

ONLINE APPENDIX 2

Note: This is Online Appendix 1 of Van der Walt, J., Plastow, N.A. & Unger, M., 2020, 'Motor skill intervention for pre-school children: A scoping review', *African Journal of Disability* 9(0), a747. <https://doi.org/10.4102/ajod.v9i0.747>

TABLE 1-A1: Description of records.

Authors	Title	Type	Level of evidence*	Activities/approaches	Outcome
Colombo-Dougovito A M, Block M E (2019)	Fundamental motor skill interventions for children and adolescents on the autism spectrum: a literature review	Literature Review (5 studie) Quasi-experimental (2) Case studies (2) Multiple method s(1)	III-2	Physical education and adapted physical education lessons Classroom Pivotal Response Teaching Therapy (CPRT)	All included studies reported positive effects following motor skill interventions. Measurements used: Peabody Developmental Motor Scales -2 (PDMS-2), Test of Gross Motor Development second edition (TGMD), Movement Assessment Battery for Children (M-ABC)
Smits-Engelsman B, Vincon S, Blank R, Quadrado V H, Polatajko H, Wilson P (2018)	Evaluating the evidence for motor-based interventions in developmental coordination disorder: A systematic review and meta-analysis	Systematic review and meta-analysis (30 studies 25 datasets) ¹ RCT (1) ² CCT (10) Case study ³ /NCT(5)	II	Virtual Reality Training Sport/play exercises e.g. physio ball/theraband exercises Taekwondo Handwriting training Functional Movement Power training Balance training circuit Trampoline	The overall effect size (cohen's d) was high (1.06) There was evidence for positive benefits for activity-oriented approaches, body function-oriented combined with activities, active video games, and small group programmes
Najafabadi M G, Sheikh M, Hemayattalab R, Memari A, Aderyani M R, Hafizi F (2018)	The effect of SPARK on social and motor skills of children with autism	Comparative study (pre-test–post-test, two-group control study design)	III-1	Sports, Play and Active Recreation for Kids (SPARK) programme. Health-fitness activities: 13 activities including aerobic dance, running games, jump ropes. Skill-fitness: 9 sports including soccer, frisbee, basketball. Control group continued with normal PE activities	Significant improvements were found (between pre and post-test scores) in dynamic balance ($p < 0.001$), static balance ($p < 0.001$) and bilateral integration ($p = 0.049$) as measured with the Bruininks–Oseretsky Test of Motor Proficiency (BOTMP) Significant differences were found between the experimental and control group scores on static and dynamic balance ($p < 0.001$) The Autism Treatment Evaluation checklist (ATEC) questionnaire and Gilliam Autism rating Scale 2 nd edition (GARS-2) showed a positive effect on social interaction ($p < 0.001$)

¹ RCT: Randomised-control trial

² CCT: Controlled clinical trial

³ NCT: Non-control trial

Van Cappellen van Maldegem S J M, van Abswoude F, Krajenbrink H, Steenbergen B (2018)	Motor learning in children with developmental coordination disorder: the role of focus, attention and working memory	Quasi-experimental field based study Pre-post design	III-2	Slingerball throwing task (target throw) Group 1: received feedback with internal focus of attention while group 2 received feedback with external focus of attention	According to the Movement Assessment Battery for Children 2 nd edition (M-ABC 2) accuracy improved for both groups ($p = 0.24$), however there was no significant effect for type of focus of attention ($p = 0.785$) There was a significant effect of visuospatial working memory on learning ($p < 0.01$) (Automated Working Memory Assessment – AWMA) Children receiving feedback with external focus of attention improved more if they have a better visuospatial working memory ($p < 0.01$), however this was not the case for children receiving feedback with internal focus of attention ($p > 0.05$)
Ketchesen L., Hauck J, Ulrich D (2017)	The effects of an early motor skill intervention on motor skills, levels of physical activity, and socialization in young children with autism spectrum disorder: A pilot study.	Pilot study (pre-test–post-test, two-group control study design)	III-2	Classroom Pivotal Response Teaching (CPRT) Locomotor skill and object control skill training – free play and indirect instruction	Significant difference between groups in three motor components: Locomotor: $p < 0.001$; object control: $p < 0.001$; gross quotient : $p < 0.01$ as measured with ⁴ TGMD - 2
Ward E, Hillier S, Raynor A, Petkov J (2017)	A range of service delivery models for children with developmental coordination disorder are effective: a randomized controlled trial	Randomised Controlled Trial	II	All groups: Fine motor warm up: e.g. playdough Fine motor task e.g. collage Body awareness task e.g. animal walk Gross motor warm up e.g. scooter board Gross motor circuit Modes of delivery: 1. In school with a support worker 2. In school with a physical therapist In clinic with a physical therapist	Overall significant improvement of motor skills as measured with the M-ABC ($p=0.00$) and TGMD-2 ($p=0.00$) over time and improvement was maintained or increased after a 6 month period (M-ABC effect size = 0.98; ⁵ TGMD-2 effect size 1.37) There was no group effect between modes of intervention ($p = 0.09$)
Lowe L, MacMillian AG, Yates C (2015)	Body Weight Support Treadmill Training for children with developmental delay who are ambulatory.	Experimental/Outcome study – sample of convenience with computer generated randomization	III-1	All subjects continued with physiotherapy sessions as usual. Experimental group received up to 3 additional Body Weight Support Treadmill Training (BWSTT) sessions weekly	Significant improvement was seen in gait velocity ($p = 0.033$) and gross motor skill attainment ($p = 0.017$) when compared with control group as measured with a 10m walking test and the Gross Motor Function Measure, E.

