

# Play and occupational therapy

*Practice guideline supplement*

## Appendix 2: Evidence tables

Royal College of Occupational Therapists  
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This supplement provides details of the evidence used to formulate the recommendations in the guideline *Play and occupational therapy* (RCOT 2023). Each piece of evidence is summarised in a table, including methodological details, study findings, and limitations. A full reference for each follows the tables. More information on the criteria and methodology of the grading of the evidence can be found in the full practice guideline, Table 10.4.

The full practice guideline is available on the Royal College of Occupational Therapists' website: <https://www.rcot.co.uk/practice-resources/rcot-practice-guidelines>

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Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Arbesman et al (2013)</p>	<p>Systematic review</p> <p>Aim: to understand the effectiveness of activity-based interventions for mental health promotion, prevention, and intervention with children and young people</p> <p>Inclusion: article published in either a peer-reviewed journal or peer reviewed evidence-based review since 1980 in English; age range of study participants: 3-21 years; intervention described embedded in activities and within domain of occupational therapy; outcomes measured included social or peer interactions or compliance with adult directives or social rules or norms; article provided Level I, II, or III evidence</p> <p>Exclusion: presentation and conference proceedings, non-peer-reviewed literature, dissertations and theses.</p>	<ul style="list-style-type: none"> <li>• Reviewers, AOTA staff, and the AOTA project methodology consultant first identified search terms, and the advisory group reviewed them.</li> <li>• Studies were grouped according to strength using a standardised system.</li> <li>• Search terms included: activities, activities of daily living, bullying, friendship, health, leisure, out of school activities, play, promotion/wellness, recreation, resiliency, school mental health, stress, and transition.</li> </ul>	<ul style="list-style-type: none"> <li>• The review used a standardised hierarchy of research to assess the quality and level of research.</li> <li>• Categorised Level I (systematic review) through to Level V (case reports).</li> <li>• Strength of evidence is classified using guidelines of the US Preventative Services Task Force.</li> <li>• The Public Health model of mental health used to identify themes.</li> </ul>	<ul style="list-style-type: none"> <li>• Strong evidence indicates that children with intellectual impairments, developmental delays, and learning disabilities benefit from social skills programming and play, leisure, and recreational activities.</li> <li>• 77 (62%) classified as Level I evidence.</li> <li>• 27 (22%) were classified as Level II studies.</li> <li>• 20 (16%) were classified as Level III studies.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Systematic review with rigorous strategy, explanations, and discussion.</li> <li>• The review covers a wide population and a broad discussion of occupational therapy practice which can be applied locally.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Axford et al (2018)</p>	<p>Non-randomised controlled trial</p> <p>Aim: to examine the effectiveness of tablet applications that required specific motor skills designed to improve fine motor skills</p> <p>2 pre-primary classes of children selected as convenience sample</p> <p>53 children (29 intervention, 25 control) Male:female ratio: 1:1 Age range: 5-6 years</p> <p>Australia.</p>	<ul style="list-style-type: none"> <li>• Identical programmes were run in the experimental and the control group, except for the tablet activity replacing 30 minutes of tabletop activities for the experimental class.</li> <li>• Activities included threading, cutting, jigsaw and form-board puzzles and building with blocks and formed a normal part of the school programme.</li> <li>• During the 30 minutes of tablet time, the teacher selected 3 apps from each curriculum area with a range of motor skills.</li> </ul>	<ul style="list-style-type: none"> <li>• Children completed the Beery Developmental Test of Visual Motor Integration (VMI) and observation checklist, the Shore Handwriting Screen, and self-care items from the Hawaii Early Learning Profile.</li> <li>• These were implemented by 6 final year occupational therapy students, trained in the use of VMI and supervised by 2 occupational therapists.</li> </ul>	<ul style="list-style-type: none"> <li>• The experimental group made a statistically and clinically significant improvement on the VMI motor coordination standard scores with a moderate clinical effect size (<math>p &lt; 0.001</math>).</li> <li>• Children's occupational performance in daily tasks also improved.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Study provides a structure which could be applied to a similar population but educational approaches vary and also the age that children start school varies globally.</li> <li>• All children identified as within typically developing range – may have greater impact on those identified as developmentally delayed in the areas assessed.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Bartie et al (2016)	<p>Qualitative study</p> <p>Aim: to determine play opportunities, activities, equipment, toys and the play environment for 5-6 year olds living in a low socio-economic community outside a small town in South Africa to better understand the nature of play in this environment</p> <p>Recruitment via purposive sampling – children selected by school teachers</p> <p>Exclusion: no telephone number given, parents or carers could not be reached, did not consent</p> <p>6 participants 3 male, 3 female</p> <p>South Africa.</p>	<ul style="list-style-type: none"> <li>• Participant observation used along with photovoice method to capture the play experience.</li> <li>• Observations occurred over course of 1 week in afternoons after school.</li> <li>• Researchers observed each participant for 1 hour each afternoon.</li> <li>• Participants were free to decide what they wished to play or do and if they wished to include the researcher in the games or not.</li> </ul>	<ul style="list-style-type: none"> <li>• Inductive content analysis used to gain insight into play environment of the demographic.</li> </ul>	<ul style="list-style-type: none"> <li>• 2 themes emerged: “neighbourhood children find ways to play” and “context influences play”.</li> <li>• Children were given opportunity to play and participated in extensive outdoor play.</li> <li>• Their games were highly social and involved the imaginative use of found items as toys.</li> <li>• Play was also used to make sense of social hazards.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Spontaneous play may have been less spontaneous because of having someone watching/ potentially joining it. However, it appears that researchers were careful to think about this in their method and analysis.</li> <li>• Limited discussion on researcher-participant relationship.</li> <li>• An interesting perspective and valuable information in terms of challenging perceptions of what play looks like. Some of the information from this study could be translated to children in the UK.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Bonney et al (2017)</p>	<p>Randomised controlled trial</p> <p>Aim: a stratified randomised pre-post single blinded design was used to evaluate practice effects on transfer of motor skills using the Nintendo Wii program in children with and without developmental coordination disorder (DCD)</p> <p>Recruitment: via one school</p> <p>Inclusion: four DSM-5 criteria were used to identify children with DCD and typically developing (TD) children: 1) no evidence of functional motor problems as observed by their teacher or parent, 2) a score above the 15th percentile on the Movement Assessment Battery for Children-2 (MABC-2), 3) no diagnosis of a significant medical condition as reported by a parent and 4) absence of intellectual or cognitive impairment as confirmed by their parent and teacher</p> <p>111 children with DCD and their typically developing peers, aged 6–10 years</p> <p>South Africa.</p>	<ul style="list-style-type: none"> <li>• Children were randomly assigned to either variable (n = 56) or repetitive practice (n = 55).</li> <li>• Participants in the repetitive practice played the same exergame (ski slalom) twice weekly for 20 minutes, over a period of 5 weeks, while those in the variable group played 10 different games.</li> <li>• Motor skills such as balance tasks (hopping), running and agility tasks, ball skills and functional activities were evaluated before and after 5 weeks of training.</li> </ul>	<ul style="list-style-type: none"> <li>• Motor coordination was assessed via the Movement Assessment Battery for Children-2 (MABC-2.)</li> <li>• Running, agility and balance measures via Bruininks Oseretsky Test of motor proficiency 2 (BOT2).</li> <li>• Functional strength tasks from the Functional Strength Measure (FSM).</li> <li>• Sprinting tests to assess how quickly children could run and turn over short distances.</li> </ul>	<ul style="list-style-type: none"> <li>• ANOVA repeated measures indicated that both DCD and TD children demonstrated transfer effects to real life skills with identical and non-identical elements at exactly the same rate, irrespective of the type of practice they were assigned to.