**Table 1: Characteristics of Included Studies in Descending Order of Level of Evidence and in Descending Order of Methodical Rigor within Each Level of Evidence**

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| **Author/**  **Year Published/**  **Country**  **and Power Mobility Training Approach(es)C Used in the Study** | **Study Design/ Level of Evidence** | **Purpose of the Study** | **Number of Subjects ≤ 21– Ages and Primary Diagnosis** | **Description of the Power Mobility Training Methods** | **Recommended Frequency and Duration of Power Mobility Training** | **Quantitative Evaluation Methods of Power Mobility Outcomes and Power Mobility Outcomes**  **of Participants**  **≤21 years of age** |
| Jones et al. 201229  United States  **Incorporating Play,**  **Natural Environments** | RCT using matched pairs/IIA | To examine  the effects of power mobility on the developmental  and functional skills of young children with severe motor  impairments aged 14 to 30 months | 28 children - 14 matched pairs (ages of experimental group 14.31-30.30 mo, mean 21.41 mo, SD 5.34. ages of control group 14.28-29.90 mo, mean 22.04 mo SD 5.13 mo)  Diagnoses: CP (17), congenital myopathy (2), Other – Dandy Walker syndrome, AMC, achondroplasic dwarfism, etc. | Initial training session with a PT to show the child how to work the WC. Children then practiced in natural environments with parents. Child sat in the WC for play each day. Parents encouraged the child to explore the power access method first, then movement, then the environment; providing positive feedback (“you found X”), only using phrases such as “lift your hand”, and allowing children time to figure out situations before intervening. Use of negative feedback or giving commands related to directionality were avoided. | Children in the experimental group had access to the power WC in their homes for 12 months. Additional details were not provided regarding actual use. | **Evaluation method:** BDI,47 PEDI,48 ECI,50 Wheelchairs Skills Checklist18 **Outcomes:** Statistically significant (p≤ .10) improvements in the intervention group on the BDI47 in receptive communication; on the PEDI48 in the Mobility domain, the Mobility and Self-care Caregiver Assistance scales. Four children achieved 100% of skills on the Wheelchair Skills Test18 in 12 to 42 weeks, 7 mastered between 2 and 6 skills, all but 2 learned to move forward 10 feet in wide areas within 2 to 34 weeks. |
| Linden et al. 201333  United Kingdom  **Virtual Reality and Computer-based Gaming** | RCT/IIA | To determine the efficacy of a computer-simulated power WC simulator in training children to use  a power WC | 28 children without physical or cognitive impairments (ages 5-7 yrs, mean age 6 yrs, SD ±5 mo) | Children used a joystick to navigate as fast as they could in a computer simulated environment comprised of 4 increasingly difficult levels (Level 1: simple turns and obstacles, Level 2: slalom courses and simple turns, Level 3: sharp turns, gaps, and ramps, Level 4: more sharp turns, wider gaps, and ramps with greater inclines. Audio feedback was used to indicate a collision. The simulation projected onto a wall. | The experimental group participated in eight, 30 minute sessions of a 3 week period. | **Evaluation method:** A 12-item power WC skills test, computer data from the simulation on completion times, errors, and total scores. **Outcomes:** An analysis of variance showed a main effect of time, with planned comparisons revealing a statistically significant change in power WC use for the experimental group but not the control group. Although the experimental group showed greater improvement than the control group,  this did not reach statistical significance. |
| Chen et al.  201419  United States  **Incorporating Play,**  **Technology-augmented Power Mobility Devices** | RCT/IIA | To explore a power mobility device that was able to locate itself, plan a path to a goal (a group of children playing, etc.), set a force field to train children to drive towards the goal, and prevent the child from running into obstacles | 10 typically-developing children (ages 2-3)  Experimental group: mean age 2.56 yrs SD ±.26 yrs, Control group (drove without force field): mean age 2:66 yrs, SD ±0:28 yrs. | Children in the experimental group used a power mobility device with an assist-as-needed haptic algorithm to train children in using power mobility to move in space and interact with caregivers and peers. A ball chasing game was used in the study. | Single session of 2 trials without force field for both groups, 4 trials (with the force field for experimental group, without for control), and 2 trials without force field for both groups | **Evaluation methods:** Proximity to ball used in in the ball chasing game. **Outcomes:** The experimental group drove closer to the ball and demonstrated short-term learning. |
