
The Effectiveness of Sensory Strategies Used in the Classroom to Increase the Productivity of Students with Autism

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CLINICAL SCENARIO:

In the late 1970's the work of Jean Ayres (1979) proposed a new theory to understand the nature of disabilities within a neurological framework focusing on the processing of sensory stimuli. Since the early 1990's, anecdotal evidence has suggested that planned, deliberate use of sensory based activities leads to improved performance for children with sensory dysfunction (Willbarger & Willbarger, 1992; Shellenberger & Williams, 2002; Stock Kranowitz, 2005). The work of Elmer and Dunn (1998) provided objective evidence of differences in sensory processing that may account for the difficulties some students encounter in school related activities. Adding support for the hypotheses related to sensory integration, has been the growing body of knowledge regarding the neuro-anatomical structures and related functions (Fisher, A. G., Murray, E.A., & Bundy, A. C, 1991) Most recently, evidence of anatomic structural differences specific to autism has been documented in post-mortem brain studies (Courchesne, E., 2006, October). The noted differences (e.g. excess number of neurons of the brains from individuals with autism, structural aberrations of the cerebellum) add further support to the hypotheses integral to sensory integration theory. The combination of these developments has lead to in increased interest in the use of sensory strategies to optimize learning for students with Autism.

FOCUSSED CLINICAL QUESTION:

Does the use of sensory strategies in the classroom increase the productivity of students with autism?

SUMMARY of Search, 'Best' Evidence' appraised, and Key Findings:

- Four citations were located that met the inclusion/exclusion criteria
 - 1 study use case study designs
 - 3 studies were expert opinion pieces
- The work by Schilling & Swartz (2004) was appraised as the design showed the most rigorous methodology developed to answer the question.
- With the use of sensory strategies (therapy balls for seating), all subjects (N= 4) demonstrated improvements in school performance behaviours tracked (in-seat behaviour and task engagement).
- Social validity for the use of therapist balls for seating was found to be strong with teachers.

CLINICAL BOTTOM LINE:

For children who have autism, the use of therapy balls for seating incorporated into classroom routines has positive impacts on behaviours associated with learning (In-seat behaviour and engagement in task behaviour). Positive impacts were noted to occur with immediate use of therapy balls for seating and tracked behaviours reverted to pre-intervention levels during the withdrawal phase. The long term effectiveness of the same strategies has not been determined.

Limitation of this CAT: This critical appraisal has been individually prepared and has not been subject to a peer-review.

SEARCH STRATEGY:**Terms used to guide Search Strategy:**

- **P**atient/Client Group: child, adolescent, elementary and secondary school, developmental disability/disorder, learning disability/disorder and behaviour
- **I**ntervention (or Assessment): sensory integration, sensorimotor, sensory motor integration, school-based, sensory strategies, sensory diet.
- **C**omparison: behaviour with/without use of sensory strategies in the classroom
- **O**utcome(s): change in behaviour associated with improved school performance/productivity (e.g. reduction in self-abusive behaviours, increase attention/engagement, improved output in school tasks)

Databases and sites searched	Search Terms	Limits used
Medline	occupational therapy, sensory integration, sensorimotor, child, adolescent	English, human subjects, publication years 1995-2006
ERIC	sensory integration, sensorimotor, elementary and secondary school	English, publication years 1995-2006
CINAHL	sensory motor integration, child, paediatric occupational therapy	peer review, research, ages 3 – 18 years, English, publication years 1995-2006

PsycInfo	sensorimotor, developmental disabilities, behaviour	peer review, research, ages 3 – 18 years, English, publication years 1995-2006
OT Seeker	Sensory Integration, sensorimotor, child	publications years 1995 - 2006

INCLUSION and EXCLUSION CRITERIA

- Inclusion:
 - Studies involved children ages 3 – 18 years.
 - Studies included children with developmental disorders.
 - Intervention involved school based activities.
 - Studies focused on behavioural changes as measured outcomes (e.g. reduction in self-abusive behaviours, increase attention/engagement, improved output in school tasks).
 - Studies were published in English.

- Exclusion:
 - Participants in studies received individual sensory integration therapy outside the classroom setting.