⁴ TGMD – 2: Test of Gross Motor Development second edition

⁵ TGMD-2: Test of Gross Motor Development second edition

Bremer E, Balogh R, Lloyd M (2015)	Effectiveness of a fundamental motor skill intervention for 4-year-old children with autism spectrum disorder: A pilot study	Experimental/Outcome study (waiting list control experimental design)	III-1	Locomotor skills (running, hopping, leaping), object control (ball skills), obstacle courses, free play Group 1 received treatment first, while group 2 acted as control group. Group 2 received the same input on completion of the first group's treatment	Significant improvement of the object manipulation raw score ($p = 0.029$) and total motor quotient ($p = 0.044$) of the ⁶ PDMS-2, when compared to the control group.
Iwanaga R, Honda S, Nakane H, Tanaka K, Toeda H, Tanaka G (2014)	Pilot study: Efficacy of sensory integration therapy for Japanese children with high-functioning autism spectrum disorder	Pilot study: (quasi-experimental design)	III-2	Sensory Integration (SI) therapy: Use of sensory and kinetic equipment such as a swing, ball pit, balance beam, ladder and trampoline. Specific SI treatment principles applied. 3. General treatment programme: social skills and communication training, kinetic activities, child-parent play. Some SI principles included.	The ⁷ SI therapy group and general therapy group made significant gains post treatment with the total score of the re-standardised version of the Millers assessment for pre-schoolers (J-MAP) Children who received SI therapy improved significantly more with regards to the total score of the ⁸ J-MAP ($p = 0.005$), including the coordination index score ($p = 0.008$) and the complex index score ($p = 0.034$)
Ajzenman HF, Standeven JW, Shurtleff TL (2013)	Effect of hippotherapy on motor control, adaptive behaviors, and participation in children with autism spectrum disorder: a pilot study	Pilot study (single group pre-post design)	IV	Functional horse-riding positions on therapy horses; schooling figures, following complex directions, turn taking, planning, and ball games included.	Significant improvement found in postural control through force plates and video motion capture. ($p = 0.028$)
Bardid F, Deconinck FJA, Descamps S, Verhoeven L, De Pooter G, Lenoir M, et al (2013)	The effectiveness of a fundamental motor skill intervention in pre-schoolers with motor problems depends on gender but not environmental context	Experimental/outcome (Cohort study)	III-2	Intervention: Locomotor skills, ball handling skills, jumping skills, postures and balance, play, rhythm and dance Regular ⁹ PE Control group: Regular PE	Intervention group: significant improvement of locomotor skills ($p < 0.001$) and object control ($p < 0.001$) measured with the ¹⁰ TGMD-2 49% achieved an average motor skill level Control group: presented with decline in motor skill level ($p = 0.009$) Gender: Girls in the intervention group made significant progress with locomotor skills ($p = 0.004$) and object control ($p = 0.004$), while boys in the control group did not show significant progress with locomotor skills ($p = 0.065$) or object control ($p = 0.278$)

