Using Self-Monitoring to Increase Attending to Task and Academic Accuracy in Children With Autism

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Abstract

This study was conducted to investigate the effectiveness of a self-monitoring procedure on increasing attending to task and academic accuracy in two elementary students with autism in their self-contained classroom. A multiple baseline across participants in two academic subject areas was used to assess the effectiveness of the intervention. Both students were taught to self-monitor in language arts and mathematics with measures of attending to task and academic accuracy being collected simultaneously. Results are interpreted to conclude that the self-monitoring procedure was effective for both students and resulted in immediate increases in attending to task and academic accuracy even though results in academic accuracy were variable. Social validity was documented by the increase in two behaviors relevant for student success (attending to task and academic accuracy) and greater student independence.

Keywords

autism, self-monitoring, attending to task, academic accuracy, elementary-aged

The ability to attend to tasks is a requisite skill for academic success in school. Of the many reasons that have been postulated for school failure, the inability to attend to task seems to be a major factor for students with and without special needs (Harris, Graham, Reid, McElroy, & Hamby, 1994; Licht, 1983). Inadequate attending skills are often characteristic of students with special needs and are generally correlated with their inability to be successful in the general education classroom (Harris, Danoff, Saddler, Frizzelle, & Graham, 2005; Platt, Harris, & Clements, 1980).

Efforts to increase attending skills have included strategies from the field of cognitive behavior modification. Among these, self-monitoring has been recommended as a means of actively involving students in the learning process (Agran et al., 2005; Ganz & Sigafos, 2005; Stahr, Cushing, Lane, & Fox, 2006; Sutherland & Snyder, 2007). Self-monitoring is defined as a procedure that requires students to systematically monitor their own behavior in order to assess whether or not a targeted behavior has occurred and then record the result in some manner (Koegel, Koegel, & Parks, 1995; Odom et al., 2003; O’Reilly, Lancioni, Gardiner, Tieman, & Lacy, 2002; Prater, Joy, Chilman, Temple, & Miller, 1991; Todd & Reid, 2006; Wilkinson, 2008).

While some researchers (Fuchs, Fuchs, Fernstrom, & Hohn, 1991; Wehmeyer, Agran, & Hughes, 2000) have found that teachers are unwilling or reluctant to teach self-monitoring procedures because they believe them to be too cumbersome to implement, they believe their students will not benefit, or they think that increases in time on task will not improve academic performance, Weber, Scheuermann, McCall, and Coleman (1993, p. 38) concluded that self-monitoring is a “viable behavior management technique in the public schools.”

Self-monitoring procedures have been found to be effective in increasing attention, academic productivity and accuracy, reading comprehension, and on-task behavior in students with learning disabilities and behavioral disorders (Clees, 1994; Maag, Reid, & DiGangi, 1993; Reid, 1996), moderate to severe intellectual disabilities (Agran et al., 2005), and varied mild disabilities (Hagaman & Reid, 2008; Lee, Wehmeyer, Palmer, Soukup, & Little, 2008;...
Stahr et al., 2006) while decreasing inappropriate and disruptive behavior (Weber et al., 1993). Self-monitoring is a process that can lead to self-regulated learning and can promote socially significant characteristics of competence and independence (Ganz & Sigafous, 2005; Levendoski & Cartledge, 2000; Stahr et al., 2006; Todd & Reid, 2006) and has been used with atypical learners to decrease direct teacher intervention and to improve academic performance (Agran et al., 2005). In addition, self-monitoring strategies can increase the maintenance of skills (Loftin, Odom, & Lantz; 2008) and generalize to untargeted behaviors (King-Sears, 1999). Self-monitoring has been shown to improve motivation in some students with disabilities (Malone & Mastropieri, 1992; McCarl, Svobodny, & Beare, 1991). Furthermore, teachers have found self-monitoring to be effective across academic subjects and settings, as well as unobtrusive and relatively easy to implement (Levendoski & Cartledge, 2000; Maag et al., 1993).