</li> <li>• Concludes that motor skills acquired in the VR environment transfers to real world contexts in similar proportions for both TD and DCD children.</li> <li>• The type of practice adopted does not seem to influence children's ability to transfer skills acquired in an exergame to life situations, but the number of identical elements does.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include the repetitive game presenting different challenges each time played, and the study having only a 5-week duration.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Brussoni et al (2021)</p>	<p>Randomised controlled trial</p> <p>Aim: to evaluate the efficacy of 2 versions of an intervention to reframe mothers' perceptions of risk and change parenting behaviours: a web-based intervention or an in-person workshop, compared with the control condition.</p> <p>Recruitment: via advertising on online forums, social media, distributing notices through networks, snowball sampling, and posting notices in community centres</p> <p>Inclusion: mothers with primary custody of a child/children aged 6-12 years; residing in the Metro Vancouver Regional District; and able to speak, read, and understand English, with access to internet</p> <p>451 mothers - 150 in the web-based intervention, 153 in the in-person workshop, and 148 in the control condition</p> <p>Canada.</p>	<ul style="list-style-type: none"> <li>•Participants randomised into a fully automated web-based intervention, the in-person workshop, or the control condition.</li> <li>•Intervention was an online risk reframing intervention where participants progressed through a series of self-reflection exercises and developed a goal for change.</li> <li>•In person workshop and material based on the online intervention.</li> <li>•Control participants received the Position Statement on Active Outdoor Play.</li> </ul>	<ul style="list-style-type: none"> <li>•Measurements were taken at baseline, 1 week, and 3 months after the intervention.</li> <li>•Tolerance for Risk in Play Scale (TRiPS), a 31-item measure examining adults' tolerance of risk during children's play was the primary outcome.</li> <li>•The secondary outcome measure was self-reported behaviour change, measured by participants' self-reported progress on attaining the goal they set for themselves within the risk reframing intervention.</li> </ul>	<ul style="list-style-type: none"> <li>•Compared with mothers in the control condition, mothers in the web-based intervention had significantly higher tolerance of risky play at 1 week (p=0.004) and 3 months after the intervention (p=0.007); and mothers in the in-person workshop had significantly higher tolerance of risky play at 1 week after the intervention (p=0.02).</li> <li>•Authors conclude the trial demonstrates that the web-based intervention was effective in increasing mothers' tolerance for risk in play.</li> </ul>	<p>Grade B – Moderate</p> <p>Downgraded due to:</p> <ul style="list-style-type: none"> <li>•Lack of confidence in transferability of results. Possibility of substantial difference in results with different population and further research would be required, which is likely to have an important impact on the confidence in the estimate of effect.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Cahill et al (2020)</p>	<p>Systematic review</p> <p>Aim: to identify evidence for occupational therapy interventions for children and young people with and at risk for mental health concerns</p> <p>Inclusion: articles describing interventions that were activity or occupation based, published in English-language peer-reviewed journals between January 2010 and March 2017 identified through searches of MEDLINE, psycINFO, CINAHL, ERIC, OTseeker, and Cochrane database</p> <p>Exclusion: conference proceedings, non-peer reviewed publications, dissertations, theses, and presentations.</p>	<ul style="list-style-type: none"> <li>•The methodology in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses was used to complete the review.</li> <li>•Of 5,310 articles screened by title and abstract, 357 were retrieved for full-text review, and 62 met inclusion criteria.</li> </ul>	<ul style="list-style-type: none"> <li>•Strength of studies analysed Level I – Level III.</li> <li>•Categorised into type of activity/intervention for mental health/positive behaviour/social participation and each article strength.</li> </ul>	<ul style="list-style-type: none"> <li>•Of the 62 studies included in the review, 20 (32%) were Level I studies, 22 (36%) were Level II studies, and 20 (32%) were Level III studies.</li> <li>•Articles were categorised into the following types: outdoor camps, video and computer games, productive occupations and life skills, meditation, animal-assisted interventions, creative arts, play, sports and yoga.</li> <li>•Moderate to strong evidence supports the use of yoga and sports.</li> <li>•Moderate-strength evidence supports the use of play and creative arts.</li> <li>•Evidence for the use of animal-assisted interventions, meditation, video and computer games, and productive occupations was of low strength.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Majority of articles reviewed were not play-related.</li> <li>•The authors did not focus on the moderate evidence found that play improves social participation for children and young people with or at risk for mental health concerns.</li> </ul>



Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Coussens et al (2020)</p>	<p>Systematic scoping review</p> <p>Aim: to synthesise peer-reviewed literature about barriers and facilitators of participation according to the perspective of parents of children younger than 6 years with Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorder (ASD), and/or Developmental Coordination Disorder (DCD)</p> <p>Inclusion: qualitative, quantitative and mixed methods studies focusing on parent's perspective of participation in young children (0-6 years) with ADHD, DCD and/or ASD</p> <p>Exclusion: Non-empirical articles</p> <p>13 articles included</p> <p>Belgium.</p>	<ul style="list-style-type: none"> <li>•Not applicable</li> </ul>	<ul style="list-style-type: none"> <li>•Elements contributing to perceived barriers and facilitators were identified and organised according to the International Classification of Functioning, Child-Youth Framework.</li> <li>•Themes from different studies are combined under ICF theme headings.</li> </ul>	<ul style="list-style-type: none"> <li>•4 studies were high-quality, 9 moderate studies.</li> <li>•4 qualitative, 4 mixed methods, 3 reviews (one systematic, one qualitative and one with mixed designs).</li> <li>•5 focused on ASD, 1 on ADHD and ASD and 1 on DCD</li> <li>•6 on children in early intervention or who were at risk of or are diagnosed with DD.</li> <li>•Leisure and play were among the top 3 parent goals.</li> <li>•Parents reported that limitations in feeding or toileting hindered participation in leisure and play.</li> <li>•Parents experienced more efficacy and satisfaction about their child's participation when interventions were embedded in family routines and settings.</li> <li>•Parents reported parent training was important in their perception of children's gains. Parents highly valued training that facilitated their skills in improving communication, play, and behaviour outcome.</li> <li>•Parents valued social communication through play.</li> </ul>	<p>Grade B – Moderate</p> <p>Downgraded due to:</p> <ul style="list-style-type: none"> <li>•Some methodological limitations.</li> <li>•Databases used were limited to MEDLINE and Web of Science. This could have limited papers related to therapy and education.</li> <li>•No meta-aggregation of data.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Engelen et al (2013)	<p>Randomised controlled trial</p> <p>Aim: to explore the effects of a school-based intervention for increasing physical activity</p> <p>Recruitment: children aged 5–7 years old randomly selected from 12 Australian primary schools</p> <p>226 children</p> <p>Australia.</p>	<ul style="list-style-type: none"> <li>• Schools were randomly allocated to the intervention or control conditions.</li> <li>• The 13-week intervention comprised: (1) altering the school playground by introducing loose materials and (2) a teacher–parent intervention exploring perceptions of risk associated with children's free play.</li> <li>• Testing took place in Sydney, 2009–2010.</li> </ul>	<ul style="list-style-type: none"> <li>• The primary outcomes were total accelerometer counts and moderate–vigorous physical activity (MVPA) during break times.</li> </ul>	<ul style="list-style-type: none"> <li>• 221 participants were tested at baseline.</li> <li>• Mixed-effect multilevel regression revealed a small but significant increase from the intervention on total counts (9400 counts, 95% CI 3.5–15.2, <math>p=0.002</math>) and minutes of MVPA (1.8 min, 95% CI 0.5–3.1, <math>p&lt;0.006</math>); and a decrease in sedentary activity (2.1 min, 95% CI 0.5–3.8, <math>p&lt;0.01</math>) during break times.</li> <li>• Retested children in one intervention school after 2 years; they maintained the gains.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include benefits may not be generalizable to rural schools or schools in other countries with different climates and cultures.