

Evidence Based Practice in Assistive Technology



Assistive technology (AT) enables infants and young children with disabilities to participate in daily routines and activities and facilitates mobility, communication, and other primary life functions. One component of AT is the devices that are used as adaptations. These devices range from readily available, off-the-shelf and generally low cost devices to those with limited availability that are designed to address the issues of disability. Readily available items may be used by all children and include bath seats, car seats, strollers, and other positioning equipment as well as toys, spoons and bowls, and other items used by young children. These items may also be labeled as low-tech. Specialized devices are generally more complex and include computer-based communication devices, highly specialized switch interfaces, power wheelchairs, computerized toys and other devices that are not readily available for use by the general population. These devices are frequently labeled as high-tech.

In order to select the most appropriate device for a particular child, assessments are conducted to determine the needs of the child and to match those needs with low- or high-tech devices. Assessments are one type of AT service that may be needed to identify potentially helpful devices. Once appropriate devices have been selected, strategies or interventions are needed to teach a child to use them effectively and efficiently within the context of his/her routines and activities.

Published articles were reviewed in order to identify those which discussed how to teach children to use AT devices successfully in their everyday lives. Of particular interest were reports that included descriptions of devices and teaching strategies and evidence for those strategies' successes with infants and young children.

Method

A list of key authors and key words was established by reviewing current reports and literature regarding the use of assistive technology with infants and toddlers (Mistrett, 2001). Inclusion criteria were developed to include (a) articles about assistive technology best practice and/or intervention with children aged 0-5 (focusing primarily on 0-3), (b) articles that reported or reviewed studies yielding evidence and (c) articles published between 1980 and 2004. Online journal searches were conducted to identify potential articles to be included in the review. The databases of Journals@ OVID full text, MEDLINE, ERIC, PsychInfo and CINAHL were searched by using author names and key terms and the searches were limited to years between 1980 and 2004. The aforementioned databases index journals from medicine, allied health, nursing, education, early childhood, early intervention, and related fields. The searches yielded 115

potential articles. Printed articles were obtained and a database was established to track and organize the article pool.

The following types of articles were eliminated from the pool: (a) articles regarding persons age 6 and above; (b) articles that reported assistive technology *needs* of children birth through age 5; (c) articles about assistive technology resources and position papers; (d) articles about technology as related to typically developing children; (e) articles that related to assistive technology best practice/intervention with children birth through age 5 but did not yield empirical evidence (“non-empirical” – i.e. AT strategies, AT frameworks, theories related to AT services/devices or intervention; AT models of practice; AT ethical or cultural issues to consider; AT assessment and intervention). A total of 88 articles were excluded. The 27 remaining articles are included in this review.

An additional database was created to further analyze these 27 evidence-based articles. The following information was identified in the database: title, author, journal, volume, issue, year, purpose, research type, description of subjects, independent variable, dependent variable, results, and level of evidence. Study-type and level-of- evidence were determined by the reviewer and based on the American Academy for Cerebral Palsy and Developmental Medicine’s (AACPDm) Levels of Evidence Classification system.¹ AACPDm’s model describes categories of treatment evaluation as: group methods (between-subjects designs), single-subject methods (within-subjects designs), outcomes research methods, and qualitative methods. The levels of evidence classification system includes five levels of evidence based on Sackett, Richardson, Rosenberg, and Haynes’ (1997) model: Level one evidence requires well-controlled experiments including random allocation and manipulation of intervention; Level two evidence describes studies that do not include randomization but are otherwise well controlled experiments, or comparison studies; Level three evidence includes comparison studies with one (or both) of the comparisons being retrospective; Level four evidence designs have no comparison groups/conditions; Level five includes all non-empirical research which can merely hint at possible relationships between interventions and outcomes.

Results

The 27 articles were classified into the AACPDm’s five levels of evidence. Of the twenty-seven studies, a three of them (11%) presented level-five evidence. In addition, 33% (nine studies) presented level-four evidence, 11% (three studies) presented level-three evidence, 41% (11 studies) presented level-two evidence, and 4% (one study) presented level-one evidence.

