Improving Early Intervention Results Through Technology Tools: A Report on the Birth to Three TechTools Phase 1 Development Project

by

Patricia L. Hutinger, Carol Bell, and Joyce Johanson

Center for Best Practices in Early Childhood
Western Illinois University
Macomb, Illinois 61455

February 2008

U.S. Office of Special Education Programs

Birth to Three TechTools

is a Phase 1 Steppingstones of Technology Innovation for Students with Disabilities Project
Project Number H327A040100

Project Directors: Patricia L. Hutinger and Carol Bell
Center for Best Practices in Early Childhood
Western Illinois University
Macomb, IL 61455

Birth to Three TechTools
was funded by
the U.S. Department of Education
Office of Special Education & Rehabilitative Services
Office of Special Education Programs
Technology and Media Services for Individuals with Disabilities
CFDA 84.327A
Washington, DC 20202

Improving Early Intervention Results Through Technology Tools: A Report on the Birth to Three TechTools Phase 1 Development Project

by Patricia L. Hutinger, Carol Bell, and Joyce Johanson

Birth to Three TechTools (TechTools), a U.S. Department of Education Steppingstones of Technology Phase 1 Development project, was conducted by staff at the Center for Best Practices in Early Childhood (the Center), a research and development unit within the College of Education and Human Services (COEHS) at Western Illinois University (WIU). The TechTools product was designed to meet two purposes of the Steppingstones funding priority: (1) to improve results of early intervention and (2) to improve access to and participation in daily experiences in the natural environment for children with disabilities, ages birth to three.

The *TechTools CD-ROM (TechTools)* combines three components: (1) the *CORE Curriculum* (*CORE*), a set of tested birth to three learning experiences developed by the Macomb 0-3 Regional Project; (2) birth to three assistive technology (AT) procedures developed and tested by Activating Children through Technology (ACTT), and (3) everyday routines and events in children's natural environments. *TechTools* emphasizes six developmental areas critical to children's interactions with people, objects, and events in their environment: *gross motor, fine motor, cognition, communication, social,* and *self care*.

Goals and Objectives

One major goal of TechTools was to develop and refine a package of two technology-based products and test their feasibility for use by families, caregivers, and service providers in order to improve results of early intervention. The second goal was to improve access to and participation daily life and learning experiences.

Three objectives supported the goals: (1) develop and evaluate the three components of TechTools; (2) implement and evaluate technical procedures required to produce the multi-

platform TechTools CD-ROM; and (3) develop procedures for using elements of the *CORE* on a PDA.

Theoretical Framework

The Foundations of TechTools

TechTools had its foundations in two OSEP-funded projects, the Macomb 0-3 Regional Project and Activating Children Through Technology (ACTT). The Macomb 0-3 Regional Project was replicated in 60 sites in 11 states. In 1980, the project received approval, considered synonymous to national validation of an effective practice, from the U.S. Department of Education's Joint Dissemination and Review Panel (JDRP). The project's activity-based *CORE Curriculum* (Hutinger, Marshall, & McCartan, 1983) was updated and expanded for use in TechTools.

The *CORE* is based on the normal developmental sequence by which infants and toddlers grow and learn, a sequence that remains stable, although children with disabilities vary in rate and sometimes sequence, depending on their disability and environmental contexts. Behaviors in the areas of interest are broken into small steps so that one can notice even tiny demonstrations of a child's progress, easy enough to observe in typically developing children, but difficult to see in children with severe disabilities, whose progress may be very slow. Included in the *CORE* are gross motor, fine motor, cognitive, social, communication, and self-care skills. The *CORE* incorporates sequences of skill-based behaviors and functional behaviors, and suggests activities providers and families can use to help children develop skills. The play-based learning activities in the *CORE* were developed in conjunction with early intervention specialists, physical and occupational therapists, communication professionals, families, and literature related to the sequence of child growth and development.

The birth to three component of ACTT was based on the technology tools available at the time the model was developed, on the *CORE*, and on the findings of the Macomb 0-3 project. The major goal of ACTT was to provide children and their families with technology tools to help children access their environment (Hutinger, Perry, Robinson, Weaver, & Whitaker, 1986). One major assumption, supported by evaluation data (Hutinger, 1993, 1996; Robinson, 1986) and later research by others (Judge & Lahm, 1998; Solano & Aller, 2000; Trachtman & Pierce, 1995) was that when children cannot access the world because of their disabilities, technology applications provide a tool to help them do some things that 'typical' children do (e.g., play with toys, listen to music, communicate, and draw).