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Graham et al (2019)</p>	<p>Interpretive phenomenological analysis</p> <p>Aim: to explore the experience of play for children with a high level of physical disability due to cerebral palsy</p> <p>Recruitment: via posters and signposts from occupational therapy practitioners within charities working with children with cerebral palsy</p> <p>Inclusion: diagnosis of cerebral palsy; 6-12 years old, were functioning at GMFCS Levels IV-V or MACS Levels III-V; good level of communication</p> <p>Exclusion: children who did not wish to discuss their experiences</p> <p>6 children Male:female ratio: 1:1 Mean age: 8</p> <p>United Kingdom.</p>	<ul style="list-style-type: none"> <li>• Each child participated in three interviews (between 60 and 90 minutes) carried out on separate occasions at own home.</li> <li>• Each interview consisted of an opportunity for a child to participate in 5-10 mins of play activity chosen by themselves.</li> <li>• Participants interviewed based on looking at recording of themselves playing.</li> </ul>	<ul style="list-style-type: none"> <li>• Phenomenological analysis meant that the researchers iteratively developed themes and sub-themes from transcribed interviews.</li> </ul>	<ul style="list-style-type: none"> <li>• Making choices and controlling play were important for the children.</li> <li>• They often experienced play differently than their peers.</li> <li>• They connected with others in play through humour and communication skills.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Effects of study on participants not discussed.</li> <li>• Potential bias and influence of researchers was not critically examined.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Graham et al (2015)	<p>Qualitative study</p> <p>Aim: to explore parents' understanding how children with cerebral palsy (CP) play and how play is used as a therapeutic tool within therapy and home programmes</p> <p>Recruitment: by referral from the Bobath Centre, a British charity providing occupational, physical, and speech therapy for children with CP</p> <p>Inclusion: parents of children with severe CP, or Gross Motor Function Classification System (GMFCS) Level 4 or 5 as assessed by Bobath Centre therapist, between ages 3 months and 9 years of age, living in Buckinghamshire, Hampshire, Hertfordshire, Greater London, Oxfordshire, Surrey, or Sussex</p> <p>Exclusion: parents of children without a diagnosis of CP and parents who were unable to speak English fluently</p> <p>Convenience sample of 7 parents</p> <p>United Kingdom.</p>	<ul style="list-style-type: none"> <li>• In depth semi structured interviews in the participants' homes, using a previously piloted topic guide.</li> <li>• Parents were asked to recall and discuss a recent play experience, other typical play, unexpected play experiences, therapist play, home programs, and play in their child's home programme.</li> </ul>	<ul style="list-style-type: none"> <li>• Contextual information sheet to collect brief demographic details about the parent and child with CP, the level of functioning of the child, and the number of other children in the family.</li> </ul>	<ul style="list-style-type: none"> <li>• Analysis of the data led to the development of 4 themes: typical play, burden of play, expanding the concept of play, and therapy and play.</li> <li>• Authors identified implications for occupational therapists: affirm elements of children's play that are similar to play in typically developing children; recognise the burden of play on parents and teach methods of independent play to help relieve burden; explain how play can be redefined and how children can experience play vicariously; Explain the need for play incorporating therapy but also "play for plays sake", in which therapeutic goals are ignored.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• This is a small-scale in-depth study with only 7 participants.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Guerette et al (2013)	<p>Cohort study</p> <p>Aim: to understand the impact of early powered mobility on children's social skills, verbal and mobility interactions and interaction with toys/objects during play and developmental level of play</p> <p>Recruitment via outpatient rehabilitation centres</p> <p>Inclusion: children with cerebral palsy (CP) between ages of 18 months and 6 years, children with orthopaedic disabilities causing severe limitation in locomotion</p> <p>Exclusion: children with profound cognitive</p> <p>23 children Mean age: 47 months (children with CP), 30.1 months (children with other orthopaedic disabilities)</p> <p>United States of America.</p>	<ul style="list-style-type: none"> <li>• Baseline data collected at the time the clinician recommended a wheelchair (pre-test 1).</li> <li>• Second set of parental assessments and observational data collected immediately prior to wheelchair delivery (pre-test 2).</li> <li>• Three to seven months after the child had received and had begun using the wheelchair, a final post-test set of parental assessments and observational data was collected.</li> </ul>	<ul style="list-style-type: none"> <li>• Social skills measured using the Adaptive Social Behaviour Inventory (ASBI) for children ages 18 months – 3.5 years, and the Preschool and Kindergarten Behaviour Scales (PKBS) for children 3-6 years.</li> <li>• Parental perceptions of their child's social skills evaluated using Survey of Technology Use (STU).</li> <li>• Frequency of mobility play activities and interactions with toys.</li> <li>• Quality of play activities and verbal interactions.</li> </ul>	<ul style="list-style-type: none"> <li>• ASBI data showed a significant difference in means between pre- and post-tests for the "prosocial" component, (<math>p= 0.02</math>) with positive social skills increasing significantly during the post-test phase.</li> <li>• No significant differences were found between phases in negative social skills, which were fairly low throughout</li> <li>• STU showed a significant difference between means in the pre- and post-testing in the child's ability to remain engaged in a task (<math>p =0.03</math>).</li> <li>• During indoor free play, the average developmental level of play increased significantly from pre-test 1 to pre-test 2, then remained elevated during the post-test (<math>p=0.04</math>).</li> <li>• For outdoor free play, there was a significant difference the quality of interactive play from pre- to post-test (<math>p=0.04</math>).</li> <li>• No change in the mean quality of verbal interactions across phases during indoor or outdoor free play (<math>p =0.26</math>, <math>p=0.89</math>, respectively).</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Study shows the importance of assessment for possible provision of powered wheelchair.</li> <li>• Can be applied to local population.</li> <li>• Positive ratings of social impact consistent with other studies.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Hammond et al (2014)	<p>Pilot randomised controlled trial</p> <p>Aim: to evaluate whether short, regular school-based sessions of movement using a commercially available home video game console (Nintendo's Wii Fit) would lead to benefits in both motor and psychological domains in children with Developmental Co-ordination Disorder (DCD)</p> <p>Recruitment: via 2 primary school following 2 day process who were already taking part in 'Jump Ahead' programme for children with movement difficulties</p> <p>Inclusion: children judged to be at risk of functional movement problems, with normal IQ (based on school assessments), and no evidence of neurological disorders</p> <p>18 participants (10 intervention, 8 comparison)</p> <p>United Kingdom.</p>	<ul style="list-style-type: none"> <li>•A crossover intervention study with 2 phases, each lasting 4 weeks with 2.5 months in between each phase.</li> <li>•Children randomly assigned to intervention or comparison.</li> <li>•Intervention group spent 10 minutes, 3 times a week for 1 month using Wii Fit during the lunch break, while the comparison group took part in their regular Jump Ahead programme.</li> </ul>	<ul style="list-style-type: none"> <li>•Children's motor skills were assessed via the Bruininks-Oseretsky Test 2<sup>nd</sup> version (BOT-2).</li> <li>•The Co-ordination Skills Questionnaire measured the child's self-perceived ability and satisfaction with motor tasks.</li> <li>•The Strengths and Difficulties Questionnaire is a parental assessment of social behaviour and psychopathy.</li> <li>•All measures were taken at baseline, week 4 (end of phase 1) and week 18 (end of phase 2).</li> </ul>	<ul style="list-style-type: none"> <li>•Significant gains were seen in motor proficiency, the child's perception of their motor ability and reported emotional well-being for many children.</li> <li>•Both groups showed improved BOT-2 total scores following the Wii Fit intervention period.</li> <li>•A mixed ANOVA comparing two intervention groups over time identified no significant main effects of either group (<math>p=0.987</math>) or time (<math>p=0.082</math>).</li> <li>•The group x time interaction was significant (<math>p&lt;0.02</math>).</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Limitations include the study being a small pilot and that the lack of blinding of the researchers and significant time lapse between the two phases.