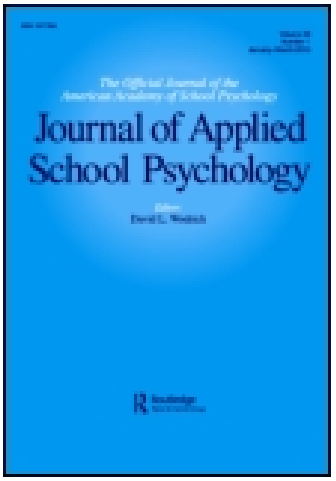

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Classroom Behavior of Participants with ADHD Compared with Peers: Influence of Teaching Format and Grade Level

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Classroom Behavior of Participants with ADHD Compared with Peers: Influence of Teaching Format and Grade Level

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*Few studies examine the classroom behavior of children with attention deficit hyperactivity disorder (ADHD) in comparison with classroom peers and which teaching formats best support classroom engagement. Observations (*N = *312) of second- and fourth-grade students with ADHD and their randomly selected classroom peers were conducted using a systematic classroom observation method. Linear regressions analyzed classroom behavior compared with peers and effects of teaching format, grade, and treatment status on classroom behavior. Children with ADHD displayed lower engagement (*p < *.001) and higher inattention (*p < *.001) during teacher-led instruction compared with other teaching formats, and lower engagement in fourth grade than in second grade (*p < *.05). Despite treatment plans, children with ADHD present with increased classroom behavior challenges. Adapting teaching formats to benefit children with ADHD should be considered.*

KEYWORDS ADHD, classroom behavior, teaching format, classroom observation, academic achievement

According to the Centers for Disease Control and Prevention, 9.5% of children between 4 and 17 years old have attention deficit hyperactivity disorder (Blumberg et al., 2012; Visser, Bitsko, Danielson, Perou, & Blumberg, 2010). Children with ADHD are at risk for associated deficits in working memory, processing information, developing strategies, and organizing and executing tasks (Barkley, 1997; Clark, Prior, & Kinsella, 2000). Adaptation to the school

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setting is often challenging for children with ADHD because of behavioral issues, such as physical and verbal aggression, seeking attention from the teacher, out-of-chair time, and noncompliance (Vile Junod, DuPaul, Jitendra, Volpe, & Cleary, 2006). Detrimental academic effects of ADHD are evident early in elementary school. Although 44% of children with ADHD also present with a learning disability (Pastor & Reuben, 2008), it is not necessary for a child with ADHD to present with a learning disability to lose academic ground. Children with ADHD fail to achieve the academic level predicted by their age or IQ even after controlling for comorbid learning disabilities (Barry, Lyman, & Klinger, 2002; Marshall, Hynd, Handwerk, & Hall, 1997).

Previous studies using classroom observations suggest that children with ADHD from ages 6 to 12 years are significantly less engaged in class than are their comparison peers (Imeraj et al., 2013; Kofler, Rapport, & Alderson, 2008; Vile Junod et al., 2006) and are at risk for dropping behind in reading skills in as early as first grade (Rabiner & Coie, 2000).

The effect of age of students with ADHD on classroom engagement is important, as negative effects of ADHD on academic functioning can be found in early grades. This leads to accumulated effects of ADHD throughout the course of the student's school career. As academic gaps accumulate each school year, there is an increased risk for school dropout as grades progress (Currie & Stabile, 2006). In later grades, adolescents with ADHD are at higher risk for teen pregnancy, criminal behavior, academic failure, and dropout (Harpin, 2005).

The complex intertwining of ADHD symptoms, executive functioning, and academic skills has led multiple experts in the field to recommend continued close academic and behavioral monitoring at school, along with proactive classroom interventions (DuPaul et al., 2004; Ferguson, 2000; Rapport, Scanlan, & Denney, 1999). Individualized behavioral classroom interventions to support students with ADHD have been consistently used over time. Common accommodations and modifications include preferential seating, repeating instructions for the student in short chunks, giving both visual and auditory cues, and incorporating physical movement time if needed into the daily schedule (Brock, 2002). However, even with these classroom supports, children with ADHD are still considerably less engaged and more off-task than are their peers, ultimately leading to negative academic outcomes.

