Effects of Therapy Cushions on Classroom Behaviors of Children With Autism Spectrum Disorder

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KEY WORDS
- autistic disorder
- behavior therapy
- child behavior
- interior design and furnishings
- task performance and analysis

OBJECTIVE. We investigated the effects of therapy cushions on the in-seat and on-task behaviors of 2 kindergarten students with autism spectrum disorder during math activities.

METHOD. We used a single-subject A–B–A–B–C design across 2 male participants who used chairs during baseline phases (A) and cushions during intervention phases (B). We included a choice phase (C) to determine participant seating preferences. Social validity was addressed by assessing teacher and participant seating preferences. Data were graphed and visually analyzed for functionally relevant changes between phases.

RESULTS. No clinically relevant changes in the in-seat or on-task behaviors of either participant were observed with cushion use.

CONCLUSION. Therapy cushions may not impose sufficient postural demands or provide adequate sensory input to produce behavioral changes. Continued research in this area is needed.


According to the Occupational Therapy Practice Framework (2nd ed.; American Occupational Therapy Association, 2008), the primary role of school-based occupational therapists is to assist students with special needs in engaging in and maximizing their performance in educational environments. For young children with autism spectrum disorder (ASD), the occupation of student can be especially complex and challenging. The classroom environment presents a sensory-rich backdrop of noise and movement against which students must attend to academic activities and routines. Research has shown that children with ASD can experience higher levels of inattention and distractibility than their typically developing peers (Dunn, 2001; Dunn & Bennett, 2002). Behavioral challenges can be formidable barriers to children’s performance because they impede participation and the ability to access vital learning opportunities.

Special education professionals have explored various strategies for maximizing the attending and on-task behavior of children with ASD. Many of these strategies use behavioral techniques, including visual and temporal supports and contingent reinforcement (Bryan & Gast, 2000; O’Neill et al., 1997). Although the strategies have, in some cases, yielded positive results (Lord & McGee, 2001), they may not address core issues that underlie students’ attending difficulties.

Occupational therapists working in special education settings offer a unique perspective on dealing with challenging behaviors by examining the possible sensory roots of the inattention and distractibility demonstrated by students with ASD. Several researchers have suggested that children with ASD often have difficulty modulating incoming sensory input (Ayers, 1972; Baranek, 1999;
Dunn, Myles, & Orr, 2002), resulting in poor attending skills and high levels of distractibility.

School-based occupational therapists often use sensory-based strategies to increase students’ levels of attending, on-task behavior, and performance in the classroom. Many clinicians perceive these approaches to be successful in promoting functional classroom behavior, and formal research conducted on sensory-based interventions has supported this belief (Schilling, 2004; Schilling & Schwartz, 2004; Schilling, Washington, Billingsley, & Deitz, 2003). Various sensory-based strategies, including the use of alternative seating devices, have been examined in the literature and, in many cases, have been found to promote functional classroom behavior (Fertel-Daly, Bedell, & Hinojosa, 2001; Schilling et al., 2003; Schilling & Schwartz, 2004; Zissermann, 1992). The use of therapy balls has been linked to marked improvements in the in-seat behavior and legible word productivity of school-age children with attention deficit hyperactivity disorder (ADHD; Schilling, 2004; Schilling et al., 2003) and to increases in the engagement and in-seat behavior of preschoolers with ASD (Schilling & Schwartz, 2004). Therapy cushions, examined only in one study found in the literature, were associated with gains in in-seat behavior and productivity in school-age children with ADHD (Schilling, 2004). However, in this multiple-treatment study examining both therapy ball and cushion use (Schilling, 2004), the gains affiliated with the cushion were less substantial than those affiliated with the ball for 2 of 5 participants. Extension of research examining therapy cushions is needed among children of other ages and with other types of disabilities because cushions are so commonly used with children with attending and behavioral difficulties in the classroom.

Therapy cushions, inflatable discs originally designed and used for core strengthening and balance training, are believed to function similarly to therapy balls, providing students with a seating surface that offers more sensory feedback than a standard classroom chair. Cushions, however, may be a more practical alternative seating choice than therapy balls because they are small and take up little space for use or storage. Unlike therapy balls, they are portable, allowing students to easily transport them to various settings. Students can also use therapy cushions discreetly in a classroom setting without being easily singled out from their peers as requiring special support.