Two types of self-monitoring procedures commonly used are self-monitoring of attention and self-monitoring of performance (Harris et al., 2005; Reid, 1996; Reid & Harris, 1993). Self-monitoring of attention involves instructing students to record whether or not they are paying attention when they are cued. Researchers have demonstrated that this type of self-monitoring process can promote an increase in on-task behavior (Akande, 1997; DiGangi, Maag, & Rutherford, 1991). Self-monitoring of performance involves instructing students to self-assess some aspect of academic performance and to record the results. Researchers have documented corresponding improvements in academic performance using such a procedure (Dunlap & Dunlap, 1989; Harris et al., 2005).

Harris et al. (1994) conducted two separate studies examining self-monitoring of attention versus self-monitoring of performance in students with learning disabilities. The researchers concluded that self-monitoring interventions resulted in positive changes in academic performance and on-task behavior with the students. They suggested that when performance is the critical issue and students possess requisite abilities, self-monitoring of performance is preferable. For some students to experience significant improvement in academic performance, a combination of self-monitoring of performance and self-monitoring of attention may be required. DiGangi et al. (1991) demonstrated that self-graphing of self-monitored data further enhances students’ abilities to attend to task and raises levels of accuracy when compared to students who do not self-graph.

Although the majority of the research on self-monitoring has been conducted with students with Emotional Behavioral Disorders (EBD) and Learning Disabilities (LD) with average levels of intelligence, self-monitoring has been used with students who have other disabilities and with students without disabilities. Weber et al. (1993) conducted a review of 27 studies relating to self-monitoring with students with learning and behavior problems in public schools. They concluded that self-monitoring increased attention to task, positive classroom behaviors (e.g., task completion), and social skills while decreasing inappropriate classroom behaviors. Self-monitoring also generalized to other settings and tasks when the self-monitoring was faded.

Self-monitoring techniques have been used more frequently with children and adolescents with autism, and positive outcomes have been reported. In their meta-analysis, Lee, Simpson, and Shogren (2007) reported that most of the literature on self-management specific to students with autism has focused on enhancing socialization and improved behavioral responses. They concluded that researchers have “demonstrated the effectiveness of self-management methods scientifically” (p. 11). Self-monitoring has been shown to increase the social interactions of elementary-age children with mild to moderate autism (Koegel, Koegel, Hurley, & Frea, 1992; Shearer, Kohler, Buchan, & McCullough, 1996; Strain, Kohler, Storey, & Danko, 1994) with some generalization of behavioral improvement (Coyle & Cole, 2004; Koegel & Frea, 1993; Morrison, Kamps, Garcia, & Parker, 2001), including generalization to unrelated behaviors (Koegel & Koegel, 1990). Todd and Reid (2006) concluded that the “self-monitoring intervention is easy to design, portable, and simple to use making it a practical intervention for teachers” (p. 175).

The purpose of the present study was to examine the effectiveness of self-monitoring on increasing attending to task of two elementary students with autism. A secondary aim was to examine the effects of increased attending on academic accuracy. Three distinguishing features of this study were: (a) the participants in this study were identified as eligible for special education under the category of autism by state, district, and local criteria; (b) the participants had disparate IQ levels, one in the mild range and the other in the moderate range of functioning; and (c) the participants self-monitored newly acquired skills in both language arts and mathematics.

Method

Participants

The participants in this study were two males who were determined to be eligible for special education services under the category of autism by separate groups of qualified educational professionals participating on each student’s Individualized Education Program (IEP) team. Participants were selected from a self-contained class for students with autism in a public elementary school where the second
The participants in this study had been in the same classroom for 5 months and were accustomed to the routine. Academic performance was erratic, and participants frequently did not complete assignments without constant verbal prompting and teacher guidance. The class had six students across Grades 3, 4, and 5. The four students who did not participate in the study completed all assignments according to the normal routine; however, during study sessions they were instructed to direct all questions to the paraprofessional when she was not serving as a second observer.