Articles were subdivided into five intervention categories: Category one involved teaching young children how to use powered mobility devices; Category two included studies that taught young children how to use Augmentative and Alternative Communication Devices; Category three featured research

¹ www.aacpdm.org - AACPDm Methodology for Developing Evidence Tables and Reviewing Treatment Outcomes Research (PDF), p. 64-79, retrieved from the World Wide Web, November, 2003.

studies regarding assistive technology device design and selection processes in supporting young children with various physical disabilities; Category four included studies about teaching young children with disabilities through the use of computers; Studies in category five explored various ways to teach young children with different types of disabilities how to use switches.

Within these categories, power mobility was represented by 11%(3) of the studies, Augmentative and Alternative Communication (AAC) was represented by 4%(1), device design and selection comprised 19% (5), computers were the subject in 22% (6 studies), and 44% (12) of studies discussed the use of switch-adapted mechanisms. The following section summarizes the evidence-based practices that were reported in the studies and related to the teaching about AT devices with young children.

Summary of Evidence for Practice

1. Teaching Young Children Power Mobility:

Studies that were categorized under this domain consisted of three single subject design studies (Butler, C., Okamoto, G., & McKay, T., 1983, 1984; Butler, 1986), all demonstrating strategies for teaching young children to utilize independent power mobility devices. In both their 1983 and 1984 studies, Butler et al. introduced several children (between 20 and 39 months) to motorized wheelchairs in order to determine their effectiveness in encouraging mobility during these critical ages. The children were found to have average cognitive abilities, considering their chronological ages and significant and varying physical disabilities. After the children were fitted for optimally sized wheelchairs, the children learned to drive the wheelchairs at home with their parents. In order for the achievement of maximum success, the researchers recommended to caregivers that their children be encouraged to spend several hours per day seated in the chairs. Children were considered competent with regard to their driving when they mastered the following seven skills: stopping and starting, driving straight in open areas, driving straight in narrow corridors, turning around, turning corners, and coming in close proximity to people and furniture. In both studies, nearly all of the children became independently mobile within three weeks; one child from each study began manipulation of the control stick during later weeks. The results of the 1984 study revealed that a clustering pattern was evident when four to five skills (e.g. forward maneuvering, start-stop, circling) were learned within a one- to five-day period. Parents of participants concluded that the powered mobility devices had positively influenced their children's social, emotional, intellectual behaviors.

Butler's (1986) third study, a single-subject design, looked specifically at how powered mobility affected the self-initiated behaviors of six 23-38 month-old children. The dependent variables of the study included frequencies of physical interaction with objects, communications with caregiver, and changes of location in space. Additionally, degree of spatial exploration was measured. Analyses looked at self-initiated behaviors with and without the use of power mobility in the natural, free-response settings of their own homes and found that although some decreases were evident for some children with regard to certain behaviors, the treatment was effective in part for all six children. Parents of the children described improved psychosocial and locomotor behaviors.

2. Teaching Young Children To Use Augmentative and Alternative Communication Devices:

In 1998, Schepis, Reid, Behrmann, and Sutton reported positive findings in teaching young children with Autism to use Augmentative and Alternative Communication devices (AAC) while receiving a naturalistic instructional strategy from teachers. The study was a single-subject design yielding level-two evidence. Schepis et al. succeeded in teaching the use of a Voice Output Communication Aid (VOCA) to four children, aged 3-5 years, during daily snack and play routines in their self-contained classroom. In order to select the most appropriate VOCAs for the children, the researchers collected detailed descriptions of the children's communicative and interaction skills from classroom staff members. Additionally, investigators were interested in staff opinions about graphic representations as well as number and content of messages that would be most useful for teaching each child. Furthermore, a clinician trained in both AAC and assistive technologies observed each child during daily routines to assess current modes of communication, while an experimenter presented each child with three different VOCAs to evaluate his/her ability to activate and visually scan each device. Based on the information collected, "Cheap Talk" was chosen as the VOCA to be used with the children. The device included black and white computer-generated symbols (each selected to be visually distinguishable from the others), which printed the words of either four or eight messages (depending on the model and the what was selected as appropriate for the individual child). The background color for each symbol matched a grammatical category that was represented by the critical word in the phrase. Only one of the children had previously used a VOCA.