ACTT 's purposes were to help infants and toddlers successfully establish a sense of control over the environment—as well as a reason to persist in attempts to do so—and to enhance autonomy and communication (Hutinger, 1987, 1993, 1996). ACTT's technology activities, which were tested and replicated in home-based and center-based early intervention programs in 43 sites in 10 states, incorporated battery-operated toys, switches, computers, interactive software, adapted input device such as expanded keyboards, touch tablets, touch screens, and simple communication devices.

AT Characteristics and Purposes

Assistive technology applications can be characterized as ranging along a continuum (ILDHS, 2001; National Assistive Technology Research Institute, 2003; Parette & McMahan, 2002) from low tech' items, which include adapted eating utensils or paint brush handles, communication boards or cards, and switch-operated toys, to 'high tech' items, such as communication devices and computers. The broad purposes of AT include "*1) assistance in acquisition of new skills, 2) making the environment more accessible at levels of specific tasks and mobility in general, 3) increasing independence in activities of daily living, 4) easing the*

processes of caretaking, and 5) increasing the quality of life for the infant and toddler and his or her family." (Robinson, 2001, p. 4).

Benefits of Technology in Early Intervention

Since the early 1980's, researchers have studied the effects of electronic technologies on children with disabilities, ages birth to three. The foundations of TechTools were important parts of those studies which documented the multiple benefits of AT for this age group. When infants and toddlers use assistive technology, they are likely to become more independent, gain access to and engage in daily activities, improve their interactions with peers, and experience greater control over their environment. Levels of self-esteem, self-confidence, and communication increase.

Technologies function as tools for children. AT devices and services allow infants and toddlers with disabilities access to the daily routines and experiences enjoyed by those without disabilities (Campbell, McGregor, & Nacik, 1994; Langone, Malone, & Kinsley, 1999). AT provides access to play, language, and socialization (Behrmann, Jones, & Wilds, 1995). Research and practical experience suggest that children with disabilities who have experiences with technologies are more likely to experience success than those without such access (Hutinger, 1994).

Intervening early with technologies produces positive changes, even in infants (Brinker, 1984; Brinker & Lewis, 1982; Judge, 2001; Rosenberg & Robinson, 1985; Sullivan & Lewis, 1988, 1990; Tots-n-Tech Research Institute, 2003). AT devices often become an extension of the child, providing a voice, a way to make choices, and a tool to interact with the environment. When Mistrett and colleagues (2001) reviewed AT devices used by infants and toddlers, they found 56% of the devices were designed to increase interaction with materials, 33% to increase movement, and 11% to increase communication.

Assistive technology shows promise for positively impacting a number of developmental arenas. AT makes it possible for children to act on and receive a response from the environment (Robinson & Robinson, 1983; Wilds, 1989). Moreover, AT makes it possible for infants and toddlers with disabilities to overcome their limitations and engage in play (Behrmann, 1984; Brinker & Lewis, 1982; Lane & Mistrett, 1996; Swinth, Anson & Deitz, 1993; Wright & Nomura, 1985). Children have opportunities to respond to their environment and become active participants.

In spite of AT's promise for positively impacting EI results, interest in applying AT to EI has been minimal and sporadic. From 1995-2000, only 4% of children in EI programs received some type of AT device or service (Danaher, Armijo, & Lazara, 2006; Wilcox, Bacon, & Campbell, 2004). That number decreased to 3% from 2001-2003 (Danaher et al., 2006). Resistance to AT use for infants and toddlers is commonplace (Dugan, Campbell, & Wilcox, 2006; Mistrett et al., 2001; Sullivan & Lewis, 2000; Wilcox et al., 2004), despite evidence that adding technology tool applications to an array of natural experiences enhances access, learning, attention, communication, and social skills (DuBois, 1997; Hutinger & Johanson, 1998; Mistrett et al., 2001; Mistrett, 2004; Sullivan & Lewis, 2000; Swinth, 1998).

Providers, caregivers, and parents need more information and training about using AT with infants and toddlers (Sawyer, Milbourne, Dugan, & Campbell, 2005; Wilcox, Dugan, Campbell, & Guimond, 2006; Wilcox, Guimond, Campbell, & Moore, 2006). A review of 104 articles on AT from 1980 through 2004 identified the need for effective practices for infants and young children with disabilities to include "*a wide range of devices, across different types of disabilities, and across a variety of settings*" (Campbell, Milbourne, & Wilcox, 2006, p. 8). The number one reason families and providers give for not using AT is limited information. Other limitations sited include resource availability, funding, and geographic barriers (Campbell, 2003).