⁶ PDMS-2: Peabody Developmental Motor Scales second edition

⁷ SI: Sensory Integration

⁸ J-MAP: Re-standardised version of the Millers assessment for pre-schoolers

⁹ PE: Physical Education

¹⁰ TGMD-2: Test of Gross Motor Development second edition

Case-Smith J, Frolek Clark GJ, Schlabach TL (2013)	Systematic review of interventions used in occupational therapy to promote motor performance for children ages birth - 5 years	Systematic review 24 studies divided into three sections: -Visual-motor interventions for preschool children with developmental delays (4 studies) Non randomised cross-over design Quasi-experimental ¹¹ NCT Single group pre/post --Developmental play-based interventions for infants at risk (5 studies) - Interventions for young children with or at risk for Cerebral Palsy(CP) (15 studies)	II	Visual-motor interventions: Sensory-motor activities Child centred vs therapy directed approach (for the purpose of this scoping review, only this section was found to be relevant)	Visual-motor interventions for pre-school children with developmental delays resulted in positive short-term effects on children's visual-motor performance
Ferguson GD, Jelsma D, Jelsma J, Smits-Engelsman BCM (2013)	The efficacy of two task-orientated interventions for children with Developmental Coordination Disorder: Neuromotor Task Training and Nintendo Wii Fit training.	Comparative study (single-blinded quasi-experimental study design)	III-2	Neuromotor Task Training (NTT): Functional groups with collated goals: soccer, netball, indigenous games. Workstations using basic equipment such as balls, buckets, cups and natural materials such as sticks, planks and bricks to practice components of games Nintendo: Wii fit games	The mean total standard score of the ¹² M-ABC 2 of the ¹³ NTT group improved significantly after intervention (p < 0.01) The Wii fit group did not show significant improvement with the total standard scores, (p = 0.26) but a moderate effect size (d = -0.50)
Smits-Engelsman BC, Blank R, Kaay AC, Mosterd-van der Meijs R, Vlugt-van den Brand E, Polatajko HJ, et al.(2013)	Efficacy of interventions to improve motor performance in children with developmental coordination disorder: a combined systematic review and meta-analysis.	Combined systematic review and meta-analysis 26 studies included 20 studies eligible for meta-analysis Systematic review (1) Meta-analysis (1) ¹⁴ RCT's & clinical trials (24)	II	Task orientated approach Motor Imagery Training Perceptual-motor training Process Orientated training (sensory integration) Medication (Methylphenidate) Teacher and parent guidance	Task orientated approaches and motor learning were indicated above other approaches (dw = 0.89 and dw = 0.83 respectively) Task orientated approaches had a significantly higher effect size than process orientated training (p = 0.01) and comparison (p = 0.006)

¹¹ NCT: Non-control trial

¹² M-ABC2: Movement Assessment Battery for Children second edition

¹³ NTT: Neuromotor task training

¹⁴ RCT: Randomised-control trial

Alhassan S, Nwaokelemeh O, Ghazarian M, Roberts J, Mendoza A, Shitole S (2012)	Effects of locomotor skill program on minority pre-schoolers' physical activity levels.	Pilot study Cohort study	III-2	Locomotor skills programme (LMS) -Low intensity music activity -locomotor skills -extension activities (e.g. rodeo galloping.) Control group: supervised free play	Locomotor skills programme: Significant improvement in leaping skills ($p = 0.01$) when assessed with the ¹⁵ TGMD-2 Significant reduction of time spent in sedentary play ($p = 0.02$) as measured with the Actigraph GTIM accelerometer
Logan SW, Robinson LE, Wilson AE, Lucas WA.(2012)	Getting the fundamentals of movement: a meta-analysis of the effectiveness of motor skill interventions in children	Meta-analysis 11 studies included ¹⁶ CCT(4) ¹⁷ NCT (5) Quasi-experimental (2)	III-1	Child facilitated Direct instruction Modified direct instruction Mastery Psychomotor training Physical education Music based motor programmes Activity based after school programme Fitness infusion Occupational Therapy programmes	A significant positive effect of motor skill interventions on the improvement of fundamental movement skills in children was found ($d = 0.39$, $p < 0.001$) When considered separately, interventions resulted in significant and similar improvements in object control ($p < 0.001$) and locomotor skills ($p < 0.001$)
Salem Y, Gropack SJ, Coffin D, Godwin EM (2012)	Effectiveness of a low-cost virtual reality system for children with developmental delay: A preliminary randomised single-blind controlled trial.	Experimental/outcome study Cohort	II	Experimental group: Nintendo Wii gaming system (Wii fit and Wii sports) Control group: Regular occupational therapy /physiotherapy, focus was on facilitation of movement transitions, balance, walking, and gross and fine motor control.	The experimental group exhibited trends towards greater improvements than the control group as measured with the Gross Motor Function Measure (GMFM). Single leg stance test ($p = 0.017$) Right grip strength ($p = 0.024$) Left grip strength ($p = 0.043$)
Golos A, Sarid M, Weill M, Weintraub N (2011)	Efficacy of an early intervention program for at-risk preschool boys: a two-group control study	Comparative study (pre-test–post-test, two-group control study design)	III-1	Intervention: Teacher training, monitoring and collaboration sessions : Graphomotor activities (e.g. colouring within lines), manual dexterity (e.g., cutting), and gross motor activities (e.g., jumping, hopping, balance exercises, ball game) Monitoring: Teacher training	The intervention group scored significantly higher than the control group in most performance skills including cognitive tasks ($p = 0.008$) (Assessments instruments used: Developmental Test of Visual Motor Integration (VMI), ¹⁸ M-ABC, ¹⁹ MAP) Significant progress was made with participation and performance (Structured Preschool Participation - Observation: SPO), with a large effect size ($h > 0.14$ in all)
Kirk MA, Rhodes RE (2011)	Motor skill interventions to improve fundamental movement skills of pre-schoolers with developmental delay	Review 11 studies included ²⁰ RCT (1)	II	Motivational climates: -child directed -facilitator instructed	81% of the studies achieved significant improvement in motor skills, mostly