Baseline observations of the children during play and snack times were recorded. To inform classroom staff of the naturalistic teaching strategies, a 30-45 minute training session was conducted. The sessions focused on one target child and a particular classroom routine selected for intervention. During the sessions, the staff and experimenter shared ideas about the best communicative messages for the child as well as the appropriate graphics to be used, and the experimenter provided verbal and written presentations outlining the main components of naturalistic training procedures in relation to the use of a VOCA during daily routines. The primary components of the naturalistic instructional strategy included: using child-preferred stimuli available within the natural routine, using child-initiated responses as the point of intervention, and providing verbal and gestural prompts with minimal use of physical guidance. The experimenter modeled natural cues such as expectant delay, questioning looks with eye contact, and physical approach techniques. Following the instructional sessions, the target children were given their VOCA devices during one of the specific classroom routines. Classroom staff began to model the use of the VOCAs for the children by pressing keys and directing attention to the graphic symbols. The children were then given one minute to freely explore their VOCAs. The children's subsequent sessions with the VOCAs included no further instruction from staff.

Children were observed for the following communicative behaviors: child-to-child communication, physically guided VOCA, word vocalization, nonword vocalization, and gesture. Observations also focused on the classroom staff members' communicative interactions with the children as well as any specific verbal prompts to communicate. Results of the analyses indicated that all children demonstrated an increase in communicative interactions during the VOCA and naturalistic teaching

condition, relative to their baseline scores for each classroom activity. The findings provide evidence for the efficacy of using a voice output communication aid in conjunction with naturalistic teaching procedures to increase the communicative interactions of young children during classroom routines.

3. Device Design and Selection:

In selecting and/or designing assistive technology for use by children, many researchers have found it important to account for durability, cosmetics, cost, function, and acceptability by children and caregivers. Four of the following studies discussed the design and selection of prosthetic arms in particular (Krebs, Lembeck, & Fishman, 1988; Mendez, 1985; Meredith, Uellendahl, & Keagy, 1993; Sauter, Dakpa, Hamilton, Milner, & Galway, 1985), while one study examined the design and selection issues surrounding the use of a small, motorized cart for a child with no limbs (Zazula & Foulds, 1983). Of the five studies that can be categorized under the domain of device design and selection, three utilized single-subject designs and two were case studies. They yielded evidence that can be classified under levels three, four, and five. The researchers in four studies explored the use of upper extremity prosthetics with children aged 1.5 - 5.5 years and found them to have high rates of success when used to perform everyday functions (Krebs et al., 1988; Mendez, 1985; Sauter et al., 1985; Meredith et al., 1993). The devices used for the young participants in these studies were custom made to ensure the most appropriate fit. Additional considerations that were found to be important for prosthetic-use with young children included the size and weight of the devices. In all cases, the devices tested had positive results, with several of the children and parents (Krebs et al.) particularly pleased with the appearance, strength, ease of operation, weight, and grasping ability of the device. In each of the four studies, the experimenters found that maintenance and glove wear were the greatest challenges. Krebs et al. (1998) demonstrated the use of a body-powered hand, attempting to provide evidence for an alternative to complicated myoelectric devices. Mendez (1985), Sauter et al. (1985) and Meredith et al. (1993), investigating the efficacy of myoelectric hand prostheses with a population similar to that of Krebs et al. (1998), demonstrated that the use of powered prosthetics are also functional, safe, and successful. In the four studies, all children fitted for prostheses had average cognitive abilities. All families found the devices satisfactory in terms of cosmetics. Children mastered prehension, grasp, and release, and showed an increase in independence with activities of daily living. Children practiced in naturally occurring routines of the home and community. In the post-intervention months, most children continued to use the devices but often on an intermittent basis.