RESULTS OF SEARCH

Table 1: Summary of Study Designs of Articles retrieved (based on Levels of Evidence, Centre for Evidence Based Medicine, 1998)

Level of Evidence	Study Design/ Methodology of Articles Retrieved	Number Located	Author (Year)
Level I	Randomized Controls Trials – large size or meta analysis	0	
Level II	Randomized Control Trials with small size, not statistically significant	0	
Level III	Non- randomized, controlled or cohort studies; case series, case controlled	1	Schilling, D.L., & Swartz, I. S. (2004)
Level IV	Expert opinion	3	Baranek, G. T. (2002); Barnhill, G. P. (2001); Dempsey, I., & Foreman, P. (2001)

Level V	Guidelines developed experience, literature and discussion	0	
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BEST EVIDENCE

The study by Schilling, D.L., & Swartz, I. S. (2004), was identified as the 'best' evidence and selected for critical appraisal. Reasons for selecting these studies were:

- the study used BAB or ABAB designs and collected data in baseline, intervention and withdrawal phases to determine the impact of therapy balls as seating
- the use of therapy balls for seating was well integrated into typical classroom routines for the subjects
- attempts were made to control for bias on the part of subjects and researchers

SUMMARY OF BEST EVIDENCE

Table 2: Description and appraisal of Studies

Study - Schilling, D.L. & Schwartz, I. (2004)

Aim/objective of the Study/Systematic Review

- To investigate the effects of therapy balls as seating on in-seat behaviour and task engagement of students with ASD
- To determine social validity of the intervention via teacher perceptions

Study Design:

Single subject withdrawal design (single case design) using ABAB intervention regime was used. Data was collected using time interrupted series. The duration of intervention phases was a minimum of 2 weeks.

Setting: The study was carried out in a pre-school program operating on a university campus. The pre-school was publicly funded. The programming occurred in an integrated pre-school classroom as well as an extended day program for students with ASD. The teacher student ratio was 1- 2.

Participants: N = 4 males. A convenience sample from the pre-school was used. All subjects had been diagnosed by physician with ASD and using teacher interviews, the subjects were reported to have difficulty with in-seat behaviour and maintained engagement to task. The age range of the subjects was 3 years 11 months to 4year 2 months.

Intervention Investigated

Students were each individually fitted with a therapy ball with moulded feet for use during selected school activities. The selected school activities were specific to each participant and determined based on teacher input regarding those activities in which the students experienced the most difficulty with in-seat behaviour and task engagement.

Baseline and withdrawal: During determined activity times, time sampling of observed in-seat behaviour and task engagement were collected. Subjects were seated on typical classroom chairs.

Intervention: Subjects were provided with therapy balls for seating. Observation time periods and activities remained as per baseline and withdrawal phases. Teachers were instructed to make no comments regarding sitting behaviour unless behaviour was deemed dangerous or destructive.

Outcome Measures

In-seat behaviour- In-seat behaviour was defined as:

- student's buttocks were in contact with the seat portion of the chair or on the floor for floor sitting
- all four chair legs were in contact with the floor/one foot of the therapy ball was in contact with the floor

Real time sampling at each 10 second interval for maximum of 10 minutes occurred with 3 data collection sessions/week. Observers scored participants as with in or out of seat behaviour as based on the definition. Recorders used wireless headsets and received prompts. They independently and simultaneously observed and scored the same participants. Inter-observer reliability was 98%

Task engagement behaviour – Task engagement behaviour was defined as:

- student was oriented to the objects and tools necessary for the lesson
- Real time sampling at each 10 second interval for maximum of 10 minutes occurred with 3 data collection sessions/week. Observers scored participants as engaged or not engaged. Recorders used wireless headsets and received prompts. They independently and simultaneously observed and scored the same participants. Inter-observer reliability was 90%

Social Validity - A qualitative research approach (phenomological) was used with a scaled response to a questionnaire that teachers completed

Main Findings:

Range and means of percentage of intervals for In-seat Behaviour and Engagement Behaviour (Numbers are estimates from graphic tables)