| Inman et al. 200127  United States  **Virtual Reality and Computer-based Gaming** | RCT crossover design with f/u testing/IIA | To determine the feasibility of using WheelchairNet, a virtual reality power WC training program, to allow children with neuro-developmental conditions to practice driving skills | 13 subjects (ages 4-20 years) Diagnosis:  CP (12), DS (1)  Note: Age and diagnosis were only provided for subjects as a whole and not by group (experimental and control). | A non-immersive virtual reality system with a training platform to simulate movement. Three increasingly complex virtual environments were used: consisting of a large open area without any walls, obstacles, or impediments; a larger space that contained obstacles and items/stations and driving on ice and in mud; (3) a street-crossing module. | 10 total hours of virtual reality use within an undefined time period (session times ranged from 10 minutes to 1 hour). | **Evaluation method:** A real life power WC driving test consisting of right and left turns, moving forward within defined boundaries, and stopping before hitting a wall. **Outcomes:** Results suggest that all 4 skills on the driving test improved as a function of training time. |
| Marchal-Crespo et al. 201037  United States  **Incorporating Play,**  **Technology-augmented Power Mobility Devices** | RCT/ IIA | To determine if a smart robotic WC trainer that that steers itself along a specific line on the floor using computer vision and haptically guides the driver’s hand in the appropriate steering motions using a force feedback joystick could help non-disabled children learn to steer a power WC | 21 non-disabled  children (age 3-9 yrs, mean 6.6 yrs, SD ± 1.5 yrs)  Guidance group (mean age 6.43 yrs, SD ± 1.47)  No Guidance  group (mean age 6.96 yrs, SD ± 1.33) | All subjects played tag with a separate robot on a 19 meter driving course. During the first 50 seconds of training, the Guidance group drove without robotic guidance, followed by 9 trials (450 seconds) with robotic guidance that was systematically decreased. Two final trials of 50 seconds were completed without guidance. In the Guidance group, the joystick also vibrated. The No Guidance group drove without any guidance or vibration and was instructed to keep a pointer aimed at the ground just below their feet. | A single training session as outlined | **Evaluation methods:** Tracking error, speed of the chair, and the value of the guidance control gains. **Outcomes:** Training with guidance improved the steering ability of non-disabled children more than training without guidance. |
| Huang et al. 201526  Taiwan  **Virtual Reality and Computer-based Gaming** | Within subjects pre-test, post-test/ IIIA | To determine the effectiveness of joystick-controlled video console games in enhancing the ability to control power WCs in healthy young adults | 20 healthy young adults without known orthopedic or neurologic conditions (ages 19-21 years) | A non-immersive virtual reality system using a joystick that looked like a toy doll. Virtual games included crossing a river, floating a boat on a river, catching objects falling from the second floor, and a maze. The games required right-left movements of the joystick to catch catching falling objects and cross a river. Forward movement of the joystick were required to trace routes. A projector displayed the games on the wall. | A single 10 minute gaming session | **Evaluation method:** Completion of a driving test that included a right turn, a left turn, and moving straight forward 5 meters as fast as possible. Lateral deviation during the driving test was also determined. **Outcomes:** Mean group time to complete right and left turns decreased significantly (<0.05). Mean group lateral deviation decreased significantly during right and left turns (<0.05). |
| Jones et al. 200328  United States  **Natural EnvironmentsC** | Case report/IVA | To demonstrate that a child as young as 20 months can learn to use a power WC | 1 child (age 20 months)  Diagnosis: SMA Type II | During the initial training session with a PT, the child was shown once how the joystick worked. Child practiced with her mother as follows: encouraging the child to explore the joystick first, then movement, then the environment; providing positive feedback (“you found X”), giving the child time to solve problems before intervening, and using phrases such as “come closer”. Use of negative feedback (“you ran into the wall”) and describing how to move “turn right”) were avoided. | Child sat in power WC daily for 6 weeks. Duration of time in the WC varied from 15 minutes to 3 hours. | **Evaluation method:** BDI,47 PEDI,48 Wheelchair Skills Checklist18  **Outcomes:** Child made gains in all domains of the BDI47 and PEDI48 over 6 months. Within 6 weeks, child was able to perform all 7 skills on the Wheelchair Skills Checklist18 and was driving independently. |
