**Effectiveness Studies of Other Interventions**

**Using Sensory or Motor Activities**

This section will include summaries from the literature on motor interventions, the impact of exercise, and other sensory / motor interventions that would not be considered Ayres’ SI intervention because they do not meet the principles as outlined in this website.

**Burkart, S., Roberts, J., Davidson, M. C., & Alhassan, S. (2018). Behavioral effects of a locomotor-based physical activity intervention in preschoolers. *Journal of Physical Activity and Health,15*(1), 46-52. doi:10.1123/jpah.2016-0479**

**BACKGROUND**: Poor adaptive learning behaviors (ie, distractibility, inattention, and disruption) are associated with behavior problems and underachievement in school, as well as indicating potential attention-deficit hyperactivity disorder. Strategies are needed to limit these behaviors. Physical activity (PA) has been suggested to improve behavior in school-aged children, but little is known about this relationship in preschoolers. This study examined the effects of a PA intervention on classroom behaviors in preschool-aged children.  
**METHODS**: Eight preschool classrooms (n = 71 children; age = 3.8 ± 0.7 y) with children from low socioeconomic environments were randomized to a locomotor-based PA (LB-PA) or unstructured free playtime (UF-PA) group. Both interventions were implemented by classroom teachers and delivered for 30 minutes per day, 5 days per week for 6 months. Classroom behavior was measured in both groups at 3 time points, whereas PA was assessed at 2 time points over a 6-month period and analyzed with hierarchical linear modeling.  
**RESULTS**:Linear growth models showed significant decreases in hyperactivity (LB-PA: -2.58 points, P = .001; UF-PA: 2.33 points, P = .03), aggression (LB-PA: -2.87 points, P = .01; UF-PA: 0.97 points, P = .38) and inattention (LB-PA: 1.59 points, P < .001; UF-PA: 3.91 points, P < .001).  
**CONCLUSIONS**:This research provides promising evidence for the efficacy of LB-PA as a strategy to improve classroom behavior in preschoolers.

**Mulvey, K. L., Taunton, S., Pennell, A., & Brian, A. (2018). Intervention. *Journal of Sport and Exercise Psychology,40*(5), 233-239. doi:10.1123/jsep.2018-0007**

Executive function skills play a critical role in school readiness for young children and can be improved through targeted intervention. However, children in preschool often experience deficits in multiple developmental domains. Thus, there is a need for integrated interventions that target multiple domains in concert. This study tested whether a proven gross motor skill intervention, Successful Kinesthetic Instruction for Preschoolers (SKIP), also improves preschoolers' executive function. Participants were randomly assigned to either intervention (n = 50) or control (n = 57) conditions. Prior to intervention, executive function and gross motor skills were tested. Intervention occurred for 6 weeks with 30-min sessions twice weekly (dose = 360 min). At posttest, participants in the SKIP condition showed significantly better gross motor and executive function skills than control participants. Results are the first to document the effectiveness of the SKIP intervention in also improving children's executive function.

### **Chatzihidiroglou, P., Chatzopoulos, D., Lykesas, G., & Doganis, G. (2018). Dancing effects on preschoolers’ sensorimotor synchronization, balance, and movement reaction time. *Perceptual and Motor Skills,*003151251876554. doi:10.1177/0031512518765545**

**In the present study, we compared an experimental group of preschool children ( n = 22; mean age = 5 years, 8 months) who followed an 8-week dance program with a control group ( n = 20; mean age = 5 years, 5 months) on pre-post measures of sensorimotor synchronization (K-Rhythm Test), balancing on one leg and movement reaction time. Compared with the control participants, the dance group demonstrated significantly better pretest to posttest improvements on sensorimotor synchronization and balance (but not movement reaction time). Considering the importance of sensorimotor synchronization and balance for subsequent child development and performance of daily and sport activities, these results suggest that dancing should be included in early childhood curricula.**

# Borji, R., Sahli, S., Baccouch, R., Laatar, R., Kachouri, H., & Rebai, H. (2017). An open-label randomized control trial of hopping and jumping training versus sensorimotor rehabilitation programme on postural capacities in individuals with intellectual disabilities. *Journal of Applied Research in Intellectual Disabilities,31*(2), 318-323. doi:10.1111/jar.12324

#### **BACKGROUND:** This study aimed to compare the effectiveness of a hopping and jumping training programme (HJP) versus a sensorimotor rehabilitation programme (SRP) on postural performances in children with intellectual disability.

#### **METHODS:** Three groups of children with intellectual disability participated in the study: the HJP group, the SRP group and a control group. Postural capacities were tested with the Berg Balance Scale (BBS) and the Tinetti tests. The HJP and the SRP groups participated in the training programmes for eight weeks. Then, all participants were retested.

#### **RESULTS:** Results showed that before the training period, there are no significant differences between the three groups. After the training period, the BBS and the Tinetti scores increased significantly in the HJP group and the SRP group with greater extent in the HJP group than in the STP group.

#### **CONCLUSION**:We suggest that HJP training is more recommended to improve postural capacities in children with intellectual disability.

**Arabatzi, F. Adaptations in movement performance after plyometric training on mini-trampoline in children. (2018).** [***J Sports Med Phys Fitness***](https://www.ncbi.nlm.nih.gov/pubmed/27813394)***,* *58(1-2):*66-72. doi: 10.23736/S0022-4707.16.06759-1**

#### **BACKGROUND**: Deficits in postural control and skill performance are important intrinsic fall risk factors. Thus, the purpose of this study was to investigate the impact of trampoline plyometrics on postural control and jumping height in prepubertal children.

#### **METHODS**: Twenty-two school children were assigned to either a trampoline group (TPLG, N.=12, 7 girls and 5 boys, age =9.30±0.55 years) or a control group (CG, N.=12, 8 girls and 4 boys, age =9.30±0.55 years). The TPLG participated in 4 weeks plyometric training on a mini-trampoline (3 times per week) integrated in their physical education lessons while the CG attended the standard physical education curriculum at school. Pre- and postintervention included the measurements of postural sway and maximum height in countermovement and drop jump.

#### **RESULTS**: Postural sway decreased significantly (P<0.05) in normal quiet stance (NQS) for the TPLG but not for the CG. Statistically significant decreases in postural sway in the anteroposterior direction during one-leg stance (OLS) were found for the TPLG whereas postural sway was unchanged at both directions for control group. Furthermore, statistically significant improvements in jump height were found only for TPLG after training (P<0.05). CONCLUSIONS:

Training on elastic surface could be incorporated into children's exercise programs aiming to enhance balance and lower-limb strength to reduce injury rates. For injury prevention during trampoline training, close supervision by experienced personnel is recommended.

### **Coulthard, H., Williamson, I., Palfreyman, Z., & Lyttle, S. (2018). Evaluation of a pilot sensory play intervention to increase fruit acceptance in preschool children. *Appetite,120*, 609-615. doi:10.1016/j.appet.2017.10.011**

**Recent research has found an association between dislike of messy play and higher levels of food neophobia in children. The aim of the present study was to pilot and assess a five week intervention with preschool children, to examine whether engagement in tactilesensory tasks leads to increased fruit acceptance. Interventions were carried out to examine whether weekly sessions of sensory play combined with fruit exposure, would increase acceptance and enjoyment of fruits to a greater extent than two non-sensory play conditions featuring fruit exposure or normal play activities alone. One hundred children aged 18 months to four years were recruited from ten playgroups in the Midlands area of the United Kingdom (UK) of which 83 completed the interventions. Participants were randomly assigned to one of four conditions: combined sensory play (fruit and non-food), non-food sensory play, fruit taste exposure, and control play. There were baseline differences in child fruit acceptance, so this was entered as a covariate into subsequent analyses. It was found that children in both the combined sensory play and non-food sensory play conditions enjoyed significantly more fruits at follow up than children in the control play condition, whilst children in the non-food sensory play group also enjoyed significantly more fruits than the fruit exposure group. These findings suggest that sensory play, with fruit and/or non-food substances, combined with exposure may be an effective strategy to increase tasting and fruit acceptance in children.**

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# Nederkoorn, C., Theiβen, J., Tummers, M., & Roefs, A. (2018). Taste the feeling or feel the tasting: Tactile exposure to food texture promotes food acceptance. *Appetite,120*, 297-301. doi:10.1016/j.appet.2017.09.010

**The texture of food can be a reason why children reject it: It matters if food is crispy, slimy, smooth or has pips and bits in it. In general, mere exposure is the best method to increase acceptance of food: becoming more familiar with a food by repeated exposure increases liking for it. However, exposure to texture can be difficult, as children can be reluctant to try tasting it. In the current study, it is tested if acceptance of a food with a specific texture is improved after exposure to the feel of it, with hands only. Sixty-six children (between 3 and 10 years old) were randomly assigned to either the exposure or control condition. In the exposure condition, children played with an colorless and odorless jelly with their hands and in the control group, children played a board game. Afterwards, children were asked to taste 3 desserts (in balanced order): smooth strawberry yoghurt, strawberry yoghurt with pieces and strawberry jelly. Results showed that the children in the exposure condition ate specifically more of the jelly dessert - the texture of which they had been pre-exposed to - compared to the children in control condition. No group differences were found for the other two desserts. The results imply that feeling the texture of a food with hands increases the acceptance of food with the same texture. Playing with food with hands seems therefore be a first step in getting familiar with food and might help to increase variety of food intake.**

### **Owen, K. B., Parker, P. D., Astell-Burt, T., & Lonsdale, C. (2018). Effects of physical activity and breaks on mathematics engagement in adolescents. *Journal of Science and Medicine in Sport,21*(1), 63-68. doi:10.1016/j.jsams.2017.07.002**

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#### **OBJECTIVES:** The purpose of this study was to determine whether physical activity has a positive relationship with school engagement regardless of the presence or absence of a recess or lunch break before the classroom lesson.

#### **DESIGN:** Data were collected over three ten-week periods: January-April 2014 (Time 1), October-December 2014 (Time 2), and April-June 2015 (Time 3).

#### **METHODS:** A cohort of 2194 adolescents (mean age=13.40years, SD=.73) wore an accelerometer during the hour before a mathematics lesson and completed a questionnaire following the mathematics lesson to assess school engagement in that lesson.

#### **RESULTS:** Linear mixed models indicated that moderate-intensity activity before a mathematics lesson had a positive linear relationship with cognitive engagement (β=.40, p<.05). Recess breaks before a mathematics lesson had a negative relationship with overall, behavioral, emotional, and cognitive engagement (β=-.18, p<.01, β=-.19, p<.01, β=-.13, p=.03, and β=-.13, p=.04, respectively).

#### **CONCLUSIONS:** Promoting moderate-intensity activity prior to mathematics lessons could improve students' cognitive engagement. Educators should be aware that students tend to demonstrate the lowest levels of school engagement after recess breaks.

### **Smits-Engelsman, B., Vinçon, S., Blank, R., Quadrado, V. H., Polatajko, H., & Wilson, P. H. (2018). Evaluating the evidence for motor-based interventions in developmental coordination disorder: A systematic review and meta-analysis. *Research in Developmental Disabilities,74*, 72-102. doi:10.1016/j.ridd.2018.01.002**

#### **BACKGROUND:** As part of the process of creating an update of the clinical practice guidelines for developmental coordination disorder (DCD) (Blank, Smits-Engelsman, Polatajko, & Wilson, 2012), a systematic review of intervention studies, published since the last guidelines statement was conducted.

#### **AIM:** The aim of this study was to 1) systematically review the evidence published from January 2012 to February 2017 regarding the effectiveness of motor based interventions in individuals with DCD, 2) quantify treatment effects using a meta-analysis, 3) examine the available information on different aspects of delivery including use of group intervention, duration and frequency of therapy, and 4) identify gaps in the literature and make recommendations for future intervention research.

#### **METHOD:** An electronic search of 5 databases (PubMed, Embase, Pedro, Scopus and Cochrane) was conducted for studies that evaluated motor-based interventions to improve performance for individuals with DCD.

#### **RESULTS:** Thirty studies covering 25 datasets were included, 19 of which provided outcomes on standardized measures of motorperformance. The overall effect size (Cohen's d) across intervention studies was large (1.06), but the range was wide: for 11 interventions, the observed effect was large (>0.80), in eight studies moderate (>0.50), and in five it was small or negligible (<0.50). Positive benefits were evident for activity-oriented approaches, body function-oriented combined with activities, active video games, and small group programs.

#### **CONCLUSION:** Results showed that activity-oriented and body function-oriented interventions can have a positive effect on motor function and skills. However, given the varied methodological quality and the large confidence intervals of some studies, the results should be interpreted with caution.