	In -seat behaviour					Engagement Behaviour				
	A	B	A	B	Mean Difference	A	B	A	B	Mean Difference
Student 1	0-19 10	70-90 80	0-35 17	55- 90 77	65	20-30 35	50-90 70	30-55 42	80-95 87	40
Student 2	0-40 20	70 – 90 80	0-20 10	80- 100 90	80	35-50 42	55- 80 67	55 – 70 62	80-90 85	23.5
Student 3	10-30 20	60 – 85 73	10 – 40 25	80 – 90 85	56.5	35-95 70	80 –100 90	50 – 75 63	90 –100 95	23
Student 4*		90 -100 95	85-100 92.5	95-100 97.5	3.5		60- 90 75	20-40 30	60 -80 70	43.5

*Data from student 4 was confounded with ODD behaviour for which a safety plan was in place with behaviour contingency for desired behaviour.

Calculations based on estimates taken from graphic tables:

- Mean increase in in-seat behaviour intervals across phases – 51.25% with ranges of 3.5% - 80%
- Mean increase in task engagement intervals across phases – 32.5% with ranges of 23% - 43.5%

Original Authors' Conclusions

- All participants displayed marked improvement in classroom behaviour measures of In-seat behaviour and task engagement behaviour.
- The study provides empirical evidence of the benefits of sensory-based treatment in classroom settings.
- Social validity provided for strong support of the use of balls for classroom seating for students with ASD.
- Authors caution regarding over-generalizing findings and the need for additional study to examine the effects of seating on therapy balls after extended use.

Critical Appraisal

Validity –

Strengths:

- ABAB design provided comparison measures for behaviour change associated with intervention
- Consistent improvement in both behaviour measures occurred across a variety of individualized activities
- Inter-observer agreement was ensured
- Confounding variables e.g. teachers' influence on in-seat behaviour was addressed

Weaknesses

- Small sample limits generalization of the results
- Researchers didn't provide statistical analysis of significance
- Variations in data collection frequencies across subjects due to class absences (not drop-outs) were not explained in detail
- The behaviour observation tools were tested for reliability however, no effort was made to ensure validity
- There is an underlying assumption in the study design that in-seat behaviour and task engagement lead to improved school performance. To determine such a correlation long term follow-up of student performance with the implementation of sensory strategies is needed.
- The data was gathered from short term intervention and did not address the possibility of sensory accommodation with longer applications of the intervention

Interpretation of Results

The study suggests that the use of therapy balls as alternative seating for students with ASD can result in improved in-seat behaviour and task engagement.

Summary/Conclusion

The study provided empirical evidence of marked improvement over the short term in two measures of behaviour associated with improved school performance as a result of the intervention. In other words, the use of therapy balls for seating of students with autism results in better in-seat behaviour and task engagement over a period of 10 minutes.

IMPLICATIONS FOR PRACTICE, EDUCATION and FUTURE RESEARCH

Current implications

- While the study sample size is very restricted, the heterogeneity of the subjects within the autism continuum, suggests that the results of this study have short term applicability in classroom settings for students with autism. This study provides preliminary support for the use of therapy balls as seating alternatives for students with autism. If therapists were to use this study to plan intervention, long term follow up to determine the ongoing benefit of therapy balls for seating would be warranted.
- The authors have used the same research design method in a small sample of students with attention deficit and found similar improvements in in-seat behaviour and legible word productivity. (Schilling, D.L., Washington, K., Billingsley, .F. & Deitz, J., 2003). Thereby adding to the body of evidence supporting the use of therapy balls as a seating alternative for students with special needs.
- The social validity of the intervention was supported by teacher reports of significant variation in student behaviour (bouncing/rocking) while sitting on the therapy balls while simultaneously noting improvements in the behaviour measures. In Schilling et al. (2003), in addition to

teacher reports, the students also reflected on the use of the therapy balls for seating and with variations in their reasoning all students indicated a preference for sitting on the therapy balls.

- There is some suggestion from the consistent evidence of both studies that the use of therapy balls as alternative seating may be of value to many students. Occupational therapists may wish to consider therapy balls as alternative seating for students with autism or attention deficit disorder.

Future research

- Further study with longer timelines is needed to demonstrate that the gains noted in Schilling's work also results in improved school performance.
- Further study with longer timelines is also needed to ensure that the impact of the therapy balls doesn't dissipate with time.
- Subjecting the data to statistical analysis for levels of significance could add to the credence of the work to date.

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