| Dunaway et al. 201321  United States    **Natural Environments,**  **Skills-based ProgramsC** | Case series/IVA | To assess the feasibility of independent powered mobility in children with SMA at an earlier age than typically would be considered | 6 children (ages 16-23 mo at initial WC; mean age 18.8 m, evaluation. Ages 24-34 mo at power WC delivery; mean age 30.17 mo)  Diagnoses: 5 SMA, 1 CMD | Parents were encouraged to allow children to practice in natural environments. A skills checklist based on the Powered Mobility Program22 was provided to parents to guide skill acquisition. | Variable - The 4 children who completed the study used their power wc an average of 1.89 hours/day and practiced an averaged total of 524.4 hours. | **Evaluation method:** The Power Mobility Skills Checklist22 and the PedsQL Neuromuscular Module Outcomes: Two children with SMA did not complete the full study - 1 achieved 65% of the items on the Power Mobility Skills Checklist22 in 68 days. The other mastered 65% of the items in 84 days.The 4 children who completed the study (3 with SMA, 1 with CMD) were able to independently perform all items on the Power Mobility Skills Checklist22 in an average of 238 days (median: 210.5 days, range: 73-458 days) or 7.9 months from WC delivery; PedsQL scores declined by 7% in 1 child, 12% in 2 children, and improved 6% in 1 child. |
| Huang et al. 201425  United States  **Incorporating Play,**  **Natural Environments,**  **Goal-directed MobilityC** | Case report/IVA | To determine the feasibility of using a modified, switch-operated, ride-on toy as a readily  available, low-cost, fun, and functional option for a child with special needs | 1 child: 21 mo of age  Diagnosis: CP | Sessions were primarily conducted by the family in natural environments and during the child’s regular physical therapy sessions. Sessions were all goal-directed and involved driving to an object such as a ball and engaging in play with someone such as playing catch with the ball.  . | The family provided opportunities to use the car for a minimum of 20 minutes/day, 5 days/week over a 12 week period. Actaul time: a total of  1150 minutes on a total of 39 days (compliance rate: 65%) for a mean duration of 19 minutes/day (± 0.13 minutes; range 0-50 minutes) | **Evaluation methods:** PEDI,48 videotaped sessions were coded for: the number of seconds driving and stopping with and without assist, visual attention to the switch) as well as the number of times child: reached for a toy or adults, had a positive facial expressions, and vocalized **Outcomes:** PEDI:48 Suggested an improvement in the Mobility and Social domains. Videotaped sessions: Subject showed improvements in all measures |
| Lynch et al. 200936  United States  **Goal-directed Mobility,**  **Self-explorationC** | Case report/IVA | To explore the feasibility of providing a 7-month-old with spina bifida with structured environmental exploration opportunities with a joystick-operated power mobility device; to quantify his driving abilities; and track his general development throughout the intervention period | 1 child (age 7mo)  Diagnosis: L4-5 MM | Each session was performed in a large open gymnasium and was composed of Directional Driving trials (encouraging the child to reach for toys) and Open Exploration that provided training and assessment of the child’s driving abilities. A standardized prompt protocol of verbal and physical cues was used if the child did not independently reach for the joystick. An attendant joystick was used to prevent the collisions. | 3 to 4 times per  week from 7 to 12 months of age | **Evaluation methods:** Bayley III46 and an onboard computer captured the number of joystick activations, the total number of joystick activations, and movement of the power mobility device. Percent directed-driving success was assessed via an onboard video camera.  **Outcomes:** The number of joystick activations and the distance the power mobility device moved doubled. The number of successful Directional Driving trials steadily increased. |
| Kenyon et al. 201530  United States  **Incorporating Play,**  **Goal-directed Mobility,**  **Self-explorationC** | Case report/IVA | To describe the development and implementation of an intervention using a Power Wheelchair Trainer to enable an individual with severe impairments to participate  in power mobility training | 1 subject (age 18 years)  Diagnosis: CP | Motivational factors were identified through an interview with the subject’s mother and were used to create an engaging environment. Targeted power mobility skills were incorporated into the engaging environment to promote meaningful play and interactions. | Two, 60-minutes sessions/week for 12 weeks | **Evaluation method:** PMS,44 CPCHILD,52 number of independent switch activations **Outcomes:** Scores on the PMS44 and the CPCHILD52 were higher after intervention. The average number of independent switch activations per session increased from 50.6 in the first month of intervention 105.1 in the final month. |