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Karamali Esmaili et al (2019)	<p>Randomised controlled trial</p> <p>Aim: to use the Model of Human Occupation to investigate the effect of peer play activities on occupational values and competence as well as executive functioning skills (EF) in children with specific learning difficulty (SLD)</p> <p>Recruitment: via 4 SLD educational centres through convenience sampling</p> <p>Inclusion: ages 7–11 years; diagnosis of SLD based the Diagnostic and Statistical Manual of Mental Disorders 5th ed, criteria; parents' mental health and ability to comprehend the questionnaires</p> <p>Exclusion: comorbid psychiatric disorders, except for attention deficit hyperactivity disorder</p> <p>49 children with SLD Intervention: 25 Control: 24</p> <p>Iran.</p>	<ul style="list-style-type: none"> <li>•Conducted in groups of 3-5 children.</li> <li>•2 x 3-hour sessions per week for 9 weeks.</li> <li>•Control group received no treatment during this intervention phase. This group did receive five sessions of peer play activities after the post-intervention assessment.</li> <li>•The intervention included practice play, symbolic play, and games with rules. It contained cooperative (shared materials for individual projects) and collaborative (adherence to responsibilities and rules for joint projects) play.</li> </ul>	<ul style="list-style-type: none"> <li>•The Behaviour Rating Inventory of Executive Function (BRIEF - Parent version) used to investigate the EF components in the context of the natural environment of children ages 5–18. It contains 2 indices: the Behaviour Regulation Index (BRI) and the Metacognitive Index (MCI).</li> <li>•Child Occupational Self-Assessment measures the child's self-assessment of participation and competence in everyday occupations.</li> <li>•Both were conducted before and after the intervention.</li> </ul>	<ul style="list-style-type: none"> <li>•Data analysis showed that the effects of the intervention on EF skills were medium to large - .12 for the BRI and .20 for the MCI based on Cohen's criteria.</li> <li>•The mean BRIEF indices significantly improved after intervention (<math>p &lt; 0.05</math>).</li> <li>•There was a slight change in the mean scores between the pre- and postintervention measurements in the control group (BRI=0.16; MCI=1.04), and a greater change in the intervention group (BRI=8.52; MCI=15.32).</li> <li>•The occupational values and competence did not change according to the COSA between the two groups (<math>p &gt; 0.05</math>).</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•The study has some application to intervention for executive function for children with learning disabilities. There are no significant limitations which appear to have impacted the relevance of the results.</li> <li>•They tested the intervention against no intervention rather than 'treatment as usual', so further investigation of what is normally offered and the effectiveness of that is needed.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kent et al (2021)	<p>Randomised controlled trial</p> <p>Aim: to examine the effectiveness of The Ultimate Guide to Play, Language and Friendship (PLF) intervention for improving the social play skills of children with Autism Spectrum Disorder (ASD) in peer to peer interactions</p> <p>Recruitment: via convenience sampling</p> <p>Inclusion: children 6-12 years old with a diagnosis of ASD by a paediatrician or psychiatrist, using recognised diagnostic procedures, with any common co-morbid conditions</p> <p>Exclusion: diagnosed with other major developmental disorders or did not attend mainstream school</p> <p>68 dyads  Mean age (intervention): 8.68  Mean age (control): 8.44  Gender (male): intervention = 93.75%, control = 81.81%</p> <p>Australia.</p>	<ul style="list-style-type: none"> <li>• Dyads randomised to either a 10-week treatment first or waitlist control group.</li> <li>• Weekly 1-hr clinic sessions over 10 weeks, with pre-clinic videos created before each session and a home play session facilitated by the parents of the child with ASD between clinic sessions.</li> <li>• At the 'clinic' phase the therapist conducted video modelling with dyad first, then play session, with therapist joining dyad for peer modelling.</li> <li>• Therapist and parent observe play and discuss observation and home play sessions.</li> </ul>	<ul style="list-style-type: none"> <li>• Test of Playfulness (TOP) was the primary outcome measure used to examine children's play skills in peer interactions.</li> <li>• Child, Parent and Teacher Report measures – the Piers-Harris 2 and the Home and Community Social Behaviour Scales for social competence and antisocial behaviour and the Parenting Relationship Questionnaire (PRQ) used as secondary measures.</li> <li>• All 3 administered at pre-control period assessment time, pre-intervention, post-intervention and 3-months follow up</li> </ul>	<ul style="list-style-type: none"> <li>• Intervention demonstrated a moderate positive effect on the play.</li> <li>• The overall change in play performance in the intervention-first group was significantly greater than the change in the wait-list control group (<math>t(63) = 2.471</math>, <math>p = 0.016</math>, <math>d = 0.6</math>).</li> <li>• Repeated measures ANOVA showed that there was a significant increase in ToP scores over time (<math>p &lt; 0.0001</math>). The treatment effect of ToP data for pre- to post-intervention once all participants were included in the analysis was moderate.</li> <li>• There were significant differences in pre-intervention ToP scores between sibling and non-sibling peer groups (<math>p = .018</math>) and between male and female participants (<math>p = 0.029</math>).</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations included not all teachers and parents returned completed secondary outcome measures, thus reducing statistical power of secondary measures, which in turn could have resulted in some moderators not being identified.</li> <li>• No confidence intervals reported but t-tests used.</li> </ul>



Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Kolehmainen et al (2015)	<p>Cohort study – mixed methods intervention development study</p> <p>Aim: to identify potentially modifiable, specific factors—across body function and structure, activity, environmental, and personal factors—related to Participation in physical play/leisure (PPP) in children with motor impairments and modifiable by therapists</p> <p>Recruitment: via 6 children’s physical therapy or occupational therapy services (or both) in the NHS in England and Scotland</p> <p>195 children 6-8 years old with motor impairments, mobilizing independently with or without equipment and seen by physical therapists or occupational therapists</p> <p>United Kingdom.</p>	<ul style="list-style-type: none"> <li>• Therapists recruited the children; administered the Children’s Assessment of Participation &amp; Enjoyment (CAPE) and collected the problem list data; handed out parent questionnaires and collected them when complete; placed each child’s data, including the parent questionnaire, in a sealed envelope; and obtained consent for passing the data to the research team.</li> </ul>	<ul style="list-style-type: none"> <li>• Children’s Assessment of Participation &amp; Enjoyment (CAPE).</li> <li>• Problem list data.</li> <li>• Parent questionnaires.</li> </ul>	<ul style="list-style-type: none"> <li>• Children’s PPP was mainly ‘recreational’ (eg, pretend play, playing with pets) rather than ‘active physical’ (eg, riding a bike/scooter).</li> <li>• Parents (n=152) reported positive beliefs about children’s PPP but various levels of family PPP.</li> <li>• Therapists reported 23 unique impairments (eg, muscle tone), 16 activity limitations (eg, walking), and 3 personal factors (eg, child’s PPP confidence).</li> <li>• Children interviewed (n=17) reported a strong preference for active play but indicated that adults regulated their PPP.</li> </ul>	<p>Grade B – Moderate</p> <p>Upgraded due to:</p> <ul style="list-style-type: none"> <li>• Robust study, large sample size with good analysis.</li> </ul> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include degree of self-selection bias possible and caution should be taken in generalizing the results to children whose parents have less positive views about PPP.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Mobbs et al (2021)</p>	<p>Systematic review</p> <p>Aim: to identify and examine the psychometric properties of participation measures for infants and toddlers aged birth to 23 months according to family of Participation-Related Constructs (fPRC)</p> <p>Inclusion: measures available in English that quantify at least one participation concept of 'attendance' and/or 'involvement' according to the fPRC, with psychometric data for infants or toddlers aged from birth to 23 months published in a full text, peer reviewed journal</p> <p>4 measures met the inclusion criteria: Child Engagement in Daily Life (CEDL) measure, Daily Activities of Infants Scale (DAIS), Test of Playfulness (ToP), and Young Children's Participation and Environment Measure (YC-PEM).</p>	<ul style="list-style-type: none"> <li>• Online biomedical databases PubMed, Cochrane, CINAHL and Embase were searched from 2001 (coinciding with the publication of the ICF) to August 2016 and repeated in November 2019 to ensure the most up-to-date articles were included.</li> <li>• Secondary searches of titles and authors and reference lists of included papers and other systematic reviews on participation measures were conducted.</li> <li>• 2 authors independently screened papers at the title and abstract phase for inclusion for full text review using Covidence systematic review software.