Sensory Processing Strategies Used in the Classroom: Evaluating the Evidence

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| Citation | Level of Evidence | Participants | Outcome of Interest | Design | Outcomes | Limitations |
| Weighted Vests |  |  |  |  |  |  |
| Lin, H.-Y., Lee, P., Chang, W.-D., & Hong, F.-Y. (2014). Effects of weighted vests on attention, impulse control, and on-task behavior in children with attention deficit hyperactivity disorder. *American Journal of Occupational Therapy, 68,*  149–158. | II | 110 children dx with ADHD in Taiwan; recruited from clinics | Attention, impulse control, and on-task behavior | Randomized, two-period crossover design; 2 conditions; with and w/out vests with 10% of body weight; participants completed  Conners’ Continuous Performance Test–II (CPT–II) task (14 min computerized task) | Significant improvement in all 3 attentional variables of the CPT–II task (inattention; speed of processing and responding; consistency  of executive management). Significant improvement on 3 of 4 on-task behavior. No  significant improvements in impulse control and automatic vocalizations | Looked at immediate effect of weighted vests; used computer task, not classroom activity |
| Collins, A., & Dworkin, R. J. (2011). Pilot study of the effectiveness of weighted vests. *American Journal of Occupational Therapy, 65*, 688–694. | IV | Non-special education students identified as:  (1) having more difficulty staying in own seat than peers; (2) having more  difficulty than peers keeping eyes on teacher, board, or  own work; (3) needing more frequent reminders to work on task than peers; and (4) asking more irrelevant  questions or talks off topic than peers.  7 yr 5 mo -  10 yr 3 mo.; 8 male, 3 female  7 children in experimental group; 4 in control | Attention, on-task behavior  (having writing supplies and work materials on the desk;  keeping eyes on the teacher, the  board, or their own work; listening to or working on the  assignment; and asking relevant questions. | 2 group, ABA  Video 3 x for 10 minutes in each phase;  Students wore | Intervention  group participants did not increase attention to task and did not differ from the control group. | Narrower inclusion criteria would have yielded a more  homogeneous sample;  small sample size with control group |
| Davis, T. N., Dacus, S., Strickland, E…. (2011). The effects of a weighted vest on aggressive and self-injurious behavior in a child with autism. *Developmental Neurorehabilitation, 16*(3): 210–215. | IV | 9 year-old male with autism (severe range on CARS); self-contained classroom | Aggressive and self-injurious behavior: Biting | Single subject ABAB design (no vest/vest)  Five conditions, counterbalanced:attention, demand, tangible, play,  and alone. Sessions were 5 min in duration. | Levels of aggressive  and self-injurious behaviors were similar across  phases, no vest mean of 21% of intervals and 20% of intervals during the weighted vest phases  Lowest rate of biting during alone condition | Observers not blind to condition; formal assessment of sensory needs not completed; participant had worn vest for 7 months prior to study |
| Hodgetts, S. , Magill-Evans, J. & Misiaszek, J. (2011). Effects of weighted vests on classroom behavior for children with autism. *Research in Autism Spectrum Disorders, 5,* 495=505. | IV | 8 boys and 2 girls between the ages of 3–10 years w/ dx of autism, difficulty with attention to task based on teacher report, and sensory  modulation dysfunction (more than 2 standard deviations below mean on the Short Sensory Profile). Most had severe language impairments and cognitive impairments. Self-contained classroom. | Off-task behavior (looking away from the activity or not participating in the intended functional  manipulation of materials related to the activity); sitting time measured in 3 children | Single-case, withdrawal design  1 wk (phase A) w/out vest followed be 2 weeks (phase B) w/ vest no weight and 2 weeks (phase C) vest w/ 5-10% of body weight.  10-, 5-min videos for each treatment condition; off-task behavior coded (rater blinded to condition)  Teacher impressions of restlessness, impulsivity and emotional lability rated at the end of each phase | Weighted vest had no effect on sitting time for the 3 children;  Weighted vest was effective in decreasing off-task behaviors of 3 children and ineffective in decreasing off-task behavior for 4 children; one child had less variability in off-task behavior and one child had more variability while wearing the weighted vest.  Vest had some effect in decreasing off-task behavior, based  on objective measures, in three participants; subjective feedback suggested ‘some’ effect  “The sensory input from the weighted vest did not override other experiences in the children’s lives.” | Homogeneous sample; school time constraints with length of phases so that stability was not achieved in the B phase. |