The first participant, Tony, was 10 years 8 months of age with a measured IQ of 70 on the Stanford-Binet Intelligence Scale (Thorndike, Hagen, & Sattler, 1986). A fifth grader, Tony performed on the third-grade level in both language arts and mathematics on the Brigance Diagnostic Inventory of Early Development–Revised (Brigance, 1991), administered by the teacher at the beginning of the year. Tony was verbal and received speech and language services for impaired articulation, fluency, and voice impairment. When misunderstood, Tony became extremely frustrated as demonstrated by long bouts of crying and body rocking. The second participant, Graham, was 9 years 4 months of age with a measured IQ of 39 on the Stanford-Binet. A third grader, Graham tested at the first-grade level in both language arts and mathematics on the Brigance. Graham was overly active with a very short attention span. Graham was echolalic and received speech and language services for communication deficits in the areas of articulation, language, fluency, and voice impairments. The school psychologist evaluated both participants on the Childhood Autism Rating Scale (CARS; Schopler, Reichen, & Renner, 1988) and determined that both participants functioned within the mild to moderate range of autism with scores of 45 and 56, respectively, for Tony and Graham.

The participants in this study received all instruction in the self-contained class with the exception of music, art, and physical education. All teachers reported that the participants demonstrated high levels of off-task behavior and low levels of task completion on all assignments during independent practice activities. These behaviors were exhibited across all academic classroom settings, but particularly during language arts and mathematics since more time was allotted for independent practice in these two academic subject areas. Instruction centered on instructional objectives as written in each participant’s IEP.

During language arts, both participants received instruction on reading comprehension, vocabulary development, use of context clues, sequencing of events, and sentence completion at their individual ability levels. During mathematics, Tony worked on one-digit multiplication problems and Graham worked on subtraction without regrouping. Both participants used manipulative materials to facilitate concept development.

**Dependent Variables**

The two dependent variables were attending to task and academic accuracy. Attending to task during language arts was recorded when any of the following were observed: (a) reading aloud, (b) writing on language arts worksheet, (c) erasing a language arts answer, (d) following a teacher directive, or (e) asking or answering a task-related question. Attending to task during mathematics was recorded when any of the following were observed: (a) reading or writing on mathematics worksheet, (b) counting manipulatives, (c) erasing a mathematics answer, (d) following a teacher directive, or (e) asking or answering a task-related question.

Changes in academic accuracy were examined by the teacher via permanent products. Academic accuracy was defined as the number of items completed correctly divided by the number of items given multiplied by 100%. Tony’s assignments always consisted of 20 language arts questions and 20 mathematics questions. Graham’s assignments always consisted of 15 language arts questions and 15 mathematics questions.

Attending to task and academic accuracy were recorded, but only attending to task was self-monitored. Academic accuracy was determined by graded assignments in both language arts and math. Language arts and math assignments were determined by grade level, functioning level, student records, and IEP goals and objectives.

**Independent Variable**

During the independent work that followed academic instruction, participants were given a copy of a self-monitoring sheet created by the teacher. They were verbally given the definition of “attending to task” and were shown two pictures from Boardmaker© software (Mayer-Johnson, 1999) that depicted attending to task. Definitions were kept simple in order to help participants understand what was expected of them. Examples of instructions given to the participants were “write,” “count,” and “work.”
Under the pictures of “count” and “write” were four numbered “Attending to task” phrases. Each had a “yes” and a “no” next to the statement. During the first 20 min of independent work, the participants were cued four times. The first verbal cue, given at 5 min, was “attending to task—one.” After the cue, the participants circled “yes” on their self-monitoring forms if they were attending to task or “no” if they were not attending to task. The process was repeated 5 min later, but the verbal cue indicated the line number the participants should record (i.e., “attending to task—two”). For each self-monitoring session, the participants made a total of four circles, one every 5 min for a total of 20 min. Verbal cueing included calling the number for each self-monitoring period to assist students in marking the correct attending to task period during self-monitoring. To ensure that the participants were circling the accurate response at the 5-min intervals, one of the trained observers simultaneously recorded whether or not the participant was attending to see if it matched the participant’s self-monitoring sheet. These were compared to participants’ self-monitoring sheets for 20% of the sessions. Participant and observer agreement ranged from 80% to 100%, with a mean agreement of 90%.