In an attempt to test the efficacy of a device for a child without arms and legs, Zazula and Foulds (1983) presented a case study of a young child with phocomelia. Yielding level-five evidence, the study described the design, fitting, and functional use of an electric cart specifically created for an 11-month-old child. In the descriptions, it was emphasized that precise molding and positioning were considered during its design. Additional design concerns included the cart's safety and comfort in relation to the child's needs and developmental level. The child was presented with the device, and then given time in a clinical setting to become familiar with its functions through use of a remote switch, which could be operated while sitting on the floor. The parents were subsequently enlisted to control the device while the child adopted the role of passenger. Before leaving the clinic, the child was reportedly making initial attempts to drive the device

by way of a foot pedal. Within four months at home, the child was able to independently drive the device forward. He quickly became familiar with usage of the cart both indoors and out. The device design allowed for movement, but did not move in a way that may cause injury to the child or others; the caregivers were able to stop the device by obstructing it if necessary. Additionally, the design features of large wheel spacing and a wide base made it unlikely to tip or roll. In only six months of continual use, the child showed complete control over all operations of the cart.

Design and selection of assistive devices is unique and frequently specified to meet a certain individual's needs. Although research studies such as the ones previously discussed indicate that there can be cost and maintenance issues associated with certain assistive technology devices, the benefits allow children with disabilities to explore their environments and achieve higher levels of independence.

4. Teaching Young Children with Computers:

The literature search revealed that six of the 27 articles included in this analysis explored the use of computers with young children. Of these articles, one used a group research design (Lehrer, Harckham, & Pruzek, 1986), four used single-subject methods (McCormick, 1987; O'Conner & Schery, 1986; Parette, Hourcade & Heiple, 2000; Spiegel-McGill, Zippiroli, & Mistrett, 1989) and one was simply an observational/exploratory study (Fazio & Reith, 1986). They yielded a range of evidence from levels two through five and all studies examined multiply-handicapped children with ages ranging from birth to five.

Lehrer et al. (1986) examined how microcomputer-based instruction in special education may affect handicapped children's problem solving skills, skill acquisition, language development, and cognitive development. In their study, the 120 preschool participants ($M = 3$ years, 11 months) were randomly assigned to one of three treatment conditions: (a) a Logo environment which included the use of robots ("Big-Trak"), (b) an environment consisting of commercially available "skills development" software, and (c) a control condition consisting of teacher-directed activities designed to replicate daily classroom routines. Based on the cognitive-distancing theory, researchers felt that skills would be imbedded and useful to the children if learned in more flexible contexts (i.e., allowing for cognitive distancing) and that learning activities vary with respect to their distancing potential. Results indicated that the children in the logo-based environments displayed higher levels of problem-solving and linguistic abilities when compared to the control group. Additionally, the instructional software condition assisted in children's acquisition of specific skills. Although treatment conditions did have positive effects on some of the children's skills, researchers found it important to point out that the existence of an aptitude-by-treatment interaction suggests that questions concerning the quality of software should include consideration of learner characteristics.

O'Connor & Schery (1986) compared the use of traditional language intervention with the use of computer-aided language instruction. All eight study-children with handicaps experienced both treatment conditions during twelve 20-minute intervention sessions over a period of 6 to 10 weeks for each condition; the order of treatment was randomly assigned for each child. The computer condition involved the children working with a vocabulary program developed specifically for developmentally delayed children (assisted by

a teacher), while the traditional language intervention condition consisted of the child and the teacher playing with and discussing a set of toys. Increases were noted in the amount of progress made, based on diagnoses, in a short period of time. Analyses revealed that the microcomputer being utilized in an interactive mode (i.e., guided by a teacher) facilitates language growth in multi-handicapped toddlers. In other words, the use of adapted computer devices, along with teacher guidance, can assist in the development of effective communication for handicapped toddlers.