| Kenyon et al. 201631  United States  **Incorporating Play,**  **Goal-directed MobilityC** | Case series/IVA | To describe the outcomes of using an alternative power mobility device to provide power mobility training to 3 young children with multiple, severe physical impairments; to develop power mobility training methods for use with these children; and to determine the feasibility of various outcome measures | 3 children (ages 17 mo, 29 mo, and 41 mo)  Diagnoses: CP | Each child’s individual preferences and initial ability with power mobility skills were identified. Findings were used to create an individualized, engaging environment for each child. An attendant control unit was used to modify the direction and motion of the power mobility device without interrupting a child’s driving. | One, 60 minute session/week for 12 weeks | **Evaluation method:** PEDI-CAT,49 DMQ,51 number of independent switch activations **Outcomes:** All children improved in various domains of the PEDI-CAT.49 Two participants had increased DMQ50 scores. The number of independent switch activations increased in 2 participants and decreased in the 3rd who progressed to using sustained switch activation. |
| Butler et al. 198418  United States  **Natural EnvironmentsC** | Case series/IVA | To determine if competent control of a power WC was attainable | 13 children (ages 20-37 mo; mean age 31.3 mo) Diagnoses: MM, CP, OI, SMA, AMC, limb deficiency, hyoptonic quadriplegia | Parents introduced the power WC at home and encourage the child to sit in the WC several hours per day with opportunities for supervised play as well as movement experimentation. Initially started in open spaces. The following were avoided: behavioral training, coordination exercises, or physical therapy for WC use. | Frequency and duration were not specifically prescribed. Average cumulative period of power WC use was 13.8 days (median 10.5 days; range 3-50 days). Cumulative time of actual power WC driving or movement averaged 8.1 hours (median 6.0 hours; range 1.7-26.1 hours) | **Evaluation method:** Wheelchair Skills Checklist18 **Outcomes:** 12/13 participants attained competency (the ability to perform all 7 skills on the Checklist). 11/12 attained competency within a 3 week period. |
| Douglas & Ryan 198720  United Kingdom  **Incorporating Play,**  **Self-explorationC** | Case report/IVA | To provide a detailed account of the progress of a preschool aged child learning to steer a power WC via a mouth-operated joystick | 1 child (age 4.5 yrs)  Diagnosis: C4 SCI sustained at 1 yr of age | Power WC use started in open areas in a day center area in a ward. Occasionally therapists had to stop the chair for safety. After an initial exploratory phase (3 sessions), a game approach was used including hide and seek, follow the leader, football (soccer), and obstacle courses. The WC was turned off briefly if the child deliberately ran into people or furniture. | 1-2 sessions per week over 5 months then regular use of the power WC for 2 years | **Evaluation method:** Therapist observation  **Outcomes:** Increased independence and confidence, enhanced language development with extended vocabulary, increased participation with other children, increased responsibility, and improved perceptual awareness. |
| Furumasu et al. 199622  United States  **Incorporating Play,**  **Skills-based ProgramsC** | Post-test only case series/IVA | To develop a power mobility program and a cognitive assessment battery to predict power mobility performance | 24 children (ages 20-36 mo; mean age 28.9 mo)  Diagnoses: AMC (8), SMA (7), SCI (3), Other – amputee, OI (6) | Sessions took place on hospital grounds under the supervision of a PT. The Powered Mobility Program22 consisting of a list of 34 skills was used to direct the training. Basic skills (turning, going forward, stopping) were learned through play then functional skills such as moving down a hallway and going through doorways were introduced in a quiet environment. Finally, practice occurred in a busy clinic setting. Verbal cues were used minimally and focused on functions (“let’s go” or “go find Mom”) rather than on directional cues. | Six, 1 hour sessions over an undefined period | **Evaluation method:** The skills listed in the Powered Mobility Program22 were assessed via a videotape on a 0-5 scale. **Outcomes:** The average total score was 2.7 (SD= 1.9; range = 0.03 – 4.85). |
| McGarry et al. 201238  Australia  **Incorporating Play,**  **Technology-augmented Power Mobility DevicesC** | Mixed methods case studies/ IVA | To explore the effects power mobility training using a Smart WC (that uses sensors to prevent collisions and is able to follow a predetermined path on the floor) on power WC skills in children with physical disabilities | 4 children (ages 5, 6, 12, and 13 yrs)  Diagnoses: CP | All sessions were conducted by therapists in a center-based setting. Children progressed as able from using the path following feature, to using only sensors, to driving without sensors. For the first 4 weeks, sessions were conducted in a large area with toys. A predetermined set of motivational activities were used. Verbal and physical feedback was provided and combined with structured practice. | Two, 60 minute sessions/week for 8 weeks | **Evaluation methods:** The skills listed in the Powered Mobility Program22 were assessed on a 0-5 scale and a total average score obtained. **Outcomes:** All 4 children showed improved total average scores (.09 to 1.36, .63 to 1.36, .18 to 3.27, 1.90 to 5) |