The literature supports several categories of instructional strategies that aim to support all student learning including students with ADHD. These include identifying similarities and differences, summarizing and note taking, reinforcing effort and providing recognition, homework and practice, nonlinguistic representations, cooperative learning, setting objectives and providing feedback, generating and testing hypotheses, and questions, cue and

advance organizers (Marzano, Pickering, & Pollock, 2001). Little research, however, analyzes the effects of changing general classroom environment (e.g., decreasing distracters such as placing computers at the back of the classroom, scheduling academic subjects at the beginning of the day) and teaching style (e.g., visual and auditory instruction simultaneously) on the engagement and achievement of the classrooms as a whole. Furthermore, there is a lack of information on how different teaching formats (e.g., teacher-led instruction versus small groups) might affect classroom engagement (Greenwood, Horton, & Utley, 2002; Vile Junod et al., 2006).

Evaluating students with ADHD in the classroom setting through direct observation can be challenging. In the literature, direct observations are dichotomized into *naturalistic observations* with anecdotal descriptions and *systematic observations* with interval coding. Standardization and psychometric testing of the observation tool cannot be done with naturalistic observations (Hintze & Matthews, 2004; Hintze, Volpe, & Shapiro, 2002). Systematic classroom observations, however, use an interval recording system, provide quantitative data, and have reliability standards. Research studies using systematic classroom observations have been helpful in supporting our understanding of how students with ADHD behave in the classroom setting. However, frequently practitioners might conduct one observation in order to interpret a student's behavioral profile and overlook the amount of observation time needed to assess the behavior of one child. Hintze (2005) stated that the total observation time to reliably estimate a child's behavior can range from two to three 15-min observations to 5 hr of observation. A meta-analysis reviewing studies using systematic classroom observations found that children with ADHD were consistently less visually on task than were their classroom peers (Kofler, Rapport, and Alderson 2008). Imeraj and colleagues (2013) found that despite higher levels of supervision by the teacher, children with ADHD were more off-task during individual schoolwork and whole-class group teaching but not during small group work. They also showed significantly lower on-task time spans than did their fellow classroom peers.

In the present study, we compared the behavior of elementary school children with ADHD to their classroom peers using rigorous systematic classroom observations. We hypothesized that participants with ADHD would be less engaged and more off-task than would their classroom peers. In addition, we hypothesized that teaching format would have an effect on the classroom behavior of children with ADHD, but not on their comparison peers. Last, we hypothesized that engagement and off-task behaviors of children with ADHD would be more severe in grade 4 compared with grade 2, while grade would have no effect on comparison peers.

METHOD

Participants

This study was conducted in 19 public elementary schools in two school districts in the Greater Boston area. Participants were eligible if they met the following criteria: (a) clinical diagnosis of ADHD made by the child's clinician and (b) a child in second or fourth grade. Exclusion criteria included (a) a coexisting diagnosis of conduct disorder, autism spectrum disorder, or other serious mental illness; and (b) an IQ of less than 80. Participants' ADHD diagnosis was submitted in written format by the child's clinician and was confirmed by the Conners 3-Parent Report, where 95% of participants scored in the clinical range with *t* scores of 65 or greater on the *DSM-IV* ADHD Inattentive and/or *DSM-IV* ADHD Hyperactive/Impulsive subscales. Five participants' ADHD diagnosis was not confirmed using this method. Peers were randomly selected for observation in the same classroom as study participants. In each participant observation, 12 classroom peers were also observed (see the "Study Design" section). Because the classroom peers were not active participants of the study, no background information was collected on them. They do, however, represent a community sample of students who may or may not have ADHD. These data were collected as a component of a larger trial investigating the efficacy of two computer attention training systems for children with ADHD (Steiner, Frenette, Rene, Brennan, & Perrin, 2014), which was supported and approved by the authors' institutional review board as well as the respective participating school districts before data collection.

Study Design

Observations were conducted using the Behavioral Observation of Students in Schools (BOSS), which is a systematic observation system for coding classroom behavior that has been found to be reliable between observers (Shapiro, 2004; Volpe, DiPerna, Hintze, & Shapiro, 2005). The BOSS has shown to both differentiate between children with ADHD and their typically developing peers and to be sensitive to treatment effects (Clark et al., 2000; Shapiro, 2004). Observed behaviors are coded over sixty 15-s intervals in the following classroom behavior categories: both passive and active on-task behaviors (hereafter, *engagement*), motor or verbal off-task behaviors (hereafter, *off-task-MV*), or passive off-task behaviors (hereafter, *inattention*).

