DOCUMENT RESUME

ED 395 411 EC 304 804

AUTHOR Hutinger, Patricia L.
TITLE Activating Children through Technology. Final Report.
INSTITUTION Western Illinois Univ., Macomb. Coll. of Education and Human Services.
SPONS AGENCY Special Education Programs (ED/OSERS), Washington, DC. Early Education Program for Children with Disabilities.
PUB DATE Apr 96
CONTRACT H024D20044
NOTE 41p.; For other reports issued by this project, see ED 355 744, ED 378 773, and ED 379 887.
PUB TYPE Reports - Evaluative/Feasibility (142)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Assistive Devices (for Disabled); Consultation Programs; *Disabilities; Early Childhood Education; *Educational Technology; Infants; Inservice Education; *Outreach Programs; *Technical Assistance; Technological Advancement; Toddlers; Young Children

ABSTRACT

This final report describes accomplishments and activities of the 3-year Activating Children Through Technology (ACTT) Outreach program at Western Illinois University, which focused on the integration of assistive technology into early childhood services for children (ages birth to 8) with disabilities. Objectives included: awareness activities; replication; product development, revision, and dissemination; training; consultation including cooperative work on a diagnostic team; assisting states; and local, regional, and national cooperative activities. The program, which trains trainers or direct service delivery staff, provided services responsive to the federal emphasis on assistive technology services. It developed three replicable components: ages birth to three, three to five, and severe disabilities. The program received 3,955 requests for technological services, trained 79 site personnel for model replication, and conducted 25 technology workshops. Project products included eight training modules, software programs which support curricular objectives, videotapes of current technology applications used by children, and equipment modification schematics. The final report addresses the project's goals and objectives, theoretical and conceptual framework, project sites and activities, problems and solutions, evaluation findings, impact, and future activities. (Contains 70 references.) (DB)

Activating Children Through Technology

A Final Report for the Project Period
October 1, 1992 - January 31, 1996

Early Education Program for Children with Disabilities
United States Department of Education
Project Number H024D20044
CFDA: 84.024D

Patricia L. Hutinger, Ed.D.
Project Director

Macomb Projects
College of Education and Human Services
Western Illinois University
Macomb, Illinois 61455
309/298-1634
309/298-2305 fax
http:/www.ECNet.Net.users/mimacp/wiu/index.html

April 1996

Table of Contents

List of Tables and Figures

ACTT Outreach Abstract

The primary purpose of ACTT (Activating Children Through Technology) Outreach, housed in Macomb Projects in the College of Education and Human Services at Western Illinois University, is to integrate assistive technology[1] into early childhood services for children, ages birth to eight, with disabilities. Major goals focus on stimulating services, training and replication, assistance to states, and providing a product-development and information dissemination resource. Objectives include awareness activities; replication; product development, revision, and dissemination; training; consultation including cooperative work on a diagnostic team; assisting states; and local, regional and national cooperative activities.

ACTT provides services that are responsive to the federal emphasis on assistive technology services legislated by IDEA, its amendments, and the Technology Related Assistance to Individuals with Disabilities Act of 1988, P.L. 100-407. Requests for replication and training come from Part H and Part B state level personnel, state Assistive Technology projects, other state level agencies, regional agencies, and individual sites. During ACTT's past three years of Outreach work, 3955 requests for technological services were received. We trained 79 site personnel for model replication and conducted 25 technology workshops.

A large number of children, families and staff have benefited directly and indirectly from ACTT Outreach activities. Three ACTT components are replicable, defined according to developmental level, chronological age, severity of disabilities, and most common service delivery strategy: 1) Birth to Three; 2) Three to Five; and 3) Severe Disabilities. ACTT currently has 44 replication sites at different levels of experience in model adoption in 14 states and Canada. Those sites have served 2,147 children. ACTT's three continuation sites served 204 children over the past 3 years. Criteria for replication as well as criteria for determining the entry level of the site (from Level I to Level IV) have been established. ACTT also provides training through numerous workshop and conference presentations. Staff conduct presentations and workshops on-site as well as through the interactive satellite television capabilities housed at WIU.

ACTT Outreach trains trainers or direct service delivery staff depending on the size of the site. Trainees can be any of those identified in the law, including early childhood personnel, occupational or physical therapists, psychologists, communication specialists, other support personnel in early intervention programs, and parents. Training content is organized into eight modules. Sites send trainees to the ACTT site for one or more five day intensive training sessions depending upon the component being replicated and the site's level of computer expertise, or ACTT staff can travel to the site to do training. Trainee outcomes are measured according to

[1] "Assistive technology" refers to those devices and applications which increase, maintain, or improve the functional capabilities of children with disabilities, including computers, alternative input and output, software, dedicated augmentative communication devices, and other aids. The term is used interchangeably with "technology" in ACTT.

technology competencies. Outreach staff provides consultation and follow-up services at the replication site. Sites collect data on children, parents, and staff.

ACTT staff have extensive experience in providing Outreach training as well as inservice and graduate-level coursework. University credit is available to participants of ACTT training sessions.

Products have been developed or revised and disseminated. They include training modules for trainers to use, software programs which support curricular objectives, videotapes of current technology applications used by children, and equipment modification schematics. Existing products have been widely distributed. Products include *Building ACTTive Futures: ACTT's Curriculum Guide for Young Children and Technology*, a software catalog, a guide to peripheral use, a switch construction book, software, and training materials. From October 1992 through September 1995, over 1339 products were distributed. A twenty-page publication is distributed quarterly to sites and subscribers. A database containing names of over 1500 individuals and agencies is maintained.

Continued coordinated activities with other technology applications groups include hosting an annual ACTT Conference and cooperating with the National Cristina Foundation Local Focus pilot sites, the Illinois Assistive Technology Project, as well as Technology Projects in other states, and with national groups focusing on technology for people with disabilities and those who focus on young children with disabilities, since both need our services.

Project ACTT: Activating Children Through Technology
Final Report

Goals and Objectives of the Project

Technology applications, including computer hardware, software, and alternative input such as switches, are learning tools that are no longer seen as frills or unneeded components of early childhood programs by many parents, professionals, and other decision makers. Legislation and practice alike acknowledge and support technology as an important aspect of services to young children with disabilities and their families. A body of research together with a wealth of revealing anecdotal data related to the benefits of technology use by young children exists. Yet instances of effective technology applications in early intervention are scattered, although futurists as well as leaders of education and industry point to the need for the educational system to make dramatic and swift changes so our children can keep pace with societal changes (Ameritech, 1993; Gates, 1995; Thornburg, 1994).

Children with disabilities and their families benefit when they have equitable access to effective technology applications; however, before any potentially wide-sweeping applications can assist children with disabilities, staff and families must know how to implement activities and use the equipment.