| Montesano et al. 201039  Spain  **Virtual Reality and Computer-based GamingC** | Case series/IVA | To describe and evaluate an intelligent power WC adapted for use with individuals who had cognitive disabilities and mobility impairments | 4 children (ages 11-16 yrs)  Diagnosis: CP | Sessions were conducted in a school setting by school therapists and engineers. Children played a 3 dimensional computer game that required execution of simple navigation tasks in a virtual environment. | A single training 45-60 minute training session | **Evaluation methods:** Navigation within a driving circuit while autonomously using the intelligent WC.  **Outcomes:** All children independently navigated the circuit. Path length and execution time were similar for all children. |
| Ragonesi et al. 201140  United States  **Incorporating Play,**  **Natural Environments,**  **Goal-directed MobilityC** | Case report/IVA | To determine the feasibility of providing a short-term mobility and socialization program focused on improving functional use of a power mobility device while simultaneously focusing on improving socialization and participation in a 3 yr old with CP | 1 child (age 3 yrs)  Diagnosis: CP | All training took place within the child’s preschool setting. Adult-directed incidental teaching methods that focused on driving included encouraging the child to drive to desired activities, to request peer assistance in moving obstacles out of the way, modifying the environment and problem solving with the child and his peers to make it easier for the child to drive and engage in activities, providing time in the class schedule for the child to complete driving tasks, and organizing specific activities that fostered the child’s participation. | Daily over a 10 day period. Actual session length varied although the child had the power mobility device available for his use all day at school. | **Evaluation methods:**  Videotaped sessions were coded for: percent time in the power mobility device and percent time driving and the amount of time in: solitary activities, parallel play, teacher interaction, and peer interaction. **Outcomes:** The child had more socialization but less driving during the training time. Socialization decreased posttraining and driving time increased. |
| Ragonesi et al. 201241  United States  **Incorporating Play,**  **Natural Environments,**  **Goal-directed Mobility,**  **Self-explorationC** | Case report/IVA | To explore the feasibility of short-term, intensive power mobility training  for an infant recently diagnosed with CP | 1 child (age 11 mo)  Diagnosis: CP | All sessions took place at a center. Sessions provided open exploration during which toys, verbal prompts with hand gestures, and hands-on assistance were used to promote driving. Five trials of prompted mobility in which the child was encouraged to drive to obtain a toy were performed. If the child did not respond, specific verbal and pointing cues were used to draw attention to the joystick. | Sessions conducted on 14 consecutive weekdays for 60 minutes. Actual session length varied based on the child’s mood and attention. | **Evaluation methods:** Videotaped sessions were coded for independent joystick contacts, visual attention to the joystick, independent mobility time, assisted mobility time, caregiver mobility time, and percent success with directed mobility. **Outcomes:** Between the first half and second half of training, all measures increased except time spent in assisted mobility (slightly decreased) and time spent in caregiver mobility (no change) |
| Adelola et al. 200917  Ireland  **Virtual Reality and Computer-based GamingC** | Case series/  IVA | To develop a training and assessment system that uses virtual reality technology to train power WC skills | 2 children (ages 6 and 17 yrs) Diagnosis: CP | Participants used a joystick (on a WC platform or mounted at a computer) to play a wayfinding virtual reality learning game focused on power WC skills (moving forward, turning right and left, and collision avoidance). Computer generated cues were used to guide the player through each game and included phrases such as “welcome”, “please drive”, “forward”, etc. A therapist provided verbal cues as needed. | Five, 30 minute sessions over a 1 week period | **Evaluation method:** Functional driving tasks in a power WC in an open, natural environment at 3 times intervals: pre and post training plus a 7 week follow up. **Outcomes:** Driver 1 - 64%, 99.2%, 84.4%; Driver 2 – 75%, 99.8%, 98.7% |