| Hodgetts, S., Magill-Evans, J., & Misiaszek, J.E. (2011). Weighted vests, stereotyped behaviors and arousal in children with autism. *Journal of Autism & Developmental Disabilities, 41,* 805-814. | IV | 5 boys and 1 girl  between the ages of 4–10 years w/ dx of autism; sensory modulation dysfunction as identified by > 2 SD below mean on  Short Sensory Profile; stereotyped behavior; self-contained classroom | Stereotyped behaviors - repetitive movements  or behaviors that did not appear to serve an adaptive  function; decreased heart rate | Single subject, withdrawal design; 3 phase  A (no equipment – 1 week); phase B (vest w/ no weight) & C (vest with 5-10% of body weight) lasted 2 weeks;  Video during table top activity; 5 min of video coded by blinded rater | Vest did not functionally  decrease motoric stereotyped behaviors; may have decreased 1 child’s verbal stereotyped behavior. Considerable variability in behavior within and between phases; weighted vests did not  decrease heart rate variability. | Time constraints of school led to change in length of phases, decreasing internal validity |
| Leew, S.V., Stein, N.G., & Gibbard, W.B. (2010). Weighted vests’ effect on social attention for toddlers with Autism Spectrum Disorders. *Canadian Journal of Occupational Therapy, 77*(2), 113-124. | IV | 4 children 2 yrs old w/ dx of autism; ITSP profile that indicated need for vest; reduced joint attention, > 1SD below mean on Commun/Symb Behavior Scale | Competing behaviors (e.g.,distraction, emotional reaction, withdrawal, etc); joint attention (e.g., joint attention, eye-gaze alteration, pointing, giving, etc.) during play with parent at home; parenting morale | Multiple baseline across subjects; regular sessions with parent as play partner and generalization sessions occurred every two sessions (play with female research assistant)  vest weight = 5% of body weight  6 weeks | Competing behaviors: no effect of intervention across particip.  Joint attention: no observable change in level and slope from baseline to intervention;  Parenting morale: 1 mother had statist signif change in morale; 2 had positive change | Observational codes may not have detected all changes of behavior; limited intervention data collected on subj 4 |
| Reichow, B. Barton, E.E., Sewell, J.N., Good, L. & Wolery, M. (2010). Effects of weighted vests on the engagement of children with developmental delays and autism. *Focus on Autism and Other Developmental Disabilities, 25*(1), 3-11. | IV | 3 children ages 4-5, 2 with dx of autism, 1 with DD. Enrolled in early childhood center | Engagement (purposeful manipulation of materials, attending to teacher or peer), stereotypic behavior (repetitive behavior, mouthing, etc), problem behavior (crying, hitting, etc) | Alternating tx design:  Weighted vest, vest with no weights, no vest.  Conditions randomly assigned, with one condition not in effect for more than 3 consecutive days  Weight -5% of body weight | Weighted vest not functionally related to engagement in table time activity for all participants  Only one participant showed a lower stereotypic behavior with weighted vest | No baseline for 1 participant  Brief experimental condition  Did not look at delayed effect of weighted vest |
| Stephenson, J. & Carter, M. (2009). The use of weighted vests with children with autism spectrum disorders and other disabilities. *Journal of Autism and Developmental Disorders, 39*, 105-114. | I | Studies included children with autism and ADHD | Varied: SIB, self-stim, attention, engagement, etc. | Review of 7 studies | Outcomes inconsistent across behaviors and participants  Problems with study designs and interpretation  Concludes that research is inconclusive and thus there is little evidence to support use of vests |  |