Data Collection and Reliability

Three trained observers (the speech language pathologist, the autism paraprofessional, and the second author who was the teacher) collected attending-to-task data during instruction during language arts and mathematics. Guided practice sessions lasted 30 min and were followed by independent practice sessions that also lasted 30 min. Data on attending to task were collected during the first 20 min of the allotted 30 min independent practice time in language arts and mathematics sessions (40 min total/daily). To collect data on attending to task, the observers used a momentary time sampling procedure. Attending to task was scored “+” if at the end of a 10-s interval the participant was attending to task. Attending to task was scored “−” if at the end of the interval the participant was not attending to task. The large classroom clock was coded with green flags on 2, 4, 6, 8, 10, and 12 in order to coordinate timing of the 10-s observation intervals. The time sample data were converted to percentages for graphing levels of attending to task.

Accuracy data were recorded via a permanent product method. Participants’ papers were collected and scored at the end of each day by the teacher.

All observers participated in 1-hr training sessions after school using videotapes of the students. Training sessions continued until 100% agreement of occurrence was obtained regarding attending to task on 3 consecutive days of training. One of the observers collected data using the time sampling technique during each of the baseline and intervention sessions. During 20% of the total sessions, a second observer recorded data simultaneously and independently. Interobserver agreement ranged from 80% to 100%, with a mean of 90%.

Experimental Design

A multiple baseline across participants design was used in two academic subject areas to determine the effectiveness of self-monitoring as an intervention to increase attending to task and academic accuracy (Hersen & Barlow, 1976; Richards, Taylor, Ramasamy, & Richards, 1999). The experiment was implemented over two phases. A third phase, which may have demonstrated success over time, was not implemented due to summer break.

Procedure

After baseline data on attending and accuracy were collected for both participants in language arts and mathematics, the intervention was implemented with the first participant, Tony. The teacher gave Tony a self-monitoring sheet immediately preceding independent seatwork in each content area and pointed to the respective locations while asking him to write his name and date. The self-monitoring sheet was then placed to the side of the desk, and Tony was verbally prompted to start on his independent seat assignment while the teacher pointed to and touched the assignment sheet. When the teacher gave the verbal prompt of “attending to task—one,” Tony circled “yes” or “no” as the teacher pointed to the phrase “attending to task” for the first interval. Tony was told “good job” if he circled “yes” accurately. If he was not attending to task, the teacher made sure he circled “no” next to the corresponding number for that interval; no praise was given. The teacher then pointed back to the assignment sheet and asked Tony to get back to work.

After 3 consecutive days of attending to task for 70% or more of the intervals in language arts, the intervention was introduced to Graham in language arts and math. Both Tony and Graham were able to self-monitor independently when cued after 6 days.

Language arts and math instruction were provided in the morning with language arts starting at 8:20 a.m. and math starting at 9:30 a.m. No breaks were provided between instruction and independent seatwork, but there was a 10-min break between language arts and math.

Results

The daily measures of attending to task and level of accuracy across language arts and mathematics for both participants are presented in Figures 1 and 2. In Figure 1, the percentage of intervals of attending to task and percentage
correct on the task (accuracy) during baseline and self-monitoring conditions for Tony and Graham during language arts are presented. In Figure 2, the percentage of intervals of attending to task and percentage correct on the task (accuracy) levels during baseline and self-monitoring conditions for both participants during mathematics are presented.

Tony’s language arts baseline data indicated low levels of attending to task and low to average levels of accuracy. Attending to task percentages ranged from 24% to 43%, with a mean of 32%. Academic accuracy ranged from 50% to 95%, with a mean of 72%.