At every fifth observation interval, the behavior of a randomly selected classroom peer is coded following the identical coding criteria as for the target participants. For example, after coding the participant's behavior for four consecutive intervals, a peer is coded for one interval, after which the pattern repeats with a different peer, rotating around the classroom in a

systematic way. The order of classroom peers to be observed every fifth interval was determined at random before beginning each observation. Over the course of the full 15-min observation, 48 intervals are of the participant and 12 intervals are of classroom peers.

Examples of engagement are looking at the teacher during presentation of material or actively engaged on the assigned worksheet at their desk during independent seatwork. Examples of off-task-MV are speaking to a classmate when they should be listening to the teacher or getting out of chair. An example of how inattention is coded for is staring off for more than 3 s as opposed to attending to the task at hand like filling in a worksheet. Engagement is scored at the beginning of each 15-s interval; this is called *momentary time sampling*. During the remainder of each 15-s interval, off-task-MV and inattention are recorded if the event occurs within that interval; this is called *partial-interval method*. All of these examples pertain to both participants and their randomly selected peers.

Four different teaching formats are also coded for, namely, teacher-led classroom instruction, small group work, supervised independent seatwork, and unsupervised independent seatwork when the teacher is in a separate small group. For the present study, teacher format was dichotomized into teacher-led classroom instruction, where the teacher was instructing the classroom as a whole, and other instruction, where the teacher was not instructing the classroom as a whole. This systematic observation system enables the comparison of the study participant with ADHD to classroom peers and the effect of teaching format on classroom behavior categories.

In the present study, three 15-min observations of each study participant were conducted. Research assistants (RAs) were trained using a systematic detailed protocol including use of a practice video and practice classroom observations before conducting the actual study observations in the schools in order to reach a high interrater reliability ($\kappa > .80$; Steiner et al., 2013). Interrater reliability is measured by two statistics, percent agreement and the more robust kappa statistic (which takes into account percent agreement). The formula for the kappa statistic is as follows:

$$\mathrm{Po} - \mathrm{Pc}/1 - \mathrm{Pc},$$

where *Po* represents the proportion of agreements between observers on occurrences and nonoccurrences, and *Pc* represents the proportion of expected agreements based on chance (Hintze, 2005).

Actual study observations occurred over 2 days during different academic subjects, either English language arts/social studies or math/science and during different teaching formats. Participants and peers did not know that they were being observed. Throughout the observation period, one third of the observations were conducted by two RAs simultaneously to both measure and assure continued high interrater reliability. Baseline questionnaires

TABLE 1 Participant Demographics

Variable (n = 104)	n (%) or M (SD)
Male	70 (67.3%)
Child's race[a]	
White	76 (74.5%)
Black or African American	7 (6.9%)
Asian	19 (18.6%)
Age at baseline	9.1 (1.1)
Age at ADHD diagnosis	7.4 (1.1)
Fourth grade	71 (68.3%)
Suburban school	76 (73.1%)
Families speaking English only	87 (83.7%)
IQ composite	110.4 (12.7)
Achievement composite	104.0 (14.3)

Note. ADHD = attention deficit hyperactivity disorder.
[a]Not all parents of participants answered each demographic question.

for study participants were filled out by parents and included information about past or current ADHD support treatments including ADHD medication, counseling (one-on-one/group therapy), and/or Individualized Education Program (IEP) services.

Statistical Analyses

Analyses were conducted using Stata 12.0. Descriptive statistics for participant demographic variables and treatment status were calculated. Separate linear mixed regression models were used to test for differences in engagement, off-task-MV, and inattentive behaviors with respect to the following independent variables: ADHD status, teaching format (teacher-led classroom instruction vs. other instruction), grade level, and treatment status. Independent variables that displayed significant bivariate relations were then included in further multivariate models that included main effects and interactions. One multivariate model was analyzed for each classroom behavior category. Mixed models (also known as multilevel or hierarchical models) were chosen to account for the fact that there were multiple observations for each child.