Therefore, the purpose of this study was to examine the efficacy of using therapy cushions to promote in-seat and on-task behavior in kindergarten students with ASD and sensory processing differences. Specifically, we examined student behavior during math time to determine the effects of using therapy cushions on the following variables:

- The percentage of intervals in which in-seat behavior was observed
- The percentage of intervals in which on-task behavior was observed
- Students’ seating preferences
- Teachers’ seating preferences for students
- Teachers’ perceptions of student behavior.

**Method**

**Setting**

This study was conducted in an integrated kindergarten classroom at the University of Washington’s Experimental Education Unit (EEU), a school serving children with special needs as well as typically developing children. The 2 participants in this study were enrolled in a classroom of 18 students, 12 of whom received special education services based on individualized education plans and 6 of whom were typically developing. The program ran 4.5 days/wk, and the classroom was staffed by a special education teacher, an assistant teacher, classroom aides, an occupational therapist, and a speech–language pathologist. Strategies based on the principles of applied behavioral analysis were most commonly used in this classroom to promote student engagement and participation.

Data for this study were collected during math time. This group instruction time lasted for 10–15 min and involved interactive instructional activities requiring students to follow the teacher’s verbal instructions, answer the teacher’s questions, and participate in group responses to math questions.

**Participants**

Both participants in this study carried a current educational diagnosis of ASD, demonstrated functional challenges with on-task behavior during math time, and demonstrated sensory processing differences by scoring in the “definite difference” range in at least one of seven categories on the Short Sensory Profile (SSP; Dunn, 1999).

**Participant 1.** Participant 1, a 5-yr-old boy, demonstrated mild delays in cognitive and language development. He demonstrated disruptive self-stimulatory behaviors during math time, including bouncing up and down or rocking back and forth forcefully in his seat, shaking his head back and forth, and verbalizing loudly. On the SSP, he scored in the “definite difference” range in five categories: tactile sensitivity, underresponsive/
seeks sensation, auditory filtering, low energy/weak, and visual/auditory sensitivity. He scored in the “probable difference” range in the movement sensitivity category.

Participant 2. Participant 2, a 6-yr 1-mo-old boy, demonstrated mild cognitive delays and substantial delays in expressive language development. During math time, he frequently looked around the room, tipped his chair backward, or turned around in his chair to look at the events behind him rather than appropriately facing forward. He also demonstrated low muscle tone and often appeared fidgety, having notable difficulty maintaining an upright sitting position in a chair. On the SSP, he scored in the “definite difference” range in three categories: taste/smell sensitivity, auditory filtering, and low energy/weak. He scored in the “probable difference” range in the underresponsive/seeks sensation category.

Independent Variables
The independent variables in this study were the seating options used during math time.

Chairs. The chairs used in the study were the standard classroom chairs provided by the school. Each chair had a hard plastic seat and back and metal legs.

Cushions. Inflated Disc ‘o’ Sit Jr. therapy cushions (Gymnic, San Diego, CA) were used in this study. They measured approximately 13 in. in diameter, were approximately 2 in. thick when inflated, and were made of latex-free PVC vinyl. Before data collection began, participants were fitted for both seating options so that their hips and knees were at approximately 90° and their feet could rest flat on the floor during all phases of the study. During intervention phases, standard classroom chairs identical to those used during baseline were used, but the chair legs were 2 in. shorter so that the 90° angles at the hips and knees were maintained with use of the 2 in. cushion. Cushions were placed on the participants’ chairs with the bumpy surface of the cushion exposed. At no point during the study did either participant attempt to flip the cushion to sit on the smooth surface.

Dependent Variables

In-Seat Behavior. In-seat behavior (chair) was defined as behavior that occurred when any portion of a participant’s buttocks was in contact with the seat portion of the chair and the four legs of the chair were in contact with the floor. In-seat behavior (cushion) was defined as behavior that occurred when any portion of a participant’s buttocks was in contact with the cushion, when any portion of the cushion was in contact with the seat portion of the chair, and when the four legs of the chair were in contact with the floor.

Out-of-Seat Behavior. Out-of-seat behavior was defined as any sitting behavior that failed to meet the criteria for in-seat behavior. Examples included any time the participant’s buttocks left contact with the seat portion of the chair or cushion and any time during which any of the chair’s four legs left contact with the floor.

On-Task Behavior. On-task behavior was defined as engagement in the appropriate classroom activity and was demonstrated by visual orientation toward the appropriate classroom activity, appropriate manipulation of materials related to the activity, or appropriate interaction with the teacher, including visual attention to the teacher’s verbalizations.