¹⁵ TGMD-2: Test of Gross Motor Development second edition

¹⁶ CCT: Controlled clinical trial

¹⁷ NCT: Non-control trial

¹⁸ M-ABC: Movement Assessment Battery for Children

¹⁹ MAP: Millers Assessment for Pre-schoolers

²⁰ RCT: Randomised-control trial

		²¹ NRCT (4) Experimental designs (4) Case Report (2)		Physical Therapy Sensory-motor therapy	locomotor skills, up to level of typically developing peers. Intervention effect for trials (N= 9): ($\eta^2 = 0.57-0.85$).
Pfeiffer BA, Koenig K, Kinnealey M, Sheppard M, Henderson L (2011)	Effectiveness of sensory integration interventions in children with autism spectrum disorders: a pilot study.	Pilot study (comparative study using a sample of convenience)	III-1`	²² SI intervention: Individualised plans, adhering to SI principles, using SI equipment Fine motor intervention: constructional activities, drawing/writing and fine motor crafts	Significant improvements occurred on the Goal Achievement Scale (GAS), including sensory processing, motor skills, and social functioning for both treatments, but more significant changes occurred for the SI group as rated by parents($p < 0.5$) and teachers ($p < 0.01$)
Bart O, Podoly T, Bar-Haim, Y (2010)	A preliminary study on the effect of methylphenidate (MPH) on motor performance in children with comorbid DCD and ADHD	Preliminary study (a double-blind within-subject research design)	III-2	Ritalin/Concerta as per individual prescribe dosages Control: Placebo tablets	Children who took MPH significantly improved their mean total score with the M-ABC when compared to the group who took placebos ($p < 0.02$)
May-Benson TA, Koomar JA. (2010)	Systematic review of the research evidence examining the effectiveness of interventions using a sensory integrative approach for children	Systematic review 27 studies including: i RCT level I (13) Level II (5) Level III (3) Case studies (6) Quality score determined by means of the MacDermid Scale	II	Sensory integration: -SI equipment -sensorimotor play (e.g. ball activity)	Outcomes, including sensorimotor skills and motor planning, related to the SI approach were better than no treatment in >50% of the studies, but not better than alternative treatment methods.
Wuang Y, Wang C, Huang M, Su C (2010)	The effectiveness of simulated developmental horse-riding program in children with autism	Experimental/outcome study (wait list control, pre-post testing)	III-2	Simulated developmental horse riding programme (with Joba equipment) in addition to regular occupational therapy sessions	Both groups made significant gains in motor skills (measured with the ²³ BOTMP ($p < 0.01$) and with sensory processing when measured with the Test of Sensory Integration Functions (TSIF) ($p < 0.1$).
Bazyk S, Michaud P, Goodman G, Papp P, Hawkins E, Welch MA (2009)	Integrating occupational therapy services in a kindergarten curriculum: a look at the outcomes.	Outcome study (one group pre-test-post-test)	IV	Indirect: teacher consultation, planning, parent consultation. Direct: Group sessions. Often co-groups with art/music teacher	Significant gains in fine motor skills as measured with the ²⁴ PDMS-2 ($p < 0.01$) were made for all children
Cosper SM, Lee GP, Peters SB, Bishop E (2009)	Interactive metronome training in children with attention deficit and developmental coordination disorders	Experimental/outcome study (pre-test-post-test design)	III-3	Headphones Rhythmic sounds Motion-sensory trigger buttons, which attach either to the hand or foot for use in performing various repetitive patterned activities	Significant improvement were made with visual-motor control ($p = 0.02$) with the BOTMP Significant improvements were made with complex visual choice reaction time on the Continuous Performance Test ($p < 0.05$) of a vigilance test.