Macomb Projects staff anticipated the growing effectiveness of technology early (1981) and have continued to develop and demonstrate state-of-the art model programs and curricula, to train others to use technology applications with children with disabilities and their families, and to develop increasingly sophisticated software and related materials. ACTT's major thrust focuses first on children and families, then on the technology tools and adaptations that can assist children **do** things they have not been able to do—communicate, play with toys, interact with others, draw, and much more.

The **ACTT model** demonstrates use of state-of-the-art computer technology, software, switches, electronic toys, adaptive peripherals, and individual adaptations as well as video technology in direct services to children and families. Applications for older computers and hardware are available. ACTT technology applications are appropriately used in inclusive early intervention and preschool programs. Videotapes are used to record child progress over time, including day to day activities. Families are integral members of ACTT teams, to the extent they wish to be involved. ACTT includes policies to ensure support for equitable access and quality technology use for *all* children and families.

Goals

The four major goals of ACTT Outreach focus on training and replication, product development, widespread dissemination and assistance to states. The goals include the following:

1. Stimulate services nationwide based on current technological innovations to children, ages birth to 8, with disabilities and their families.
2. Train personnel and family members to use developmentally appropriate technology applications and adaptations for children from birth to 8 with disabilities.
3. Assist states to include plans for use of technology with young children in their comprehensive delivery systems and in their plans for the Technology Related Assistance for Individuals with Disabilities Act[1], and to implement those plans.
4. Serve as a national resource in product development related to young children and technology and in disseminating information and delivery strategies.

Objectives

The major objectives needed to accomplish the goals are listed below.

1.0 Accomplish awareness activities focusing on ACTT goals and contributions.

2.0 Stimulate high quality programs which integrate computer technology in their intervention activities, provide training and technical assistance in the implementation of ACTT component replication in Level I, Level II, Level III, and Level IV sites. (Site levels are determined according to the degree of computer expertise the site has when they begin the program.)

3.0 Revise, develop, and disseminate ACTT products, including software, instructional materials, and video training tapes.

4.0 Provide training on topics related to the use of computer technology with young children with disabilities.

5.0 Provide consultation on topics associated with the use of microcomputer technology and young children with disabilities and their families.

6.0 Serve as a resource to states as they develop and implement comprehensive delivery systems that include technology applications for young children with disabilities and as they respond to the Tech Act of 1988.

7.0 Cooperate and participate with other agencies in local, regional, and national activities related to computer technology applications for young children with disabilities.

[1] P.L. 100-407 will be referred to as the Tech Act. The state Assistive Technology Projects will be referred to as Tech Projects.

Theoretical or Conceptual Framework of the Project

ACTT is a tested model that effectively pairs emphasis on early intervention, as evidenced in the components of IDEA[2] (Individuals with Disabilities Education Act - P.L. 102-119), with technology for individuals with disabilities as demonstrated by both IDEA and the Technology Related Assistance for Individuals with Disabilities Act of 1988 (reauthorized in 1994). Originally the ACTT model was based on the early computer-based contingency intervention research of Brinker and Lewis (1982). When ACTT began in 1983, it was the first Handicapped Children's Early Education Program (HCEEP)[3] demonstration project designed to use technology with children, ages birth to 8, with disabilities. ACTT is based on the philosophy that technology offers young children with disabilities a set of tools to assist them in achieving developmental goals across integrated content areas as they interact with the people, objects, and events in their environment.

Although the use of technology with young children with severe disabilities was considered to be a fairly new field of study in the early 1980's, research since that time indicates that intervening with computers and other technologies produce changes in young children, even in infants (Abrahamsen, Romski, & Sevcik, 1989; Behrmann, 1984; Behrmann & Lahm, 1983; Behrmann & Lahm, 1984a, 1984b; Behrmann & Lahm, 1994; Brinker, 1984; Brinker & Lewis, 1982; Haugland, 1992; Hutinger, 1987a, 1987b; Hutinger, in press; Hutinger, Johanson, & Stoneburner, 1996; Parette & Van Biervliet, 1991; Rosenberg & Robinson, 1985; Sivin-Kachala & Bialo, 1996; Sullivan & Lewis, 1988, 1990).

Young children with severe disabilities can use computer technology to produce interesting events (Butler, 1988; Rosenberg & Robinson, 1985; Robinson 1986a, 1986b); to manipulate contingencies (Butler, 1988; Brinker & Lewis, 1982; Sullivan & Lewis 1988,1990); to select activities or objects (Behrmann & Lahm, 1984a, 1984b; Locke & Mirenda, 1988); to interact socially (Hutinger, Johanson, & Stoneburner, 1996; Nastasi & Clements, 1993; Podmore & Craig, 1989; Spiegel-McGill, Zippiroli, & Mistrett, 1989); to operate devices in their environment and to communicate (Herman & Herman, 1989; Hutinger, 1986a, 1986b; Meyers, 1984, 1990; Muhlstein & Craft, 1986; Sartorio, 1993; Shane & Anastasio, 1989; Spiegel-McGill, Zippiroli, & Mistrett, 1989); to develop a sense of control over their environment (Hutinger, 1994; Parette, Dunn, & Hoge, 1995); to solve problems (Hutinger 1987b; Nastasi, Clements, & Battista, 1990; Wright & Samaras, 1986); and to aid mobility (Butler, 1988; Holder-Brown & Parette, 1992).

---

[2]Individuals with Disabilities Act - P.L. 102-119 has not yet been reauthorized.

[3]HCEEP is now Early Education Program for Children with Disabilities or EEPCD.

Positive benefits of technology use over time related to social and emotional outcomes as well as improvements across developmental domains of cognition and communication were reported by Hutinger and colleagues (Hutinger, Hall, Johanson, Robinson, Stoneburner, & Wisslead, 1994; Hutinger, Johanson, & Stoneburner, 1996). Parents and service providers perceived that using assistive technology produced positive effects on the children's academic skills. Children in the study who began using technology in ACTT sites had been using technology for an average of 6.4 years. A group of children who were beginning technology users was also followed. Findings showed barriers related to limited financial resources, few opportunities for staff training, inconsistency between family and staff goals and expectations, and inadequate equipment maintenance. Changes in placements as well as lack of communication and collaboration among school personnel, schools, and families also created obstacles.

Some argue that computers might have negative effects on normally developing young children, but the research does not generally support this view (Sivin-Kachala & Bialo, 1996). However, studies suggest that impact depends on the quality of the software, the attitude of the teachers, the physical and social arrangement, the accessibility of the machine, and on other events occurring in the classroom (Buckleitner, 1996; Campbell & Fein, 1986; Haugland, 1992; Haugland & Shade, 1990; Kristeller, 1996; Shade & Watson, 1990).