In two similar studies (McCormick, 1987; Spiegel-McGill et al, 1989), researchers explored the use of computers in the classroom as social facilitators. Both studies compared the abilities of computer and toy play activities to impact handicapped children's communicative interactions with their non-handicapped peers. McCormick's (1987) study included five preschool children (two of which had social and language delays) and established that "dyadic computer activities may provide handicapped preschoolers with motivating contexts for practice, expansion, and refinement of social and language skills" (p. 202). Some possible explanations for this effect may be that such activities involve little or no adult direction and they require close physical proximity and the use of turn taking among peers. Similarly, Spiegel-McGill et al. (1989) paired four children identified as handicapped with four typically developing peers and observed the dyads in three conditions: toy, computer, or both available. Teachers were available to facilitate interaction at the onset of the session; the teachers were later present for supervision purposes only. The computers were loaded and ready for use with Muppet Learning Keys (touch screen keyboard) and a variety of developmentally appropriate software activities – some open-ended and some specific to building skills. Results of this study revealed that although the computer activity did not significantly enhance the social interactions of two of the four children with disabilities (those two with more mild disabilities), it did act as a significant social facilitator for the two children that had more significant social interaction deficits. A limitation of both studies included the lower level of external validity due to data collection taking place in controlled, experimental environments.

Parette, Hourcade, and Heiple (2000) reiterated the importance of structured computer experiences for young children with disabilities in their article discussing a field test of the "Keyboard Kids Curriculum," a computer-training program for young children. To test the effectiveness of this program with three groups of children ranging from ages three to five, they used the Computer Skills Testing Inventory (CSI) to measure both pretest/posttest abilities. Before the introduction of the program, teachers and other staff members determined what modifications might be necessary in order for all children to have the opportunity to participate (e.g. positioning devices for children with cerebral palsy). Each group of children then received a 1-hour training session twice a week targeting the computer skills from the Keyboard Kids Curriculum. The sessions were conducted with teachers in small groups of three. Results indicated that significant training effects were evident for all three groups. The Keyboard Kids curriculum was found to be an effective tool for teaching fundamental computer skills to children both with and without disabilities.

Lastly, Fazio and Reith (1986) conducted an observational study of the patterns of microcomputer use of 20 preschool children with disabilities in a special education classroom. Although their study was descriptive, it provided good information on the patterns of AT computer-use with a young population, and

therefore was included in this evidence-based review. Specifically, the study examined the children's computer use during their free-choice periods, and included analyses of their software selection, the average amount of time they spent using the computer, and the amount of assistance they required from an adult teacher. The children were observed during free-choice playtime once per week for 30 weeks. Results indicated that the computer was a popular activity in the classroom. For the higher-functioning children, the computer was chosen during free-choice play 84% of the time; the lower-functioning children chose the computer 70% of the time. The authors also noted that when they did choose to use the computers, the children stayed with the activity for almost ten minutes at a time (the maximum time allotted per child). Adult aid was required for most children toward the beginning; however, less assistance was needed during the last five weeks of the study. The lower-functioning children consistently needed more teacher assistance than the higher-functioning children. The children infrequently chose the drill-and-practice software as well as software requiring complex motoric and conceptual responses. Instead, they preferred software that included bright colors, sound and animation.

5. Teaching Young Children with Switches:

Switches are key examples of basic technology that can be used to help children with disabilities learn various skills. As Sullivan and Lewis (2000) point out, such basic technology is the key to creating responsive environments because it creates contingencies between actions and outcomes. Twelve studies (Behrmann & Lahm, 1983; Cook, Liu, & Hoseit, 1990; Daniels, Sparling, Reilly, & Humphry, 1995; Dunst, Cushing, & Vance, 1985; Ferrier, Fell, Mooraj, Delta, & Moscoe, 1996; Hanson & Hanline, 1985; Horn & Warren, 1987; Horn, Warren, & Reith, 1992; Sullivan & Lewis, 1990; Sullivan & Lewis, 2000) focused on the use of switches for teaching contingent feedback learning to children ages birth through five with disabilities. The studies taught children to better understand cause-and-effect relationships and to learn to more effectively control their environments. They included case studies, single-subject methods, and group research designs and yielded evidence ranging from one to five.