**Nederkoorn, C., Theiβen, J., Tummers, M., & Roefs, A. (2018). Taste the feeling or feel the tasting: Tactile exposure to food texture promotes food acceptance. *Appetite,* *120*, 297-301. doi:10.1016/j.appet.2017.09.010**

The texture of food can be a reason why children reject it: It matters if food is crispy, slimy, smooth or has pips and bits in it. In general, mere exposure is the best method to increase acceptance of food: becoming more familiar with a food by repeated exposure increases liking for it. However, exposure to texture can be difficult, as children can be reluctant to try tasting it. In the current study, it is tested if acceptance of a food with a specific texture is improved after exposure to the feel of it, with hands only. Sixty-six children (between 3 and 10 years old) were randomly assigned to either the exposure or control condition. In the exposure condition, children played with an colourless and odourless jelly with their hands and in the control group, children played a board game. Afterwards, children were asked to taste 3 desserts (in balanced order): smooth strawberry yoghurt, strawberry yoghurt with pieces and strawberry jelly. Results showed that the children in the exposure condition ate specifically more of the jelly dessert - the texture of which they had been pre-exposed to - compared to the children in control condition. No group differences were found for the other two desserts. The results imply that feeling the texture of a food with hands increases the acceptance of food with the same texture. Playing with food with hands seems therefore be a first step in getting familiar with food and might help to increase variety of food intake.

**Coulthard, H., Williamson, I., Palfreyman, Z., & Lyttle, S. (2018). Evaluation of a pilot sensory play intervention to increase fruit acceptance in preschool children. *Appetite,* *120*, 609-615. doi:10.1016/j.appet.2017.10.011**

Recent research has found an association between dislike of messy play and higher levels of food neophobia in children. The aim of the present study was to pilot and assess a five week intervention with preschool children, to examine whether engagement in tactile sensory tasks leads to increased fruit acceptance. Interventions were carried out to examine whether weekly sessions of sensory play combined with fruit exposure, would increase acceptance and enjoyment of fruits to a greater extent than two non-sensory play conditions featuring fruit exposure or normal play activities alone. One hundred children aged 18 months to four years were recruited from ten playgroups in the Midlands area of the United Kingdom (UK) of which 83 completed the interventions. Participants were randomly assigned to one of four conditions: combined sensory play (fruit and non-food), non-food sensory play, fruit taste exposure, and control play. There were baseline differences in child fruit acceptance, so this was entered as a covariate into subsequent analyses. It was found that children in both the combined sensory play and non-food sensory play conditions enjoyed significantly more fruits at follow up than children in the control play condition, whilst children in the non-food sensory play group also enjoyed significantly more fruits than the fruit exposure group. These findings suggest that sensory play, with fruit and/or non-food substances, combined with exposure may be an effective strategy to increase tasting and fruit acceptance in children.

**2017**

**Shemy, S., & Mohamed, N. (2017). Effect of Sensory Integration on Motor Performance and Balance in Children with Developmental Coordination Disorder: A Randomized Controlled Trial. *International Journal of Therapies and Rehabilitation Research,* *6*(1). doi:10.5455/ijtrr.000000213**

Objective: To investigate the effect of designed sensory motor paradigm on motor performance and balance in children with developmental coordination disorder. Design: Thirty children with developmental coordination disorder according to the Movement Assessment Battery for children 2nd edition from both sexes ranging in age from eight to ten years old were assigned into two groups of equal number. Control group did not receive any intervention, and study group received sensory motor integration therapy. Stability indices were evaluated using Biodex instrument system as well as motor skills were assessed using the Bruininks-Oseretsky Test of Motor Proficiency 2nd edition before and after three months of treatment. Results: Comparing the pre- and post-treatment mean values, the results revealed no significant difference in all the measuring variables of the control group, while a significant improvement observed in all the measuring variables of the study group. Also, a significant difference in favor to the study group observed when comparing the post-treatment results of the two groups. Conclusion: Observing the study group results revealed the ability to effectively integrate sensory activities that meet a variety of sensory processing needs, and the improvement of motor skills and dynamic balance among children with developmental coordination disorder.

**Mills, C., & Chapparo, C. (2017). Listening to teachers: Views on delivery of a classroom based sensory intervention for students with autism. *Australian Occupational Therapy Journal,* *65*(1), 15-24. doi:10.1111/1440-1630.12381**

**BACKGROUND/AIM**: Occupational therapists consider the impact of autism spectrum disorder on occupational performance at school. Occupational therapists work with teachers to support student participation. Atypical sensory processing is common in children with autism. Therefore, collaborating with teachers to enable students with autism to appropriately process sensory information within classrooms may be necessary. This qualitative pilot study aimed to capture teachers' perceptions of using a Sensory Activity Schedule, a sensory based intervention, in the classroom.

**METHODS**: A qualitative descriptive approach was used to analyse semi-structured interview responses from 19 qualified teachers who taught children with autism from seven different autism specific special schools in NSW. Teachers were asked about their motivation to complete the intervention as well as helpful and difficult aspects of the intervention.

**FINDINGS**: Three main categories and eight sub-categories were identified from the 19 respondents who reported that helping their students was an important motivation for using a Sensory Activity Schedule as well as the opportunity to evaluate whether sensory based intervention was beneficial. Teachers reported that learning new ideas, working with an occupational therapist and seeing an increase in concentration and a reduction in undesired behaviours were positive aspects of utilising the intervention. Timing, staffing and fidelity of the intervention were areas of concern.

**CONCLUSION**: Collaboration with classroom teachers is an essential part of school-based occupational therapy. Insights from teachers who implemented a sensory based intervention in the classroom assist occupational therapists to better support students with autism spectrum disorder in schools.

**Coulthard, H., & Sealy, A. (2017). Play with your food! Sensory play is associated with tasting of fruits and vegetables in preschool children. *Appetite,* *113*, 84-90. doi:10.1016/j.appet.2017.02.003**

The objective of the current study was to ascertain whether taking part in a sensory play activity with real fruits and vegetables (FV) can encourage tasting in preschool children, compared to a non-food activity or visual exposure to the activity. Three to four-year-old pre-school children (N = 62) were recruited from three preschool nursery classes from a school in Northamptonshire, UK. A between participants experimental study was conducted with each class assigned to one of three conditions; sensory FV play, sensory non-food play and visual FV exposure. Parental report of several baseline variables was taken; child baseline liking of the foods used in the study, parental and child FV consumption (portions/day), child neophobia and child tactile sensitivity. Outcome measures were the number of fruits and vegetables tasted in a post experiment taste test which featured (n = 5) or did not feature (n = 3) in the task. Analyses of covariance controlling for food neophobia and baseline liking of foods, showed that after the activity children in the sensory FV play condition tried more FV than both children in the non-food sensory play task (p < 0.001) and children in the visual FV exposure task (p < 0.001). This was true not only for five foods used in the activity (p < 0.001), but also three foods that were not used in the activity (p < 0.05). Sensory play activities using fruits and vegetables may encourage FV tasting in preschool children more than non food play or visual exposure alone. Long term intervention studies need to be carried out to see if these effects can be sustained over time.

**Bestbier, L., & Williams, T. I. (2017). The Immediate Effects of Deep Pressure on Young People with Autism and Severe Intellectual Difficulties: Demonstrating Individual Differences. *Occupational Therapy International,* *2017*, 1-7. doi:10.1155/2017/7534972**

**Background**: Deep pressure is widely used by occupational therapists for people with autism spectrum disorders. There is limited research evaluating deep pressure. Objective. To evaluate the immediate effects of deep pressure on young people with autism and severe intellectual disabilities.

**Methods**: Mood and behavior were rated for 13 pupils with ASD and severe ID before and after deep pressure sessions.

**Results**: Sufficient data was available from 8 participants to be analyzed using Tau-U, a nonparametric technique that allows for serial dependence in data. Six showed benefits statistically. Five of these showed benefits across all domains, and one showed benefit on three out of five domains. Relevance to Clinical Practice. Deep pressure appears to be of immediate benefit to this population with autism and severe ID, but the heterogeneity of response suggests that careful monitoring of response should be used and deep pressure discontinued when it is no longer of benefit.

**Limitations:** This is an open label evaluation study using rating scales. Recommendations for Future Research. Future studies of the use of deep pressure should use physiological response measures, in addition to blinded raters for aspects of behaviors such as attitude to learning psychological health not captured physiologically.

**Silverman, F., & Tyszka, A. C. (2017). Supporting Participation for Children With Sensory Processing Needs and Their Families: Community-Based Action Research. *American Journal of Occupational Therapy,* *71*(4). doi:10.5014/ajot.2017.025544**

**OBJECTIVE**: This qualitative study was part of efforts to develop and analyze specialized sensory-friendly, community-based programming at a local museum for families with children or young adults with sensory processing issues.

**METHOD:** A qualitative, descriptive framework was used, aimed at uncovering the experience of families in attendance. Using convenience sampling, 46 participants were recruited from six separate cohorts of parents across a 1.5-yr period, using a community-based action research approach.

**RESULTS**: Survey and interview data suggest that specialized programs with appropriate modifications in place improved the quality and the duration of museum visits for families with children or young adults with sensory processing needs, promoting both participation and well-being. **CONCLUSION**: Adapted community events that increase participation in context may be a promising intervention to support well-being for people with disabilities and their families.

**Pfeiffer, B., Clark, G. F., & Arbesman, M. (2017). Effectiveness of Cognitive and Occupation-Based Interventions for Children With Challenges in Sensory Processing and Integration: A Systematic Review. *American Journal of Occupational Therapy,* *72*(1). doi:10.5014/ajot.2018.028233**

This systematic review examines the evidence for the effectiveness of cognitive and occupation-based interventions to improve self-regulation in children and youth who have challenges in processing and integrating sensory information. The Preferred Reporting Items for Systematic Reviews and Meta-Analysis guided the methodology. Five studies identified through a comprehensive database search met the inclusion criteria and were separated into categories of cognitive and occupation-based interventions. Articles that did not specifically measure sensory integration (SI) or processing challenges were omitted. Synthesis of the articles suggests that self-regulation (e.g., sensory processing, emotional regulation, executive functioning, social function) improved with cognitive and occupation-based interventions. Because the number of studies that measured sensory processing or SI challenges was limited, researchers are encouraged to include these measures in future research to understand the impact of a broader range of cognitive and occupation-based interventions.

**Weitlauf, A. S., Sathe, N., Mcpheeters, M. L., & Warren, Z. E. (2017). Interventions Targeting Sensory Challenges in Autism Spectrum Disorder: A Systematic Review. *Pediatrics,* *139*(6). doi:10.1542/peds.2017-0347**

**CONTEXT**: Sensory challenges are common among children with autism spectrum disorder (ASD).

**OBJECTIVE:** To evaluate the effectiveness and safety of interventions targeting sensory challenges in ASD. DATA SOURCES: Databases, including Medline and PsycINFO.

**STUDY SELECTION:** Two investigators independently screened studies against predetermined criteria.

**DATA EXTRACTION:** One investigator extracted data with review by a second. Investigators independently assessed risk of bias and strength of evidence (SOE), or confidence in the estimate of effects. RESULTS: Twenty-four studies, including 20 randomized controlled trials (RCTs), were included. Only 3 studies had low risk of bias. Populations, interventions, and outcomes varied. Limited, short-term studies reported potential positive effects of several approaches in discrete skill domains. Specifically, sensory integration-based approaches improved sensory and motor skills-related measures (low SOE). Environmental enrichment improved nonverbal cognitive skills (low SOE). Studies of auditory integration-based approaches did not improve language (low SOE). Massage improved symptom severity and sensory challenges in studies with likely overlapping participants (low SOE). Music therapy studies evaluated different protocols and outcomes, precluding synthesis (insufficient SOE). Some positive effects were reported for other approaches, but findings were inconsistent (insufficient SOE). **LIMITATIONS:** Studies were small and short-term, and few fully categorized populations.

**CONCLUSIONS:** Some interventions may yield modest short-term (<6 months) improvements in sensory- and ASD symptom severity-related outcomes; the evidence base is small, and the durability of the effects is unclear. Although some therapies may hold promise, substantial needs exist for continuing improvements in methodologic rigor.