Integrating technology, including new interactive computer software, into early childhood activities, is receiving increasing attention among early childhood professionals (Becker, 1990; Buckleitner, 1996; Clements & Nastasi, 1992; Clements, Nastasi, & Swaminathan, 1993; Clements & Swaminathan, 1995; Haugland, 1992; Kristeller, 1996; Wright & Shade, 1994). Campbell and Fein (1986) published results of research related to computers and young children. Some results of the cited studies indicate that preschoolers can work cooperatively, with minimal instruction and supervision, with adequate adult support; that social interaction occurs frequently and positively; that children cooperate, helping and teaching one another; that children gain a sense of competence; and that they can use the keyboard as input to the computer even though they do not know the alphabet. Building upon earlier research findings and best practices, a volume of NAEYC guidelines for computer applications in early childhood is now available (Wright & Shade, 1994).

A single computer can be used by an individual child, two or three children, or by a larger group of children participating in a group activity. The speech capabilities of newer computers or the addition of a speech synthesizer to older models provides a voice to communicate or to stimulate communication. Children and adults can add their own voices in some instances. Combined with graphics and animation, speech output provides an added component to enhance communication (Behrmann & Lahm, 1994; Meyers, 1986, 1990; Shane & Anastasio, 1989).

Technology applications can be integrated into a variety of early childhood curriculum content, including learning about people and places, music, daily activities, dramatic play, emergent literacy, art, and much more.

Early evidence suggests that younger children may benefit more from computer use than older children and that computers may indeed help children learn things in new ways (Beeson & Williams, 1985; Kulik, 1986). In practice, we see repeated evidence of children learning things in new ways (Hutinger, in press). Results of an early study carried out by the ACTT staff (Hutinger 1987b; Hutinger & Ward, 1988) indicated that children with mild to moderate disabilities and developmental delays were able to use an ACTT created version of Instant Logo to solve a variety of problems. Children's problem-solving skills, understanding directions, and social interaction skills (communication, following directions given by peers, turn taking) increased as a result of curriculum activities using Logo. Moreover, children retained those skills over a six-month time span during the summer before Logo was again started in the classroom. These results were replicated with 115 at-risk children in the Head Start PACT/ACTT Partnership in 1990 (Hutinger, Robinson, & Johanson, 1990) and with the children involved in the Springfield Urban League's Project CAPSULE (Hutinger, Johanson, & Clark, 1993).

Description of the Project

Description of the Model

Project ACTT is based on the philosophy that technology offers young children with disabilities a set of tools to assist them to achieve developmental goals. The ACTT model contains procedures for conducting technology activities with switches, battery-operated devices, computers and computer-related activities; designing the technology learning environment; integrating computer activities into a variety of developmental domains and content areas; involving families in planning and interventions; and evaluating child progress and parent participation. The model reflects the fact that the **way** in which the technology is used is more important than what piece of equipment or software is actually being used. ACTT 's work in technology has focused on the Apple computers because their open architecture makes them easy to modify for use with young children. Procedures developed by the project can be used with the Apple IIGS and the older IIe and II+ versions, as well as with the newer Macintosh computers. One of our major strengths is our ability to adapt equipment for necessary applications.

ACTT has three major replicable components 1) Birth to Three; 2) Three to Five; and 3) Severe Disabilities. These components are defined according to 1) the developmental level and chronological age of the child, 2) the severity of the child's disability, 3) and the most common service delivery strategy used with the age range. For example, home-based intervention is more

often used with the birth to 3 population while the classroom is used for the 3-5 year olds. Although chronological age is an artificial factor in determining programs and IEPs for children with disabilities, we have chosen to base the components upon age because it is used as a criterion for placement in the commonly-used program organization in most states where birth to three programs are not mandated by law. When programs for children beginning at age three are mandated, they are found in public schools. The age range for children in the Severe Disabilities Component is birth to eight.

Each component includes developmental activities (or "curriculum"), procedures for hardware and peripheral use as well as adaptations, suggested software and its applications, necessary competencies for service delivery staff, management, procedures for working with families, and evaluation techniques. Similarities between procedures, equipment and activities are found in the Birth to Three Component and the Severe Disabilities Component.

The ACTT developmentally-based curriculum is easily integrated into an existing early intervention curriculum and emphasizes strategies to integrate technology into preschool curriculum content as part of ongoing learning activities. Adoption of the ACTT model provides computer activities to aid in problem solving, communication, social interaction, gaining a sense of autonomy, competency, and other important learning for young children with disabilities. The ACTT model also provides tested strategies for family participation and for integrating children with disabilities into the types of settings in which young children without disabilities would participate.

Learning experiences for children. Use of technology as demonstrated by the model is highly effective in empowering children with disabilities or developmental delays when they learn to use technology applications. The ACTT curriculum is designed to: 1) foster the child's expectations of control over the environment; 2) provide an opportunity to participate in equalized play activity; 3) provide communication possibilities; and 4) enhance development of problem solving and general thinking skills, as well as related preschool curriculum skills. ACTT depends on a team approach in assessing and determining the most beneficial technology activities for individual children.

Children with moderate to severe disabilities need assistive technology applications. Technology can serve as an equalizer for a child with disabilities in many situations so that s/he can function in the same settings and similar activities that typical young children do, including playing games, interacting socially, drawing, and making music. Technology activities can assist in all these experiences.

Families. Families participate in the ACTT model at three different levels, depending on their choices. The three levels include 1) obtaining information and observing; 2) assisting with the computer intervention; and 3) conducting the computer intervention. ACTT training modules

contain procedures for involving families and providing training on the use of technology with their children. *Building ACTTive Futures* contains a section on parent participation at all three levels for each of the three components (Birth to Three, Three to Five, and Severe Disabilities).

Equipment. Equipment children use in ACTT includes switches, battery-operated toys and devices such as tape recorders, computers, color monitors, CD-ROM drives, and printers. Added to these are adaptive peripherals such as graphics tablets (pressure-sensitive devices that children can use to draw or use to give the computer "input" signals similar to pressing a key on the keyboard); touch tablets, such as a TouchWindow that attaches to the monitor permitting the child to draw or control a program by touching the screen with a finger; alternate keyboards such as IntelliKeys; and other devices that allow young children with disabilities to easily access the electronic potential of the computer. These peripherals are easy to operate; however, training and expertise are needed for set up and troubleshooting.

Contrary to what some computer salespeople or ads suggest, most computer applications take a degree of technological sophistication that beginners do not have. Helping our site staff and our trainees learn to set up computer equipment, connect and operate peripherals, troubleshoot when something does not work, and know when they need to call in expert help, is one of ACTT's secondary purposes.