Switch technologies were presented to the participants of these studies in a variety of settings, for a variety of reasons, under a variety of conditions. Some were attached to toys, others computers, some prompted feedback from mom, while others helped children to control tools with the goal of completing a task. In contingent learning theory, children are taught both in experimental and natural environments through the use of reinforcing feedback. For example, in their study of the effects of a microcomputer-mediated motor skills instructional package, Horn et al. (1992), examined if this type of assistive technology would result in both more child engagement with peers and more precise prompting and recording of child performance. The children with cerebral palsy who were used as the participants showed increased general levels of engagement as well as performance of target motor skills. Dunst et al. (1985) looked more specifically at how response-contingent learning using AT can help profoundly disabled infants. Researchers used a multicolored visual display, which illuminated contingent upon fixated head movements, to assist with an operant conditioning teaching strategy. They found that such technology can help constitute a successful tool for early intervention with children with severe disabilities. Additional studies (e.g. Sullivan & Lewis, 1990; Cook et al., 1990) have also emphasized the importance of

contingency experiences using AT for sensory-motor development of children with disabilities. In general, with the help of participating parents and teachers, the researchers of the studies first presented the switches or comparable AT to the children without feedback in order to reduce fear/anxiety. The children then were given time to familiarize themselves with the devices and discover their respective reinforcements or consequences. Children of ages from birth through five with cognitive/physical disabilities learned to control their environments and make choices by learning about cause-and-effect relationships through the use of switches. All children required practice and at least intermittent feedback. The power of reinforcements is revealed in those studies in which removal of feedback in cases resulted in decreases or extinctions of behaviors.

Cook et al. (1990) demonstrated, through contingency-based concepts, that children with cognitive and physical disabilities as young as eighteen months old could come to see a robotic arm as a tool and subsequently use it for completing tasks. This was evidenced by the ability of the children to activate the arm (through a single switch) to reach a toy. If the toy could not be reached/seen after first activation, the child would again activate the robotic arm to bring the toy close enough to touch. The children were first taught the use of the switch with a favored toy. The toy was removed and the switch was attached to a robotic arm. The children were given ample time to get used to the robotic arm and retrieve items through a single-touch activation mode on the switch. The switch was then changed and required multiple switch activations. In this condition, in order to retrieve an item (or complete a task) using the robotic arm, the children were required to continuously activate the switch until the task was complete. Two out of the six participating children with disabilities, one of which was observed to have cognitive disabilities, achieved mastery of this skill.

Systematic prompting and prompt withdrawal techniques for learning to use an AT device was used by Meehan, Mineo, and Lyon (1985) to teach a five-year-old boy with severe mental and physical disabilities to activate an adapted battery-operated and electronically controlled toy. The student in this experiment was placed in a prone position over a wedge in a quiet but familiar classroom in his school. A switch was placed within reach with a toy attached. If the switch was activated the child was praised. In the first phase of treatment the child was given both verbal and physical feedback including hand-over-hand activation of the switch. Phase two was identical with the exception of the child's hand being placed on the switch but not activated. In the third phase, the physical prompt consisted of a nudge or tap behind the child's below, which moved his arm a short distance toward the switch. The final phase was a verbal prompt only condition. Results indicated that switch activation response was quickly and efficiently established using the prompting procedures. The child demonstrated 100% switch activation by the end of the final phase, which was higher than the responses from the second and third phases.

In another case study (Light, 1993), a four-year-old girl was taught to use an automatic linear scanning device through a cognitive developmentally-based teaching strategy (Case, 1985). An automatic linear scanning technique highlights individual response choices one at a time, in a row, on a computer screen, so that the child can indicate a desired response through the activation of a switch. According to this instructional theory, in order for instruction to be optimally effective, the child should have maximal time for familiarity with the tools/content, relevant cues should be highlighted, and the number of items

and information to be organized should be limited. In this study a story format was used to familiarize the child with the tools/content, and a game of tag within the story provided a metaphorical concept, which allowed for easier comprehension of the scanning tool. In order to minimize the information she would be required to organize, the task was broken down into four concrete steps: first she would watch the cursor move on the screen and activate the switch to select one of three items (two of which were blank). Next she would make a selection, using the switch, from a choice of first three pictures, then four, then five. Instruction was given in twenty-minute sessions, four times per week. In the end the use of the highlighting cue was removed and the child was able to master linear scanning, without cues, using a zygo-lever switch mounted in the headrest of her wheelchair.