**Niklasson, M., Norlander, T., Niklasson, I., & Rasmussen, P. (2017). Catching-up: Children with developmental coordination disorder compared to healthy children before and after sensorimotor therapy. *Plos One, 12*(10). doi:10.1371/journal.pone.0186126**

The aims of the present study were to (a) compare healthy children in terms of sensorimotor maturity to untreated children diagnosed with developmental coordination disorder (DCD) and (b) compare healthy children to diagnosed children following completed treatment with sensorimotor therapy. Participants were 298 children, 196 boys and 102 girls, distributed into a Norm group of healthy children (n = 99) and a group of children diagnosed with DCD (n = 199) with a total mean age of 8.77 years (SD = 2.88). Participants in both groups were assessed on instruments aimed to detect sensorimotor deviations. The children in the DCD group completed, during on average 36 months, sensorimotor therapy which comprised stereotypical fetal- and infant movements, vestibular stimulation, tactile stimulation, auditory stimulation, complementary play exercises, gross motor milestones, and sports-related gross motor skills. At the final visit a full assessment was once more performed. Results showed that the Norm group performed better on all sensorimotor tests as compared to the untreated children from the DCD group, with the exception of an audiometric test where both groups performed at the same level. Girls performed better on tests assessing proprioceptive and balance abilities. Results also showed, after controls for natural maturing effects, that the children from the DCD group after sensorimotor therapy did catch up with the healthy children. The concept of "catching-up" is used within developmental medicine but has not earlier been documented with regard to children and youth in connection with DCD.

**Harland, A., Swarbrick, C., & Haines, D. (2017). The impact of sensory integration groups on the participation of children and young people with learning disabilities: perceptions of therapists and teaching staff. *Brighton Journal of Research in Health Sciences,* *1*, 1-10.**

**Background:** Sensory integration techniques which follow the theory outlined by Ayres (1972) are widely used by occupational therapists as an intervention for children and young adults with learning disabilities, but their efficacy is unclear. Research studies have suggested increased levels of participation and other positive behavioural changes following group sessions using sensory integration techniques, but literature reviews have highlighted a scarcity of evidence supporting their use. Materials and **Methods:** A qualitative study in which therapy and teaching staff of children and young adults with learning disabilities aged between 5 and 22, at a school and a college in England, were interviewed to gain understanding of their perceptions of the impact of these groups. **Findings:** Groups involving sensory integration techniques were perceived to have a positive effect on the abilities and participation (in both the group itself and subsequent learning and other activities) of children and young adults with learning disabilities and other complex needs in educational settings.

**Conclusions:** The findings are of relevance to occupational therapists and others working with young people with learning disabilities in special educational and other settings. In particular, they suggest variables that may have the potential to be measured in future research evaluating such sensory integration groups.

**Chuang, T., Kuo, M., Fan, P., & Hsu, Y. (2017). A kinect-based motion-sensing game therapy to foster the learning of children with sensory integration dysfunction. *Educational Technology Research and Development,* *65*(3), 699-717. doi:10.1007/s11423-016-9505-y**

Sensory integration dysfunction (SID, also known as sensory processing disorder, SPD) is a condition that exists when a person’s multisensory integration fails to process and respond adequately to the demands of the environment. Children with SID (CwSID) are also learners with disabilities with regard to responding adequately to the demands made by a learning environment, and usually have performance difficulties in one or more areas of life, such as productivity, leisure and play, or activities of daily living, and this can reduce their learning motivation. This study tries to develop a motion-sensing digital game-based SID therapy to help such children become more engaged in physical training, with the hope that by improving their bodily-kinesthetic intelligence these children can be more confident of facing various learning challenges, like those associated with social participation. This research applied the Microsoft Kinect system and a specially designed motion-sensing game related to SID, and used interviews to collect responses from the children and their parents. The Chinese version of the sensory profile and clinical observation were applied to evaluate the effects of the therapy, and the triangulation method applied in the data analysis reveals the improvements of all participants in eight clinical observation items. The results imply that our approach was able to increase the learning motivation and actions of the CwSID who participated in this study, with better results than those obtained in our earlier work, which used the Nintendo Wii device and its commercially available games.

**Salami, F., Ashayeri, H., Estaki, M., Farzad, V., & Entezar, R. K. (2017). Studying the Effectiveness of Combination Therapy (Based on Executive Function and Sensory Integration) Child-Centered on the Symptoms of Attention Deficit/Hyperactivity Disorder (ADHD). *International Education Studies,* *10*(4), 70. doi:10.5539/ies.v10n4p70**

The aim of the present study is to examine the effectiveness of combination therapy based on executive function and sensory integration child-centered on ADHD. For this purpose, from among all first, second and third grade primary school students in Shiraz, 40 children were selected. The selected students were randomly assigned in two groups of experimental (n = 20) and control group (n = 20) by random method through internet call from Education site, and by Clinical Interview, implementation of CSI-4 parent form, and according to the criteria for entry and after matching. Combination therapy based on executive function and sensory integration includes 24 sessions of an hour and a half, in groups of five in four groups of children that was held three times a week. Pre-test and post-test in both groups was performed using CSI-4 parent form. Data obtained were analyzed using analysis of covariance and SPSS software. The results showed that combination therapy based on executive function and sensory integration child-centered reduces attention deficit and hyperactivity.

**2016**

**Blanche, E. I., Chang, M. C., Gutiérrez, J., & Gunter, J. S. (2016). Effectiveness of a sensory-enriched early intervention group program for children With developmental disabilities. *American Journal of Occupational Therapy*, *70*(5), 7005220010p1-7005220010p8.**

**OBJECTIVE:** The study’s objective was to evaluate the effectiveness of the Interdisciplinary Sensory-Enriched Early Intervention (ISEEI) group program for children with developmental delays.

**METHOD:** We conducted a retrospective chart review of 63 children ages 18–36 mo who participated in ISEEI. We evaluated participants with the Bayley Scales of Infant and Toddler Development III (Bayley–III) and the Infant/Toddler Sensory Profile (ITSP) at enrollment and after 3–9 mo. We conducted a paired *t* test to examine changes in the Bayley–III between pre- and posttests.

**RESULTS:** At enrollment, 70% of children presented atypical scores in two or more areas of sensory processing in the ITSP. Results revealed that children with sensory processing difficulties demonstrated significant improvement in all areas of development except fine motor skills; children without sensory processing difficulties showed significant improvement in language and cognition.

**CONCLUSION:** The ISEEI group program is an effective method to ameliorate developmental delays.

**Fong, S. S., Guo, X., Liu, K. P., Ki, W. Y., Louie, L. H., Chung, R. C., & Macfarlane, D. J. (2016). Task-specific balance training improves the sensory organisation of balance control in children with developmental coordination disorder: A randomised controlled trial. *Scientific reports*, *6*.**

Sensory organisation of balance control is compromised in children with developmental coordination disorder (DCD). A randomised controlled trial involving 88 children with DCD was conducted to evaluate the efficacy of a task-specific balance training (functional-movement training, FMT) programme in improving balance deficits in a DCD population. The DCD participants were randomly assigned to either a FMT group or a control group. The FMT group received two training sessions/ week for 3 months. Measurements of the participants' sensory organisation (somatosensory, vestibular and visual ratios), balance and motor proficiency (Movement Assessment Battery for Children, MABC scores) and center of pressure sway velocity (Unilateral Stance Test, UST scores) were taken at baseline, immediately after FMT and 3 months after FMT. The FMT group showed greater improvements than the controls in somatosensory ratio at 3 and 6 months (all P < 0.001), but the within-group changes were not significant (P > 0.05). The results of both the MABC and the UST also indicated that the balance performance of the FMT group was significantly better than that of the control group at 3 and 6 months (all P < 0.05). Task-specific balance training was found to marginally improve the somatosensory function and somewhat improve the balance performance of children with DCD.

**Jirikowic, T., McCoy, S. W., Price, R., Ciol, M. A., Hsu, L. Y., & Kartin, D. (2016). Virtual sensorimotor training for balance: pilot study results for children with fetal alcohol spectrum disorders. *Pediatric physical therapy*, *28*(4), 460-468.**

#### **PURPOSE**: To examine the effects of Sensorimotor Training to Affect Balance, Engagement, and Learning (STABEL), a virtual reality system to train sensory adaptation for balance control, for children with fetal alcohol spectrum disorders (FASDs).

#### METHODS: Twenty-three children with FASDs received STABEL training in a university laboratory, or home, or were controls. The Movement Assessment Battery for Children-2nd edition (MABC-2) and Pediatric Clinical Test of Sensory Interaction for Balance-2 (P-CTSIB-2) were analyzed by group (lab, home, and control), session (pre-STABEL, 1 week post-STABEL, and 1 month post-STABEL), and group-by-session interaction.

#### **RESULTS**: Significant effects were group and session for MABC-2 Balance and interaction for MABC-2 Total Motor and P-CTSIB-2.

#### **CONCLUSION**: Preliminary results support improved sensory adaptation, balance, and motor performance post-STABEL, which warrant further study with a larger, randomized sample.

**Kachouri, H., Borji, R., Baccouch, R., Laatar, R., Rebai, H., & Sahli, S. (2016). The effect of a combined strength and proprioceptive training on muscle strength and postural balance in boys with intellectual disability: An exploratory study. *Research in developmental disabilities*, *53*, 367-376.**

The aim of our study was to investigate the effect of a combined strength and proprioception training (CSPT) program on muscle strength and postural balance in children with intellectual disability (ID). The maximum voluntary contraction (MVC) and postural parameters (CoPVm, CoPLX, CoPLY) of 20 children with ID were recorded before and after 8 weeks of a CSPT program. The participants were divided into two groups: an experimental group who attended a CSPT program and a control group who continued with daily activities. In the trained group, the MVC increased significantly (p<0.001) after the training period and the postural parameters decreased significantly in Double-Leg Stance (DLS) and One-Leg Stance (OLS) during the firm surface condition as well as in the DLS during the foam surface condition; in both eyes open (EO) and eyes closed (EC) conditions. A CSPT program improves postural balance in children with ID could be due to the enhancement in muscle strength and proprioceptive input integration.

**2015**

**Farhat, F., Hsairi, I., Baati, H., Smits-Engelsman, B. C. M., Masmoudi, K., Mchirgui, R., ... & Moalla, W. (2016). The effect of a motor skills training program in the improvement of practiced and non-practiced tasks performance in children with developmental coordination disorder (DCD). *Human movement science*, *46*, 10-22.**

The purpose of the present study was to examine the effect of a group-based task oriented skills training program on motor and physical ability for children with [DCD](http://topics.sciencedirect.com/topics/page/Developmental_coordination_disorder). It was also investigated if there was an effect on fine motor and handwriting tasks that were not specifically practiced during the training program. Forty-one children aged 6–10 years took part in this study. Children were assigned to three groups: an experimental training group consisting of 14 children with DCD, a control non-training group consisted of 13 children with DCD and a control non-training group consisting of 14 typically developed children. The measurements included were, the Movement Assessment Battery for Children (MABC), the Modified Agility Test (MAT), the Triple Hop Distance (THD), the 5 Jump-test (5JT) and the Handwriting Performance Test. All measures were administered pre and post an 8-week training program. The results showed that 10 children of the DCD training-group improved their performance in MABC test, attaining a score above the 15th percentile after their participation in the training program. DCD training-group showed a significant improvement on all cluster scores (manual dexterity (*t* (13) = 5.3, *p* < .001), ball skills (*t* (13) = 2.73, *p* < .05) and balance (*t* (13) = 5.13, *p* < .001). Significant performance improvements were also found in MAT, THD, 5JT (*t* (13) = –4.55; *p* < .01), handwriting quality (*t* (12) = –2.73; *p* < .05) and speed (*t* (12) = –4.2; *p* < .01) after the training program. In conclusion, improvement in both practiced and non-practiced skills, in the training program, may reflect improvement in [motor skill](http://topics.sciencedirect.com/topics/page/Motor_skills) but also transfer to other skills.

* **Myer, G. D., Faigenbaum, A. D., Edwards, N. M., Clark, J. F., Best, T. M., & Sallis, R. E. (2015). Sixty minutes of what? A developing brain perspective for activating children with an integrative exercise approach. *British journal of sports medicine*, *49*(23), 1510-1516.**

Current recommendations for physical activity in children overlook the critical importance of motor skill acquisition early in life. Instead, they focus on the quantitative aspects of physical activity (eg, accumulate 60 min of daily moderate to vigorous physical activity) and selected health-related components of physical fitness (eg, aerobic fitness, muscular strength, muscular endurance, flexibility and body composition). This focus on exercise quantity in youth may limit considerations of qualitative aspects of programme design which include (1) skill development, (2) socialisation and (3) enjoyment of exercise. The timing of brain development and associated neuroplasticity for motor skill learning makes the preadolescence period a critical time to develop and reinforce fundamental movement skills in boys and girls. Children who do not participate regularly in structured motor skill-enriched activities during physical education classes or diverse youth sports programmes may never reach their genetic potential for motor skill control which underlies sustainable physical fitness later in life. The goals of this review are twofold: (1) challenge current dogma that is currently focused on the quantitative rather than qualitative aspects of physical activity recommendations for youth and (2) synthesise the latest evidence regarding the brain and motor control that will provide the foundation for integrative exercise programming that provide a framework sustainable activity for life.