The ACTT training modules, used for both families and professional staff, contain information on how to use equipment and peripherals, make adaptations, and design integrated curriculum applications. The curriculum activities in *Building ACTTive Futures: ACTT's Curriculum Guide to Young Children and Technology* are designed to encourage communication, cooperation and other social interaction among children and the people in their environment. ACTT's approach stresses the need to let children explore and manipulate the variety of inputs and outputs the computer allows and to give them an opportunity to feel and demonstrate a sense of control over their environment.

Description of Sites and Levels

A list of agencies we serve, together with their resources and the numbers of children they serve, is included in Table 1. Currently ACTT has three continuation sites and 44 active replication sites in 14 states and Canada.

A measure of interest in participating in ACTT is the amount of financial support and resources agencies provide for replication and training. Agencies pay expenses for their staff to travel to Macomb, Illinois, for a week of ACTT training. In most instances, they also pay for ACTT staff to travel to their replication sites for follow-up. Many agencies pay for ACTT staff to travel to their sites to provide two-day awareness and hands-on workshops for an entire staff. A variety of sources are used to fund ACTT replication sites, including federal and state grants and

Table 1. ACTT Outreach Sites According to Levels of Involvement

ACTT Outreach Sites According to Levels of Involvement	Children Served	Staff	0-3	Preschool	Both
LEVEL II					
Bona Vista Programs - Kokomo, Indiana	64	11			√
Carthage Community Unit District #338 - Ferris, Illinois	9	1		√	
Coulee Children's Center 0-3 - LaCrosse, Wisconsin	126	20	√		
Crystal Lake Elementary School, District #47 - Crystal Lake, IL	60	20		√	
Developmental Therapy Center - Huntington, West Virginia	128	7			√
Early Intervention Services - Peoria, Illinois	90	12	√		
Franklin Elementary School - Muscatine, Iowa	16	7		√	
Gateway Services, Inc. - Princeton, Illinois	25	2	√		
Harlem School District #122 - Love Park, Illinois	60	7		√	
Josephine County Early Intervention - Grants Pass, Oregon	110	22			√
Rehabilitation Center of Sheboygan - Sheboygan, Wisconsin	100	17	√		
Valley View Schools - Romeoville, Illinois	20	2		√	
Warren Achievement - Birth to Three - Monmouth, Illinois	10	2	√		
LEVEL III					
Cabell Co. - Huntington, West Virginia	60	15		√	
Early-On - West Frankfurt, Illinois	50	6	√		
Easter Seal Society of HI/Kauai Service Center - Lihue, Kauai, HI*	35	10	√		
Geisinger Elementary, Conroe ISD - Conroe, Texas	9	3		√	
Hilo Easter Seal Society - Hilo, Hawaii*	50	8	√		
Hope School - Springfield, Illinios	60	2		√	
Hopewell Special Ed. Regional Resource Center - Hillsboro, OH**	52	6		√	
IMUA Rehab - Wailuku, Maui, Hawaii*	100	11	√		
Just Kids Early Childhood Learning Center - Middle Island, New York	700	300		√	
Kapiloani Medical Center for Women & Children - Honolulu, HI*	200	33	√		
Knox County Elementary School - Edina, Missouri	16	7		√	
Kona Infant Development Program - Kaulakekua, Hawaii*	68	6	√		
Lanakila Infant Program - Honolulu, Hawaii*	52	7	√		
Leeward Early Intervention Program - Pearl City, Hawaii*	76	9	√		
Macon/Piatt Special Education District - Decatur, Illinois**	180	69		√	
Parent-Child Development Center - Waianae, Hawaii*	88	6	√		
Project CHILD - Trenton, New Jersey*	150	30	√		
Sangamon Area Special Education - Springfield, IL	20	5		√	
Sultan Easter Seal School - Honolulu, Hawaii*	60	8	√		
Town Day Care Centre - Nova Scotia, Canada	95	15		√	
United Cerebral Palsy Development Center - Honolulu, Hawaii*	8	7	√		
Wahiawa Infant/Toddler Development - Wahiawa, Hawaii*	40	9	√		
Washington City Schools/Sp Ed Preschool - Washington Court, Ohio	14	1		√	
William M. BeDell Achievement and Resource Center - WoodRiver, IL	62	32			√
Windward Infant Development Program - Kaneohe, Hawaii*	40	6	√		
LEVEL IV					
Bushnell Prairie City Community Unit District #170 - Bushnell, IL	13	2		√	
Habilitative Systems, Inc. - Chicago, Illinois	100	12		√	
LAUREL Regional Program - Lynchburg, Virginia**	56	40		√	
Signal Centers - Chatanooga, Tennessee**	140	8			√
Society for Manitobans with Disabilities, Inc. - Winnipeg, Canada**	250	35		√	
Union District #115 - Biggsville, Illinois	14	2		√	
CONTINUATION SITES					
Bridgeway 0-3 Program - Macomb, Illinois	40	6	√		
Galesburg Early Childhood Education - Galesburg, Illinois	30	4		√	
West Central Illinois Special Ed. Cooperative - Macomb, Illinois**	5	4		√	
Current Replication and Continuation Sites Total	**3751**	**854**	**20**	**22**	**5**
presents a State Level Agency commitment			**21**	**23**	**6**
presents a Regional commitment					

private foundations. In the past 12 months, various agencies have contributed over $7,600 in travel expenses for ACTT training plus $3,000 in travel expenses for ACTT Outreach staff to travel to sites for follow-up.

Replication sites are classified according to their level of existing computer experience and skill and the number of personnel in their agency who are involved in ACTT replication. Sites with 10 or fewer staff members can send their entire staff for training or two persons to be trained as trainers who can then go back and train the remainder of the staff. ACTT training modules, instructional videotapes developed by the Microcomputer Applications Special Project, and a multimedia product developed by Project TTAP (Technology Team Assessment Process) are used by site trainers to facilitate training other staff members. Sites with more than 10 personnel can send one person for each five staff members to be trained as a trainer. Since learning to use a computer is frequently an anxiety-producing experience for service delivery staff, we spend differing amounts of time training sites, depending on prior computer experience. The ACTT competencies are used to determine entry and exit levels for sites.

Level I sites are those that have had little or no previous computer training or experience. They receive initial training on computer use either through ACTT or through their own state or local resources. Level I sites systematically begin to integrate computer activities into their existing curriculum and begin data collection. If needed, ACTT staff provide additional training and follow-up until it is determined that adequate computer skills have been acquired by staff to begin Level II training.

Level II sites are those whose staff have acquired or demonstrated basic computer skills. These sites receive initial training on the ACTT curriculum. After completion of initial training, sites begin implementation of the ACTT curriculum and data collection. ACTT staff provide follow-up to determine what additional competencies will be required to allow full implementation of the curriculum.

Level III sites are those that have received the necessary training to fully implement the ACTT curriculum. These sites keep child data based on curriculum goals and objectives. ACTT staff provide assistance in data collection and analysis procedures. Additionally, Project staff provide follow-up support on curriculum training and determine if the agency requires specific specialized training so that goals and objectives can be attained.