| Cox, A.L., Gast, D.L., Luscre, D. & Ayres, K.M. (2009). The effects of weighted vests on appropriate in-seat behaviors of elementary-age students with autism and severe to profound intellectual disabilities. *Focus on Autism and Other Developmental Disabilities, 24*(1), 17-26. | IV | 3 elementary-age students with  autism, intellectual disabilities, and sensory processing dysfunction as identified on the SSP | In-seat behavior (child facing forward with head oriented  to the teacher leading the activities and buttocks  touching the seat of the chair) during Circle time | Experiment 1: Alternating treatment design; 3 conditions – no vest, vest without weight, weighted vest (5% of body weight)  5 sessions each  Experiment 2: BABA, with noncontingent reinforcement (NCR) alternating with no treatment  Social validity: questionnaire before and after | Experiment 1:  no difference between conditions (percentage of overlap between conditions calculated)  Experiment 2:  NCR resulted in higher levels of in-seat behavior in all participants; no overlap of data  Social validity: weighted vests easy and non-intrusive but not effective; one parent reported it was effective | Target behavior difficult to quantify  No functional analysis of behavior  Vest worn first 10 min of circle time |
| Carter, S.L. (2005). An empirical analysis of the effects of a possible sinus infection and weighted vest on functional analysis outcomes of self-injury exhibited by a child with autism*. Journal of Early and Intensive Behavior Intervention, 2*(4), 252-258. | IV | 4 year-old boy with autism, non-verbal, self-injurious | Self-injurious behavior (hitting head with hand, hitting head against object or person, slapping backside of hand against object) | Alternating treatment; functional analysis of SIB (attention, demand, alone, play) when infection present and when absent; 72 sessions  Vest 7.5% of body weight; worn for 5 minute assessment sessions | Vest had no effect on rates of SIB; presence and absence of sinus infection effected rates of SIB | No definitive dx of sinus infection from MD  Limited data |
| Kane, A., Luiselli, J.K., Dearborn, S., & Young, N. (2004-2005). Wearing a weighted vest as an intervention for children with autism/pervasive developmental disorder*. The Scientific Review of Mental Health Practice, 3*(2), 19-24. | IV | 4 children 8-11 years old; 2 boys; 2 girls; 3with autism, 1 with PDD-NOS  All were identified as having “sensory integration needs” | Stereotypic behavior  Attention to task (purposeful manipulation of objects); children were instructed to use the object but no one interacted with them | A (no vest), B (weighted vest), C (vest, no weight) design  Weighted vest: 5% of body weight |  | Same activity presented daily  No inter-observer data reported  No patterns of sensory processing reported |
| Myles, B.S., Carlson, J., Laurant, M., Gentry, A.M., Cook, K.T. & Earles-Vollrath (2004). Examining the effects of the use of weighted vests for addressing behaviors of children with autism spectrum disorders. *Journal of the International Association of Special Education, 5*, 47-62. | IV | Case 1: 5 year old girl in self-contained class for children with autism; functional analysis indicated need for deep pressure  Case 2: 3 year 6 mo boy in sp.ed. preschool class; functional analysis indicated over-stimulation/removal from group for self-calming  Case 3: 4 yr 11 mo boy in sp.ed. preschool | Case 1: Attending behaviors (eyes orienting to person, materials)  Case 2: off-task behavior during Circle Time  Case 3: Deep pressure seeking behaviors during circle time (eg, lying down on back/stomach; sitting on hands) | Case 1:ABAB  Vest worn during one-on-one and group activities  Weighted vest 10% of body weight  Case 2: ABAB; vest worn for 15 minute Circle Time  Case 3: ABAB; vest worn for 30 minutes prior to circle time and removed during circle time | Case 1: Weighted vest was not effective; attending behaviors decreased  Case 2: Weighted vest possibly effective; slight change in means in A and B phases  Case 3: Deep pressure seeking decreased significantly with use of vest  Overall, results inconsistent | Short intervention phase  No stable baselines |