RESULTS

Research assistants maintained high interrater reliability on observations throughout the study (κ = .86). The study sample consisted of 312 observations of 104 participants (see Table 1 for participant demographics) and their randomly selected peers. Each observation consists of 15 min with 48 intervals of the participant and 12 intervals of classroom peers. This amounts

TABLE 2 Participant ADHD Treatments

Treatment type (n = 104)	n (%)
On Individualized Education Program	52 (50.0)
Counseling (e.g., one-on-one, group therapy)	24 (23.1)
Medication	
ADHD medication[a]	49 (47.1)
Stimulant medication	45 (43.3)
Atomoxetine	3 (2.9)
Antihypertensive	4 (3.8)
Other psychotropic medications[b]	2 (1.9)

Note. ADHD = attention deficit hyperactivity disorder.
[a]Some students were on polypsychotropic treatments so subtypes do not sum to the total.
[b]The only non-ADHD psychotropic medications listed by parents of these children were selective serotonin reuptake inhibitors, and the children were not taking any additional medication in conjunction.

to a total of 14,976 intervals coded for participants and 3,744 intervals coded for peers. Forty-nine of the study participants were receiving medication for ADHD (see Table 2 for participant ADHD treatments).

Teacher-led classroom instruction was the most frequently observed teaching format (45% of the time). Other classroom instruction represented small group work 11% of the time, supervised independent seatwork 37% of the time, and unsupervised independent seatwork when the teacher is in a separate small group 7% of the time. Participants were engaged with classroom activities 74.6% of the time, while classroom peers were engaged with classroom activities 83.9% of the time. Furthermore, participants were motor or verbally off-task 25.8% of the time and inattentive 7.5% of the time, while classroom peers were motor or verbally off-task only 14.7% of the time and inattentive 4.6% of the time (see Table 3 for percentages and standard errors of study variables). Relative risks reflect that off-task and inattentive behavior was observed 114%–196% more often for participants than for peers, while engagement with classroom activities was observed 85%–94% less for participants than for peers (see Table 3 for more details).

Initial linear regression models revealed significant associations between classroom behavior categories and three independent variables: ADHD status, grade level, and teaching format. No effect of treatment status on the three classroom behavior categories was found. Multivariate models for each classroom behavior category therefore included ADHD status, grade level, and teaching format. Figure 1 presents adjusted means from the engagement classroom behavior regression model. No three-way interactions were significant.

When comparing participants with ADHD to their peers across behavioral categories, participants displayed lower levels of engagement, $t(103) =$

TABLE 3 Percentage of Time Engaged, Off-Task-MV, or Inattentive Behavior by ADHD Status, Grade Level, and Teaching Format

			Engagement	Off-task MV	Inattentive
	Grade level	Teaching format	*M* (*SE*)	*M* (*SE*)	*M* (*SE*)
Participant	Second				
		Teacher led	75.94(2.50)	23.85(2.87)	7.90(1.30)
		Other[a]	81.63(2.44)	24.24(2.81)	4.04(1.27)
	Fourth				
		Teacher led	69.00(1.63)	30.26(1.88)	10.10(0.84)
		Other	77.11(1.76)	22.19(2.01)	6.03(0.92)
	Total				
		Teacher led	72.47(2.07)	27.06(2.37)	7.92(1.07)
		Other	79.37(2.10)	23.22(2.41)	6.51(1.10)
Peer	Second				
		Teacher led	85.79(2.50)	11.57(2.87)	4.39(1.30)
		Other	83.47(2.44)	16.40(2.81)	4.70(1.27)
	Fourth				
		Teacher led	82.28(1.63)	16.32(1.88)	4.26(0.84)
		Other	85.22(1.76)	13.27(2.01)	5.57(0.92)
	Total				
		Teacher led	84.04(2.07)	13.95(2.37)	4.33(1.07)
		Other	84.34(2.10)	14.83(2.41)	5.13(1.10)
Relative risk[b]	Second				
		Teacher led	0.91	1.75	1.57
		Other	0.94	1.71	1.14
	Fourth				
		Teacher led	0.85	1.62	1.96
		Other	0.89	1.74	1.50
	Total				
		Teacher led	0.88	1.77	1.77
		Other	0.92	1.72	1.72

Note. ADHD = attention deficit hyperactivity disorder.
[a] Other is a mean of small group work, supervised independent seatwork, and unsupervised independent seatwork when the teacher is in a separate small group teaching formats.
[b] Relative risk = % of participants/% of peers.

–8.60, $p < .001$, and higher levels of off-task-MV behavior, $t(103) = 7.89$, $p < .001$, regardless of grade or teaching format.