Universal Design

Technology and toys used in *TechTools* incorporate principles of universal design, defined here in reference to electronic toys and software that can be used with the widest range of infants and toddlers. These electronic toys and software programs offer multiple means of expression and engagement; are readily available, inexpensive, easy to use; and have features that appeal to many senses (Burgstahler, 2007; Center for Universal Design, 1997; Family Center, 2006). The Center for Applied Special Technology (CAST), earned international recognition for developing innovative, technology-based educational resources and strategies based on the principles of Universal Design for Learning (UDL). UDL calls for "*Multiple means of representation,*" to give learners various ways of acquiring knowledge; "*Multiple means of expression,*" to provide learners alternatives for demonstrating what they know; and "*Multiple means of engagement,*" to tap into learners' interests, offer appropriate challenges, and increase motivation (Rose, 2001).

Mistrett and Ruffino (2006) created a *Universal Design for Play Tool (UDPT)* that families, service providers, consumers, and toy designers can use to assess children's toys. Six factors are considered: the toy's appeal, ease of use, adjustability, and promotion of development; the clarity of how to play with the toy; and different ways to play with the toy. A five-point Likert scale is used to evaluate each factor. The highest total *UDPT* score is 30. The 37 toys used in *TechTools* were analyzed using the *UDPT*. Toys' scores ranged from 20.8 to 29.

Natural Environment and Early Intervention

All young children, whether they have disabilities or not, deserve learning activities based on content that helps them understand and experience their world. Effective early interventionists understand the importance of incorporating elements of daily experience into curriculum.

IDEA 2004 Part C requires services to families of infants and toddlers be provided in *natural environments* that include "*the home and community settings in which children without disabilities participate.*" Natural environments encourage participation in naturally occurring events such as play and daily routines of life at home and with caregivers (Bricker & Cripe, 1992; Educational and Developmental, n.d.; Sandall, Hemmeter, Smith, & McLean, 2005). With the economic necessity of both parents needing to work—sometimes more than one job—natural environments may realistically consist of varying group childcare settings (Sandall et al., 2005; Smith, 2000).

In 2006, 56% of mothers with children under age three were in the workforce (U.S. Department of Labor, 2007). The proportion of children in childcare that year remained the same as in 1995, with nearly 12 million children receiving care by persons other than their parents (Federal Interagency, 2007).

TechTools was based on the assumption that learning takes place while children are engaged in every day activities and routines across environments. When an infant has a disability preventing his or her exploration and interaction with the environment, ongoing development is delayed or may not occur. Identifying the specific skills and knowledge children learn, or will probably learn, while engaging in varied integrated activities and experiences is critical for interventionists and reassuring for families (Hutinger, 1988, 1994). Infants and toddlers with disabilities cannot always make use of the opportunities their environments offer without the technology that make the settings accessible. *TechTools* was designed to assist families and EI providers in determining appropriate AT and experiences that can be used in any of these settings.

Description of the TechTools Product

The *TechTools* package consists of a database on CD-ROM, a recordkeeping function for a PDA, and technology activities. The product is packaged in a 9" x 7" binder that houses 84 printed, tabbed Technology Activity cards and the CD-ROM containing the *TechTools* database (described in the following paragraphs), the technology activities in .pdf format, an introduction to the product, and a brief video explaining how to use the database.

Components of *TechTools*

The *TechTools CD-ROM (TechTools)* contains three components: *CORE Curriculum*, Technology Activities, and Daily Experiences. Its content is based on research and practice, reflects recent developments and applications in the field, and incorporates appropriate and effective multimedia. *TechTools* is intended to improve the results of early intervention and to provide access to and participation in daily experiences in natural environments for infants and toddlers with disabilities or at risk. Each of the three components is described in the following sections.

Component 1: The *CORE Curriculum (CORE)*. A major component of *TechTools* is the *CORE*, a set of tested birth to three learning experiences, developed by the Macomb 0-3 Regional Project (Hutinger et al., 1983). (See page 2.) As TechTools staff updated the *CORE* and checked for continuing relevancy, they cross-referenced the *CORE* with the *AEPS (Assessment, Evaluation, and Programming System) for Infants*, and the *HELP (Hawaii Early Learning Profile)*. The *AEPS*, a curriculum-embedded assessment system, incorporates goal development for infants and toddlers in six developmental areas and can be used for both ongoing and periodic evaluations. The *HELP* is a curriculum-based assessment developmentally sequenced, covering 685 skills in six domains. In addition, TechTools staff reviewed over fifty journals and books to update information and references in the *CORE*.