²¹ NRCT: Nonrandomised-control trial

²² SI: Sensory Integration

²³ BOTMP: Bruininks– Oseretsky Test of Motor Proficiency

²⁴ PDMS-2: Peabody Developmental Motor Scales second edition

Robinson LE, Goodway JD (2009)	Instructional climates in preschool children who are at-risk. Part I: object-control skill development	Comparative study (quasi-experimental design)	III-2	<p>Control group: free play, with access to general playground equipment</p> <p>Low autonomy group: warm up, motor skill stations, closure. Clear directions and instructions. Facilitator indicates when to change stations.</p> <p>Mastery motivational group: Same activities, but students progress independently through activity stations.</p>	Both instructional climate approaches indicated a significant progress (treatment x time interaction: $p < 0.001$) in object control when compared to control group when measured with the ²⁵ TGMD-2. No significant difference between the two approaches i.e. mastery motivational climate and low autonomy ($p = 0.42$)
Lahav O, Apter A, Ratzon N (2008)	A comparison of the effects of directive visuomotor intervention versus nondirective supportive intervention in kindergarten and elementary school children	Comparative study Cohort study	III-2	<p>Directive patterns, paper work and fine motor activities</p> <p>Non directive : mind games, memory games, games of chance, social games, cards, board games</p> <p>Control group: No extra input</p>	<p>Significant improvement in visual motor integration skills (measured with the ²⁶VMI) with the nondirective approach for Kindergarten learners ($p < 0.05$) when compared to control group.</p> <p>Significant greater improvement with the non-directive approach when compared to the directive approach ($p < 0.05$). VMI and Developmental Tests of Visual Perception (DTVP)</p> <p>Grade 1 learners showed a significant greater response with the directive approach when compared to the kindergarten group (< 0.05) and a significant improvement in visual motor integration for both approaches when compared to the control group (< 0.05)</p> <p>Grade 1 learners showed significant greater improvement in visual motor integration with the directive approach when compared to children in Kindergarten ($p < 0.05$)</p>
Hillier S.(2007)	Intervention for children with developmental coordination disorder: a systematic review.	<p>Systematic review</p> <p>31 studies</p> <p>Level 1: 1 Meta-analysis</p> <p>Level II 16 ²⁷RCT's</p> <p>Level III: 14 outcome based studies</p> <p>According to NH-MRC levels of evidence (1999)</p>	II	<p>General occupational therapy</p> <p>Sensory Integration</p> <p>Perceptual-motor therapy</p> <p>Kinaesthetic training</p> <p>CO-OP (cognitive orientation to daily occupational performance)</p> <p>Task orientated learning</p> <p>Process orientated learning</p>	<p>Meta-analysis was not possible due to the clinical heterogeneity of the primary studies included.</p> <p>Evidence was considered to be sufficient and of sufficient quality to suggest that all interventions were positive and any of these was considered to be better than no input.</p>