Discussion

This review identified 27 studies published within the past 25 years, which reported some level of empirical evidence about effective ways of teaching infants and young children to use AT to improve involvement and engagement in daily activities and routines. As would be expected, a majority of the articles used small sample sizes and some form of a within-subject design. The articles discussed how several different types of AT, including power mobility, AAC, switch activation, and computers can be used by children with disabilities to accomplish functional tasks. Additionally, several articles discussed the importance of the design and selection of AT when working with very young children. It is important to note that none of the evidence-based reports discussed strategies for helping children use readily available or low-tech items. Furthermore, the limited number of published evidence-based AT teaching practices, and the emphasis on high-tech devices, indicate a potentially low interest in identifying optimal AT intervention practices for young children with disabilities and suggest that evidence-based intervention practices may be viewed as necessary only when complicated devices are being utilized.

Evidence-Based Literature

Author	Year	Title	Journal	Type of Study	Intervention	Level of Evidence	Description (AACPD)
Behrmann & Lahm	1983	Critical Learning: Multiply Handicapped Babies Get On-Line	Eric Document: ED232330	Single Subject	Computers/ Switches/ Software	4	Designs have no comparison group or condition.
Butler	1986	Effects of Powered Mobility on Self-Initiated Behaviors of Very Young Children with Locomotor Disability	Developmental Medicine & Child Neurology	Single Subject	Powered Mobility	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Butler, Okamoto, & McKay	1983	Powered Mobility for Very Young Disabled Children	Developmental Medicine & Child Neurology	Single Subject	Powered Mobility	4	Designs have no comparison group or condition.
Butler, Okamoto, & McKay	1984	Motorized Wheelchair Driving by Disabled Children	Archives of Physical Medicine and Rehabilitation	Single Subject	Powered Mobility	4	Designs have no comparison group or condition.
Cook, Liu, & Hoseit	1990	Robotic Arm Use by Very Young Motorically Disabled Children	Assistive Technology	Single Subject	Computers/ Switches/ Software	5	Non-empirical evidence; it can only hit at possible relationships between intervention and outcome.

Daniels, Sparling, Reily, & Humphry	1995	Use of Assistive Technology with Young Children with Severe and Profound Disabilities	Infant-Toddler Intervention	Single Subject	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Dunst, Cushing, & Vance	1985	Response-Contingent Learning in Profoundly Handicapped Infants: A Social Systems Perspective	Analysis and Intervention in Developmental Disabilities	Single Subject	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Fazio & Rieth	1986	Characteristics of Preschool Handicapped Children's Microcomputer Use During Free-Choice Periods	Journal of the Division for Early Childhood	Non-Empirical	Computers/ Switches/ Software	5	Non-empirical evidence; it can only hit at possible relationships between intervention and outcome.
Ferrier, Fell, Mooraj, Delta, & Moscoe	1996	Technical Note Baby-Babble-Blanket: Infant Interface with Automatic Data Collection.	AAC Augmentative and Alternative Communication	Case Study/Single Subject	Computers/ Switches/ Software	4	Multiple baseline design across behaviors with a single subject.
Hanson & Hanline	1985	An Analysis of Response-Contingent Learning Experiences for Young Children	Journal of the Association for Persons with Severe Handicaps	Single Subject	Computers/ Switches/ Software	3	Designs are comparison studies, but one (or both) of the comparisons is retrospective.