**Pepino, V. C., & Mezzacappa, M. A. (2015). Application of tactile/kinesthetic stimulation in preterm infants: a systematic review. *Jornal de Pediatria (Versão em Português)*, *91*(3), 213-233.**

**OBJECTIVE:** To verify the methods used by the clinical trials that assessed the effect of tactile/kinesthetic stimulation on weight gain in preterm infants and highlight the similarities and differences among such studies.

**SOURCES:** This review collected studies from two databases, PEDro and PubMed, in July of 2014, in addition to bibliographies. Two researchers assessed the relevant titles independently, and then chose which studies to read in full and include in this review by consensus. Clinical trials that studied tactile stimulation or massage therapy whether or not associated with kinesthetic stimulation of preterm infants; that assessed weight gain after the intervention; that had a control group and were composed in English, Portuguese, or Spanish were included.

**SUMMARY OF THE FINDINGS:** A total of 520 titles were found and 108 were selected for manuscript reading. Repeated studies were excluded, resulting in 40 different studies. Of these, 31 met all the inclusion criteria. There were many differences in the application of tactile/kinesthetic stimulation techniques among studies, which hindered the accurate reproduction of the procedure. Also, many studies did not describe the adverse events that occurred during stimulation, the course of action taken when such events occurred, and their effect on the outcome.

**CONCLUSIONS:** These studies made a relevant contribution towards indicating tactile/kinesthetic stimulation as a promising tool. Nevertheless, there was no standard for application among them. Future studies should raise the level of methodological rigor and describe the adverse events. This may permit other researchers to be more aware of expected outcomes, and a standard technique could be established.

**Woo, C. C., Donnelly, J. H., Steinberg-Epstein, R., & Leon, M. (2015). Environmental enrichment as a therapy for autism: A clinical trial replication and extension. *Behavioral neuroscience*, *129*(4), 412.**

Based on work done in animal models showing that autism-like symptoms are ameliorated following exposure to an enriched sensorimotor environment, we attempted to develop a comparable therapy for children with autism. In an initial randomized controlled trial, children with autism who received sensorimotor enrichment at home for 6 months had significant improvements in both their cognitive ability and the severity of their autism symptoms (Woo & Leon, 2013). We now report the outcomes of a similar randomized controlled trial in which children with autism, 3 to 6 years old, were randomly assigned to groups that received either daily sensorimotor enrichment, administered by their parents, along with standard care, or they received standard care alone. After 6 months, enriched children showed statistically significant gains in their IQ scores, a decline in their atypical sensory responses, and an improvement in their receptive language performance, compared to controls. Furthermore, after 6 months of enrichment therapy, 21% of the children who initially had been given an autism classification, using the Autism Diagnostic Observation Schedule, improved to the point that, although they remained on the autism spectrum, they no longer met the criteria for classic autism. None of the standard care controls reached an equivalent level of improvement. Finally, the outcome measures for children who received only a subset of sensory stimuli were similar to those receiving the full complement of enrichment exercises. Sensorimotor enrichment therapy therefore appears to be a cost-effective means of treating a range of symptoms for children with autism.

**Miller, S. A., Rodriguez, N. M., & Rourke, A. J. (2015). Do mirrors facilitate acquisition of motor imitation in children diagnosed with autism?. *Journal of applied behavior analysis*, *48*(1), 194-198.**

We evaluated the efficacy of a procedure that incorporated a mirror to teach gross motor imitation with a 2-year-old boy who had been diagnosed with autistic disorder. Responses taught with a mirror were acquired more quickly than responses taught without the mirror and were maintained after the mirror was removed. These data indicate that a mirror can facilitate acquisition of motor imitation.

**Baldi, S., Nunzi, M., & Brina, C. D. (2015). Efficacy of a task-based training approach in the rehabilitation of three children with poor handwriting quality: a pilot study. 1. *Perceptual & Motor Skills*, *120*(1), 323-335.**

Evidence suggests that task-based training approaches can improve the performance of children with handwriting difficulties. The present case study tests the efficacy of the Handwriting Task Program (HTP). Three male children (9-10 yr. old) with poor handwriting skills and different developmental disorders participated in the HTP, twice per week, for 13 wk. Handwriting legibility was assessed through the Concise Evaluation Scale for Children's Handwriting, and fine motor performance and handwriting speed were evaluated at pre- and post-treatment with the Visual Motor Integration Test and the Battery for the assessment of writing skills of children from 7 to 13 yr. old. The results showed that motor efficiency and global handwriting quality improved in all the children, although some handwriting difficulties still persisted in one child with Developmental Coordination Disorder (DCD). Further study may confirm on a larger sample that a visual-spatially based training may improve the handwriting legibility of children with DCD.

**2014**

**Pedersen, S. (2014). Deliberate laterality practice facilitates sensory-motor processing in developing children. *Physical Education and Sport Pedagogy, 19*(2), 136-148. doi 10.1080/17408989.2012.726983.**

**Background**: The innate ability for typically developing children to attain developmental motor milestones early in life has been a thoroughly researched area of inquiry. Nonetheless, as children grow and are required to perform more complex motor skills in order to experience success in physical activity and sport pursuits, the range of developmental abilities becomes increasingly variable. What is less known in the literature is if physical education and sport programmes deliberately designed to facilitate the motor development of these underlying abilities can improve the efficiency of purposeful movements in children.

***Purpose*:** To determine if the sensory-motor processing of lateral arm movements in children can be initiated quicker as a result of deliberate laterality practice.

*Participants and setting*: Forty-five children (boys = 23, girls = 22), between the ages of 8 and 11 years, randomly selected from several Tasmanian (Australia) communities participated in this study. Each child participated in 1 day (∼90 min) of data collection in a laboratory at the university.

**Research design:** A repeated measures design using upper-extremity choice reaction time (RT) tests, separated by a 30-min treatment was employed in the current study. To test the effects of deliberate laterality practice on processing speed, children were randomly assigned into contralateral ball-bouncing (CBB), ipsilateral ball-bouncing, or a control video-game group (*n* = 15 in each). The treatments were designed using tenants of Ericsson, Krampe, and Tesch-Romer's theory of deliberate practice on expert performance, and the specificity of the training principle commonly discussed in the exercise science literature.

***Data collection:*** On an individual basis, each participant performed 27 empirical trials of goal-directed aiming movements with each arm separately, during the pretest and post-test. The stimulus-response trials occurred randomly in three different directions at the same distance from the starting position (ipsilateral, contralateral, and midline).

***Data analysis*:** A 3 (treatment group) × 2 (test) × 2 (arm) × 3 (direction) mixed design analysis of variance with repeated measures on the last three factors was used to test for significant differences, with an alpha level set at 0.05.

***Findings***: Results revealed the CBB group experienced significantly shorter RTs in the contralateral direction during the post-test, likewise the ipsilateral group had significantly shorter RTs in the ipsilateral direction after the treatment. Further, the control group exhibited longer RTs in the contralateral direction compared to their pretest.

***Conclusions*:** Even after a short bout of deliberate laterality practice, children were able to reduce the processing speed associated with their lateral movements. Practitioners in the field may utilize these findings to foster developmental readiness in children wishing to improve their ability to perform the more complex motor skills requisite for successful sport and physical activity participation.

# Re P., McConnell JW., Reidinger G., Schweit R., & Hendron A. (2014). Effects of Yoga on Patients in an Adolescent Mental Health Hospital and the Relationship Between Those Effects and the Patients' Sensory-Processing Patterns. *Journal of Child and Psychiatric Nursing, 27*(4), 175-182. doi: 10.1111/jcap.12090.

**Problem:** This study investigated the effects of yoga as a sensory regulation tool in reducing adolescent distress in an acute care psychiatric hospital.

**Methods:** This was a descriptive, correlational pre-intervention/post-intervention design conducted in a mental health hospital over 5 months from mid-January to mid-June 2012. The population consisted of a convenience sample of 75 adolescent mental health unit inpatients and partial-hospitalization patients 12–18 years of age who participated in two or more yoga sessions. Patient charts provided *Diagnostic and Statistical Manual of Mental Disorders-IV* Axes I-V diagnosis, gender, and age. Dependent variables were pulse and Subjective Units of Disturbance Scale scores, which were recorded before and after each yoga class. The Adult/Adolescent Sensory Profile provided a measure of patient sensory-processing preference levels that were related to the pulse and Subjective Units of Disturbance Scale results.

**Findings:** Yoga sessions significantly improved patient pulse and self-reported distress ratings regardless of gender or sensory profile levels.

**Conclusions:** This article contributes to research on the therapeutic effects of yoga as a sensory regulation intervention in the treatment of psychiatrically hospitalized adolescents. Yoga has the potential to help adolescents in an acute care psychiatric hospital learn to soothe themselves, to regulate their emotions, and to find relief from emotional distress while hospitalized.

# Jelsma, D., Geuze, R.H., Mombarg, R., & Smits-Engelsman, B.C. (2014). The impact of Wii Fit intervention on dynamic balance control in children with probable Developmental Coordination Disorder and balance problems. *Hum Mov Sci, 33*, 404-18. doi: 10.1016/j.humov.2013.12.007.

The aim of this study was to examine differences in the performance of children with probable Developmental Coordination Disorder (p-DCD) and balance problems (BP) and typical developing children (TD) on a Wii Fit task and to measure the effect on balance skills after a Wii Fit intervention. Twenty-eight children with BP and 20 TD-children participated in the study. Motor performance was assessed with the Movement Assessment Battery for Children (MABC2), three subtests of the Bruininks Oseretsky Test (BOT2): Bilateral Coordination, Balance and Running Speed & Agility, and a Wii Fit ski slalom test. The TD children and half of the children in the BP group were tested before and after a 6weeks non-intervention period. All children with BP received 6weeks of Wii Fit intervention (with games other than the ski game) and were tested before and afterwards. Children with BP were less proficient than TD children in playing the Wii Fit ski slalom game. Training with the Wii Fit improved their motor performance. The improvement was significantly larger after intervention than after a period of non-intervention. Therefore the change cannot solely be attributed to spontaneous development or test-retest effect. Nearly all children enjoyed participation during the 6weeks of intervention. Our study shows that Wii Fit intervention is effective and is potentially a method to support treatment of (dynamic) balance control problems in children.

**2011**

**Verkerk G, Jeukens-Visser M, Koldewijn K, van Wassenaer A, Houtzager B, Kok J, & Nollet F. (2011). Infant behavioral assessment and intervention program in very low birth weight infants improves independency in mobility at preschool age. J Pediatr. 2011 Dec;159(6):933-8.e1.**

**OBJECTIVE**: To evaluate the effects of the Infant Behavioral Assessment and Intervention Program(©) (IBAIP) in very low birth weight infants on sensory processing and daily activities at preschool age.

**STUDY DESIGN:** Follow-up of children included in a randomized controlled trial. Eighty-six infants were enrolled in post-discharge IBAIP until 6 months corrected age, and 90 infants received standard care. At 3.5 years of age, the Sensory Profile-Dutch version (SP-NL) and Pediatric Evaluation of Disability Inventory-Dutch version (PEDI-NL) were administered. For comparison, parents of 41 term-born children also completed the SP-NL.

**RESULTS**: Seventy-six children (88%) in the IBAIP group and 75 children (83%) children in the control group were examined at 44 months corrected age. After adjustment for pre-randomization differences in perinatal characteristics, the IBAIP group outperformed the control group significantly on SP-NL domains of oral sensory processing and sensory processing related to endurance/tone and PEDI-NL domains of mobility. The control group only scored significantly lower than the term group on the SP-NL domain endurance/tone. The very low birth weight groups performed significantly below the PEDI-NL's norm.

**CONCLUSION**: In line with the positive developmental effects of the IBAIP until 24 months corrected age, independency in mobility in daily activities was improved at 3.5 years.

**Ricotti L, Ravaschio A. (2011). Break dance significantly increases static balance in 9 years-old soccer players. Gait Posture. 2011 Mar;33(3):462-5. Epub 2011 Jan 19.**

Static balance in young athletes is an important ability that has a relevant influence on their present and future sport performances, as well as on the reduction in risk of injury. The present study reports data collected on three homogeneous groups of 9 years-old athletes (n=10 for each group), whose static balance was monitored every two months during an overall period of six months. At the beginning of the study, all of the children in each of the three groups were performing soccer activity with a frequency (three times a week) that was kept constant during the observation period. During the six months, group 1 maintained only the soccer activity, group 2 also performed swimming activity (twice a week) in parallel with the soccer activity, while group 3 started, at month 2, to perform soccer activity with a break dance course (twice a week). Double leg stance (with eyes open and closed) and single leg stance (on dominant and non-dominant leg) tests were performed using a force platform, and the COP area calculated for each trial. Results show a clear decrease in the "soccer+break dance" players COP area values during the six months, suggesting an improvement in their static balance. The difference was significantly greater with respect to that of soccer players and "soccer+swimming" players. This was evident in all the tests performed starting from two months after the break dance activity began.

