task participation—motor or manipulative responses (e.g., key-boarding, coloring, pasting, cutting, using calculators, counting on fingers) involving an academic task
3. Reading aloud—looking at assigned materials and reading aloud what is written
4. Reading silently—looking at assigned materials for at least 2 seconds with eye movements that indicate that words, numbers, or letters are being read
5. Academic talk—talk about academic subjects/materials, teacher instructions, or other topics that involve the academic curriculum, or asking/answering academic questions

Task Management Responses

1. Attention—student directly looks at a teacher or peer who may be asking or answering questions or otherwise teaching the student
2. Manipulate materials—looking for, using or handling curriculum materials
3. Talking about management issues—conversation with a peer about the activity or task such as inquiries about the page of assigned tasks
4. Moving—walking/running to a new station in the classroom during transition or when seeking help or materials away from desk
5. Hand-raising—hand in air requesting teacher assistance

Competing Responses

1. Self-stimulation—active and repetitive sensory-motor behaviors
2. Looking around—looking away from academic tasks
3. Inappropriate talk—talking to a peer or teacher about nonacademic or nontask management issues
4. Non-compliance—not complying with teacher directives or classroom rules
5. Self-abuse—biting, slapping, hitting, or pinching oneself

6. Disruptive—producing noise levels or behaviors loud enough to attract the attention of peers or the teacher

Teacher Events

Teacher Behavior

1. Attention—looking at or paying attention to students
2. Talk academic—discussing academic topics and materials with students
3. Question academic—asking questions related to the curriculum
4. Talk management—talking to students about events that precede student academic responding
5. Read aloud—reading aloud to or in concert with one or more students
6. Nonverbal prompt—using gestures or physical signals or physical guidance to cue student responses
7. Command academic—making a verbal statement intended to cue student responses
8. Talk nonacademic—verbal behavior that does not apply to academic, management, or discipline events or behaviors
9. Disapproval—expression of dislike, dismay, dissatisfaction, or disgust with student's classwork, appearance, or conduct
10. Command management—verbal statement cueing a management response
11. Question management—questions related to behaviors that precede academic instruction
12. Approval—expressing praise, appreciation, or satisfaction with student's classwork, appearance, or conduct
13. Command discipline—giving commands related to the content and form of social interactions, personal conduct, and school/classroom rules of behavior
14. Talk discipline—talking to students about the content or form of their social interactions, conduct, or school/class rules
15. Question discipline—asking questions about the content or form of social interactions, personal conduct, or school/class rules
16. No response—no observable response directed toward students

Teacher Focus

1. Focusing on target students—directing behavior on target student exclusively
2. Focusing on other individuals—directing behavior towards a student other than the target student
3. Focusing on groups that include target students—directing behavior toward the target student as well as peers
4. Focusing on no one—not directing behavior toward any student in the classroom

Teacher Position

1. Side—standing or sitting to the side of or directly next to the target student
2. Front—standing to the front of the target student
3. Behind—standing or sitting to the rear of the target student
4. Out-of-room—not located in the same room as the target student
5. At teacher's desk—seated at or standing near the teacher's desk

Instructional Ecology

Activities

1. Math—numerical concepts and operations
2. Spelling—teaching the spelling of words
3. Language—teaching speech, vocabulary, language structure, foreign language, sign language, communication skills, or creative writing
4. Handwriting—learning to write in print or cursive
5. Transition—a change in activity
6. Reading—translation of written letters into words, and the comprehension of words, phrases, sentences, and paragraphs
7. Science—physical, geological, or biological science subjects
8. Social studies—history, geography, economics, psychology, and anthropology
9. Arts and crafts—artistic techniques, expression, or appreciation
10. Business management—routine business of the day

11. Other—activities excluding those listed above

Tasks

1. Paper and pencil—copying letters or numbers onto paper
2. Other media—viewing films, filmstrips, overhead projector, flip charts, flashcards, blackboard, or listening to music
3. Discussion—verbal interaction between the teacher and students
4. Workbooks—paperback booklets that provide problems or tasks that can be solved directly on their pages
5. Listen to lecture—listening to teacher presentations
6. Fetch and put away—getting or putting away new materials or changing tasks
7. Readers—textbook in any subject area or fiction and nonfiction reading book
8. Worksheets—prepared sheets on which students are expected to read and then write their responses
9. No task—student not using any materials or engaged in any task

Physical Arrangements

1. Individual—target student situated away from all other students in the class
2. Entire group—target student located in the same general seating arrangements as all others in the classroom
3. Divided group—target student situated from all other students in class

Instructional Grouping

1. One-on-one—target student working alone with the teacher, aide, or peer tutor
2. Whole class—target student receiving same instruction as all other students
3. Independent—target student engaged in an activity and task that is self-determined and self-managed
4. Small group—target student receiving same instruction as at least one other student but not all students in the class
5. No instruction—when there is no task, and student is receiving no direct questions, commands, or talk from the teacher