</li> </ul>	<ul style="list-style-type: none"> <li>• Consensus-based Standards for selection of health Measurement Instruments (COSMIN) checklist was used to rate the methodological quality of studies across nine measurement properties.</li> </ul>	<ul style="list-style-type: none"> <li>• All 4 measures measured 'attendance' and 3 also measured 'involvement'.</li> <li>• Measures showed unknown to moderate validity and unknown to moderate reliability, with the CEDL reporting the strongest psychometric properties.</li> <li>• There are few measures that evaluate infant and toddler participation.</li> <li>• Further research is needed to develop psychometrically sound participation measures that evaluate 'attendance' and 'involvement' for this population.</li> </ul>	<p>Grade B – Moderate</p> <ul style="list-style-type: none"> <li>• Downgraded due to: Only 4 studies of variable quality met the inclusion criteria, age groups not able to be broken down in some papers. Cost effectiveness not considered.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Mohammadi et al (2021)</p>	<p>Randomised Controlled Trial</p> <p>Aim: to investigate the effect of play-based occupational therapy on symptoms and participation in daily life activities in hospitalized children with cancer undergoing chemotherapy</p> <p>Recruitment: via one children's hospital</p> <p>Inclusion: children aged 7-12 years receiving a type of childhood cancer diagnosis, a history of chemotherapy in hospital, readmission to the oncology department for chemotherapy, obtaining a minimum score of 4 in pain and fatigue, and 3 in anxiety for children; parents have sufficient reading and writing ability and fluent in Persian</p> <p>Exclusion: any changes in the chemotherapy protocol and unwillingness to cooperate with the study for more than two treatment sessions</p> <p>25 children with cancer undergoing chemotherapy</p> <p>Iran.</p>	<ul style="list-style-type: none"> <li>•The intervention group received eight 1-hour play-based occupational therapy sessions (45 minutes of play-based occupational therapy and 15 minutes of free play).</li> <li>•Control group received traditional occupational therapy services.</li> </ul>	<ul style="list-style-type: none"> <li>•Participation in daily life activities, therapy-related symptoms, pain, anxiety, and fatigue were evaluated.</li> <li>•The therapy-related symptom checklist (TRSC) - includes 30 items categorized into seven groups of symptoms, including nutritional, psychosocial, oropharyngeal, toxicity of bone marrow, skin, nervous system, and respiratory system symptoms.</li> <li>•The Children Participation Assessment Scale (CPAS) - a 71-item questionnaire used to assess the participation of children in 8 areas of basic and instrumental daily life activities, play, leisure, social participation, education, work, and sleep/rest.</li> </ul>	<ul style="list-style-type: none"> <li>•Total mean scores of participation in daily life activities in the intervention group in the diversity of activities, intensity of participation, with whom done, enjoyment and parents' satisfaction were significantly higher than in the control group.</li> <li>•Symptoms decreased in both groups; however, this trend had a significant difference in the intervention group for the therapy-related symptom checklist, pain, anxiety, and fatigue scores.</li> <li>•Authors conclude a 2-week course of inpatient play-based occupational therapy is an effective approach in the reduction of cancer symptoms, therapy-related symptoms, and the participation facilitation of children with cancer in daily life activities.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Limitations include small study size and context of children with cancer undergoing chemotherapy.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Moore and Lynch (2018)</p>	<p>Cross-sectional online survey</p> <p>Aim: to explore paediatric occupational therapists' perspectives on place of play and play occupation</p> <p>Recruitment: non-probability convenience sampling and snowball recruitment through membership of the Association of Occupational Therapists in Ireland email invite</p> <p>Inclusion: participants working with children within past two years, or working as an occupational therapist with children up to 12 years of age in Ireland</p> <p>65 participants</p> <p>Ireland.</p>	<ul style="list-style-type: none"> <li>•Data for the study were gathered using an adapted version of a survey examining the current use of play in paediatric occupational therapy practice in the USA.</li> <li>•Used closed response questions to generate nominal data as well as open-ended questions used to generate understanding of values and attitudes towards play occupation and perceived barriers and/or facilitators to practice.</li> </ul>	<ul style="list-style-type: none"> <li>•The final instrument consisted of 24 questions related to demographics, education on play, service provision and play and practice, including questions on values and attitudes towards play occupation.</li> </ul>	<ul style="list-style-type: none"> <li>•Assessment tool usage: The Preferences for Activities of Children (PAC) was used most frequently (20 per cent, n=13) followed by the Children's Assessment of Participation and Enjoyment (CAPE) (13.8 per cent, n=9) and the Vineland Adaptive Behaviour Scales (13.8 per cent, n=9).</li> <li>•More than half of respondents (52.3 per cent, n=34) did not use any standardised assessments. The majority identified using observation and non-specific play assessments, with some reporting that they did not have access to standardised assessments.</li> <li>•In response to what play means to daily work themes were: play as a means to an end, play as a primary occupation of childhood and play as a reward.</li> <li>•Most respondents reported using play as a means to an end (61.5 per cent, n=40), in home/school programmes (20 per cent, n=13) or as a reward (10.8 per cent, n=7). The least common use of play was play as an aim (7.7 per cent, n=5).</li> <li>•Perceived barriers to play-centred occupational therapy included: overburdened workloads; a lack of resources; play being perceived as a "waste of time" among parents and teachers.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Findings are clear and highlight a disparity between the recognition that play is a meaningful occupation for children and how it is utilised in therapeutic interventions.</li> <li>• Indicates need for additional training/different approach.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Potasz et al (2013)	<p>Randomised controlled trial</p> <p>Aim: to see if unstructured play can reduce stress for children during hospitalisation</p> <p>Stratified sampling according to age range</p> <p>Inclusion: children aged 4-14 years hospitalised at a public paediatric hospital for respiratory diseases; minimum hospital stay of 6 days</p> <p>Exclusion: children with neurological or psychiatric disorders, locomotion restrictions, and other common childhood diseases; children who had taken any medication previous to or during hospitalisation that could influence cortisol levels (LC)</p> <p>53 patients Male: female: 27:26</p> <p>Brazil.</p>	<ul style="list-style-type: none"> <li>• Children divided into: <ul style="list-style-type: none"> <li>•1) the playing group (PG), formed by children admitted to wards participating in play activities during hospitalisation (27 children).</li> <li>•2) non-playing group (NPG) consisting of children admitted to a ward not engaging with play activities (26 children).</li> </ul> </li> <li>• These were randomly allocated by physicians not aware of the study.</li> <li>• Rotation between wards allocated by a lottery.</li> <li>• Toy library formed using a variety of toys stored in room where children invited to play twice a day, and toys could be taken back to beds.</li> <li>• Toys included “home” toys, “beauty” toys, games such as puzzles and competitive games, dolls and “doll-like” toys.</li> <li>• Trained professionals, 10 entertainers, and an occupational therapist from the neuro-psychiatry staff monitored play activities.</li> </ul>	<ul style="list-style-type: none"> <li>• LC in the urine sampled for 24 hours. Variations in cortisol in relation to baseline in both groups and compared mean values pre- and post-intervention within the groups.</li> </ul>	<ul style="list-style-type: none"> <li>• No statistically significant differences in baseline LC considering the intervention play, gender, age range, social classification, CDI scores, and previous experience of hospitalization.</li> <li>• The number of children who showed a reduction in LC was larger in the PG than the NPG. At the end of the intervention period, 20 children in the PG showed a reduction in LC of 20% over baseline values (AR=71.4%), while in the NPG 12 children showed a reduction in LC (AR=41.4%). The AR reduction was 30% (RR=1.73; CI95%=1.03 to 12.53; NNT=3.32 and p=0.04).</li> </ul>	<p>Grade A - High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Demonstrates the value of play to reduce stress for some children during admission.</li> <li>• Resources likely to be available in a standard children’s hospital – may be restricted in a general hospital.</li> <li>• May be more suited to specialised hospital units as focuses on unstructured play.