Off-Task Behavior. Off-task behavior was defined as behavior failing to meet the criteria for on-task behavior. Loss of visual orientation to the activity or teacher was considered off task, even if it was only momentary. Off-task behavior also included inappropriate manipulation of activity-related materials and failure to respond or provide verbal responses related to the appropriate activity when given a direct instruction or asked to answer a question.

Design
This study used a single-subject, A–B–A–B–C interrupted time series design (Kazdin, 1982). During baseline phases (A), participants used standard classroom chairs during math time. During intervention phases (B), participants used standard classroom chairs with therapy cushions during math time.

Each phase of the A–B–A–B portion of this study was 2 to 3 wk in duration, and the plan was to collect data on in-seat and on-task behavior during four math sessions each week. A 1-wk acclimation phase occurred before the first intervention phase to allow for initial acclimation to the therapy cushion and to the presence of a video camera in the classroom. A choice phase (C), spanning 1.5 wk, occurred after the second intervention phase to assess participant seating preferences. The entire study spanned 13.5 wk, with a 1-wk break in data collection because of spring break. Data were graphed and visually analyzed using trend lines. Teacher impressions and preferences were assessed by means of a questionnaire administered at the conclusion of data collection.

Data Collection
We used indirect classroom observations and an interval recording method to collect data on participants’ in-seat and on-task behaviors throughout all phases of the study. During the A and B phases of the study, each participant was video recorded by research assistants during math
time 4 days/wk. These video recordings were used to collect data on both in-seat and on-task behavior. To allow sufficient time for the participants to get settled in their seats and orient to the group activity, video recording began ≥30 s after the beginning of math time instruction. At this time, a 6-min segment was recorded. The 1-wk acclimation phase that occurred before the initial baseline phase was included in the study to minimize any effects of the camera’s presence on participants’ behavior in addition to providing the participants time to adjust to cushion use.

Two coders, blind to the study’s purpose, were responsible for viewing the video recordings and recording data on both in-seat and on-task behavior. Both coders were licensed occupational therapists with pediatric experience. Each coder was randomly assigned to a participant and rated that participant’s videos for the duration of the study. Data were collected on the middle 5 min of each 6-min video clip through an interval recording method. Data collection intervals consisted of a 6-s observation interval followed by a 4-s recording period, resulting in 30 possible data points for each video clip. In-seat and on-task behavior were rated separately, and only one behavior at a time was observed when viewing the video recordings. Each participant’s behavior during each interval was recorded as “in seat” or “on task” only if the participant met the behavioral requirements for the categories throughout the entire 6-s interval. If at any time during the 6-s interval the participant’s behavior could not be viewed fully on the video, that interval was considered “not ratable.” If >50% of the intervals for a dependent variable were “not ratable” during a data collection session, data for that specific variable were not charted.

Interrater agreement between the two coders was assessed before data collection began by using sample video recordings and was regularly checked throughout the study. The minimum standard of agreement for both in-seat and on-task behavior was set at 80% (Kazdin, 1982), and coders were required to achieve this standard on three consecutive sample videos before beginning data collection. Final interrater agreement percentages ranged from 83% to 100% for in-seat behavior and from 80% to 97% for on-task behavior.

Procedural reliability was addressed throughout the study by means of a short questionnaire, which research assistants completed after each recorded math session. The questionnaire addressed issues related to classroom procedures and various classroom environmental factors that could potentially have influenced the data obtained. Specific issues addressed included consistency of classroom staff, interaction style, and daily schedule. Procedural reliability percentages ranged from 86% to 100%. Procedural adherence <100% was rare and was usually attributed to a schedule change or a disruption in the classroom, such as another child throwing a tantrum.

Results

The data on in-seat and on-task behavior for both of the participants are shown in Figures 1 and 2. Successive data points in a series connected by a line indicate that the data were recorded on consecutive calendar days. Successive data points in a series not connected by lines indicate periods of ≥1 calendar day over which data were not collected. Data were usually collected Monday through Thursday; thus, scheduled breaks in data collection occurred Fridays through Sundays. Additional breaks in data collection occurred on holidays, half-days during which math time was cut, and days when research assistants were absent. Spring break fell during the first intervention period and resulted in the lack of data between April 9 and April 15.

Data were not charted when >50% of data collection intervals were not ratable on a particular day. For Participant 1, data were not charted for in-seat data and on-task data for 3 days during the acclimation phase (March 26–28), for on-task data for 1 day (March 12) in the first baseline phase, and for 1 day in the choice phase (June 11). For Participant 2, data were charted for all days because both dependent variables met the requirement of 50% or more ratable intervals on all days.