The *CORE* was revised to reflect universally recognized and accepted language in order to be more easily understood by caregivers and family members. Updates were sensitive to family concerns, goals, and expectations for children (Carlson & Harwood, 1999/2000). Revisions to the *CORE* also focused on person-first language (e.g., *a child with disabilities* rather than a *handicapped child*).

A new and important revision to the *CORE* was the addition of images and video to illustrate skill sequences. Staff collected over 165 images and 23 minutes of video, which were evaluated for appropriateness in demonstrating specific skill areas and sequences. Those deemed appropriate were used in the *CORE*.

Component 2: Technology Activities. The technology component was based on birth to three technology activities developed and tested during Activating Children Through Technology (ACTT), an OSEP-funded model development and outreach project (Hutinger, 1993, 1996). (See page 3.) TechTools staff reviewed existing activities from ACTT's birth to three component and evaluated new materials on the market, particularly technology-based toys targeting infants and toddlers. The toys were evaluated based on their contribution to the development of skills in the *CORE* areas, on their Universal Design (see page 6), and on their appeal to the interests and abilities of children under age three. Staff revised ACTT activities then cross-referenced them to the *CORE* skills and sequences.

Component 3: Daily Routines and Events in the Natural Environment. The term "natural environments" may encompass not only a child's home but also childcare and community settings. *TechTools* was designed to assist families and providers in determining appropriate technology and experiences for use in any of these settings. Each skill sequence in the *CORE Curriculum*, Component 1, contains activities relating to daily routines and experiences of infants and toddlers and their families in the natural environment, whether that

environment is the home, a day care, or community settings.

Description of the *TechTools* Database

The *TechTools* database was developed for and works in conjunction with *FileMaker Pro 8.5* or later. A user needs to have basic knowledge of databases to operate the product successfully. *FileMaker Pro 8.5* must be installed on the user's computer for the *TechTools* database to work.

The interface of the CD-ROM contains six main areas that can be accessed from each page in the database: the *Child Record, PLAN, CORE, Technology Activities, Contacts*, and *Reports*. Each of these areas is color-coded so that if a person is in a main area, that area is identified not only by text, but also by color. A "find" icon is located at the top of each area, allowing a user to search the entire database by key word(s).

The *Child Record* contains a general area for recording a child's personal information including name, birth date, and identifying number. The date-of-birth field features a drop-down calendar for easily entering the date. After a date is entered, a calculation field displays the child's age in years, months, and days. Additional personal information is entered in a tabbed field showing the child's street address, city, state, zip code, phone number, contact name, and the relationship of the contact (parent or guardian) to the child. A second tabbed area displays a child's evaluation scores by percentage of delay and age equivalence. Scores can be entered from the initial evaluation through further 6-month and annual evaluations for comparison of gains and losses across time. A third tabbed area in the *Child Record* contains early intervention authorization information. Fields include authorization start date, end date, procedure information, frequency information, type of authorization, place of service authorized, service coordinator name, primary care physician, diagnosis code, and fields for entering names of other providers.

The *PLAN* contains a script field that allows the user to find a child from a list of children's names contained in the *Child Record*. Once selected, the child's personal information automatically fills into the form. This information includes full name; birth date; age in years, months, and days; and identifying number. *PLAN* features a drop-down calendar for entering the date of service and fields for entering information such as the site where service was provided (home, daycare, other), time in, and time out. A calculation field enters the duration of the service. Number of units of service can also be recorded. *PLAN* also contains fields for the skill sequence or objective of the visit as well as planned activities. Skill sequences are captured from the *CORE* database and used for planning activities for a child. Records can be added and deleted to this section with a click on a button. *PLAN* can quickly capture an activity from the *CORE* or can be edited to include activities and strategies from curricula that might already be used in a child care center.

The *CORE*, the database used in conjunction with the *PLAN*, contains six developmental areas critical to children's interactions with people, objects, and events in their environment: *gross motor, fine motor, cognition, communication, social,* and *self care*. Each developmental area can be easily accessed with a click on a button. The *CORE* Skill Area and developmental sequences are then displayed, along with suggested activities and, if appropriate, an image or QuickTime video illustrating the skill sequence. A user can customize the *CORE* by adding activities related to a skill sequence.