**Fucile S, Gisel EG, McFarland DH, Lau C. (2011). Oral and non-oral sensorimotor interventions enhance oral feeding performance in preterm infants. Dev Med Child Neurol. 2011 Sep;53(9):829-35. doi: 10.1111/j.1469-8749.2011.04023.x.**

**AIM**: The aim of this study was to determine whether oral, tactile/kinaesthetic (T/K), or combined (oral+T/K) interventions enhance oral feeding performance and whether combined interventions have an additive/synergistic effect.

**METHOD**: Seventy-five preterm infants (mean gestational age 29 wk; standard error of the mean [SEM] 0.3 wk; mean birthweight 1340.3g; SEM 52.5 g; 49 males and 26 females) were randomly assigned to one of three intervention groups or a control group. The oral group received sensorimotor input to the oral structures, the T/K group received sensorimotor input to the trunk and limbs, and the combined group received both. The outcomes were time from introduction of nipple feeding to independent oral feeding (d), proficiency (intake in the first 5 min, %), volume transfer (%), rate of transfer (mL/min), volume loss (%), and length of hospital stay (d).

**RESULTS**: Infants in the three intervention groups achieved independent oral feeding 9-10 days earlier than those in the control group (p<0.001; effect size 1.9-2.1). Proficiency (p ≤ 0.002; effect size 0.7-1.4) at the time of one to two and three to five oral feedings per day, volume transfer (p ≤ 0.001; effect size 0.8-1.1) at one to two, three to five, and six to eight oral feedings per day, and overall rate of transfer (p ≤ 0.018; effect size 0.8-1.1) were greater, and overall volume losses were less (p ≤ 0.007; effect size 0.9-1.1), than in the control group (p ≤ 0.042). The combined group attained independent oral feeding at a significantly younger postmenstrual age than controls (p=0.020) and had clinically greater proficiency than the T/K group (p=0.020; effect size 0.7) and oral group (p=0.109; effect size 0.5). Length of hospital stay was not significantly different between groups (p=0.792; effect size 0.02-0.3).

**INTERPRETATION:** Oral and T/K interventions accelerated the transition from introduction to independent oral feeding and enhanced oral feeding skills. T/K has beneficial effects beyond the specific targeted system. The combined sensorimotor intervention led to an additive/synergistic effect for proficiency, further benefiting this population.

**Diamond A, Lee K. (2011). Interventions shown to aid executive function development in children 4 to 12 years old. Science, 19;333(6045):959-64.**

To be successful takes creativity, flexibility, self-control, and discipline. Central to all those are executive functions, including mentally playing with ideas, giving a considered rather than an impulsive response, and staying focused. Diverse activities have been shown to improve children's executive functions: computerized training, noncomputerized games, aerobics, martial arts, yoga, mindfulness, and school curricula. All successful programs involve repeated practice and progressively increase the challenge to executive functions. Children with worse executive functions benefit most from these activities; thus, early executive-function training may avert widening achievement gaps later. To improve executive functions, focusing narrowly on them may not be as effective as also addressing emotional and social development (as do curricula that improve executive functions) and physical development (shown by positive effects of aerobics, martial arts, and yoga).

**Wilkes S, Cordier R, Bundy A, Docking K, Munro N. (2011). A play-based intervention for children with ADHD: a pilot study. Aust Occup Ther J. 2011 Aug;58(4):231-40. doi: 10.1111/j.1440-1630.2011.00928.x.**

**INTRODUCTION**: Many children with attention deficit hyperactivity disorder (ADHD) have serious social and peer difficulties that can lead to adverse outcomes in adolescence and adulthood. To date, psychosocial treatments have produced poor outcomes in reducing social impairments commonly associated with ADHD. This study aimed to examine the efficacy of a new intervention designed to improve the play and social skills of children with ADHD and their playmates within the natural context of play.

**METHODS**: Participants included children (aged 5-11 years) diagnosed with ADHD, age-matched typically developing playmates (n=14/group) and parents of children with ADHD. The intervention involved seven weekly video-recorded free-play sessions; video feed-forward/feedback and therapist- and peer-modelling were used to promote social play. The Test of Playfulness was used as a pre-/post-test measure. Data were subjected to Rasch analysis to calculate measure scores on interval level; dependant sample t-test and Cohen-d calculations were used to measure effect.

**RESULTS:** A dependant samples t-test revealed that both children with ADHD (t=8.1; d.f.=13; P<0.01) and their playmates (t=6.9; d.f.=13; P<0.01) improved in their social play. Results demonstrated a large effect in improving the social play of children with ADHD (d=1.5) and their **playmates (d=1.3).**

**DISCUSSION:** Results support the use of play, video feed- forward/feedback techniques, therapist- and peer-modelling and parent involvement as an effective means to develop the social play skills of children with ADHD. Further larger-scale research is required.

[**Fischer U**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Fischer%20U%22%5BAuthor%5D)**,** [**Moeller K**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Moeller%20K%22%5BAuthor%5D)**,** [**Bientzle M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Bientzle%20M%22%5BAuthor%5D)**,** [**Cress U**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Cress%20U%22%5BAuthor%5D)**, &** [**Nuerk HC**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Nuerk%20HC%22%5BAuthor%5D)**.(2011).** [**Sensori-motor spatial training of number magnitude representation.**](http://www.ncbi.nlm.nih.gov/pubmed/21327351)[**Psychon Bull Rev.**](http://www.ncbi.nlm.nih.gov/pubmed) **18(1):177-83.**

An adequately developed spatial representation of number magnitude is associated with children's general arithmetic achievement. Therefore, a new spatial-numerical training program for kindergarten children was developed in which presentation and response were associated with a congruent spatial numerical representation. In particular, children responded by a full-body spatial movement on a digital dance mat in a magnitude comparison task. This spatial-numerical training was more effective than a non-spatial control training in enhancing children's performance on a number line estimation task and a subtest of a standardized mathematical achievement battery (TEDI-MATH). A mediation analysis suggested that these improvements were driven by an improvement of children's mental number line representation and not only by unspecific factors such as attention or motivation. These results suggest a benefit of spatial numerical associations. Rather than being a merely associated covariate, they work as an independently manipulated variable which is functional for numerical development.

[**Holt RL**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Holt%20RL%22%5BAuthor%5D)**, &** [**Mikati MA**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Mikati%20MA%22%5BAuthor%5D)**. (2011).** [**Care for child development: basic science rationale and effects of interventions.**](http://www.ncbi.nlm.nih.gov/pubmed/21397164)[**Pediatr Neurol.**](http://www.ncbi.nlm.nih.gov/pubmed) **44(4):239-53.**

The past few years have witnessed increasing interest in devising programs to enhance early childhood development. We review current understandings of brain development, recent advances in this field, and their implications for clinical interventions. An expanding body of basic science laboratory data demonstrates that several interventions, including environmental enrichment, level of parental interaction, erythropoietin, antidepressants, transcranial magnetic stimulation, transcranial direct current stimulation, hypothermia, nutritional supplements, and stem cells, can enhance cerebral plasticity. Emerging clinical data, using functional magnetic resonance imaging and clinical evaluations, also support the hypothesis that clinical interventions can increase the developmental potential of children, rather than merely allowing the child to achieve an already predetermined potential. Such interventions include early developmental enrichment programs, which have improved cognitive function; high-energy and high-protein diets, which have increased brain growth in infants with perinatal brain damage; constraint-induced movement therapy, which has improved motor function in patients with stroke, cerebral palsy, and cerebral hemispherectomy; and transcranial magnetic stimulation, which has improved motor function in stroke patients.

**Smith, Chelsey Danielle (2011). "The Effect of a Three Point Sensory Diet on Vocal and Verbal Behavior in a Non-Verbal Child on the Autism Scale" *Honors College Capstone Experience/Thesis Projects.* Paper 255.**

The study involved a single subject, a non-verbal child on the autism spectrum, in a clinical setting over a 10-week period. The subject was on a three-point sensory diet that was administered before therapy sessions. The tactile, vestibular and proprioceptive systems were targeted with deep pressure touch, a suspension swing, and joint compression. The primary focus was on participation in therapy and language development with specific attention given to the increase of vocalizations and/or verbalizations. The child experienced the sensory diet for schedule of 1 week off, 2 weeks on, 1 week off, 2 weeks on, 1 week off and 1 weeks on for the 10 weeks. A graduate student speech-language pathologist was assigned to plan, direct and work with the client for one hour twice a week for 10 weeks. A student researcher observed to document data and oversee progress. From this study, positive efficacy of sensory integration therapy was seen in direct relation to an increase in vocalization/verbalization as well as the client being more engaged in the therapy session and in daily life.

**Jessica Kathrine Ordaz Charles G. Zartman, Cynthia Ratekin, Jessica Katherine Ordaz, Hsuying Ward. (2011). A Training Module: Understanding and Managing Sensory and Behavior Issues in Children with Autism**

Sensory needs and the related behavioral challenges are prevalent in individuals with autism. With the increasing number of students with autism enrolled in special education classrooms, teachers and paraprofessionals should know what to do with these students to address these sensory issues and negative behaviors that accompany them. The purpose of the project is to develop a training module to teach classroom staff how to address these sensory needs and the related behaviors and, further, replace them with more appropriate activities. The written training module serves as a resource for teachers to use to understand the theories and practical implementation of providing appropriate replacement activities and as a training resource for specialists to ix use. The Sensory Processing Inventory Assessment is a practical tool for classroom staff to assess these behaviors and clearly develop a list of replacement activities to teach. To ensure that this training serves its purpose, three workshops were conducted using the training module. Overall, respondents felt that the training module was good, with some respondents rating it as excellent. Based on the survey results, changes in amount of information and the size of the font on each slide were made to the final training module. It will be necessary for professionals to continue to train on this subject and find more practical tools for classroom staff to better serve their students with autism.

**Demopoulos, M. (2011). A pilot study of the effect of a sensory diet on the in-seat behaviour of grade one learners in the classroom.**

Sensory integration based paediatric occupational therapists working in schools commonly function with a dual role of providing the child with therapy to assist the child to function optimally as well as act as consultants in assisting teachers to develop strategies to help promote the classroom performance of students with sensory processing difficulties. A single-group pre-test post-test quasi-experimental research design was used in this pilot study on a convenient sample of 11 participants to explore the effects before and after exposure to the intervention of a sensory diet on the in-seat behaviours of the child and determine whether the desirable sensory input is effective in improving the performance of children with sensory processing difficulties during a handwriting lesson. The behaviours showing the highest trend of improvement in the hypothesized direction included less distractibility and trend of work ethos related behaviours (not giving up easily and completing the task; being less impulsive, not working too fast, better planning; better able to initiate and carry tasks out independently). Trends of various in-seat behaviours (restless, overactive and fidgety, disorganized on self and in his work, difficulty in getting down to his work, slow to complete a task) to regress in the hypothesized direction were also noted. Descriptive and statistical analysis was performed to examine trends in changes of pre- and post-intervention behavioural scores. The data were also analysed using Poisson’s regression to the normal distribution to calculate p values (using a chisquared distribution) to compare the number of observations in a period of time intervals. Implications of the results of the study for therapists working with students with sensory processing difficulties and their teachers are discussed.

**Semira Manaseki-Holland, BMedSci, MBBS, MPH, MRCP, MFPHM, PhD, Elizabeth Spier, BA, MA, PhD, Bayasgalantai Bavuusuren, MD, MSc, PhD, Tsogzolma Bayandorj, MD, MSc, Susan Sprachman, BA, MA, Tom Marshall, BA, MSc. (2011). Effects of Traditional Swaddling on Development: A Randomized Controlled Trial.**

**Objective:** Evidence of the effects of tight, prolonged binding of infantson development is inconclusive and based on small ethnographicstudies. The null hypothesis was that Mongolian infants notswaddled or swaddled tightly in a traditional setting (to >7months of age) do not have significantly different scores forthe Bayley Scales of Infant Development, Second Edition (BSID-II).

**Patients and Methods:** In a randomized controlled trial, 1279 healthy newborns in Ulaanbaatar,Mongolia, were allocated at birth to traditional swaddling orno swaddling. The families received 7 months of home visitsto collect data and monitor compliance. At 11 to 17 months ofage, the BSID-II was administered to 1100 children.