Level IV sites are those that have completed all training and have fully implemented the ACTT curriculum. These sites use adequate procedures for data collection and evaluation. Additionally, they develop and incorporate their own activities into the existing curriculum. Project staff provide follow-up and specialized training as determined and requested by the agency. Level IV sites also make presentations to interested groups or organizations, assist in dissemination activities in their region and are capable of providing initial training on computer

use and the ACTT curriculum. Level IV sites have the option of being groomed to serve as resources on technology for early intervention professionals in their region or state.

Conditions for site replication. Sites chosen to replicate ACTT must meet the following requirements: 1) serve children with disabilities and/or high risk children from birth to 8 or some part of that age range; 2) have computers and resources to purchase software and peripherals; 3) purchase ACTT materials (at reduced costs) for use in the components they are replicating; 4) send representatives or their entire staff to Macomb for training; 5) participate in follow-up activities as needed at the agency's expense; 6) provide feedback on, and additions to, the ACTT curriculum; 7) collect data on child progress, family participation, and staff competencies and share it with the Outreach staff; 8) field test new materials and suggest new activities, adaptations, and procedures. Replication sites sign an agreement with ACTT when they are accepted as sites. Acceptance is based on ACTT staff's assessment of site needs and commitment to computer intervention, the order in which the request is received, and the agency's ability to meet the above requirements.

Site evaluation. The site monitoring plan includes follow-up visits and consultation involving observation, assessment of model components, child performance, parent skills and attitudes, staff skills and effectiveness, as well as their satisfaction with Outreach services. Strategies for follow-up include transfer of information by modem and videotapes of site intervention activities sent to Macomb for critique. Site monitoring procedures are used to determine the site's entrance into a new level and provide valuable information for planning future monitoring procedures.

ACTT services to sites. ACTT Outreach provides training, consultation, technical support including trouble shooting, critique of videotapes, analysis of data, and materials at reduced cost to the replication sites. Staff maintain communication through telephone, fax, and electronic mail. We also provide resource information to sites and updates on new products and applications through *ACTTive Technology*, a 20 page publication distributed quarterly.

Dissemination Activities

Target audiences for ACTT training and replication are those cited in the law, including families, parent organizations, state agencies (including education, developmental disabilities, rehabilitation services, public health, and others), early intervention committees and councils, public and private agencies that house early intervention services, public schools, special education cooperatives, colleges of medicine, public and private universities and commercial vendors. Our mailing list, containing the names and addresses of more than 1500 people and agencies, is updated as we make new contacts.

We advertise and distribute our products from the base established by the Macomb Projects. We use direct mailings, present at national and regional conferences, write articles about aspects of the model and the results of their use, and make personal contacts with state personnel and agency personnel. We produce training videotapes and can use the WIU/ISBE Satellite Educational Network, centered at WIU, for training and dissemination purposes. We have produced a 90-minute technology overview show via satellite, an ACTT I Conference Highlights show and, in cooperation with the Illinois Assistive Technology Project, a 90-minute program on funding technology for young children with disabilities. ACTT staff have also planned and participated in four other satellite broadcasts on technology, sponsored by Macomb Projects' STARNET, an Illinois' technical assistance project. Videotapes recorded during the live interactive broadcasts are available and can distributed to those who did not watch the program or who want a copy of the program for their own use.

For the past seven years, we have held a technology conference at Macomb in the spring. This conference provides a way for us to disseminate information at the awareness, knowledge, and skills level. Sessions cover a variety of topics related to assistive technology use, and most presentations are given by Project ACTT and Macomb Projects' staff, although we have accepted presentations by others whose philosophy about technology use for young children with disabilities matches our own. The conference lasts two days, and allows people from across the country (attendees have come from Arizona, Illinois, Indiana, Iowa, Kentucky, Michigan, Minnesota, Montana, South Dakota, Wisconsin, and Canada) an opportunity to share experiences, network, and learn from each other.

Besides hosting an annual conference, ACTT staff have traveled and participated in dissemination activities with other states during the past three years. Highlights of these state activities include invited presentations at regional conferences sponsored by Wisconsin's Assistive Technology Project (WISTECH), as well as their statewide Augmentative Alternative Communication and Assistive Technology Conference. ACTT staff were also invited to present at the first and second "Breaking Boundaries Through Assistive Technology" conferences, a collaborative endeavor of four Tech Act state projects (Iowa, Nebraska, Minnesota, and South Dakota).

In 1995, ACTT presented information on technology for early intervention during a 3-hour teleconference sponsored by the Assistive Technology Education Network of Florida. Early intervention personnel across the state were the target audience for the teleconference. ACTT staff also held a half-day workshop for local service providers in Orlando, Florida. In the fall of 1994, the National Early Childhood Technical Assistance System (NEC*TAS) requested a presentation on assistive technology training strategies for Part H and Part B coordinators and state technology project representatives at the national Assistive Technology Meeting held in

North Carolina. Participants at this meeting were those who had identified assistive technology as a priority for training in their states. An all-day technology workshop was also conducted for the Early Childhood/Special Education Summer Institute at the request of the Iowa Department of Education in 1994. Other state level activities include a workshop held as part of a state effort at the University of South Mississippi's Training Institute and a workshop in the fall of 1993 for Massachusett's Continuing Education Consortium for Early Intervention Providers in Boston.

On a national level ACTT staff present annually at the Closing the Gap Conference in Minnesota. They have also presented at the international CEC Conference as well as the divisional conferences of Early Childhood (DEC) and Technology and Media (TAM). In recent years, staff have also been accepted for technology presentations at the NAEYC Conference and the regional Midwest AEYC Conference. In the Spring of 1994 we were also invited to conduct an all-day workshop for the National Symposium for Information Technology's annual conference in South Carolina.

Our dissemination strategies tend to produce the highest benefits for the Project, but not the highest costs. Much of the advertising for ACTT is word-of-mouth from satisfied trainees. We continue to upgrade our awareness materials and dissemination strategies.

We are experienced in nationally disseminating materials related to ACTT. Tables 2 and 3 provide evidence of our successful dissemination efforts.

Table 3. Summary of ACTT Services from September 30, 1989 to March 31, 1996

	International	National	Individual States	Illinois	Total
Presentations	23	40	15	39	117
Persons attending	1,514	1,305	750	1,293	4,862
Children served *	45,354	22,441	13,774	26,356	107,925
Workshops	1	9	28**	16	54
Persons attending	45	150	1,040	205	1,440
Children served	675	1,723	27,234	2,533	32,165
Replication Site Training	2	NA	32	20	54
Persons attending	3	NA	110	105	218
Children served	179	NA	3,532	1,406	5,117
Printed References to ACTT	2	12	11	24	49
Products Distributed	218	NA	1,801	501	2,520

*Some attendees were administrative personnel responsible for thousands of children.
**One statewide workshop was conducted through teleconference in Florida.