TechTools contains 84 activities representing 37 toys divided by different age groups: four activities with children birth-6 months; one activity with children 3-6 months; one activity with children 9-12 months; 13 activities with children 6-12 months; 20 activities with children 12-18 months; 20 activities with children 18-24 months; and 25 activities with children 24-36 months. The *TechTools* package comes with 8.5" x 6" activity cards already printed, tabbed, and

part of the *TechTools* binder, separated by age for each technology toy. Each of the activities is also available on the CD-ROM as a separate, printable .pdf file, useful for replacing lost or damaged cards or for printing activities to leave with families.

The layout of *Technology Activities* includes fields for the activity title, suggested age for the activity, goals and purpose of the activity, child outcomes related to the *CORE*, and recommendations for introducing and playing with the technology toy. Records can be sorted by name or by age. They can also be edited so new ideas for using each activity or additional toys can be added to the database.

The *Contacts* section was developed to maintain names and addresses of other early intervention providers and professionals. This section contains fields for name, phone, email, and address information. Records can be added and deleted to this section with a click on a button.

In the *Report* section, a user can access two types of reports. One will run a report related to the *PLAN*. This report names a child and lists skill sequences and activities that were used with him or her and the dates they were used. The second report runs a list of children and their contact information.

***TechTools* on PDA**

The TechTools staff developed a process by which a provider could use his/her PDA to collect child data. The result is a simple PDA data collection tool that can be used prior to and after working with a child. The PDA user must first purchase *FileMaker Mobile 7* then set up his/her PDA with *TechTools* to select the fields to be transferred from the *PLAN*. The database transfers information found on the *PLAN* in the *TechTools* database to the PDA and any changes made on the PDA back to the *TechTools* database. Information entered on the PDA overrides information entered on the desktop database. This information can be pulled out in report form to show objectives for a session and the session date. An additional checkbox indicates whether or

not an objective was achieved.

Product Testing

TechTools established a five-member Advisory Panel that participated throughout the project period. Members included two parents of children with disabilities, an expert in early intervention assistive technology, the coordinator of a state technical assistance project, and a coordinator of a home-based program for children at risk. Each member agreed to review and evaluate selected content of TechTools materials.

Two agencies agreed to participate in field-testing portions of *TechTools*. Wesley Child Care agreed to provide space and access to children so TechTools staff could test toys and technology activities. Consent forms were collected from 33 (70%) of the 47 families in all Wesley classrooms housing children ages 6 weeks to 3 years. The second agency, Early Beginnings, a state-funded at-risk program, agreed to test the full product. Sixteen parents (100%) signed consent forms for their children's participation.

TechTools staff maintained a resource library of 64 technology-based toys and assistive devices, including Aquadoodle, Baby Learn Along Piano, Busy Ball Popper, Gazillion Bubbles, Lullaby Gloworm, Mozart Magic Cube, Musical Shape Sorter, Rhyme and Discover Book, Sunshine Symphony, and Touch and Tug Discovery Book, as well as a variety of switches. Toys were ordered, catalogued in a *FileMaker Pro* database, and offered for loan to providers and families. During field-testing, providers and families had access to all toys and assistive technology devices. Toys tested at Wesley Day Care were left for teachers' use. Early Beginnings staff checked out 17 toys from the resource library for the activities they tested. Two Early Beginnings families subsequently checked out toys to see how their children would respond to them.

Toys were field-tested at Wesley Child Care Facility, a day care center in Macomb,

Illinois. Evaluation involved observations of children playing with the toys and informal interviews with teachers. Features evaluated included children's interest in a toy, each toy's durability, and use of the toys by children in different age groups.

Prior to field-testing the technology activities, each Advisory Panel member reviewed the TechTools Activity Reports, instruments that would first be used to collect information related to the development of the technology activities and later used by field-testing personnel who evaluated the activities. Panel members reviewed the instrument to see if it would provide sufficient information about the activities (i.e., who selected the activities, how well the activity was received, the setting in which the activity was implemented, adaptations used for the activity, the child's response, and if the early intervention personnel thought the activity would make a difference in the development of the child). Panel members were asked to consider how the questions were worded, if the questionnaire would provide the type of information necessary for the evaluation, or if additional questions were needed. Each of the five members returned comments that were considered when TechTools staff refined the activity report.