The acclimation phase fell between the initial baseline and intervention phases, and data from that phase are plotted in Figures 1 and 2 but were not used in the examination of the participants’ responses to alternative seating.

Participant 1

In-Seat Behavior. As shown in Figure 1, Participant 1’s in-seat behavior when seated on a standard classroom chair did not differ substantially from that when seated on a therapy cushion. One exception occurred on the third day of intervention, when his in-seat percentage was exceptionally low. Review of the video recording, however, shows that this low percentage was obtained because the participant was resting one leg of the chair on top of his shoe for most of math time. He therefore did not meet in-seat criteria for most data recording intervals even though he was actually seated and still. The percentages of intervals during which in-seat behavior was observed varied widely during the initial baseline and
initial intervention phases of the study. During the second baseline phase and the second intervention phase, higher and less variable in-seat percentages were seen. During the choice phase, the participant chose to sit on the standard chair on 5 of 6 days of data collection.

**On-Task Behavior.** As seen in Figure 1, although the highest data points occurred during intervention, the data for Participant 1 generally did not indicate any substantial difference in on-task percentages obtained during baseline and intervention phases. On-task percentages were variable but low during the initial baseline phase and never exceeded 50%. After the acclimation phase, variability continued, with percentages ranging from 20% to 63% in the first intervention phase. When the standard chair was reintroduced during the return-to-baseline phase, no substantial changes were evident. During the second intervention phase, variability in on-task percentages again increased. During the choice phase, less variability in percentages occurred. Over the course of the study, the four data points that fell >60% for on-task

**Figure 1.** In-seat and on-task behavior by session for Participant 1.

**Figure 2.** In-seat and on-task behavior by session for Participant 2.
behavior occurred during the intervention phases. However, two of the three lowest on-task percentages (falling <10%) were also obtained during intervention.

**Participant Preferences.** For the first 3 days of the acclimation phase, Participant 1 verbally expressed resistance to sitting on the cushion. He complied with cushion use, however, immediately on the fourth day of acclimation, when he was given a choice of two identical cushions, each with a unique Star Wars character taped to the bottom surface. From that point forward, the participant used the cushion without hesitation or expression of discomfort. During the choice phase, however, Participant 1 chose to sit on the cushion on the first day only; he chose the standard classroom chair for all remaining days.

**Teacher Perceptions.** The classroom teacher reported that Participant 1’s attention to task appeared better when sitting on the standard classroom chair, but that his sitting behavior and level of disruptiveness were equal with either seating device. The teacher felt that this participant presented with day-to-day variability in on-task behavior, a pattern that was pervasive and noticed with both seating options.

**Participant 2**

**In-Seat Behavior.** As with Participant 1, Participant 2’s in-seat behavior percentages did not differ substantially during baseline and intervention phases (Figure 2). Participant 2’s in-seat percentages were highest during the initial baseline phase and then appeared to drop and become more variable after introduction of the cushion during the first intervention phase. Variability in in-seat percentages generally persisted throughout the remainder of the study, increasing slightly during the second intervention phase. During the choice phase, Participant 2 chose to sit on the cushion for 5 of 6 days of data collection. However, no substantial differences in percentages of in-seat behavior were seen during this phase compared with the study’s A and B phases.

**On-Task Behavior.** The data for Participant 2 (Figure 2) generally do not indicate any substantial difference in the on-task percentages obtained during the baseline and intervention phases. Percentages were low and variable across all phases of the study. Similar to Participant 1, however, Participant 2’s two highest percentages of on-task behavior, 52% and 46%, and his lowest percentage, 0%, were obtained during intervention.

**Participant Preferences.** When the therapy cushion was introduced at the beginning of the acclimation phase, Participant 2 agreed to sit on the cushion without protest and showed no signs of discomfort; he agreed to cushion use throughout both B phases of the study. During the choice phase, Participant 2 chose the cushion over the standard chair on 5 of 6 days.

**Teacher Perceptions.** The classroom teacher reported that Participant 2’s attention to task appeared better when using the therapy cushion. As with Participant 1, however, the teacher felt that sitting behavior and level of disruptiveness were generally comparable when using either type of seating device. The teacher reported that this student’s behavior appeared variable and affected by the rate of instruction and the behavior of other children in the group. The teacher did, however, specifically report noticing less backward head turning and less backward tilting of the chair during periods of cushion use.