²⁵ TGMD-2: Test of Gross Motor Development second edition

²⁶ VMI: Developmental Test of Visual Motor Integration

²⁷ RCT's: Randomised control trials

				Parent assisted home exercises Physiotherapy Mastery Cognitive-affective tasks Sport activities Task specific training Neuromotor task training Le Bon Depart Teacher/parent guidance	
Bayona CL, McDougall J, Tucker MA, Nichols M, Mandich A (2006)	School-based occupational therapy for children with fine motor difficulties: evaluating functional outcomes and fidelity of services.	Evaluation of service / programme (one-group pre-test-post-test quasi-experimental research design)	III-3	Recommendations to school regarding motor function (in-hand manipulation and motor planning) as well as specific strategies to improve visual perceptual skills. Recommendations for task/environmental changes (e.g. slanted desks) and strategies. All above in form of written home programmes with paper and pencil tasks Limited individual OT sessions	Significant progress was made in written communication as measured with the Vineland Adaptive behaviour Scales – Classroom edition (VABS-C) ($p < 0.001$) Significant improvement with written work and using materials on the School Function Assessment (SFA) ($p < 0.5$)
Niemeijer AS, Schoemaker MM, Smits-Engelsman BCM (2006)	Are teaching principles associated with improved motor performance in children with developmental coordination disorder? A pilot study	Experimental/outcome study (pilot)	III-3	Neuromotor task training Teaching principles: Giving instruction, sharing knowledge, providing or asking for feedback	Significant progress occurred with all students as measured with the ²⁸ M-ABC ($p = 0.007$) as well as with the ²⁹ TGMD-2 ($p = 0.001$) The following teaching principles were associated with success: Providing clues on how to perform a task, asking child about a task, explaining why a task should be executed in a certain way.
Valentini NC, Rudisill ME (2004)	Motivational climate, motor skill development, and perceived competence: two studies of developmental delayed kindergarten children	Comparative study Experiment 1: compared the two motivational climates Experiment 2: Mastery climate 6 months follow up.	III-1	Low autonomy group: teacher in authority roll, rigid grouping and duration for activities, public recognition Mastery: Self-paced instruction and pace with tasks, greater variety of tasks, decision making opportunities and private recognition Same activities for both groups: meaningful motor tasks matching children's abilities	Children in both groups made significant progress in locomotor skills and object control skill with the ³⁰ TGMD ($p = 0.0001$). The children in the mastery group made significantly more progress than those in low autonomy group ($p = 0.001$) The mastery group performed significantly better on long term follow-up assessments for locomotor skills and object control ($p = 0.001$)
Dankert HL, Davies PL, Gavin WJ (2003)	Occupational therapy effects on visual-motor skills in preschool children	Experimental/outcome study (quasi-experimental, two-factor mixed design)	III-2	Fine motor activities: arts and crafts, finger plays, and small manipulatives Gross motor activities: obstacle course, music, dancing Visual-motor and visual perception activities: drawing, cutting, and assembly	Children with developmental delays and typically developing peers (treatment and control groups) demonstrated significant

²⁸ M-ABC: Movement Assessment Battery for Children

²⁹ TGMD-2: Test of Gross Motor Development second edition

³⁰ TGMD: Test of Gross Motor Development

					<p>improvement in visual motor integration with the ³¹VMI scores ($p < 0 .0005$) Significant progress was also seen with the VMI subtest of visual perception ($p < 0 .0005$) Significant progress with the motor coordination subtest was only seen in the typical development group with treatment ($p < 0.0005$)</p> <p>Planned comparison tests showed that students with developmental delays developed skills at a rate faster than expected when compared to typically developing peers on the VMI</p>
Dreiling DS, Bundy AC (2003)	A comparison of consultative model and direct-indirect intervention with pre-schoolers.	Comparative study (between group design)	III-2	<p>Consultation: therapeutic strategies in the classroom, consultation with teachers and parents Direct treatment: Regular individualised OT programmes</p>	<p>No significant differences were found between the two models ($p = 0 .724$) Both groups made progress when measured according to goals reached: Consultation group: (Mconsult = 48.25; Mdir.svc = 49.69) at approximately the rate expected (Mexpected = 50; SD = 10)</p>
Goodway D, Crowe H, Ward P (2003)	Effects of motor skill instruction on fundamental motor skill development.	Experimental/outcome study (pre-test-post-test quasi-experimental design)	III-1	<p>Experimental group: SKIP programme: ball skills, galloping, skipping, running, jumping Control group: Normal Kindergarten play</p>	<p>The intervention (SKIP) group presented with significant progress in both locomotor skills ($p < 0.001$) and object control ($p < 0.001$) as measured with the ³²TGMD-2 The experimental groups' progress was significantly better than the control groups' ($p < 0.001$)</p>
Mandich AD, Polatajko HJ, Macnab JJ, Miller LT (2001)	Treatment of children with developmental coordination disorder: what is the evidence?	Comprehensive survey and review 32 studies included (classification of included studies not available)	III-1	<p>Bottom-up approaches - sensory integration - process orientated treatment - perceptual motor training Top-down approaches -task specific interventions -cognitive approaches (problem solving, cognitive-motor, CO-OP)</p>	<p>All interventions included were considered to be more positive than no input. More evidence available for a top-down approach, however a joint approach was recommended</p>
Case-Smith J (2000)	Effects of occupational therapy services on fine motor and functional performance in preschool children.	Evaluation of service / programme (single group pre/post testing) Descriptive design	IV	<p>Direct intervention through ³³SI, motor/manipulation, self-care and play/peer interaction</p>	<p>The participants made significant gains in all eight measures over the course of the academic year (based on Tukey post hoc analysis)</p>