When self-monitoring was introduced in language arts, Tony’s percentage of attending to task increased to a mean of 86%, with a range of 75% to 97%. Accuracy also increased to a mean of 93%, with a range of 85% to 100%. Overall, Tony’s mean percentage of attending to task increased 169%, and his accuracy increased 29% when self-monitoring was introduced.

Graham’s baseline data during language arts also revealed a deficit in attending to task and academic accuracy. Percentage of attending to task during baseline ranged from 23% to 40%, with a mean of 32%. Academic accuracy ranged from 33% to 75%, with a mean of 51%.

When self-monitoring was introduced, attending to task and academic accuracy for Graham increased. Percentage of attending to task increased to a mean of 88%, a 175% increase. Self-monitoring was equally effective for Graham’s accuracy, resulting in a mean of 85%, which was an increase of 67% from baseline.

In Figure 2, the percentages of attending to task and academic accuracy during baseline and self-monitoring for Tony and Graham during mathematics are presented. Tony’s baseline data in mathematics indicated low levels of attending to task and academic accuracy. Percentage of attending to task ranged from 33% to 48%, with a mean of 38%. His accuracy ranged from 15% to 60%, with a mean of 46%.
When self-monitoring was introduced during mathematics, Tony’s level of attending to task and accuracy both increased. Attending to task increased to a mean of 69% with a range of 22% to 95%, for an increase of 50%. His accuracy increased to a mean of 90%, with a range of 83% to 98%, for an increase of 137%.

Graham’s baseline data in mathematics, like language arts, exhibited low attending to task but variable levels of accuracy. Attending to task behaviors ranged from 38% to 53%, with a mean of 43%. His accuracy ranged from 40% to 100%, with a mean of 60%.

When self-monitoring was introduced in mathematics, Graham’s percentage of attending to task increased immediately. Attending to task increased to a mean of 96%, with a range of 88% to 100%, for an increase of 123%. Academic accuracy ranged from 87% to 100%, with a mean of 97%, for an increase of 62%.

Even though Graham’s language arts data varied from session to session, visual inspection of these data indicate immediate increases in attending to task behaviors from baseline to self-monitoring during language arts and mathematics. When examining academic accuracy for Graham, there was an 18% overlap during language arts but no overlap during mathematics. Graham’s variability in accuracy in language arts may have been due to the number of skills (i.e., reading and writing) needed to master language arts when compared to math (counting). In attending to task, Tony showed an immediate increase during both language arts and mathematics but exhibited a 13% overlap overall in attending to task during mathematics. When examining accuracy level, Tony had immediate increases and no overlap during either language arts or mathematics.

Discussion

In this study, two elementary students with autism and disparate levels of intellectual functioning demonstrated their ability to self-monitor attending to task during language arts.
A limitation relates to the time required of the teacher to cue students to self-record (i.e., every 5 min). However, this could be overcome by creating prompt recordings for students for individual or group playback so students know when to mark their self-monitoring sheets. The teacher then would have more time to provide individualized instruction. Future researchers may want to explore the effects of varying the amount of time between prompts.

A final limitation of this study relates to the generalization of the findings. Due to autism’s being a spectrum disorder, findings from this study may not result in similar results in other students with autism. Even though self-monitoring procedures have been found to be effective, limited research has been conducted using students with autism. Therefore, more studies need to be conducted to examine various settings and other socially relevant behaviors in this population. Future researchers also should add a self-graphing component, as well as comparing self-monitoring of attention versus self-monitoring of productivity.

In summary, the findings from this research study support the use of self-monitoring for increasing attention to task, which subsequently enhanced accuracy levels in two elementary-aged students with autism. Self-monitoring provides an effective means for improving attending that may result in improved accuracy and productivity. The independence promoted through self-monitoring allows teachers to spend more time on curriculum and instruction and less time on prompting students to maintain engagement.

Declaration of Conflicting Interests
The author(s) declared no potential conflicts of interests with respect to the authorship and/or publication of this article.

Financial Disclosure/Funding
The author(s) received no financial support for the research and/or authorship of this article.

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