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Ramugondo et al (2018)	<p>Randomised controlled trial</p> <p>Aim: to describe playfulness in children with HIV and progressive HIV encephalopathy (PHE) living in challenging socioeconomic areas in South Africa and evaluate feasibility and preliminary effectiveness of a play informed, caregiver implemented, homebased intervention (PICIHBI) for improving play</p> <p>Recruitment: via outpatient paediatric antiretroviral clinic Inclusion: children 6 months - 8 years with HIV on HAART (highly active antiretroviral treatment), attended clinic Exclusion: participants with incomplete data</p> <p>24 children Male:female ratio: 11:13 Mean age: 4 years in PICIHBI group, 4.7 in conventional group</p> <p>South Africa.</p>	<ul style="list-style-type: none"> <li>•Children randomized into PICIHBI intervention group or group that received usual one-on-one occupational therapy.</li> <li>•The PICIHBI focused on the caregivers of children with HIV, aiming to equip them to playfully engage with their children and to improve children's playfulness.</li> <li>•The PICIHBI comprised 10 monthly sessions facilitated by an occupational therapist, involving group discussions with caregivers and periods of experiential play.</li> <li>•Children filmed playing pre, mid, and post-intervention.</li> </ul>	<ul style="list-style-type: none"> <li>•Test of Playfulness (ToP) used to assess playfulness.</li> </ul>	<ul style="list-style-type: none"> <li>•Only data from participants attending more than 50% of intervention sessions included.</li> <li>•The mean ToP overall measure score was higher at baseline assessment for the PICIHBI group at 33.6 (SD=17.3) than the comparison conventional group at 31.5 (SD=23.2), but not statistically significant different (<math>p&gt;0.05</math>).</li> <li>•The PICIHBI group ToP measure score improved from 33.6 (SD=17.3) at baseline assessment to 35.0 (SD=17.0) at post-intervention assessment and was not statistically significant (<math>p&gt;0.05</math>).</li> <li>•Changes were not statistically significant for the control group.</li> </ul>	<p>Grade B - Moderate</p> <p>Downgraded due to:</p> <ul style="list-style-type: none"> <li>•Unclear if differences in time between intervention sessions affected the results, unclear if differences between population samples were considered.</li> </ul> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Paediatric HIV population is very specific so results less applicable to other contexts.</li> <li>•Unclear if study groups were similar at start of trial or if differences such as additional diagnoses/TB history/gender difference would affect outcomes.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Román-Oyola et al (2018)	<p>Semi-structured interviews guided by a phenomenological design</p> <p>Aim: to explore the perspectives of parents with children with autism spectrum disorder (ASD) regarding play experiences and self-efficacy during play encounters</p> <p>Recruitment: via direct contact or referral from occupational therapists of children with ASD</p> <p>Inclusion: availability of both parents for participation, parents ≥ 21 years old, and children 3-7 years of age with a diagnosis of ASD</p> <p>4 mothers 4 fathers</p> <p>Puerto Rico, USA</p>	<ul style="list-style-type: none"> <li>• Not applicable.</li> </ul>	<ul style="list-style-type: none"> <li>• None identified.</li> </ul>	<ul style="list-style-type: none"> <li>• General context of the play experience: all expressed positive emotions related to play experiences with their children and commented on the importance of it. They also described the difficulty of fitting play into busy lives.</li> <li>• Playfulness in the context of parent-child interactions: play was often shaped by the child's preferences, making them more effective and enjoyable. When children were not in control of play, it could lead to tantrums or trying to change the activity. Parents also framed activities to make them more attractive.</li> <li>• Self-efficacy during play: motivations vs benefits: perceived ability to interact with their children made parents feel competent and playing allowed parents to relate to their children and strengthen bonds. While fathers were more likely to say they played with their children for emotional reasons (to see them laugh, etc), they perceived the benefits as development. Mothers said they played to develop their child's skills but perceived the benefits to be emotional.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include the small number of participants and relative diversity of participants means data saturation was not reached, and that results might not be generalisable.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Romli and Wan Yunus (2020)</p>	<p>Systematic review</p> <p>Aim: to identify play instruments relevant to occupational therapy and its clinimetric properties</p> <p>Inclusion: study on instrument for leisure type of play, instrument generally evaluating play, study investigating the psychometric property of the instrument, the instrument is used solely on play and is relevant to occupational therapy</p> <p>Exclusion: study on competitive play or sports, not a primary study, no full text available or not available in English, grey literature or in a non-peer reviewed journal</p> <p>30 articles, mostly from Western countries.</p>	<ul style="list-style-type: none"> <li>•Quality assessment conducted on eligible papers using Terwee's checklist.</li> <li>•Instruments reviewed: Children's Play Therapy Instrument, Children's Playfulness Scale, Enjoyment of Lunchtime Play Survey Cards, Fair Play Questionnaire, Howes Peer Play Scale, Lowenfeld World Technique, Lunzer's Play Scale, Mature Make-Believe Play Observational Instrument, Modified Revised Class Play, Parten's Social Play Hierarchy, Penn Interactive Peer Play Scale, Perception of Play Questionnaire for Older People, Play Behaviour Observation System, Play Performance Scale, Playfulness Scale for Adults, Singer's Observational Play Instructions and Imaginative Play Predisposition Interview, Symbolic Play Test, The Play Checklist, The Social Play Record, The Test of Pretend Play, and Transdisciplinary Play-Based Assessment-Child Development Resources.</li> </ul>	<ul style="list-style-type: none"> <li>•Investigations for concurrent and construct validity, interrater and test-retest reliability.</li> </ul>	<ul style="list-style-type: none"> <li>•Most instruments focused on extrinsic elements, such as developmental, behaviour and attitude, and skills and performance.</li> <li>•The Revised Knox Preschool Play Scale is considered the most extensive and comprehensive play instrument for extrinsic aspects.</li> <li>•The Test of Playfulness plus the Test of Environmental Supportiveness Unifying Measure is promising for intrinsic aspect of play utilising observation.</li> <li>•My Child's Play is a potential questionnaire-based instrument for the intrinsic aspect of play.</li> <li>•Because the development of play instruments for occupational therapy is evolving, good clinical reasoning is necessary.</li> </ul>	<p>Grade A – Very high</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Limitations include including journal publications only, when psychometric properties of the instrument may be published elsewhere, several instruments may only be available in grey literature, excluding publications not in English, psychometric properties may only be briefly reported and the Terwee's checklist (used to assess quality), is not comprehensive enough to illustrate all psychometric properties.</li> </ul>



Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Rousseau-Harrison and Rochette (2013)</p>	<p>Systematic Review</p> <p>Aim: to explore the impacts of wheelchair (WC) acquisition on children's social participation, personal factors and social environment</p> <p>Inclusion: population studied was children from birth to age 12, published in French or English and concern the impacts of a WC on children, their social participation or social environment, published in a peer-reviewed journal, at least half of the sample had to consist of children up to age 12, all study design types</p> <p>Exclusion: studies that looked only at biomechanical aspects (positioning) or WC components (e.g. joystick controls)</p> <p>9 studies</p> <p>Canada United States, Sweden, Guatemala and Italy.</p>	<ul style="list-style-type: none"> <li>• A literature search was done in MEDLINE for the years 1996 to 2011 (June).</li> <li>• Acquisition of a powered WC.</li> </ul>	<ul style="list-style-type: none"> <li>• Parents' perceptions of their stress, negative emotions and family social interactions (PSSC, MATCH, Survey of Technology Use, QUEST).</li> <li>• Caregivers' perceptions of changes following WC acquisition (interviews, observations, photos and review of medical file).</li> <li>• Mothers' perceptions of children's use of powered WC (In-depth interviews).</li> <li>• Skill driving powered WC – development and functioning (BDI, PEDI, interviews).</li> <li>• Perception and experience of children with disabilities who use a mobility aid (PIQ, VIQ, GMFM, COPM, Furumasu's driving test, ICIS, SAQ-self, SAQ-others).</li> <li>• LIFE-H, Locomotion section of WeeFIM PFIM.</li> </ul>	<ul style="list-style-type: none"> <li>• Observed a trend towards improved participation in personal care, mobility, interpersonal relationships, and play.</li> <li>• Data regarding the effect on the development of cognitive functions are contradictory.</li> </ul>	<p>Grade A - High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Didn't consider all important outcomes – most studies analysed observed perceptions. Cannot infer true impact on children.</li> <li>• 5 out of 9 studies analysed were statistically significant; however article does not provide further information on the numbers.