Table 2. Summary of ACTT Product Dissemination from October 1, 1992 to March 31, 1996

	Illinois	National	Canada	International	Total
Peek & Speak	2	10	1		20
Switch 'N See	3	18		7	28
0-3 Core	1	3			4
Master Blaster	12	38			50
Simple Switch	3	5			8
The Latest Technology For Young Children	2	18			20
Good Leads for Software Needs-Apple	3	7			10
How To's for Apple II's	4	6			10
A Switch To Turn Kids On	3	14			17
Best of The ACTTion News	1	4		1	6
Building ACTTive Futures	4	6			10
Simple Switch Activities	2	6			8
TECH ACCESS	1	5			6
Tech Team Assessment Process	2	15			17
Good Leads For Software Needs-Macintosh	4	7			11
MACcessories	11	12			23
Ke:nx Set-Ups	4	8			12
Public Domain Software	44	61	2		107
Benefits & Applications - Infants & Toddlers	6	10			16
The Mac, Where to Begin	1	5	2		8
Const. Battery Interrupter & Tread Switch	3	9		2	14
ArtSpace	14	31	2		47
ACTTive Technology Subscriptions	38	54	4	2	98
Using Comp. Tools to Encourage Language	1	8	6		15
Easy Com	1	10			11
Mice	2				2
Alternative Input and Output	1	7	1		9
TOTALS	263	1018	44	15	1340

Training Activities

Format. ACTT Outreach training strategies are based on principles related to inservice (Bailey, 1989; Bents & Howey, 1981; Glickman, 1985; Guskey, 1986; Mohlman, 1982; Wolfe, 1990), adult learning (Knowles, 1978, 1980), and change (Bailey, 1989; Beckhard & Pritchard, 1992; Jones & Lowe, 1990). The assumptions that adult learners want to be able to use what they learn in the immediate future, that they bring a wealth of experience to the learning process, together with their need to be involved in the planning, guide our training philosophy. Training for replication sites, parent groups, state agencies, and broader target audiences uses these principles.

Since many adults are fearful of computers and the accompanying technology, ACTT uses tested, successful strategies, providing ample time for trainees who are new computer users to have hands-on time in a non-threatening situation so they can become comfortable with the equipment before they use it with children. This is an essential condition. The training pattern includes the following steps: 1) assess needs; 2) train; 3) apply what has been learned in the trainee's site; 4) consult with ACTT staff; 5) participate in follow-up activities; 6) participate in a follow-up site visit by ACTT staff. Further training repeats the cycle.

The bulk of the training is done at the ACTT site in Macomb because we have access to a wide variety of equipment, necessary peripherals, an extensive library of children's software, and because most sites requesting training do not have enough hardware or adaptive peripherals to train a group of 10 people. Traveling with enough equipment to train a group is difficult for staff and hard on expensive equipment. We have used this strategy successfully to train sites since 1986.

Procedures. The needs, computer skills, and level of sophistication of the replication site are assessed. ACTT staff and site staff together then determine whether the site requires Level I training or should begin with Level II training. If Level I training is needed, we recommend that site staff attend a Level I training session at the ACTT site or receive this initial training through their state or local resources. Upon completion of Level I training, trainees spend a period of one to two months applying ACTT methods and procedures at their home site. At the end of this period, ACTT staff conducts a follow-up assessment of the site's attainment of Level I competencies. Together ACTT staff and site staff then determine whether additional training and/or an extended application period is required or if Level II training should be scheduled.

Sites that have completed Level I training, or sites that have already acquired necessary computer skills and sophistication, schedule and complete a 2 to 5 day Level II training session. Trainees then return to their home site to begin program implementation. The site applies ACTT methods and procedures and takes part in follow-up activities for a 2 to 4 month period determined by need. After an appropriate implementation period, ACTT staff make an on-site

follow-up visit as needed. This visit assesses attainment of competencies and program status. Videotapes of the site may be used to substitute for a visit. ACTT staff and site staff then determine whether or not additional training is required. If more training is required, arrangements are made and ACTT staff provide the necessary training. This cycle of training followed by an application period continues according to site needs. Follow-up is continued until all Level II competencies have been attained.

Sites which have attained Level III status continue to participate in follow-up activities, including on-site follow-up, to determine whether or not specialized training is required to ensure attainment of program goals and objectives. Project staff also assist the site, if necessary, in establishing systematic procedures for data collection and analysis. Upon attainment of all Level III competencies, sites achieve Level IV status.

Level IV sites have fully completed project replication. These sites continue to supply the ACTT office with project impact and effectiveness data. Follow-up for Level IV sites is provided as requested by the replication site. Level IV sites are expected to provide Level I training for other groups or agencies within their region although this usually requires further training. However, this system allows ACTT staff to concentrate training efforts on Level II and Level III replication sites.

Training competencies. A set of computer competencies to be gained by staff and families alike provide the basis for ongoing training. Competencies are stated in behavioral terms and have been tested in replication sites, preservice coursework, inservice for early intervention staff, and in our work with families. A summary and analysis of the competencies acquired by trainees provides us with an evaluation tool. The competencies needed for ACTT modules have been tested and are routinely used in our training.

Content. A series of training modules which include written materials and videotapes, and "hands-on" computer experiences form the basis for the content of training events. The eight ACTT training modules include the following topics: Computer Training, Birth to Three Curriculum Applications, Preschool Curriculum Applications, Severe Disabilities Curriculum Applications, Switch Construction and Applications, Program Evaluation, Tool Use, and Training Trainers. These modules reflect the knowledge and skills needed to replicate ACTT components. They are updated as technology changes.

Families. The ACTT model provides for working directly with families at three different levels: acquiring awareness, assisting with intervention, and conducting intervention. Content related to working with families includes providing staff with materials and strategies to demonstrate the need for technology and the benefits of computers. It also includes strategies for training parents and family members to use computer applications with the children and for their own purposes. The ACTT competencies are used when training family members. Activities,

organizational plans, and lists of equipment to conduct parent workshops are also included in the ACTT training materials.

Problems and Solutions

ACTT experienced few methodological or logistical problems during its 1992 - 1995 funding period. We can attribute this to our technology expertise and experience in providing outreach training since 1986.

ACTT's hands-on, non-threatening training atmosphere alleviates any fear and distrust of technology that interferes with its successful integration into early childhood programs. Ample opportunity to try things out in meaningful ways encourages participants' positive attitudes about technology. We especially emphasize the use of adult-productivity computer functions (word processing, data bases, graphic programs, record keeping software), showing participants ways they can use the computer themselves to make their lives easier. Individuals who use computers themselves are far more likely to use technology applications with young children. We stress the importance of using developmentally appropriate activities. We also find that adequate administrative support for equipment purchases and maintenance, training and follow-up training is important for successful technology integration.