Significant interactions between ADHD status and teaching format were identified for engagement ($p < .01$) and inattention ($p < .001$) but not for off-task-MV ($p = .08$). In teacher-led classroom instruction, participants with ADHD displayed lower levels of engagement ($p < .001$) and higher levels of inattention ($p < .001$). However, no differences in engagement or inattention were identified in other classroom instruction formats.

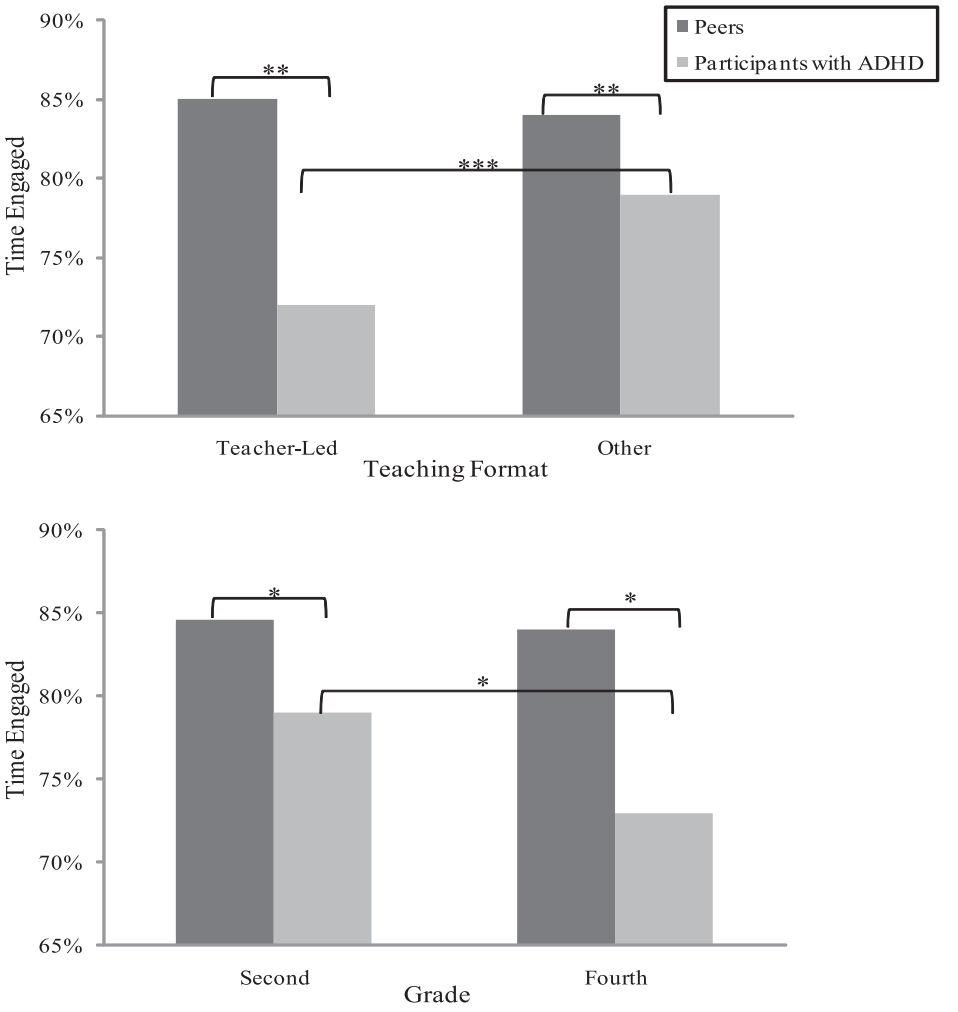

FIGURE 1 Engaged classroom behavior, by ADHD status, teaching format, and grade. ADHD = attention deficit hyperactivity disorder. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Last, a significant interaction between ADHD status and grade level was identified for engagement ($p < .05$). Participants displayed lower levels of engagement in fourth grade than in second grade ($p < .05$), whereas no differences in engagement with respect to grade were identified for peers.