Horn & Warren	1987	Facilitating the Acquisition of Sensorimotor Behavior with a Microcomputer-Mediated Teaching System: An Experimental Analysis	Journal of the Association for the Severely Handicapped	Single Subject	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Horn, Warren & Rieth	1992	Effects of a Small Group Microcomputer-Mediated Motor Skills Instructional Package	Journal of the Association for the Severely Handicapped	Single Subject	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Krebs, Lembeck, & Fishman	1988	Acceptability of the NYU Number 1 Child-sized Body-powered Hand	Archives of Physical Medicine and Rehabilitation	Single Subject	Prosthetics (Powered)	3	Designs are comparison studies, but one (or both) of the comparisons is retrospective.
Lehrer, Harckham, Archer, & Pruzek	1986	Microcomputer-based Instruction in Special Education	Journal of Educational Computing Research	Group Research	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.

Light	1993	Teaching Automatic Linear Scanning for Computer Access: A Case Study of a Preschooler with Severe Physical and Communication Disabilities	Journal of Special Education Technology	Case Study/Single subject	Computers/Switches/Software	4	Multiple baseline design across behaviors with a single subject.
McCormick	1987	Comparison of the Effects of a Microcomputer Activity and Toy Play on Social and Communication Behaviors of Young Children	Journal of the Division for Early Childhood	Single Subject	Computers/Switches/Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Meehan, Mineo, & Lyon	1985	Use of Systematic Prompting and Prompt Withdrawal to Establish and Maintain Switch Activation in a Severely Handicapped Student	Journal of Special Education Technology	Case Study/Single Subject	Computers/Switches/Software	2	Multiple baseline design across behaviors with a single subject.
Mendez	1985	Evaluation of a Myoelectric Hand Prosthesis for Children with a Below-Elbow Absence	Prosthetics and Orthotics International	Single Subject	Prosthetics (Powered)	4	Designs have no comparison group or condition.
Meredith, Ullendahl, & Keagy	1993	Successful Voluntary Grasp and Release Using the Cookie Crusher Myoelectric Hand in 2-Year-Olds	The American Journal of Occupational Therapy	Single Subject	Prosthetics (Powered)	4	Designs have no comparison group or condition.

O'Connor & Schery	1986	A Comparison of Microcomputer-Aided and Traditional Language Therapy for Developing Communication Skills in Nonoral Toddlers	Journal of Speech and Hearing Disorders	Single Subject	Computers/ Switches/ Software	1	Well controlled experiments that must also include random allocation and manipulation of the intervention.
Parette, Hourcade & Heiple	2000	The Importance of Structured Computer Experiences for Young Children With and Without Disabilities	Early Childhood Education Journal	Single Subject	Computers/ Switches/ Software	3	Designs are comparison studies, but one (or both) of the comparisons is retrospective.
Sauter, Dakpa, Hamilton, Milner, & Galway	1985	Prosthesis with Electric Elbow and Hand for a Three-Year-Old Multiply Handicapped Child	Prosthetics and Orthotics International	Case Study/Single subject	Prosthetics (Powered)	4	Multiple baseline design across behaviors with a single subject.
Schepis, Reid, Behrman, & Sutton	1998	Increasing Communicative Interactions Of Young Children With Autism Using A Voice Output Communication Aid And Naturalistic Teaching	Journal of Applied Behavioral Analysis	Single Subject	AAC Device	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Spiegel-McGill, Zippoli & Mistrett	1989	Microcomputers as Social Facilitators in Integrated Preschools	Journal of Early Intervention	Single Subject	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.

Sullivan & Lewis	1990	Contingency Intervention: A Program Portrait	Journal of Early Intervention	Group Research	Computers/ Switches/ Software	2	Designs do not include randomization but are otherwise well controlled experiments or comparison studies.
Sullivan & Lewis	2000	Assistive Technology for the Very Young: Creating Responsive Environments	Infants and Young Children	Group Research	Computers/ Switches/ Software	5	Non-empirical evidence; it can only hit at possible relationships between intervention and outcome.
Zazula & Foulds	1983	Mobility Device for a Child with Phocomelia	Archives of Physical Medicine and Rehabilitation	Case Study/Single subject	Powered Mobility/ Prosthetics (powered)	4	Multiple baseline design across behaviors with a single subject.

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