</li> <li>• The authors propose that the results incentivise therapists to suggest mobility options to children with the appropriate profile.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Salem et al (2012)	<p>Randomised controlled trial – single blinded</p> <p>Aim: to determine the feasibility and preliminary effectiveness of a low-cost gaming system for young children with developmental delay</p> <p>Recruitment: via a segregated or integrated preschool from 2 centres</p> <p>Inclusion: children 3 to 5 years; clinical diagnosis of developmental delay; documented physical impairments or motor delay; no musculoskeletal defects that might prevent ability to use the Wii and grasp the Wii Remote™; normal or corrected hearing and vision; no previous experience with the Wii; and ability to understand and follow simple directions and perform requested tasks</p> <p>Exclusion: Children with known genetic/medical conditions, a diagnosis of autism or attention deficit disorders, orthopaedic surgery in the past 6 months prior to participation in the study, uncontrolled seizures</p> <p>40 children</p> <p>United States of America.</p>	<ul style="list-style-type: none"> <li>• Children were randomly assigned to an experimental (Wii) group (n = 20) or a control group (n = 20).</li> <li>• 2 weekly sessions for 10 weeks using Nintendo Wii Sports™ and Nintendo Wii Fit™, including balance, strength training and aerobics games.</li> <li>• Participants were evaluated 1 week before and 1 week after the programme by a blinded investigator.</li> </ul>	<ul style="list-style-type: none"> <li>• Primary outcomes were gait speed, timed up and go test, single leg stance test, five-times-sit-to-stand test, timed up and down stairs test, 2-minute walk test and grip strength.</li> <li>• The Gross Motor Function Measure (GMFM) was used to assess gross motor skills.</li> </ul>	<ul style="list-style-type: none"> <li>• The 2 groups were homogenous regarding all parameters at baseline.</li> <li>• The Wii training was feasible and enjoyable for those in the experimental group.</li> <li>• There were no adverse effects or injuries reported over 267 training sessions.</li> <li>• Comparison of groups following the intervention indicated that the experimental group showed significant improvements compared with the control group in single leg stance test (mean difference 1.03 [standard deviation (SD) 1.7], 95% confidence interval (CI)=0.2-1.9; p&lt;0.017), right grip strength [mean difference 1.11 (SD 1.84), 95% CI=0.15-2.06; p&lt;0.024] and left grip strength [mean difference 0.90 (SD 1.67), 95% CI=0.03-1.77; p&lt;0.043].</li> <li>• Although changes in other outcome measures were not significant between the study groups, there were trends towards greater improvements in the experimental group compared with the control group.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations included the lack of blinding of the supervising therapist, that children’s physical activity outside the intervention could not be controlled, a lack of true control group since they received usual care that may have resulted in improvements, a modest sample size, and that the results cannot be generalised to children with severe disabilities.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Schaaf et al (2018)</p>	<p>Systematic Review</p> <p>Aim: to understand the efficacy of Ayres Sensory Integration® (ASI) in occupational therapy to support functioning and participation of people with processing and sensory integration challenges</p> <p>Inclusion: (1) articles published in the peer-reviewed scientific literature in English between 2007 and May 2015; (2) the intervention approach adhered to the principles of ASI; and (3) participants were children and adolescents assessed to have challenges in processing and integrating sensation</p> <p>United States of America.</p>	<ul style="list-style-type: none"> <li>• A total of 5 articles met the inclusion criteria and were included in the final review: 3 Level I studies, 1 Level III study, and 1 Level IV study.</li> <li>• Articles included 3 randomized controlled trials, 1 retroactive analysis, and 1 single-subject ABA design.</li> <li>• All were published from 2007 to 2015</li> <li>• All studied children with autism.</li> </ul>	<ul style="list-style-type: none"> <li>• Studies measured functioning and participation.</li> <li>• Measurements used included the Goal Attainment Scaling (GAS), the Sensory Processing Measure, the Vineland Adaptive Behaviour Skills 2<sup>nd</sup> edition, Paediatric Evaluation of Disability Inventory (PEDI), and the Revised Knox Playschool Play Scale.</li> </ul>	<ul style="list-style-type: none"> <li>• The evidence is strong that ASI intervention demonstrates positive outcomes for improving individually generated goals of functioning and participation as measured by GAS for children with autism.</li> <li>• Moderate evidence supported improvements in impairment-level outcomes such as autistic behaviours and skills-based outcomes of reduction in caregiver assistance with self-care activities.</li> <li>• Child outcomes in play, sensory–motor, and language skills and reduced caregiver assistance with social skills had emerging but insufficient evidence.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include weaknesses in the methodology of the included studies. More studies need to include intervention fidelity, sensitive outcome measures, adequate power, larger and homogeneous samples.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Sonday and Gretschel (2016)</p>	<p>Case study</p> <p>Aim: to explore the way powered mobility impacted the exploratory play of two children with significant motor impairments</p> <p>Recruitment: purposive sampling</p> <p>Inclusion: child with impaired motor ability. Ability to communicate was considered.</p> <p>2 children</p> <p>South Africa.</p>	<ul style="list-style-type: none"> <li>• Powered wheelchair recently acquired by the child.</li> </ul>	<ul style="list-style-type: none"> <li>• Parent interview with questions drawn from Takata's Play History.</li> <li>• The Kid Play Profile was used to obtain information directly from the child about their interests.</li> <li>• Photovoice, where parents captured images that represented changes to their child's play since the introduction of powered mobility.</li> </ul>	<ul style="list-style-type: none"> <li>• The theme 'Opportunity to play' illustrated how powered mobility gave the child new opportunities to play, including less stationary play and more self-directed play beyond what they had done previously.</li> <li>• The them 'My child was transformed' illustrated how the child could become more autonomous, and allowed different aspects of their personality to come through.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include the researcher not discussing their own role in relation to the participants.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Stagnitti et al (2012)</p>	<p>Cohort study</p> <p>Aim: to investigate the change in the relationship between play, language and social skills of children aged 5–8 years pre and post-participation in the 'Learn to Play' programme</p> <p>Recruitment: via specialist schools</p> <p>Inclusion: Children in their 1<sup>st</sup> &amp; 2<sup>nd</sup> year whose parents gave consent</p> <p>19 participants in who attended a specialist school, in Victoria, with 10 of the 19 children having a diagnosis of autism</p> <p>Australia.</p>	<ul style="list-style-type: none"> <li>•The Learn to Play programme (6 months) - a child led play-based intervention aimed at developing self-initiated pretend play skills in children.</li> <li>•Children participated in the programme during school hours, in small groups of 4 to 7 children with 2 adults per group.</li> </ul>	<ul style="list-style-type: none"> <li>•Child-Initiated Pretend Play Assessment (ChIPPA) - a standardised and norm-referenced play assessment that measures children's ability to initiate pretend play, as well as their quality of pretend play.</li> <li>•Penn Interactive Peer Play Scale (PIPPS) - a 32 item rating scale of preschool children's interactive peer play competencies.</li> <li>•Preschool Language Scale 4th edition (PLS-4) - a psychometrically viable instrument developed to assess language skills in children from birth to 6 years 11 months old.</li> <li>•Demographic data.</li> <li>•Baseline data collected and follow up data collected after 6 months.</li> </ul>	<ul style="list-style-type: none"> <li>•The ChIPPA raw scores indicate that the group had very low play ability for age.</li> <li>• Age was not significantly related to any of the variables.</li> <li>• Indicators of typical play and the PIPPS Social Disconnection score (<math>p &lt; 0.01</math>) had a shared variance of 36% at follow up, which was a 36% increase in the shared variance from baseline.</li> <li>• The 'Learn to Play' programme was associated with increases in children's social interaction, decreases in children's social disconnection and increases in language over a 6-month period with a group of children who were developmentally delayed with diagnoses of intellectual disability and autism.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Limitations include small sample size and no confidence intervals given.</li> <li>•This study was part of a larger study.</li> <li>•The applicability of this study for practice may need to be considered in a UK context and current practice. Its comparison with other models would need to be evaluated along with cost effectiveness and benefits of implementation.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