Evaluation Findings

Reports of child change, benefits, barriers, participation, satisfaction, new skills, and other aspects of technology use occur regularly when ACTT model activities are evaluated. ACTT focuses the major portion of its evaluation efforts on directly observable behaviors in children as opposed to internal behavior inferred from scores on standardized tests, including intelligence tests. The bulk of our data is qualitative in nature. From the beginning, our effort has been on demonstrating that young children with disabilities can independently use technology as a tool to control or access aspects of their environment. We are also interested in the amount of social behavior children display while using computers and their ability to use the computer in "equalized play" situation with children without disabilities as well as with other children with disabilities. Other interests that are examined via inferred effects include the use of computers to increase problem solving behavior, and more recently, the effects of drawing with computer application and the effects of multimedia software on emerging literacy.

While further study is needed on the effects of technology, our evaluation and qualitative studies, modified longitudinal case studies, extensive experience and videotape

library of children with disabilities using technology over time, in addition to the behavior coding already completed, point towards positive effects in these areas. Data shows that computer use leads to increased positive social and emotional outcomes. ACTT intervention made a positive difference among children and, when continued, leads to benefits. Data collected from sites are similar to that collected during the model development demonstration phase.

Since our efforts have been in an area which were previously not topics for research because the technology did not exist, and since there was originally a question of whether or not young children with disabilities could even use the equipment, we have collected a great deal of descriptive data which will be of great value to the field. The data has already served as a base for a federally-funded modified longitudinal research study recently completed (Hutinger, et al., 1994; Hutinger, Johanson, & Stoneburner, 1996). Now, we know that young children handle the equipment easily, often with unexpected proficiency. We **do** have data that show computer-using preschool children are significantly more skilled in computer knowledge and use ($p<.01$) than those who have not used computers.

The information we have collected provides a base to ask further questions about the specific effects of computers on young children. For example, what are the effects of using interactive multimedia software to enhance emergent literacy concepts in young children with disabilities? Can children with severe physical disabilities derive benefits from simulated drawing software designed to coincide with the images produced by typically developing children? We are studying these questions at the present time. Our preliminary data suggests positive effects in both instances. Adding new replication sites and new studies to support ACTT procedures provides a broader sample of children and their families and is useful to confirm our findings.

Sources of Data

Data sources for model impact include direct observation of children with accompanying written records, videotapes, records of activities and use of materials, interviews and surveys of children, families and staff. Data sources for Outreach impact include questionnaires related to training, competencies attained, observation, and model impact data for sites. In addition, we have conducted small scale studies on selected ACTT intervention. A qualitative research study funded by OSERs, using a modified longitudinal approach to determine the effects of technology use of ACTT children as well as the barriers to technology use was completed in May 1994. It includes case studies of children with severe disabilities as well as interview data from ACTT sites. We are currently studying

preschool classrooms as a qualitative unit of measurement to determine the effects of interactive multimedia and classroom-produced software using *HyperStudio™*.

Child Progress

When children cannot access the world because of their disabilities, technology applications provide them with an opportunity to do so. Data indicate that children with multiple disabilities can do many more things when they have access to a computer than when they are expected to use traditional early childhood materials. Further, although these children move from ACTT sites to placements that may or may not value technology, over time children improve in social and emotional skill as well as cognitive skills. Computers provide the analog to help them do some things that "typical" children do (for example, play games, communicate with voice synthesizers, draw, and later use word processing). In our most recent study (Hutinger, et al, 1994; Hutinger, Johanson, & Stoneburner, 1996) we found that both parents and staff reported improvements in social, emotional, and cognitive abilities. Moreover, they believed that children's responses were improved when they used technology as compared to non-technology activities.

Evidence indicates that children under the age of three need pre-computer experiences with switches, toys, and other environmental devices such as tape recorders and mobiles as well as simple computer programs. Young children need many direct experiences with objects in the world around them. Some do not need or want to use computers. While "drill and practice" computer software may provide some tutorial functions so that young children with disabilities can learn facts and/or concepts, we believe such software is inappropriate since it concentrates on isolated facts and skills out of context. Because of the developmental level of the children in early intervention programs, concrete and manipulative materials must be provided and in most instances, will not take the place of direct experiences in young children's concept learning. The most current multimedia software provides more interaction and a range of interesting experiences for all children.

Birth to 3 services. Many children in the Birth to 3 component have been videotaped at regular intervals since the beginning of their involvement with ACTT. Some of these videotapes have been coded for existing behaviors. Samples of coding on two children indicate that desirable behaviors increase over time. For example, a 2-year-6-month-old, severely delayed in several developmental domains, increased both vocalizations and use of words from approximately 5% to 21% while less prompting was needed, a finding that the Child Development Computer Specialist (CDCS) felt indicated an increase in the child's intent to activate the program on her own. In another youngster with severe disabilities, aged 1 year 9 months, the child activated the head switch 16% of the time in April and increased to 47%

in August, six months later. This same child also turned her face toward the toy she activated 23% of the time in August, but not at all when the project started. The CDCS and parent both said that the increase in activation of the mercury headband switch to start a toy and the increase in turning toward the stimulus was positive. Since this child had no physical ability to interact with toys and usually showed no interest in the environment, this data seems to indicate an increasing awareness and desire to control her environment. A blind child under three has shown consistent progress with the switch and a tape recorder activity. He will consistently use a switch to activate a tape recorder with a "Crazy Sounds" tape, and continue to press the switch and enjoy the sounds for several minutes without adult prompting. Prior to this activity, the child tended not to attempt to exert efforts to control any aspect of the environment.

We are interested not in increasing intelligence test scores but in helping infants, toddlers, and young children with disabilities successfully establish a sense of control over the environment, as well as a reason to persist in attempts to do so, and enhance autonomy and communication. Twelve youngsters with mild and moderate disabilities in five Hawaii birth to 3 ACTT sites were observed using the computer. Their behaviors were recorded using categories on our BIT (Behavior Interaction Tool) Checklist at the beginning of a year and six months later. Notable changes in behavior at the .05 significance level occurred in six behaviors including demonstrating planning abilities while at the computer, a positive computer approach, independent computer use, simple cause and effect relationships between the keyboard and the monitor, appropriate behaviors, and obtaining attention from adults in socially acceptable ways (a gain that could also be partially attributed to participation in other early intervention activities, not technology activities alone).