| Fertel-Daly, D., Bedell, G., & Hinojosa, J. (2001). Effects of a weighted vest on attention to task and self-stimulatory behaviors in preschoolers with pervasive developmental disorders. *American Journal* *of Occupational Therapy, 55,* 629–640. | IV | 5 preschool-aged children (2 yr – 4 yrs); PDD | Duration of attention to task (length of  time a child looked at and simultaneously engaged in some  deliberate manipulation of fine motor objects or materials  related to the activity); self- stimulatory behaviors; number of distractions (the number of  times the participant turned his or her head or eyes away  from the task) | ABA design  Weighted vest with four .25 lb weights in pockets;  weighted vests were worn  three times a week for a 2-week period; data recorded for 5 min after the child had worn the vest for 1.5 hrs., 5 times | Four participants demonstrated a mean decrease in the duration  of self-stimulatory behaviors while wearing a weighted  vest; this increased without the vest; all participants increased attention and decreased distraction while wearing vest | Relatively weak design  Relatively small changes in behavior  No control over conditions |
| VandenBerg, N. L. (2001). The use of a weighted vest to increase on-task behavior in children with attention difficulties. *American Journal of Occupational Therapy, 55*, 621 – 628. | IV | 4 children; ADHD; 5-6 years old | Attention; on-task behavior;  “engagement in those processes  that were necessary to complete the activity assigned by  the teacher and were a part of the expected process” “visually focused on the  activity and engaging in the processes to complete the  activity” | AB design  Weighted vest (5% of body weight) worn during classroom activities  Time on task during six 15 min activities recorded  Vest put on 5 min before activity | On-task behavior increased 18-25%; 2 children asked to continue to wear the vest | Relatively weak design  No control over conditions |
| Therapy Ball Chairs |  |  |  |  |  |  |
| Fedewa, A. L., & Erwin, H. E. (2011). Stability balls and students with attention and hyperactivity concerns: Implications for ontask  and in-seat behavior. *American Journal of Occupational Therapy, 65*, 393–399. | IV | 8 students in grades 3-5 who scored >92nd percentile, classified as  “high” or “very high” probability of ADHD, on the ADHDT | In-seat and on-task behavior during language arts, math and social studies  Social validity | A–B continuous time-series; 12 wk intervention | Statistically significant change in score on SDHDT  Significant change in on-task and in-seat behavior  Social validity: positive response from teachers | All students in clsroom used balls, thus results may not be generalized to individual use |
| Bagatell, N., Mirigliani, G, Patterson, C, Reyes, Y., & Test, T. (2010). The effectiveness of therapy ball chairs on classroom participation in children with autism spectrum disorders. *American Journal of Occupational Therapy, 64*(6), 895-903. | IV | 6 K-1 grade children with moderate to severe autism | In-seat behavior and engagement during Circle Time  Social validity | A-B-A-C (baseline, intervention, baseline, choice condition) | Only one child showed a meaningful change in in-seat behavior; none showed changes in engagement  Social validity: teacher did not view ball chair as effective | Phases short due to school schedule  Baselines not stable |
| Schilling, D. L., Washington, K., Billingsley, F. F., & Deitz, J. (2003). Classroom seating for children with attention deficit hyperactivity disorder: Therapy balls versus chairs. *American Journal of Occupational Therapy, 57*(5), 534-541. | IV | 3 students (2 male, 1 female) with ADHD  9 years old; 4th grade | In-seat behavior  Legible word productivity  (the percentage difference between the participant’s  legible word production and the class mean)  Social validity | ABAB  All children in class sat on therapy ball chairs during B phases; 12 weeks  Data recorded for five 2-minute periods each session during the middle 40 min of a 60 min period for in-seat behavior  Legibility: 5 randomly selected assignments per phase  Social validity questionnaires completed at the end of the BAB phases from teacher and all students | Increased in-seat behavior for all participants  Legibility generally higher on ball  Social validity: all 3 participants preferred the ball; teachers reported positive changes | Relatively short duration  1 child’s legibility still below class mean |