**Results:** No significant between-group differences were found in meanscaled mental and psychomotor developmental scores. The unadjustedmean difference between the groups was –0.69 (95% confidenceinterval [CI]: –2.59 to 1.19) for psychomotor and –0.42(95% CI: –1.68 to 0.84) for mental scores in favor ofthe swaddling group. A subgroup analysis of the compliant sampleproduced similar results. BSID-II–scaled psychomotor andmental scores were 99.98 (95% CI: 99.03–100.92) and 105.52(95% CI: 104.89–106.14), respectively. Background characteristicswere balanced across the groups.

**Conclusions:** In the Mongolian context, prolonged swaddling in the first yearof life did not have any significant impact on children's earlymental or psychomotor development. Additional studies in othersettings need to confirm this finding. The Mongolian infantsin this trial had scaled BSID-II mental and psychomotor scorescomparable to United States norms.

**2010**

[**Lambourne K**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Lambourne%20K%22%5BAuthor%5D)**,** [**Audiffren M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Audiffren%20M%22%5BAuthor%5D)**,** [**Tomporowski PD**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tomporowski%20PD%22%5BAuthor%5D)**. (2010).** [**Effects of acute exercise on sensory and executive processing tasks.**](http://www.ncbi.nlm.nih.gov/pubmed/20019631)[**Med Sci Sports Exerc.**](about:blank) **2010 Jul;42(7):1396-402.**

**PURPOSE:** The immediate and delayed effects of a single bout of steady-state aerobic exercise on 19 young adults' (mean = 21.1 yr) sensory sensitivity (critical flicker fusion, CFF) and executive function (modified Paced Auditory Serial Addition Task, PASAT) were assessed.

**METHODS:** Tests were performed before exercise, five times during 40 min of ergometer cycling at 90% ventilatory threshold, and three times during a 30-min postexercise period. In a separate control session, each participant performed the same sequence of tests while seated on the ergometer without pedaling.

**RESULTS:** ANOVA were performed separately on CFF and PASAT scores, which compared performance during exercise and nonexercise conditions at nine time points. Planned ANOVA of CFF scores revealed that the participants' sensory discrimination increased during exercise and then quickly returned to baseline levels immediately after exercise. PASAT scores did not change during or after exercise.

**CONCLUSIONS:** Exercise-induced arousal facilitates sensory processes involved in stimulus detection but does not influence the updating component of executive processing.

[**Todd T**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Todd%20T%22%5BAuthor%5D)**,** [**Reid G**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Reid%20G%22%5BAuthor%5D)**,** [**Butler-Kisber L**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Butler-Kisber%20L%22%5BAuthor%5D)**. (2010).** [**Cycling for students with ASD: self-regulation promotes sustained physical activity.**](http://www.ncbi.nlm.nih.gov/pubmed/20571157)[**Adapt Phys Activ Q.**](about:blank) **2010 Jul;27(3):226-41.**

Individuals with autism often lack motivation to engage in sustained physical activity. Three adolescents with severe autism participated in a 16-week program and each regularly completed 30 min of cycling at the end of program. This study investigated the effect of a self-regulation instructional strategy on sustained cycling, which included self-monitoring, goal setting, and self-reinforcement. Of particular interest was the development of self-efficacy during the physical activity as a mediator of goal setting. A multiple baseline changing criterion design established the effectiveness of the intervention. The results suggest that self-regulation interventions can promote sustained participation in physical activity for adolescents with severe autism.

**Pluncevic-Gligoroska** [**J**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Pluncevic-Gligoroska%20J%22%5BAuthor%5D)**,** [**Manchevska S**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Manchevska%20S%22%5BAuthor%5D)**,** [**Bozhinovska L**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Bozhinovska%20L%22%5BAuthor%5D)**. (2010).** [**Psychomotor speed in young adults with different level of physical activity.**](http://www.ncbi.nlm.nih.gov/pubmed/20645504)[**Med Arh.**](about:blank) **2010;64(3):139-43.**

**AIM:** This paper presents the relationship between physical activity and cognitive function in young adults. We set a hypothesis that there might be a relationship between the level of physical activity and psychomotor response on the Trial Making Test (TMT). Physical exercise influences on many aspects of cognitive functioning and has a huge effect on the general mental health. The benefits of exercise are best defined in the field of learning, memorizing of executive functions, protection from neurodegenerative changes and onset of depression.

**METHODS:** This investigation included 90 healthy subjects with mean age of 21.2 years, range from 16 to 35 years, divided into three groups according to the level of physical activity: low, moderate and high. Each group consisted of 30 subjects, adjusted by gender, age and level of education. TMT was applied and it assessed visual conceptual abilities and visual motor tracking.

**RESULTS:** Statistical analysis showed a significant difference of the TMT results between the examined groups. Subjects in the group with a low level of physical activity required a longer time to finish both parts of the test (TMT A = 31.98 4 10.14; TMT B = 79.70 4 22.33) than subjects in the group with a moderate level of physical activity (26.3749.45; 68.23 4 22.39). Time necessary for completion of the test in the group with a moderate level of physical activity was longer (25.30 4 5.12; 60.67 4 14.24) than in athletes but without a statistical significance.

**CONCLUSION:** The results obtained support the hypothesis that physical activity can have a positive impact on psychomotor abilities in young adults.

[**Kozulin A**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Kozulin%20A%22%5BAuthor%5D)**,** [**Lebeer J**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Lebeer%20J%22%5BAuthor%5D)**,** [**Madella-Noja A**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Madella-Noja%20A%22%5BAuthor%5D)**,** [**Gonzalez F**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Gonzalez%20F%22%5BAuthor%5D)**,** [**Jeffrey I**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Jeffrey%20I%22%5BAuthor%5D)**,** [**Rosenthal N**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Rosenthal%20N%22%5BAuthor%5D)**,** [**Koslowsky M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Koslowsky%20M%22%5BAuthor%5D)**. (2010).**[**Cognitive modifiability of children with developmental disabilities: a multicentre study using Feuerstein's Instrumental Enrichment--Basic program.**](http://www.ncbi.nlm.nih.gov/pubmed/20056377)[**Res Dev Disabil.**](about:blank) **Mar-Apr;31(2):551-9. Epub 2010 Jan 6.**

The study aimed at exploring the effectiveness of cognitive intervention with the new "Instrumental Enrichment Basic" program (IE-basic), based on Feuerstein's theory of structural cognitive modifiability that contends that a child's cognitive functioning can be significantly modified through mediated learning intervention. The IE-basic program is aimed at enhancing domain-general cognitive functioning in a number of areas (systematic perception, self-regulation abilities, conceptual vocabulary, planning, decoding emotions and social relations) as well as transferring learnt principles to daily life domains. Participants were children with DCD, CP, intellectual impairment of genetic origin, autistic spectrum disorder, ADHD or other learning disorders, with a mental age of 5-7 years, from Canada, Chile, Belgium, Italy and Israel. Children in the experimental groups (N=104) received 27-90 h of the program during 30-45 weeks; the comparison groups (N=72) received general occupational and sensory-motor therapy. Analysis of the pre- to post-test gain scores demonstrated significant (p<0.05) advantage of experimental over comparison groups in three WISC-R subtests ("Similarities", "Picture Completion", "Picture Arrangement") and Raven Coloured Matrices. Effect sizes ranged from 0.3 to 0.52. Results suggest that it is possible to improve cognitive functioning of children with developmental disability. No advantage was found for children with specific aetiology. Greater cognitive gains were demonstrated by children who received the program in an educational context where all teachers were committed to the principles of mediated learning.

[**Polatajko HJ**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Polatajko%20HJ%22%5BAuthor%5D)**,** [**Cantin N**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Cantin%20N%22%5BAuthor%5D)**. (2010).** [**Exploring the effectiveness of occupational therapy interventions, other than the sensory integration approach, with children and adolescents experiencing difficulty processing and integrating sensory information.**](http://www.ncbi.nlm.nih.gov/pubmed/20608273)[**Am J Occup Ther.**](about:blank) **64(3):415-29.**

This literature review was completed as part of the Evidence-Based Literature Review Project of the American Occupational Therapy Association to explore the effectiveness of occupational therapy interventions with children and adolescents experiencing difficulty processing and integrating sensory information. This part of the review focused on interventions other than the sensory integration approach. Twenty articles (reporting on 21 studies) met the inclusion criteria. This systematic review found that children with difficulty processing and integrating sensory information and difficulties with the performance of daily occupations can benefit from intervention. However, the great variability that characterizes this literature in terms of populations, interventions, and study quality precludes the formation of any firm conclusions regarding specific approaches. There is an urgent need for well-controlled studies examining the effectiveness of frequently used pediatric occupational therapy interventions with well-defined, homogeneous populations on outcomes that target participation in everyday life.

[**Ferreira AM**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Ferreira%20AM%22%5BAuthor%5D)**,** [**Bergamasco NH**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Bergamasco%20NH%22%5BAuthor%5D)**. (2010).** [**Behavioral analysis of preterm neonates included in a tactile and kinesthetic stimulation program during hospitalization.**](http://www.ncbi.nlm.nih.gov/pubmed/20464169)[**Rev Bras Fisioter.**](about:blank) **14(2):141-8.**

**OBJECTIVE:** To evaluate the effect of tactile and kinesthetic stimulation on behavioral and clinical development in preterm neonates while still in the hospital.

**METHODS:** Thirty-two clinically stable preterm infants weighing <2.500 grams, with no significant perinatal asphyxia, were allocated to two groups: a control group (CG) in which no intervention was made (n=16) and a study group (SG) in which the newborn infants received tactile and kinesthetic stimulation (n=16). Data on the infants' clinical progress were collected from medical charts and behavioral evaluations by means of a series of weekly, eight-minute films recorded from the time of inclusion into the study until hospital discharge.

**RESULTS:** There was a trend towards a shorter duration of hospital stay, increased daily weight gain and a predominance of self-regulated behavior (regular breathing, state of alertness, balanced tonus, a range of postures, coordinated movements, hand-to-face movement control, suction, grip, support) in infants in the SG. With respect to motor control, comparative analysis of postconceptional ages according to age-bracket (I - 31-33 weeks 6/7; II - 34-36 weeks 6/7; and III - 37-39 weeks 6/7) revealed balanced tonus and coordinated voluntary movements in all three periods, a longer time spent in a range of postures (age bracket I) or in flexion (age bracket II) and more regular breathing in age bracket I in the SG.

**CONCLUSION:** In the hospital, tactile and kinesthetic stimulation was shown to have a positive effect, contributing towards adjustment and self-regulation of behavior in the preterm newborn infant.

[**Leisman G**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Leisman%20G%22%5BAuthor%5D)**,** [**Melillo R**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Melillo%20R%22%5BAuthor%5D)**,** [**Thum S**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Thum%20S%22%5BAuthor%5D)**,** [**Ransom MA**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Ransom%20MA%22%5BAuthor%5D)**,** [**Orlando M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Orlando%20M%22%5BAuthor%5D)**,** [**Tice C**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tice%20C%22%5BAuthor%5D)**,** [**Carrick FR**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Carrick%20FR%22%5BAuthor%5D)**. (2010).** [**The effect of hemisphere specific remediation strategies on the aca**](http://www.ncbi.nlm.nih.gov/pubmed/21061929)**d**[**emic performance outcome of children with ADD/ADHD.**](http://www.ncbi.nlm.nih.gov/pubmed/21061929)[**Int J Adolesc Med Health.**](about:blank) **2010 Apr-Jun;22(2):275-83.**

The development and normal function of the cerebrum is largely dependent on sub-cortical structures, such as the cerebellum and basal ganglia. Dysfunction in these areas can affect both the nonspecific arousal system and information transfer in the brain. Dysfunction of this sort often results in motor and sensory symptoms commonly seen in children with ADD/ADHD. These brain regions have been reported to be underactive, with that underactivity restricted to the right or left side of the sub-cortical and cortical regions. An imbalance of activity or arousal of one side of the cortex can result in a functional disconnection similar to that seen in split-brain patients. Since ADD/ADHD children exhibit deficient performance on tests thought to measure perceptual laterality, evidence of weak laterality or failure to develop laterality has been found across various modalities (auditory, visual, tactile) resulting in abnormal cerebral organization and associated dysfunctional specialization needed for lateralized processing of language and non-language function. This study examines groups of ADD/ADHD elementary school children from first through sixth grade. All participants were administered all the subtests of the Wechsler Individual Achievement Tests, the Brown Parent Questionnaire, and given objective performance measures on tests of motor and sensory coordinative abilities (interactive metronome). Results measured after a 12-week remediation program aimed at increasing the activity of the hypothesized underactive right hemisphere function, yielded significant improvement of greater than two years in grade level in all domains except in mathematical reasoning. Results are discussed in the context of the concept of functional disconnectivity in ADD/ADHD children.