³¹ VMI: Developmental Test of Visual Motor Integration

³² TGMD-2: Test of Gross Motor Development second edition

³³ SI: Sensory Integration

					Participants who received more occupational therapy sessions improved more in visual motor skills ($p = 0.43$) and social function ($p = 0.44$). Play ($p = 0.15$) and peer interaction ($p = 0.13$) were the only significant predictors of progress with visual motor integration skills. Parts of the following assessments were used: ³⁴ M-ABC, Sensory Integration and Praxis Test (SIPT), ³⁵ DTVP, ³⁶ PDMS, Draw a person (DAP), Pediatric Evaluation of Disability Inventory (PEDI).
Leemrijse C, Meijer OG, Vermeer A, Adèr HJ, Diemel S (2000)	The efficacy of Le Bon Départ (LBD) and Sensory Integration treatment for children with developmental coordination disorder: a randomized study with six single cases.	Evaluation of service/programme (single subject design with multiple baseline and alternating treatments)	III-3	Baseline condition: Movement games at home ³⁷ LBD: Combination of rhythmic music, geometric shapes and body movements ³⁸ SI : Specific SI principles applied	Significant improvement in motor skills following both treatments (SI and LBD) when measured with the M-ABC ($p = 0.003$), praxis test ($p = 0.059$) and visual analogue scales ($p = 0.028$). The LBD treatment showed significantly more gains with a rhythm test when compared to the SI treatment ($p < 0.05$)
Pless M, Carlsson M, Sundelin C, Persson K. (2000)	Effects of group motor skill intervention on five- to six-year-old children with developmental coordination disorder.	Experimental/outcome study	III-1	Experimental group: Purposeful, joyful functional motor activities e.g. skipping with rope, ball games, obstacle courses, games Regular ³⁹ OT consultations service Control group: Regular OT consultation service	No significant difference between groups Within subjects: ($F(1) = 2.007$, $p = 0.165$) Between subjects: ($F(1) = 0.402$, $p = 0.530$) Significantly more children in the experimental group ($p = 0.001$) changed to a different (improved) category on the M-ABC than those in the control group ($p = 0.809$) with the final assessment.
Case-Smith J, Heaphy T, Marr D, Galvin B, Koch V, Ellis MG, et al (1998)	Fine motor and functional performance outcomes in preschool children	Comparative study (quasi-experimental design)	III-2	Regular individualised OT programmes: Visio-motor and manipulation activities Sensory integration activities Consultation	The group without fine motor difficulties made significant gains in the following areas (Tukey's post hoc analysis): In-hand manipulation, manual form perception, visual perception, draw a person, visual motor integration, functional skills, and self-care.

³⁴ M-ABC: Movement Assessment Battery for Children

³⁵ DTVP: Developmental Test of Visual Perception

³⁶ PDMS: Peabody Developmental Motor Scales

³⁷ LBD: Le Bon Départ

³⁸ SI: Sensory Integration

³⁹ OT: Occupational Therapy

					<p>The group with fine motor difficulties made significant gains in the following areas: In-hand manipulation, manual form perception, motor accuracy, visual perception, draw a person, Peabody fine motor scales, visual motor integration, functional skills, self-care.</p> <p>Children who received therapy input made significantly more progress in the following areas: in-hand manipulation, motor accuracy, draw a person, Peabody fine motor scale, functional skills (p<0.05)</p>
Baker BJ, Cole KN, Harris SR (1998)	Cognitive referencing as a method of ⁴⁰ OT/ ⁴¹ PT triage for young children.	Comparative study (between group comparison)	III-2	Goal orientated occupational therapy and physiotherapy Consultation Monitoring	<p>Significant improvements in gross and fine motor skills for both groups were made (p< 0.025) when measured with the ⁴²PDMS.</p> <p>No correlation was found between fine motor gains and Intelligence Quotient (IQ) (p = 0.095) or gross motor skills and IQ (p = 0.020)</p>
Rintala I, Pienimaki K, Ahonen T, Kooistra L (1998)	The effects of a psychomotor training program on motor skill development in children with developmental language disorders.	Comparative study	III-2	<p>Psychomotor training: Circuit activities including running, climbing on ladder, jumping on trampoline, rhythmic floor jumping, skipping with rope, ball activities, balancing tasks. Body awareness through the Sherborne development movement method</p> <p>PE: Games and sports</p>	<p>Both groups showed significant improvement over time with scores on the ⁴³M-ABC and ⁴⁴TGMD (p<0.001)</p> <p>Children in the psychomotor training group improved significantly more in object control (TGMD) (p= 0.034) and ball skills with the M-ABC (p=0.09) than children who attended regular ⁴⁵PE.</p>
Parush S, Hahn-Markowitz J (1997)	A comparison of two group settings for treatment in promoting perceptual-motor function of learning disabled children	Comparative study (Quasi-experimental)	III-2	<p>Gross motor: simulated playground with equipment to facilitate perceptual motor training activities e.g. crawling, climbing, balancing</p> <p>Fine motor: quiet room with table top activities such as puzzles, pegboards, block</p>	<p>The two groups were equivalent in making positive perceptual-motor gains, with no significant difference between results on eight areas tested (p>0.05). Instruments used for measurements: ⁴⁶BOTMP, ⁴⁷VMI, Motor Free Visual</p>