DISCUSSION

For participants with ADHD, risks for academic delays are evident early in elementary school. Our results are consistent with previous studies

(Vile Junod et al., 2006) that have found students with ADHD have significant difficulty fulfilling behavior expectations in the classroom, as motor or verbal off-task behaviors were observed approximately twice as much as their peers. Regardless of treatment type (ADHD medication, counseling, or IEP) classroom behavior means were similar between participants with ADHD, showing no clear benefit of any specific approach. Furthermore, classroom engagement was lower during teacher-led classroom instruction and lower in fourth grade compared with second grade. In contrast, the behavior of classroom peers was not found to vary by teaching format or grade. These observational findings suggest that students with ADHD are more sensitive to the type of teaching format. Because this is a cross-sectional observed effect of students in their natural classroom environment and there is no experimental shift in teaching conditions, other variables not accounted for might also influence outcomes such as classroom environment. Nevertheless, differences between second- and fourth-grade students were observed and might represent an increase of difficulties over time. Modifications to teaching format may benefit the substantial proportion of students with ADHD who are having a hard time engaging and staying on-task in the classroom.

Strengths of this study include use of a highly reliable, systematic observational system for assessing classroom behavior. The BOSS was an appropriate choice for the direct behavioral observations for this investigation as it utilizes a systematic observation method as opposed to a naturalistic observation method; therefore, it requires quantitative data and that can help reduce biases. Furthermore, this approach allowed for researchers to achieve high reliability between observers. Classroom peers were not selected based on background information, making them a true community sample. It is very likely that some of the peer children observed also had ADHD or other mental disorders that could affect their classroom behavior, yet our results still showed that participants with ADHD were significantly more off-task than were their peers.

Limitations of this study include that RAs were aware that participants had ADHD, which could lead to expectancy effects, such that RAs would expect the participants to be more off-task than their peers. However, the RAs were unaware whether the peers had ADHD or other mental health disorders that might affect classroom behavior. Also, the 45 min of total observation time may not be considered sufficient time to capture a full representation of the behaviors of every student, however observations were conducted over multiple days, and in both English language arts/social studies and math/science subjects with the goal of collecting a comprehensive picture of each student. Furthermore, participants were observed for more intervals than were their classroom peers because this is how the BOSS is conducted. However, this imbalance was accounted for in the analysis.

Implications for Practice

We found that children with ADHD are more off-task and less engaged in teacher-led large group classroom settings, in which they have less opportunity to actively engage, as opposed to group work or independent seatwork settings, where they can be actively engaged in work either with peers or on their own. Research shows that an increased opportunity for students to respond to classroom activities highly correlates with increased academic achievement (DiPerna, Volpe, & Elliott, 2002). Therefore, decreasing teacher-led classroom instruction time, while increasing small group work time and other research-based strategies, such as Classwide Peer Tutoring, could be considered to support students with ADHD. Classwide Peer Tutoring is a collaborative teaching approach where peers in the classroom support the learning of their other peers (Kamps et al., 2008). Furthermore, the Department of Education suggests the following strategies to support students with ADHD: reviewing previous lessons, setting learning expectations, stating materials needed, simplifying instructions, being predictable, using audiovisual materials, performing ongoing student evaluations, using oral and written directions, dividing work into smaller units, highlighting key points, and using assistive technology (Jackson, 2004).

Based on our results that show a progression of off-task behavior from second to fourth grade in students with ADHD, and the literature that associates weaker academic outcomes with students with ADHD, we suggest proactive academic surveillance and support for students with ADHD early on, before academic concerns develop. If future research continues to consolidate findings of academic discrepancies between children with and without ADHD, it will be important to investigate this type of preventative approach, along with experimental shifts in teaching conditions to support students with ADHD.

Last, we recommend that school psychologists train (Steiner et al., 2013) and carry out systematic classroom observations, coding for classroom setting/format, as we have found children with ADHD to be sensitive to different settings. Given that increased engagement is associated with higher academic achievement (Marks, 2000), this information could inform teachers how their students are engaged and which classroom format results in the highest level of engagement in their classroom. This may benefit not only the children with ADHD, but other students in the classroom as well.

Implications for Research

This study included a greater amount of observation time over more than 1 day compared with previous studies (Vile Junod et al., 2006), enabling the research team to collect a more complete data set representing participants

and classroom peers. This allowed for a more accurate analysis and a greater ability to generalize to the larger population of students with ADHD. Future research should address the possible effect time of day has on the engagement of students with ADHD in the classroom and should perhaps examine specific activities within the different teaching formats to gain a more precise picture of the activities teachers could plan in their classrooms to increase the engagement of children with ADHD. Furthermore, because the effect of medication treatment on academic success in students with ADHD is far from clear (Barnard-Brak & Brak, 2011), these studies will continue to assess alternative approaches to psychotropic medications that influence academic outcomes.

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