[**Hung WW**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Hung%20WW%22%5BAuthor%5D)**,** [**Pang MY**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Pang%20MY%22%5BAuthor%5D)**. (2010). Effects of group-based versus individual-based exercise training on motor performance in children with developmental coordination disorder: a randomized controlled study.** [**J Rehabil Med.**](about:blank) **42(2):122-8.**

**OBJECTIVE:** To compare the effects of group-based and individual-based motor skill training on motor performance in children with developmental coordination disorder.

**DESIGN:** Randomized controlled pilot intervention study.

**SUBJECTS/PATIENTS:** Twenty-three children (4 girls) with developmental coordination disorder (mean age (standard deviation (SD)) 8 years (1 year and 2 months)).

**METHODS:** Twelve children were randomly assigned to undergo a motor training programme once a week for 8 consecutive weeks in a group setting, and 11 children received the same training on an individual basis during the same period. Each child was also instructed to perform home exercises on a daily basis. The Movement Assessment Battery for Children (MABC) was used to assess motor ability. Home exercise compliance and parental satisfaction with the programmes were also evaluated.

**RESULTS:** A significant reduction in the MABC total impairment score was found following both group-based (mean -4.4 (SD 5.0), p = 0.003) and individual-based training (mean -5.2 (SD 5.1), p = 0.016). However, the change in total impairment score did not differ significantly between the 2 groups (p = 0.379). There was similarly no significant between-group difference in home exercise compliance (p = 0.288) and parental satisfaction (p = 0.379).

**CONCLUSION:** Group-based training produced similar gains in motor performance to individual-based training. Group-based training may be the preferred treatment option due to the associated cost savings.

**2009**

**Ginny L. Van Rie & L. Juane Heflin (2009). The effect of sensory activities on correct responding for children with autism spectrum disorders.** ***Research in Autism Spectrum Disorders*, Volume 3, Issue 3, p. 783-796.**

Sensory-based activities are commonly recommended for students with ASD, even in the absence of empirical data to substantiate their effectiveness. A single subject alternating treatment design was used to assess functional relations between sensory-based antecedent interventions and correct responding in four students with autism. As individuals with autism constitute a heterogeneous population, it is not surprising that a functional relation was found for only two of the four students. Results of this study lead to the conclusion that sensory-based interventions may be effective for some but not all students with autism. Implications for evaluating aptitude by treatment interactions and suggestions for future research are discussed.

[**Bart O**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Bart%20O%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Bar-Haim Y**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Bar-Haim%20Y%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Weizman E**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Weizman%20E%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Levin M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Levin%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Sadeh A**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Sadeh%20A%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Mintz M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Mintz%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**.(2009).** [**Balance treatment ameliorates anxiety and increases self-esteem in children with comorbid anxiety and balance disorder.**](http://www.ncbi.nlm.nih.gov/pubmed/18775641)[**Res Dev Disabil.**](about:blank) **30(3):486-95.**

Comorbidity between balance and anxiety disorders in adult population is a well-studied clinical entity. Children might be particularly prone to develop balance-anxiety comorbidity, but surprisingly they are practically neglected in this field of research. The consequence is that children are treated for what seems to be the primary disorder without noticing possible effects on the other disorder. In Study 1, children with balance dysfunction were compared to normally balanced controls on anxiety and self-esteem. In study 2, children with balance dysfunction were assigned to either balance training or a waiting-list control. Training consisted of 12 weekly sessions of balance treatment. Anxiety and self-esteem were tested before and after treatment/waiting. Study 1 confirmed significantly higher anxiety and lower self-esteem in the balance dysfunction group compared to the control group. Study 2 showed that treatment improved balance performance, reduced anxiety, and increased self-esteem relative to the control waiting list group. Taken together, the present findings are in accord with the observations of comorbidity between balance and anxiety disorders in adults and confirm their validity in children younger than 7 years of age. This profile of comorbidity between balance dysfunction and anxiety also include lower self-esteem.

[**Lambourne K**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Lambourne%20K%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Audiffren M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Audiffren%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Tomporowski PD**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tomporowski%20PD%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**. (2009).** [**Effects of Acute Exercise on Sensory and Executive Processing Tasks.**](http://www.ncbi.nlm.nih.gov/pubmed/20019631)[**Med Sci Sports Exerc.**](about:blank) **2009 Dec 14.**

**PURPOSE**:The immediate and delayed effects of a single bout of steady-state aerobic exercise on 19 young adults' (mean 21.1 years) sensory sensitivity (critical flicker fusion, CFF) and executive function (modified Paced Auditory Serial Addition Task, PASAT) were assessed. **METHODS:** Tests were performed prior to exercise, 5 times during 40 min of ergometer cycling at 90% ventilatory threshold, and 3 times during a 30-min post-exercise period. In a separate control session, each participant performed the same sequence of tests while seated on the ergometer without pedaling.

**RESULTS:** ANOVAs were performed separately on CFF and PASAT scores, which compared performance during exercise and non-exercise conditions at 9 time points. Planned ANOVAs of CFF scores revealed that participants' sensory discrimination increased during exercise, and then quickly returned to baseline levels immediately following exercise. PASAT scores did not change during or following exercise.

**CONCLUSION:** Exercise-induced arousal facilitates sensory processes involved in stimulus detection but does not influence the updating component of executive processing.

[**Riethmuller AM**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Riethmuller%20AM%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Jones R**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Jones%20R%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Okely AD**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Okely%20AD%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**.(2009).** [**Efficacy of interventions to improve motor development in young children: a systematic review.**](http://www.ncbi.nlm.nih.gov/pubmed/19736263)[**Pediatrics.**](about:blank) **2009 Oct;124(4):e782-92.**

**OBJECTIVE**: The objective of this study was to systematically review evidence from controlled trials on the efficacy of motor development interventions in young children.

**METHODS**: A literature search of interventions was conducted of 14 electronic databases. Three reviewers independently evaluated studies to determine whether they met the inclusion criteria. Studies were compared on 5 components: design, methodologic quality, intervention components, efficacy, and alignment with the Consolidated Standard of Reporting Trials (CONSORT) and Transparent Reporting of Evaluation with Nonrandomized Designs (TREND) statements.

**RESULTS**: Seventeen studies met the inclusion criteria. More than half (65%) were controlled trials and delivered at child care settings or schools (65%). Three studies had high methodologic quality. Studies were approximately 12 weeks in duration and delivered by teachers, researchers, and students. Parents were involved in only 3 studies. Nearly 60% of the studies reported statistically significant improvements at follow-up. Three studies aligned with the CONSORT and TREND statements.

**CONCLUSIONS:** This review highlights the limited quantity and quality of interventions to improve motor development in young children. The following recommendations are made: (1) both teachers and researchers should be involved in the implementation of an intervention; (2) parental involvement is critical to ensuring transfer of knowledge from the intervention setting to the home environment; and (3) interventions should be methodologically sound and follow guidelines detailed in the CONSORT or TREND statement.

[**Rosenkranz K**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Rosenkranz%20K%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Butler K**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Butler%20K%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Williamon A**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Williamon%20A%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Rothwell JC**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Rothwell%20JC%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**. (2009).** [**Regaining motor control in musician's dystonia by restoring sensorimotor organization.**](http://www.ncbi.nlm.nih.gov/pubmed/19923295)[***J Neurosci.***](about:blank) ***29*(46),14627-36.**

Professional musicians are an excellent model of long-term motor learning effects on structure and function of the sensorimotor system. However, intensive motor skill training has been associated with task-specific deficiency in hand motor control, which has a higher prevalence among musicians (musician's dystonia) than in the general population. Using a transcranial magnetic stimulation paradigm, we previously found an expanded spatial integration of proprioceptive input into the hand motor cortex [sensorimotor organization (SMO)] in healthy musicians. In musician's dystonia, however, this expansion was even larger. Whereas motor skills of musicians are likely to be supported by a spatially expanded SMO, we hypothesized that in musician's dystonia this might have developed too far and now disrupts rather than assists task-specific motor control. If so, motor control should be regained by reversing the excessive reorganization in musician's dystonia. Here, we test this hypothesis and show that a 15 min intervention with proprioceptive input (proprioceptive training) restored SMO in pianists with musician's dystonia to the pattern seen in healthy pianists. Crucially, task-specific motor control improved significantly and objectively as measured with a MIDI (musical instrument digital interface) piano, and the amount of behavioral improvement was significantly correlated to the degree of sensorimotor reorganization. In healthy pianists and nonmusicians, the SMO and motor performance remained essentially unchanged. These findings suggest that the differentiation of SMO in the hand motor cortex and the degree of motor control of intensively practiced tasks are significantly linked and finely balanced. Proprioceptive training restored this balance in musician's dystonia to the behaviorally beneficial level of healthy musicians.

[**Niklasson M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Niklasson%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Niklasson I**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Niklasson%20I%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Norlander T**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Norlander%20T%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**. (2009). Sensorimotor therapy: using stereotypic movements and vestibular stimulation to increase sensorimotor proficiency of children with attentional and motor difficulties.** [**Percept Mot Skills.**](about:blank)**108(3),643-69.**

The current naturalistic study examined whether sensorimotor therapy utilizing the training program, Retraining for Balance, might be an appropriate technique for sensorimotor proficiency. The 232 children (181 boys, 51 girls), whose mean age was 9.3 yr. (SD = 2.7), presented attentional and motor difficulties (according to the School Health Care) as indicated by their parents before starting therapy. The children were divided into three groups, i.e., a younger group (7 yr. old or younger, n = 65), a middle group (8 to 10 yr. old, n = 91), and an older group (11 yr. old or older, n = 76). The program has seven parts, including fetal and neonatal movements, vestibular and auditory perceptual stimulation, and gross motor movements, among others. The treatment period was close to 3 yr. on the average. Analyses in a repeated-measures design indicated significant improvement of sensorimotor skills among the three age groups, but the older children performed better than the others on several tests. There were only a few sex differences. Retraining for Balance may be a functional technique for training children and youth with sensorimotor difficulties and might constitute a complement to regular treatment of Developmental Coordination Disorder, Learning Disability, and ADHD, but controlled studies are necessary before more decisive conclusions can be drawn.

[**Tsai CL**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Tsai%20CL%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**. (2009).** [**The effectiveness of exercise intervention on inhibitory control in children with developmental coordination disorder: using a visuospatial attention paradigm as a model.**](http://www.ncbi.nlm.nih.gov/pubmed/19497707)[**Res Dev Disabil.**](about:blank)**30(6),1268-80.**

Children with developmental coordination disorder (DCD) have been demonstrated to show a deficit of inhibitory control in volitional shifts of attention. The aim of this study was to use ecological intervention to investigate the efficacy of table-tennis training on treating both problems with attentional networks and motor disorder in children with DCD. Forty-three children aged 9-10 years old were screened using the Movement Assessment Battery for Children and divided into DCD (n=27) and typically developing (TD, n=16) groups. Children with DCD were then quasi-randomly assigned to either a DCD-training group who underwent a ten-week table-tennis training program with a frequency of 3 times a week or a DCD non-training group. Before and after training, the capacity of inhibitory control was examined with the endogenous Posner paradigm task for DCD and TD groups. Table-tennis training resulted in significant improvement of cognitive and motor functions for the children with DCD. The study demonstrated that exercise intervention employed within the school setting can benefit the inhibitory control and motor performance in children with DCD. However, future research efforts should continue to clarify whether the performance gains could be maintained over time.

[**Rothlisberger M**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Rothlisberger%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Michel E**](http://www.ncbi.nlm.nih.gov/pubmed?term=%22Michel%20E%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**. (2009).Development and evaluation of a motor coordination training for children in special-needs classes Prax Kinderpsychol Kinderpsychiatr.58(3),215-30.**

Previous research showed that children in classes with reduced curriculum ("ready for school classes") perform systematically poorer in short-term memory, attention control and motor coordination skills than children in regular classes. Based on these results, a training to improve children's planning, sequencing, and executive control of motor actions was developed. It includes body coordination, (bi-) manual coordination, rhythm and balance. The tasks stress flexibility of action, interference control and focused attention. Training sessions proceed from easy to complex, from action accuracy to speed, and from teacher guidance to children's self monitoring. Over the course of 3 weeks, 53 children were trained daily for 20 mins. In pre- and posttests, motor coordination was assessed with the M-ABC; focused attention, short-term memory performance, and self-concept was tested with paper-pencil and computerized tasks. Half of the children were trained between pre- and posttest, the other half received the training after posttest. Results revealed no global training effects; however, children in the training condition caught up during training in specific cognitive and motor tasks, and trained children showed a more optimistic self-concept. Training effects were pronounced for children with balance problems. The findings are discussed in terms of reasons for the weak training effects, and potential improvements of the training.