| Galloway et al. 200823  United States  **Natural EnvironmentsC** | Case series/IVA | To determine if young infants, without structured training, could drive a mobile robot, and if so, to determine how their driving changed over multiple sessions | 2 children- 1 typically developing (age 7 mo) and 1 with DS (age 14 mo) | Sessions were conducted in an open space that had a table and some large pieces of play equipment. The child was made aware of the joystick and verbally encouraged to touch it. Hand-over-hand facilitation was not provided. The child was allowed to explore the joystick, the robot, and the environment. When the robot was close to an object and headed directly for it, an experimenter used a 2nd joystick to turn the robot 180◦ to avoid a collision. | 2 sessions/week for 6 weeks. Sessions lasted a maximum of 20 minutes. Session length was variable based on child’s response and fatigue indicators. | **Evaluation method:** Data was collected by the robot and included: session length, percentage of driving time, the total distance and path travelled in the session, and the number and average duration of joystick activations. **Outcomes:**  Typical child: child showed improvements on all measures.  Child with DS: child shoed improvements in all measures. |
| Harrison et al. 200224  United Kingdom  **Virtual Reality and Computer-based GamingC** | Case series/IVA | To assess the application of 2 virtual reality environments on assessment and training of novice power WC users with neurological conditions | 1 pediatric subject (age 20 yrs)  Diagnosis: Brainstem hemorrhage 8 mo before onset of study. | Sessions occurred within a hospital and consisted of training in a non-immersed virtual reality environment. One virtual reality environment depicted a single room in the hospital with chairs and tables present that required the subject to perform a series of 6 WC skills. The other depicted a floor within a hospital wing and required use of the 6 WC skills but also wayfinding and avoidance of other people moving through the environment. | Daily 30-40 minutes sessions over a 7 day period | **Evaluation method:** Assessment of wayfinding in a real life setting. **Outcomes:** Slight improvements in route finding ability at follow up in the real life setting.Subject reported that moving within the virtual environment was difficult to control |
| Larin et al. 201232  United States  **Natural Environments,**  **Goal-directed Mobility,**  **Self-explorationC** | Multiple case series/IVA | To assess the feasibility using a robotic mobility device to promote early self-initiated mobility in infants and to assess the results of a training protocol and robot experience | 20 typically children in 3 different series (5-ages 6-9 mos; 10- ages 5-8 mo, mean 6 mo, 18 days; 5 – ages < 9 mo, mean age 7 mo, 8 days)  3 children with disabilities (ages 15 mo, 7 mo, and 3yrs)  Diagnoses: CP (2), DS (1) | All cases except the DS case were conducted in a standardized indoor environment. The DS case was conducted in the child’s home. Children were offered toys from 3 directions (forward, right, left) and at 3 distances (6, 12, and 36 inches). A sequence of verbal, tactile, and physical cues were provided at 5 second intervals. A free play session occurred immediately before and after each training. | Each session included 10 minutes of training and two, 2 -3 minute free play session before and after the training. Typically developing infants participated in 5 sessions over a 2-5 week period. Each of the children with disabilities participated in 6 sessions (the 15 month-old), over 4 mo (the 3 year-old), and for an unspecified time period (child with DS). | **Evaluation methods:** Via videotapes, goal-directed behaviors (related to reaching activities) were coded and time in motion was assessed.  **Outcomes:** Typically infants demonstrated significant improvements in driving performance and goal-directed movement. Results for the 2 infants and the 4 year-old with disabilities were mixed with both children with CP demonstrating improvements. |
| Marchal-Crespo et al. 201037  United States  **Incorporating Play,**  **Technology-augmented Power Mobility DevicesC** | Case report/IVA | To determine a smart robotic WC trainer that that steers itself along a specific line on the floor using computer vision and haptically guides the driver’s hand in the appropriate steering motions using a force feedback joystick could help children learn to steer a power WC | 1 child (age 8 yrs)  Diagnosis: CP | Subject played tag with a separate robot on a 19 meter driving course. During the first 50 seconds of training, the child with CP drove without robotic guidance, followed by 9 trials (450 seconds) with robotic guidance that was systematically decreased. Two final trials of 50 seconds were completed without guidance. | A single training session as outlined | **Evaluation methods:** Tracking error, speed of the chair, and the value of the guidance control gains. **Outcomes:** The child with CP showed even greater improvements in steering after training with guidance than did the non-disabled children. |