Advisory Panel members reviewed the technology activities after they were developed. The activities were divided evenly among panel members with consideration given to each panel member's expertise with specific subject matter and age group. Panel members provided information regarding the activities' appropriateness for the age group identified and the skill areas identified for each activity. Each panel member gave feedback. Revisions were made to activities based on that feedback. Two activities were eliminated as a result of Advisory Panel feedback.

Technology activities were field-tested by four early childhood at-risk providers. Each provider was asked to choose technology activities that addressed specific goals identified for each of four children. Four providers tested 23 activities over a 1-month period. Of the 23

activities, 22 were found to increase a child's skills in one or more of the six *CORE* developmental areas. One caused children some frustration yet was ultimately included because providers commented that it had potential to increase cognitive, communication, and motor skills.

Four early intervention providers tested the *TechTools* database. The providers were asked to evaluate the database on 18 different items ranging from organization, images, text, content, appropriateness, presentation, printing, and navigation features. All providers rated the 18 items as *average* to *excellent*. Positive feedback identified strong features of the database:

- excellent activities and content
- variety of activities available from which to choose
- calculation feature for determining a child's age
- *Technology Activities* labeled by age
- ease in identifying skills
- color-coding which made navigation easier
- ease in following the *PLAN*s
- ability adapt the tool to use in conjunction with a program's existing strategies and curriculum

Weaknesses reported included difficulty with printing the activities from the CD-ROM, questions about age appropriateness of some activities, difficulty finding activities related to a certain age, problems with navigation between the *CORE* database and the *PLAN*, and problems with the telephone number field on the Child information form turning numbers into symbols and letters. Revision tasks addressed all but one weakness. The telephone number field was revised from a numerical field to a text field. The *Technology Activities* layout was revised so that all activities were one page long, allowing the print function to work so that each record

corresponded with a page number for printing. Two sort functions were added to the *Technology Activities* to sort activities by age and by name. Navigation features were changed between the *CORE* and the *PLAN* to eliminate an extra step when using the *PLAN* and navigating between the two areas. No activities were eliminated.

Product Availability

TechTools is available from the Center for Best Practices in Early Childhood, 32 Horrabin Hall, Western Illinois University, Macomb, Illinois 61455.

References

Behrmann, M. (1984). A brighter future for early learning through high tech. *The Pointer, 28*(2), 23-26.

Behrmann, M.M., Jones, J.K., & Wilds, M.L. (1995). Technology intervention in very young children with disabilities. In J.A. Blackman (Ed.) *Technology in early intervention*. (10-23). Gaithersburg, MD: Aspen.

Bricker, D., & Cripe, J. (1992). *An activity-based approach to early intervention*. Baltimore: Paul H. Brookes.

Brinker, R. (1984). *The microcomputer as perceptual tool: Searching for systematic learning strategies with handicapped infants*. Princeton, NJ: Haworth Press.

Brinker, R., & Lewis, M. (1982). Contingency intervention. In J. Anderson and J. Cox (Eds.), *Curricula for high risk and handicapped infants*. Chapel Hill, NC: Technical Assistance and Development Systems.

Burgstahler, S. (2007). *Universal Design: Principles, processes, and applications*. University of Washington. Retrieved December 20, 2007, from http://www.washington.edu/doit/Brochures/Programs/ud.html

Campbell, P. (2003, November). *Tots-n-Tech*. Poster session presented at the annual meeting of 2003 OSEP National Early Childhood Conference, Washington, DC.

Campbell, P.H., McGregor, G., & Nacik, E. (1994). Promoting the development of young children through use of adaptive and assistive technology. In P.H. Safford, Ed. *Yearbook in early childhood education: Early childhood special education* (192-217). New York: Teachers College Press.

Campbell, P. H., Milbourne, S.D., Wilcox, L.M. (2006). A review of evidence on practices for teaching young children to use assistive technology. *Topics in Early Childhood Special Education 26*(1), 3-13.

Carlson, V., & Harwood, R. (1999/2000). Understanding and negotiating cultural differences concerning early developmental competence: The six raisin solution. *Zero to Three Journal, 20*(3), 19-24.

Center for Universal Design, (1997). North Carolina State University, Raleigh. NC: Author.

Danaher, J. Armijo, C, & Lazara, A. (Eds.). (2006). Part C Updates (8th ed.). Chapel Hill: The University of North Carolina, FPG Child Development Institute, National Early Childhood Technical Assistance Center.

DuBois, S. (1997). Playthings: Toy use, accessibility and adaptation. In B. Chandler (Ed.), *The essence of play: A child's occupation* (pp. 107-128). Bethesda, MD: American Occupational Therapy Association.