**Rauch F. (2009).** [**Vibration therapy.**](http://www.ncbi.nlm.nih.gov/pubmed/19740225)[**Dev Med Child Neurol.**](about:blank) **2009 Oct;51 Suppl 4:166-8.**

Whole-body vibration training is a method for muscle strengthening that is increasingly used in a variety of clinical situations. Key descriptors of vibration devices include the frequency, the amplitude, and the direction of the vibration movement. In a typical vibration session, the user stands on the device in a static position or performs dynamic movements. Most authors hypothesize that vibrations stimulate muscle spindles and alpha-motoneurons, which initiate a muscle contraction. An immediate effect of a non-exhausting vibration session is an increase in muscle power. Most studies of the longer term use of vibration treatment in various disorders have pursued three therapeutic aims: increasing muscle strength, improving balance, and increasing bone mass. In a small pilot trial in children we noted improvements in standing function, lumbar spine bone mineral density, tibial bone mass, and calf muscle cross-sectional area.

**Prior to 2009**

[**Watemberg N**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Watemberg%20N%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Waiserberg N**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Waiserberg%20N%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**,** [**Zuk L**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Zuk%20L%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**, &** [**Lerman-Sagie T**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Lerman-Sagie%20T%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_RVAbstract)**. (2007). Developmental coordination disorder in children with attention-deficit-hyperactivity disorder and physical therapy intervention.** [***Developmental Medicine & Child Neurology,***](about:blank)  ***49*, 920-5.**

Although physical therapy (PT) is effective in improving motor function in children with developmental coordination disorder (DCD), insufficient data are available on the impact of this intervention in children with combined attention-deficit-hyperactivity disorder (ADHD) and DCD. This prospective study aimed to establish the prevalence of DCD among a cohort of patients with ADHD, characterize the motor impairment, identify additional comorbidities, and determine the role of PT intervention on these patients. DCD was detected in 55.2% of 96 consecutive children with ADHD (81 males, 15 females), mostly among patients with the inattentive type (64.3% compared with 11% of those with the hyperactive/impulsive type, p<0.05). Mean age was 8 years 4 months (SD 2 y). Individuals with both ADHD and DCD more often had specific learning disabilities (p=0.05) and expressive language deficits (p=0.03) than children with ADHD only. Twenty-eight patients with ADHD and DCD randomly received either intensive group PT (group A, mean age 9 y 3 mo, SD 2 y 3 mo) or no intervention (group B, mean age 9 y 3 mo, SD 2 y 2 mo). PT significantly improved motor performance (assessed by the Movement Assessment Battery for Children; p=0.001). In conclusion, DCD is common in children with ADHD, particularly of the inattentive type. Patients with both ADHD and DCD are more likely to exhibit specific learning disabilities and phonological (pronunciation) deficits. Intensive PT intervention has a marked impact on the motor performance of these children.

**Rine, R.M., Braswell, J., Fisher, D., Joyce, K., Kalar, K., & Shaffer, M. (2004). Improvement of motor development and postural control following intervention in children with sensorineural hearing loss and vestibular impairment. International Journal of Pediatric Otorhinolaryngology, 68, 1141-1148.**

The effects of an intervention protocol using motor activities and exercise was examined in 21 children with sensorineural hearing loss and bilateral vestibular impairment. The intervention included 30 minute sessions, 3 times a week for 12 weeks with 10 minutes each of 3 out of 4 categories of activities. The categories included eye hand coordination, visual motor training, general coordination, and balance. Pre and post tests were administered to the sample using rotary chair VOR, electrooculogrpahy, posturography and the gross motor portion of the PDMS.

**SIGN note**: This treatment protocol would not be considered Ayres’ SI because it does not meet the principles as outlined. It was not child directed, did not focus on the provision of appropriate sensory opportunities or the just right challenge for example. However, it does support the idea that interventions that require active movement can lead to improvements in motor skills even in those with severe sensory processing impairments due to sensory receptor and pathway damage.

**Molteni, R., Wu, A., Vaynman, S., Ying, Z., Barnard, R.J., & Gomez-Pinilla, F. (2004). Exercise reverses the harmful effects of consumption of a high fat diet on synaptic and behavioral plasticity associated to the action of brain derived neurotrophic factor. *Neuroscience, 123*, 429-440.**

One of the important modulators of synaptic plasticity is brain-derived neurotrophic factor (BDNF). BDNF is also a predictor of the efficacy of learning performance in rodents. Diets high in fat and sugar, typical of our Western culture, can reduce the levels of BDNF in the hippocampus (an area of the brain important for memory and learning). In rats, a program of exercise was initiated to examine the effects of exercise on the diet related changes in BDNF. A total of 344 rats were fed a high fat diet and were either able to run on a wheel or not. The exercise of running on the wheel was found to reverse the decrease in BDNF resulting from the high fat diet, and also led to other changes in the brain at the molecular level. The exercise also prevented the typical spatial deficits found in rats exposed to these diets.

**SIGN note**: Of course we do not know how alike we are to rats, but, if the same results can be found in humans, it is yet another reason we need to change our diets. Can our children’s diets be hindering their learning?

**Schoemaker, M.M, & Niemeijer, A.S. (2003). Effectiveness of neuromotor task training for children with developmental coordination disorder: A Pilot Study . Neural Plasticity, 10, 155-163.**

The authors of this study examined the effectiveness of Neuromotor Task Training (NTT) on children with Developmental Coordination Disorder (DCD). The training consisted of a task-oriented program centered upon the ideals of motor control and motor learning. To examine NTT, 15 children with DCD participated in the study. Ten children participated in the intervention group. These children were assessed with The Movement Assessment Battery for Children (Movement-ABC) and the Concise Assessment Method for Children’s Handwriting (BHK) at the start of the study, after nine intervention sessions, and after another nine intervention sessions. The intervention sessions involved individual treatment sessions for 30 minutes once a week. These treatment sessions followed the principles of NTT and incorporated functional exercises, including both fine and gross motor skills, such as ball catching. Five children participated in the control group. These children participated in no intervention and were assessed with the Movement-ABC and BHK twice with a period of nine weeks in between in order to account for spontaneous improvement. The authors found no improvement in the motor skills of the control group. The intervention group, however, demonstrated improvement in both gross and fine motor skills as measured by the Movement ABC. They also demonstrated improvement in handwriting quality.

[**Müller SV**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22M%C3%BCller%20SV%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**von Schweder AJ**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22von%20Schweder%20AJ%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Frank B**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Frank%20B%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Dengler R**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Dengler%20R%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Münte TF**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22M%C3%BCnte%20TF%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**, &** [**Johannes S**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Johannes%20S%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**. (2002). The effects of proprioceptive stimulation on cognitive processes in patients after traumatic brain injury.** [***Arch Phys Med Rehabil.***](about:blank)***,83*, 115-21.**

**OBJECTIVE:** To investigate the hypothesis that proprioceptive stimulation may be effective in the treatment of brain injury, using neurophysiologic and neuropsychologic measures. DESIGN: Cohort analytic study.

**SETTING:** Patients recovering from traumatic brain injury (TBI) in a neurologic rehabilitation hospital were examined. PARTICIPANTS: Eleven patients with TBI (Glasgow Coma Scale score > 3) and 11 healthy control subjects matched for age and education.

**INTERVENTIONS:** Subjects were examined with the event-related potential (ERP) technique during a computerized choice-reaction-time task, in which they had to discriminate between even and odd digits. There were experimental runs with and without vibratory stimuli applied to the left forearm serving as proprioceptive stimulation. In addition, ERPs were recorded to vibratory stimuli without any additional task. MAIN **OUTCOME MEASURES:** Outcome measures included latencies and amplitudes of the P300 ERP component and of the late negative component. RESULTS: In the passive vibration condition, both groups showed the same ERP distribution. In the choice-reaction-time task, latencies and amplitudes of the P300 differed between the 2 groups. The patient group showed longer P300 latencies, which were shortened by vibratory stimuli. In contrast, the control subjects were not affected by vibratory stimuli.

**CONCLUSION:** Our findings support the hypothesis that pathologic cognitive processes after TBI can be improved by proprioceptive stimulation. Muscle vibration has positive effects on pathologically slowed cognitive processes but not in healthy subjects.

[**Torvinen S**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Torvinen%20S%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Kannus P**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Kannus%20P%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Sievänen H**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Siev%C3%A4nen%20H%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Järvinen TA**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22J%C3%A4rvinen%20TA%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Pasanen M**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Pasanen%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Kontulainen S**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Kontulainen%20S%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Järvinen TL**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22J%C3%A4rvinen%20TL%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Järvinen M**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22J%C3%A4rvinen%20M%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Oja P**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Oja%20P%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**, &** [**Vuori I**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Vuori%20I%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**. (2002). Effect of four-month vertical whole body vibration on performance and balance.** [***Med Sci Sports Exerc.***](about:blank) ***34,* 1523-8.**

**PURPOSE**: This randomized controlled study was designed to investigate the effects of a 4-month whole body vibration-intervention on muscle performance and body balance in young, healthy, nonathletic adults. **METHODS**: Fifty-six volunteers (21 men and 35 women, aged 19-38 yr) were randomized to either the vibration group or control group. The vibration-intervention consisted of a 4-month whole body vibration training (4 min.d(-1), 3-5 times a week) employed by standing on a vertically vibrating platform. Five performance tests (vertical jump, isometric extension strength of the lower extremities, grip strength, shuttle run, and postural sway on a stability platform) were performed initially and at 2 and 4 months.

**RESULTS:** Four-month vibration intervention induced an 8.5% (95% CI, 3.7-13.5%, P=0.001) net improvement in the jump height. Lower-limb extension strength increased after the 2-month vibration-intervention resulting in a 3.7% (95% CI, 0.3-7.2%, P=0.034) net benefit for the vibration. This benefit, however, diminished by the end of the 4-month intervention. In the grip strength, shuttle run, or balance tests, the vibration-intervention showed no effect.

**CONCLUSION:** The 4-month whole body vibration-intervention enhanced jumping power in young adults, suggesting neuromuscular adaptation to the vibration stimulus. On the other hand, the vibration-intervention showed no effect on dynamic or static balance of the subjects. Future studies should focus on comparing the performance-enhancing effects of a whole body vibration to those of conventional resistance training and, as a broader objective, on investigating the possible effects of vibration on structure and strength of bones, and perhaps, incidence of falls of elderly people.

**Niemeijer AS,** [**Smits-Engelsman BC**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Smits-Engelsman%20BC%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**,** [**Reynders K**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Reynders%20K%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**, &** [**Schoemaker MM**](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=Search&Term=%22Schoemaker%20MM%22%5BAuthor%5D&itool=EntrezSystem2.PEntrez.Pubmed.Pubmed_ResultsPanel.Pubmed_DiscoveryPanel.Pubmed_RVAbstractPlus)**.(2003). Verbal actions of physiotherapists to enhance motor learning in children with DCD.** [***Hum Mov Sci.***](about:blank) ***22*, 567-81.**

In this study, the motor teaching principles taxonomy (MTPT) was developed to investigate which teaching principles physiotherapists use to treat children with developmental coordination disorder during Neuromotor Task Training (NTT). In NTT, special attention is paid to the best ways to instruct and provide feedback. Based on motor learning theory and video observations of NTT treatments, teaching principles aimed at improving motor learning were categorised into three categories: giving instruction, providing or asking feedback, and sharing knowledge. The MTPT's reliability and validity were satisfactory. Therapists gave instructions very frequently. In addition, the principle frequency showed hardly any correlation with the children's initial motor performance level, indicating that the principles used are not related to the child's entry level.

**Other Citations of Interest**

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**Wann, J. P., Mon-Williams, M., & Rushton, K. (1998). Postural control and coordination disorders: The swinging room revisited. *Human Movement Science,17*(4-5), 491-513. doi:10.1016/s0167-9457(98)00011-6**

The postural stability of different groups of children was examined using the “swinging room'' paradigm of Lee, D.N., Aronson, E., 1974. Perception and Psychophysics 15, 529± 532. Nursery age children (3±4 years), children with coordination difficulties (DCD: 10±12 years), age-matched controls and adults were compared in their sway responses when they were presented with a moving visual world while standing upright on a static ¯oor. Gain estimates for the vision-posture transfer function suggested that nursery children still depend upon vision as a major source of postural information, whereas this dependence is not evident in older control children. The children with DCD could be separated into two groups: (i) those who had postural control problems and demonstrated a bias to use visual information equivalent to the nursery children and (ii) those who passed a standard postural control assessment and did not differ from age-matched controls in the swinging room context.