| Zeng et al. 200942  Republic of Singapore  **Technology-augmented Power Mobility DevicesC** | Case series/IVA | To evaluate a robotic power WC that provides guidance along virtual paths programmed in software and allows the user to control the speed | 1 pediatric subject (age 16 yrs)  Diagnosis: TBI sustained at age 6 yrs | All training was performed in a laboratory setting using a robotic WC that can operate in guided mode (guides the user to move along a specified path) or free mode (regular power WC). Use of the joystick and the different modes were explained to subjects. Basic driving skills (forward, reverse, turns) were then taught in guided mode. Subjects progressed as able to advanced skills. | A single session of unspecified duration. | **Evaluation methods:** A navigation test, frequency counts, joystick moves.  **Outcomes:** The child demonstrated little improvement in frequency counts and joystick moves. He was able to drive in guided mode but not in free mode and was unable to progress within the training. |
| Logan et al. 201434  United States  **Incorporating Play,**  **Natural Environments,**  **Goal-directed Mobility,**  **Self-explorationC** | Single subject A-B-A research design/VB | To determine the feasibility and family perceptions of including use of a modified ride-on car to increase  mobility, socialization, and fun for a child with DS | 1 child (age 13 mo)  Diagnosis: DS | Following an initial researcher led visit focused the child exploring and driving to a target, the family supervised the child’s use of the ride-on car in natural environments. Each session with included time for exploration, goal-directed driving, and play-based interactions with siblings, parents, and friend. Weekly research-led session’s car play sessions were also provided. | Daily 20-30 minutes sessions over a 12 week period | **Evaluation method:** PEDI,48 weekly videotaped sessions were coded for: the number of seconds driving and stopping with and without assist, visual attention to the switch, the number of times child: reached for a toy, had a positive facial expressions, or had a negative facial expression. **Outcomes:** PEDI:48 Increased scores in all functional domains and a decrease in caregiver assistance. Videotaped sessions: Independent mobility and total driving time both increased during the intervention phase. Visual attention to the switch increased from baseline to intervention. Positive facial expressions increased during the intervention phase. |
| Logan et al. 201635  United States  **Incorporating Play,**  **Goal-directed Mobility,**  **Self-explorationC** | Single subject AB research design/VB | To evaluate the feasibility of short-term use of a modified ride-on toy with 3 children who had complex medical needs | 3 children (ages 6 mo, 19 mo, and 5 yrs, 10mo)  Diagnoses: Use of a mechanical ventilator via a tracheotomy tube | All sessions took place in a pediatric long-term care facility. Clinical staff provided opportunities for exploration, goal-oriented driving (driving to obtain a favorite toy), and play-based activities (social games with peers in the gymnasium). Weekly researcher-led sessions focused on exploration. | Daily 20-30 minute sessions over a 12 week period | **Evaluation methods:**  Videotaped sessions were coded for: the number of seconds driving and stopping with and without assist, visual attention to the switch, the number of times child: reached for a toy, had a positive facial expressions, or had a negative facial expression. **Outcomes:** All children progressed to driving independently 100% of the driving time. Total drive time increased. The 2 younger children primarily explored and did not progress to goal-directed driving. The oldest child progressed to goal-directed driving. The frequencies of positive facial expressions varied in 2 children. The youngest exhibited negative facial expressions more often. |

AMC: arthrogryposis multiplex congenita**; Bayley III: Bayley Scales of Infant and Toddler Development – 3rd edition; BDI: Battelle Developmental Inventory; CMD: congenital muscular dystrophy;** CP: cerebral palsy; CPCHILD: Caregiver Priorities and Child Health Index of Life with Disabilities; DMQ: Dimensions of Mastery Questionnaire; DS: Down syndrome; f/u: follow-up; ECI: Early Coping Inventory; MM: myelomeningocele; mo: months; OI: osteogenesis imperfecta; PEDI: Pediatric Evaluation of Disability Inventory; PEDI-CAT: Pediatric Evaluation of Disability Inventory – Computer Adaptive Test; PedsQL: Pediatric Quality of Life Inventory; PMS: Power Mobility Screen; PT: physical therapist; RCT: randomized controlled trial; SCI: spinal cord injury; SMA: spinal muscular atrophy; TBI: traumatic brain injury; yrs: years.

A Level of evidenced determined using the Oxford Centre for Evidence-Based Medicine 2011 Levels of Evidence13

B Level of evidence determined using the Levels of Evidence for Single-Subject Research Designs14

**C Refer to Table 3 for a complete description of power mobility training approaches**