| Schilling, D.L. & Schwartz, I.S. (2004). Alternative seating for young children with autism spectrum disorder: Effects on classroom behavior. *Journal of Autism and Developmental Disorders, 34*(4), 423-432. | IV | 4 boys ASD  3 yr 11 mo to 4 yr 2 mo  Integrated preschool classroom | In-seat behavior (for 3 participants)  Engagement: student was orientated towards appropriate  classroom activities  1 participant: oppositional behavior | ABAB for 3 participants  BAB for 1 participant; intervention phases lasted 2 weeks;  collection sessions ranged from a minimum of  5 minutes to a maximum of 10 minutes and occurred 3 times per week  Social validity questionnaires | In-seat behavior: positive, significant  changes in in-seat behavior were seen immediately with 3 participants; return to seat resulted in immediate decline in behavior  Engagement: all four participants  increased engagement substantially with ball chair  Social validity: teachers reported feeling positive about the use of the ball and a preference over other seating devices | Specific sensory processing concerns not identified (behavioral concerns reported)  Unstable baselines |
| Seat Cushions |  |  |  |  |  |  |
| Umeda, C. & Deitz, J. (2011). Effects of therapy cushions on classroom behaviors of children with autism spectrum disorder. *American Journal of Occupational Therapy*, 65, 152-159. Doi:10.5014/ajot.2011.000760. | IV | 2 kindergarten students with ASD in an integrated classroom. Functional challenges with on-task behavior; demonstrated sensory processing differences (score in “definite difference” range on SSP in at least one category). | In-seat behavior and on-task behavior during math | ABABC interrupted time series design; each phase 2-3 wks, with A (chair), B (cushion) and 1 wk acclimation to cushion. C phase was a choice phase. Study spanned 13.5 wks. | In-seat behavior and on-task behavior percentages did not differ substantially with the use of the cushion for either participant.  Teacher reported that great variability from day to day with both children; indicated desire to have cushions available | Small sample size in single classroom |
| Pfeiffer, B., Henry, A., Miller, S., & Witherell, S. (2008). The effectiveness of Disc ‘O’ Sit cushions on attention to task in second-grade students with attention difficulties. *American Journal of Occupational Therapy, 62,* 274–281. | II | 62 children; 29 tx, 32 control  Children identified by teacher as having attentional difficulties on an observational form | Attention; as measured by the Behavior Rating Inventory of Executive Function (including self-control, problem-solving, behavioral regulation, metacognition | Pre-post testing using the BRIEF; children in treatment group sat on cushion 2 hr/day for 2 wks; children in control group sat on regular chairs for the same length of time | A significant difference was found in the percentage  of change between the treatment and control group  (*F*[1, 59] = 28.31, *p* < .05). | Small effect size  Teachers and pre/post testers not blind to group assignment |

LEVELS OF EVIDENCE

Level I: Systematic review, meta-analyses, randomized controlled trials

Level II: Two groups, nonrandomized studies (e.g., cohort, case-control)

Level III: One group, nonrandomized (e.g., before and after, pretest and posttest)

Level IV: Descriptive studies that include analysis of outcomes (single subject design, case series)

Level V: Case reports and expert opinion that include narrative literature reviews and consensus statements

What to look for:

* Participants: age, diagnosis, behavior or concern, underlying reason for behavior (ie, sensory processing issue)
* Research design: see levels above
* Outcome of interest: behavioral or occupational?
* Length of intervention: how many sessions?
* Intervention: equipment, length of time strategy used in session, when data was collected? during what activity? where?
* Observation and recording arrangements: inter-observer reliability?
* Reporting of outcomes: how was data presented? percentage of non-overlapping data? how much variability in data? are the changes robust?