Dugan, L., Campbell, P, & Wilcox, J. (2006). Making decisions about assistive technology with infants and toddlers. *Topics in Early Childhood Special Education, 26* (1), 25-32.

Educational and Developmental Intervention Services. (n.d.). *Family-centered early intervention services in natural environments*. Washington, DC: Author.

Family Center on Technology and Disability. (November, 2006). Toys for children with special needs: You can see a lot by observing (interview with Sue Mistrett). *News and Notes, 56,* 1-11.

Federal Interagency Forum on Child and Family Statistics. (2007). *America's children: Key national indicators of well-being, 2007*. Retrieved December 20, 2007, from http://www.childstats.gov/americaschildren/famsoc3.asp

Hutinger, P. (1987). Computer-based learning for young children. In J. L. Roopnarine & J. E. Johnson (Eds.), *Approaches to early childhood education* (pp. 213-236). Columbus, OH: Charles E. Merill.

Hutinger, P. (1988). Linking screening, identification, and assessment with curriculum. In J. Jordan, J. Gallagher, P. Hutinger, & M. Karnes (Eds.), *Early childhood special education: Birth to three* (pp. 29-66). Reston, VA: Council for Exceptional Children.

Hutinger, P. (1993). *Activating children through technology. Final report.* Macomb, IL: Western Illinois University, Macomb Projects. (ERIC Document Reproduction Service No. ED 355744)

Hutinger, P. (1994). Integrated program activities for young children. In L. Johnson, R. Gallagher, M. LaMontagne, J. Jordan, J. Gallagher, P. Hutinger, & M. Karnes (Eds.), *Meeting early intervention challenges: Issues from birth to three* (pp. 59-94). Baltimore: Paul H. Brookes.

Hutinger, P. (1996). *Activating children through technology. Final report.* Macomb, IL: Western Illinois University, Macomb Projects. (ERIC Document Reproduction Service No. ED 395411)

Hutinger, P., & Johanson, J. (1998). Software for young children. In S. Lesar Judge and H. Parette (Eds.), *Assistive technology for young children with disabilities: A guide to providing family-centered services* (pp. 76-126). Cambridge, MA: Brookline.

Hutinger, P., Marshall, S., & McCartan, K. (1983). *Macomb 0-3 CORE Curriculum*. Macomb, IL: Western Illinois University, Macomb Projects.

Hutinger, P., Perry, L., Robinson, L., Weaver, K., & Whitaker, K. (1986). *ACTT curriculum*. Macomb, IL: Western Illinois University, Macomb Projects.

Illinois Department of Human Services. (2001). *Early Intervention Assistive Technology Guidelines.* Springfield, IL: Author.

Judge, S. L. (2001). Computer application in programs for young children with disabilities: Current status and future directions. *Journal of Special Education Technology, 16*(1), 29-40.

Judge, S. L., & Lahm, E. (1998). Assistive technology applications for play, mobility, communication, and learning for young children with disabilities. In S. Lesar Judge & H. Parette (Eds.), *Assistive technology for young*

children with disabilities: A guide to providing family-centered services (pp. 16-44). Cambridge, MA: Brookline.

Lane, S., & Mistrett, S. (1996). Play and assistive technology issues for infants and young children with disabilities: A preliminary examination. *Focus on Autism and Other Developmental Disabilities, 11*(2), 96-104.

Langone, J., Malone, D.M., & Kinsley, T. (1999). Technology solutions for young children with developmental concerns. *Infants and Young Children, 11*(4), 65-78.

Mistrett, S. (October, 2004). Assistive technology helps young children with disabilities participate in daily activities. *Technology in Action*, *1*(4), 1-8.

Mistrett, S.G., Hale, M.M., Gruner, A., Sunshine, C., & McInerney, M. (2001). *Synthesis on the use of assistive technology with infants and toddlers (Birth - Two).* American Institutes of Research: Washington, DC.

Mistrett, S., & Ruffino, A. (2006). *Universal design for play guidelines*. Buffalo, NY: Let's Play! Center for Assistive Technology, University at Buffalo. Retrieved November 4, 2007, from http://letsplay.buffalo.edu/UD/ud_toy_features_1.htm

National Assistive Technology Research Institute (2003). *Assistive Technology Continuum*. Retrieved April 12, 2004, from http://natri.uky.edu/resources/fundamentals/defined.html

Parette, P. & McMahan, G. (2002). What should we expect of assistive technology? Being sensitive to family goals. *Teaching Exceptional Children*, *35*(1), 56-61.