Stanton-Chapman and Schmidt (2017)	<p>Qualitative</p> <p>Aim: to survey and interview caregivers of children with disabilities (ages 2–5 years) to obtain their input as to whether current playground equipment meets their child's need</p> <p>Recruitment: via purposive sampling – contacted The Department of Education, the Head Start Association and the Infant and Toddler Connection</p> <p>Inclusion: caregivers with children with disabilities of ages 2-5 years,</p> <p>149 participants Specific language impairment (n = 94, 63%); developmental delay (n = 75, 50%); and autism (n = 71, 48%)</p> <p>United States of America.</p>	<ul style="list-style-type: none"> <li>• Online survey.</li> </ul>	<ul style="list-style-type: none"> <li>• The Family Recreational Facility and Activity Perception Survey used to gather information on family members' perceptions of their current recreational activities, available community facilities, and their perceptions regarding playground equipment for toddlers and pre-schoolers with disabilities.</li> </ul>	<ul style="list-style-type: none"> <li>• Caregivers indicated that their child with a disability could not fully participate in the playgrounds offerings (n=141; 95%), that the playground was not appropriate for their child (n=97, 65%) and dreamed of a fully inclusive playground that met their child's need.</li> <li>• Other concerns included: their child was not interested in the playground (n=82, 55%), worries about the child's safety (n=52, 35%), and not feeling comfortable bringing their child to a playground due to possible bullying or teasing (n=37, 25%).</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• The study was conducted in one specific geographical location within the USA, so the generalisability of the findings is questionable, though the methodology could be easily replicated in other locations.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Stanton-Chapman et al (2018)</p>	<p>Cohort study</p> <p>Aim: to explore similarities and differences in physical activity levels for boys and girls in 7 areas across two playgrounds</p> <p>Recruitment: recently built playgrounds intended to be fully inclusive for all children, including those with disabilities</p> <p>Inclusion: All children approximately aged 5-12 years using the playground during observations</p> <p>Participants remained anonymous to project staff throughout the study</p> <p>United States of America.</p>	<ul style="list-style-type: none"> <li>• Two playgrounds in a mid-Atlantic state were purposefully selected based on their playground design and structure.</li> <li>• Playground A had 5 different areas, and Playground B had 3 different areas.</li> <li>• Across the 2 playgrounds, data were collected by observational coders, across 416 total 1-minute intervals (morning, afternoon, and evening), spanning 13 days (weekend and weekdays) over a 3-month period.</li> </ul>	<ul style="list-style-type: none"> <li>• The System for Observing Play and Leisure Activities in Youth was used to document children's physical activity types, track children's locations, and code activity type.</li> </ul>	<ul style="list-style-type: none"> <li>• Detailed observations of children's play equipment and activity choices may provide insight into optimal playground equipment design and layout for play and social interactions between peers.</li> <li>• Fixed contemporary play equipment and open play spaces should be considered when designing new community playgrounds, as they appear to be equally interesting to boys and girls.</li> <li>• Girls' attire on a community playground and more available play space may contribute to more active play in girls than what was found in studies investigating play patterns on school playgrounds.</li> </ul>	<p>Grade C – Low</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Findings support the influence of physical environment structures on play.</li> </ul>

Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Wilkes-Gillan et al (2016)</p>	<p>Randomised controlled trial</p> <p>Aim: to examine the effectiveness of a play-based intervention for improving the social play skills of children with attention-deficit hyperactivity disorder (ADHD) in peer-to-peer interactions</p> <p>Recruitment: via flyers in paediatric services and ADHD parent support groups in Sydney, national online ADHD support groups and a press release through the University of Sydney's website</p> <p>Inclusion: children between 5-11 years old with formal diagnosis of ADHD</p> <p>Exclusion: major developmental disorders (for children with ADHD or typically developing peers)</p> <p>31 children with ADHD (15 in intervention group 14 in control group) and their typically developing peers who were known to the child</p> <p>Australia.</p>	<ul style="list-style-type: none"> <li>•The intervention group received a 10-week play-based intervention, while the control group waited 10 weeks before receiving the intervention.</li> <li>•Intervention included: 6 x 1 hour clinic consisting of 20 minute video feedback sessions which included the child, parent and therapist; 25 minute play modelling by the therapist; and 15 minute feedback session with the parent.</li> <li>•Parents were trained to complete home modules, which consisted of reading a manual chapter, watching a DVD with their child, and discussing the behaviour of the characters. They also held 4 playdates with the peer, and gave the child feedback before, during and after.</li> <li>•1 month after intervention, home visit by author to record and code child playing with their peer.</li> </ul>	<ul style="list-style-type: none"> <li>•Test of Playfulness (ToP) to see if the change in the overall play skills in the intervention group increased significantly compared to the control group.</li> <li>•Children's play was assessed at baseline, post-intervention and at 1-month follow up.</li> </ul>	<ul style="list-style-type: none"> <li>•Data reported on 29 children; 1 dropped out from each group.</li> <li>•Children's play skills in the intervention group changed significantly more than the control group over the 10 week intervention (intervention group change=23.9, range=6.1–48.3; control group change=-1.4, range=-7.5–10.1; <math>p &lt; 0.001</math>).</li> <li>•Children's play skills increased significantly from pre to post intervention (mean pre=46.65 vs mean post = 67.79; <math>p &lt; 0.001</math>; 95% CI = 16.27–26.00), and from pre to 1 month follow up (mean follow up = 69.68; <math>p = 0.873</math>; 95% CI = - 2.59–6.38).</li> <li>•All ToP social items improved significantly for both groups from pre to post-intervention and from pre-intervention to 1 month follow up (<math>p &lt; 0.006</math>).</li> </ul>	<p>Grade A – Very high</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>•Limitations include a relatively small sample size, the lack of data concerning the severity of neuropsychological impairments and presence of ADHD symptomology, and it is impossible to rule out that a parent change in behaviour caused the ToP improvements instead of the intervention (though the authors think this is unlikely).</li> </ul>



Source	Design and participants	Intervention	Outcome measures	Results	Quality and comment
<p>Wuang et al (2011)</p>	<p>Randomised controlled trial</p> <p>Aim: to compare the effect of standard occupational therapy (SOT) and virtual reality using Wii gaming technology (VRWii) on children with Down's syndrome (DS)</p> <p>Recruitment: via relevant educational and clinical sources – controls recruited via primary schools</p> <p>Inclusion: children aged between 7 and 12 years and with a diagnosis of DS determined by the board-certified physicians at local designated hospitals</p> <p>Exclusion: children with co-existing autism, cerebral palsy, blindness, or deafness, or with history of neurological disorders such as traumatic brain injury, muscular dystrophies, and epilepsy</p> <p>155 children</p> <p>Taiwan.</p>	<ul style="list-style-type: none"> <li>• Children (n = 105) were randomly assigned to intervention with either SOT or VRWii, while another 50 served as controls.</li> <li>• Each intervention group received a 1-hour treatment session 2 days per week for 24 weeks.</li> <li>• Treatment was conducted on an individual basis, and each child was randomly assigned to 2 therapists who administered either SOT or VRWii techniques according to the child's assigned group.</li> <li>• Children in the intervention groups were tested after the 24 weeks at occupational therapy clinic.</li> <li>• Children in the no-treatment control group were tested in a quiet classroom at the children's respective schools.</li> <li>• Testing session 1-1.5 hours with breaks.</li> </ul>	<ul style="list-style-type: none"> <li>• The Bruininks–Oseretsky Test of Motor Proficiency-Second Edition (BOT-2).</li> <li>• The Developmental Test of Visual Motor Integration (VMI).</li> <li>• The Test of Sensory Integration Function (TSIF).</li> </ul>	<ul style="list-style-type: none"> <li>• At post-intervention, the treatment groups significantly outperformed the control group on all measures.</li> <li>• Participants in the VRWii group had a greater pre–post change on motor proficiency, visual-integrative abilities, and sensory integrative functioning.</li> </ul>	<p>Grade A – High</p> <p>Comments:</p> <ul style="list-style-type: none"> <li>• Limitations include lack of confidence intervals.</li> </ul>

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