**Discussion**

The data did not reveal substantial changes in sitting or task-related behavior for either study participant when seated on cushions. Comparing this study’s results with those of related studies and analyzing the participants’ responses to cushion use provide insight into the relative effectiveness of different forms of alternative seating and potential mechanisms responsible for making alternative seating effective in promoting behavioral change. Of the three previous alternative seating studies, two focused solely on therapy ball use (Schilling & Schwartz, 2004; Schilling et al., 2003) and the third on both balls and cushions (Schilling, 2004). In all of the studies, substantial increases in functional classroom behaviors resulted from therapy ball use. In the multiple-treatment study, however, slightly less dramatic change was noted with cushion use than with ball use (Schilling et al., 2003), and in this study, we found no substantial change in functional behavior with cushion use. This result suggests that cushions are less effective than balls in promoting functional change.

Possibly, therapy cushions lack a quality unique to therapy balls, resulting in cushions’ decreased effectiveness as a form of alternative seating. Cushions are placed on the seat of standard chairs, preserving a relatively stable seating surface. Unlike cushions, balls provide an extremely
unstable surface, demanding activation of a balance response. To sustain a stable sitting position on the ball, the nervous system must detect the balance challenge presented, activate the core musculature, and remain alert and responsive to prevent falling. In addition, sustaining balance on the ball usually requires bracing at least one extremity on a supportive surface, such as one leg on the ground. These postural demands may be key to the ball’s ability to promote positive changes in functional behaviors.

Participant 2’s response to the therapy cushion also suggests the possibility that the cushion fails to provide sensory input intense enough to facilitate behavioral change. During intervention phases, Participant 2 used the sensory input provided by the cushion. He rocked side to side, attempted to bounce, pushed down hard on the cushion to shift his weight forward and back, and rubbed his hands over the bumpy surface. He often appeared to be seeking more input from the cushion than it naturally provided. Ironically, these attempts to increase the sensory feedback provided by the cushion appeared more distracting than organizing. This participant’s on-task percentages might have been higher during intervention periods if alternative seating naturally provided him with more intense amounts of input and feedback.

When examining the results of this study in light of Schilling’s (2004) multiple-treatment study, it is important to highlight key differences between the two studies that may underlie differences in the studies’ obtained results regarding cushion effectiveness. First, the age and diagnoses of participants in this study differed notably from those of participants in the multiple-treatment study, which targeted fifth-grade students with ADHD rather than kindergarteners with ASD. Additionally, a methodological difference existed between the data collection strategies used in the two studies. Schilling’s (2004) multiple-treatment study used a momentary timesampling method to collect data on dependent variables. By contrast, we used an interval-recording method, requiring participants to sustain functional behaviors for the entirety of a 6-s interval to meet in-seat or on-task criteria. We chose this method because we felt it was important to examine sustained behavior to obtain functionally relevant results.

Limitations and Strengths

Limitations of this study included the small sample size and the use of a single classroom. Strengths of the study included the collection of data in a natural environment, the use of interrater agreement and procedural reliability checks, and the use of single-subject research methods to individually track each participant’s behavioral responses throughout a multiweek period.

Directions for Future Research

Two suggestions for future investigation emerged from this study. First, research exploring the effects of alternative seating devices on a variety of functional behaviors of children with a variety of sensory processing differences would be relevant. Comparing the effectiveness of devices with high postural demands, including therapy balls and T-stools, with that of devices with lower postural demands, such as therapy cushions and inflatable wedges, would be of interest. These comparative studies would help provide needed information regarding the specific properties of alternative seating devices that are most effective in promoting positive changes in the functional behavior of children with specific sensory processing differences.

Second, in the realm of data collection methodology, future researchers would benefit from further exploring the implications of using interval recording rather than other measurement methods in studies measuring attention-related behaviors. Exploring whether use of different measurement systems leads to different results regarding an intervention’s effectiveness in promoting behavioral change would be important.

Conclusion

Although the use of therapy cushions in this study did not result in substantial change in either in-seat or on-task behavior for the 2 participants, this study’s results add to the limited body of research on sensory-based intervention and, specifically, alternative seating. The results raise important questions about what specific qualities make alternative seating devices effective in promoting behavioral changes. Results also suggest that the effectiveness of alternative seating devices may be linked to their ability to impose substantial postural and balance demands or to provide intense amounts of sensory feedback. Both of these qualities are absent or decreased with the therapy cushion but are present to a greater degree with devices such as therapy balls. Future research should address these hypotheses to expand understanding of alternative seating devices’ role in supporting functional classroom behaviors.

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