Robinson, C. (2001). *AT—Access*. Denver: University of Colorado, Health Sciences Center, JFK Partners.

Robinson, C., & Robinson, J. (1983). Sensorimotor functions and cognitive development. In M. Snell (Ed.), *Systematic instruction of the moderately and severely handicapped* (2nd ed., pp. 227-266). Columbus, OH: Charles E. Merrill.

Robinson, L. (1986). Designing computer intervention for very young handicapped children. *Journal of the Division for Early Childhood, 10*(3), 209-215.

Robinson, L. (2003). A new way to learn: Guidelines for choosing developmentally appropriate software for young children. *KANSAS Child*, *2*(4), 12-13.

Rose, D.H. (2001). Universal design for learning: Deriving guiding principles from networks that learn. *Journal of Special Education Technology 16*(1): 66-70.

Rosenberg, S., & Robinson, C. (1985). Enhancement of mothers' interactional skills in an infant education program. *Education and Training of the Mentally Retarded, 20*, 163-169.

Sandall, S., Hemmeter, M.L., Smith, B.J., & McLean, M.E. (2005). *DEC recommended practices: A comprehensive guide for practical application in early intervention/early childhood special education*. Longmont, CA: Sopris West.

Sawyer, B., Milbourne, S., Dugan, L., & Campbell, P. (2005). Report of assistive technology training for providers and families of children in early intervention. *Research Brief, 2*(1). Tots-n-Tech Research Institute. Available from http://tnt.asu.edu

Smith, K. (2000). Who's minding the kids? Child care arrangements. *Current Population Reports*. Washington, DC: U.S. Census Bureau.

Solano, T., & Aller, S. (2000, June). Tech for tots: Assistive technology for infants and young children (Part 1). *Exceptional Parent Magazine,* 44-47.

Sullivan, M., & Lewis, M. (1988). *Contingency intervention: A program portrait*. Paper presented at the 1988 International Conference on Infancy Studies, Washington, DC.

Sullivan, M., & Lewis, M. (1990). Contingency intervention: A program portrait. *Journal of Early Intervention, 14*(4), 367-375.

Sullivan, M., & Lewis, M. (2000). Assistive technology for the very young: Creating responsive environments. *Infants and Young Children, 12*(4), 34-52.

Swinth, Y. (1998). Assistive technology in early intervention: Theory and practice. In J. Case-Smith (Eds.), *Pediatric occupational therapy and early intervention* (2nd ed.). Boston, MA: Butterworth-Heinemann.

Swinth, Y., Anson, D., & Deitz, J. (1993). Single-switch computer access for infants and toddlers. *The American Journal of Occupational Therapy, 47*(11), 1031-1038.

Tots-n-Tech Research Institute. (2003). *What are the benefits of using AT with my child?* Retrieved December 20, 2007, from http://tnt.asu.edu/clas/tnt/home_files/e/early.html#FAQ2

Trachtman, L., & Pierce, P. (1995). *North Carolina infant, toddler & preschooler assistive technology needs assessment. A report on the provision of assistive technology devices and services to children with disabilities from birth to age 5 in North Carolina*. Raleigh, NC: North Carolina State Department of Human Resources.

U.S. Department of Labor, Bureau of Labor Statistics. (2007). *Employment characteristics of families in 2006*. Retrieved December 20, 2007, from ftp://ftp.bls.gov/pub/news.release/famee.txt

Wilcox, M., Bacon, C., & Campbell, P. (2004). National survey of parents and providers using AT in early intervention. *Research Brief, 1*(3). Tots-n-Tech Research Institute. Available from http://tnt.asu.edu

Wilcox, M., Dugan L., Campbell, P., Guimond, A. (2006). Recommended practices and parent perspectives regarding AT use in early intervention. *Journal of Special Education Technology*, *21*(4), 7-16.

Wilcox, M.J., Guimond, A., Campbell, P., & Moore, H. (2006). Provider perspectives on the use of assistive technology for infants and toddlers with disabilities. *Topics in Early Childhood Special Education*, *26*(1), 33-49.

Wilds, M. (1989). Effective use of technology with young children. *National Information Center for Children and Youth with Disabilities (NICHCY) News Digest, 13,* 6-7.

Wright, C., & Nomura, M. (1985). *From toys to computers*. San Jose, CA: C. Wright.