⁴⁰ OT: Occupational Therapy

⁴¹ PT: Physiotherapy

⁴² PDMS: Peabody Developmental Motor Scales

⁴³ M-ABC: Movement Assessment Battery for Children

⁴⁴ TGMD: Test of Gross Motor Development

⁴⁵ PE: Physical Education

⁴⁶ BOTMP: Bruininks– Oseretsky Test of Motor Proficiency

⁴⁷ VMI: Developmental Test of Visual Motor Integration

				design, drawing and scissor tasks and creative tasks	perception Test (MVPT), ⁴⁸ DAP, Loewenstein Occupational therapy Cognitive assessment (Constructional Praxis subtest), Pediatric Examination of Educational Readiness (spatial directions subtest), Basic Motor Ability Test (bead stringing).
Case-Smith J (1996)	Fine motor outcomes in preschool children Who Receive Occupational Therapy Services	Experimental/outcome study(single group pre/post testing)	III-3	Finger painting on vertical surfaces, finding small objects in resistive materials such as play clay, using magnetic wands to pick up small metal objects, or creating animals from pipe cleaners or other textured materials, use of tweezers, eye droppers, or small tongs to stimulate tool use, adaptation of classroom activities to fit with OT goals	Significant improvement of motor function: in-hand manipulation, tool use and eye-hand coordination ($p < 0.005$) (peg rotation test, ⁴⁹ SIPT, pencil grasp – developmental progression (dp), scissors grasp (dp), bulb dynamometer) Significant improvement of functional skills as measured with the ⁵⁰ PEDI (4 subtests: $p < 0.0$; 2 subtests: $p < 0.5$).
Davies PL, Gavin WJ (1994)	Comparison of individual and group/consultation treatment methods for preschool children with developmental delays	Comparative study (Quasi-experimental)	III-3	Individual sessions: Occupational therapy and physical therapy treatment using a sensory integration and neurodevelopmental approach Group sessions: Occupational therapy and physiotherapy group sessions using a sensory integration and neurodevelopmental approach	Both groups were equivalent in making significant progress in gross and fine motor skills when measured with the ⁵¹ PDMS ($p < 0.01$) as well as the ⁵² VABS ($p = 0.001$) There were no statistical significant differences between the two groups as measured with the PDMS and VABS
De Gangi A, Wietlisbach S, Goodin M, Scheiner N (1993)	A comparison of structured sensorimotor therapy and child-centered activity in the treatment of preschool children with sensorimotor problems	Comparative study (A-B cross-over design)	III-2	Both groups received 8 weeks of an intervention, a retest and the followed up by 8 weeks of the other intervention Interventions: Sensorimotor intervention: Therapists used specific handling techniques, exercises, skill training and therapeutic activities Child centered activity: The child initiates all play, the therapist acts as observer and facilitator. Toys and activities that promote sensorimotor development are made available in a safe environment	All children receiving structured sensorimotor therapy showed significant progress in number of months gained with gross motor skills ($p = 0.016$) and functional skills ($p = 0.05$) as measured with the PDMS

⁴⁸ DAP: Draw-a-person

⁴⁹ SIPT: Sensory Integration and Praxis Test

⁵⁰ PEDI: Pediatric Evaluation of Disability Inventory

⁵¹ PDMS: Peabody Developmental Motor Scales

⁵² VABS: Vineland Adaptive behaviour Scales

TABLE 2-A2: Hierarchy of evidence (Merlin, Weston and Tooher, 2009).

Level of evidence	Study design
I	Evidence obtained from a systematic review of all relevant randomised controlled trials
II	Evidence obtained from at least one properly-designed randomised controlled trial
III-1	Evidence obtained from well-designed pseudorandomised controlled trials (alternate allocation or some other method)
III-2	Evidence obtained from comparative studies (including systematic reviews of such studies) with concurrent controls and allocation not randomised, cohort studies, case-control studies, or interrupted time series with a control group
III-3	Evidence obtained from comparative studies with historical control, two or more single arm studies, or interrupted time series without a parallel control group
IV	Evidence obtained from case series, either post-test or pre-test/post-test