A series of observations over an 8 month period made with ACTT's "Computer Intervention Planning Form" in our Kauai site, demonstrate that a hearing impaired youngster who was 2 years 11 months on the first observation, showed more complex behaviors during her computer time. She was receptive to software programs, and in the first observation worked on "same" and "different" concepts. During the sessions, she increasingly used appropriate signs, requested computer activities, and became interested in using the printer for hard copy. During the last observed session she teased the clinician by pressing the switch on purpose for the wrong matching shapes, then shaking her head "no-no." Analysis of observations of intervention demonstrate growth for other children too.

Preschool services. Our earlier studies (Hutinger, 1987b; Hutinger & Ward, 1988) indicate that preschool-aged children with disabilities can learn to use technology successfully when presented with the curricular approach provided by ACTT. In one study, 65 of 68 children had enough skill on the computer to insert the disk into the disk drive to start a

program. Sixty could perform the operations needed to start the computer; put the disk in, shut the drive door, turn on the monitor, and turn on the computer. When we started ACTT we were not sure whether young children with disabilities could even use the equipment. We have found, overwhelmingly, that they can. When we compared four ACTT classrooms who had been involved with computers for five months (no ACTT child had previous computer experience) to a classroom without computer intervention, as expected, we found that the ACTT classrooms performed better ($p<.01$) than the control classroom. When we compared children who had computer experience to those who did not, we found that they performed significantly better on computer knowledge and use than the control group ($p<.01$). Computer knowledge included naming parts of a computer, identifying command-l keys, and using the command keys to direct a "turtle" through a maze on the monitor.

Recently we collected data over a two-week time period to determine what centers preschool children chose to work in and how much time they spent there. Choices included the computer, art, blocks, and housekeeping centers which were favorites of the children. Although the data is not yet completely analyzed, prelimary observations indicate that children were as likely to choose the computer center as any of the others and spent as much or more time there.

In looking at the 3-5 population in preschool classrooms for children with disabilities, a group displaying mild to moderate disabilities, our data shows that these children are likely to demonstrate positive behaviors such as attention spans that increase from two or three minutes to 15 minutes or longer when using *Logo* (a graphic programming language sometimes referred to as a tutee function of the computer where the child "teaches" the computer to perform an operation) or other interactive multimedia software such as *Harry and the Haunted House.*

Children in the original ACTT 3-5 preschool classrooms as well as replicating Head Start classrooms were videotaped on regular schedules, with all being videotaped on testing occasions at the beginning and end of the second year of computer use and at the beginning of their third year. These children demonstrate long periods of attention on the computer. Children with behavior problems and those who do not talk to adults tend to exhibit fewer negative behaviors during computer time and are more likely to communicate.

Individual children also exhibit changes as they work with computers. For example, a shy 3-year-old who preferred to help a peer physically (72.41% times per session) began to use language more in helping a peer during computer sessions (from 17.24% times in February to 71.43% in May). She also began to call attention to her own performance in May, something she rarely did earlier. Over a 4 month period, another child became less distracted while a peer worked with him on the computer and began to focus on what the peer was

doing. This child, who exhibited some serious behavior problems, began to express enthusiasm for himself or a peer (32% of the time during a session) in May.

Severe disabilities. Children with severe and multiple disabilities have been participating in ACTT since its inception. Two children with cerebral palsy are severely involved, and one of them is blind, the other vision impaired. These children have been regularly videotaped since they started using computers. They have progressed from sporadically using a switch to activate a computer program, to using two switches with intent to using a communication program to make choices during eating and to control two different events (i.e., a mechanical toy or sounds). They can now use various alternative inputs and can find parts of programs they wish to listen or see, and display preferences for certain sounds or visuals. The parents of these children have purchased a computer for use at home and, through ACTT efforts, the West Central Illinois Special Education Cooperative bought a computer for use in their classroom. The mother has acquired skills necessary to conduct computer activities with the children.

We know that technology assists children to operate in mainstreamed settings. A child severely involved with cerebral palsy who was served by ACTT for three years before he was transitioned into a regular first grade classroom has continued in inclusive settings. At age three he was adept at controlling a robot around his classroom via computer input. This child, now 15 and still confined to a wheelchair, attends a rural high school. He cannot hold a pencil, but he can use the computer for word processing, math, other content area learning, and equalized play (computer games with peers). He learned, with considerable help, to put a disk into a disk drive. His parents both have been involved with computer sessions and have acquired computer skills through participation in ACTT. We participate in his IEP staffings and, with his mother, have been instrumental in ensuring that technology goals are written into his IEP.

He is but one example. Jenna uses a LightTalker to communicate with other children at Sunday School and in other settings. Matt can play turn-taking games with other children with the appropriate software and peripherals. There are many others!

Project Impact

A summary of outreach services over the past six and a half years is shown on page 12 in Table 3, indicating the nature of the audience (international, national, other states, and Illinois) and the number of people who attended presentations, workshops, replication site training, references and articles published about ACTT, and distributed products. Numbers of children served are indicated.

Table 4, **Indicators of Impact,** provides a summary and comparison of selected activities over the past **9** years. In that period, **7,165** people attended ACTT presentations at conferences, and over **2,300** requests for awareness materials were received. ACTT replication sites served **8,143** children; programs receiving project materials served more than **316,000** children, while more than **37,000** children were served by people receiving ACTT training through workshops and inservices sponsored by their agencies. ACTT has benefited **2,097** staff serving **45,535** children through ACTT replication training and workshops on selected technology topics, for a total of **47,632** individuals. Requests for training **(888)** grew steadily, increasing from **128** in 1986-89 to over **450** in 1992-95.

Benefits

Benefits of the ACTT model and ACTT Outreach encompass children, families, and staff. Agencies and communities also benefit. ACTT Outreach replication and staff development training result in a greater number of early intervention personnel, support personnel, and families attaining the knowledge and skills needed to implement appropriate technology activities so that outcomes for children and families are satisfying, workable, and effective. ACTT produces long terms positive changes in children, families, and staff.

Assistive technology offers a wide range of possibilities never before available to many individuals with disabilities, of all ages. The potential of technology for young children with special needs has dramatically increased since 1980. Today, children who cannot hold a pencil to draw can access a graphics software program using alternative input, sometimes a switch, sometimes a TouchWindow. Providing appropriate alternative input offers children new capabilities. When young children with disabilities can use technology applications, they have opportunities to equalize play, to communicate, to draw, to interact, and to participate in early childhood settings in meaningful and functional ways. Aspects of technology use lead to optimal functioning levels within inclusive environments.

Children's faces light up when they accomplish a task, whether it is controlling a toy's movement or making an understandable sound for the first time. When a child communicates with others and makes him/herself understood using an augmentative communication device, the child, family, and early intervention staff are understandably pleased and excited. We are continually amazed at the potential that technology applications provide for children who are finally able to do things that surprise themselves and their families.

Benefits to families and their children. Training families and professionals to use ACTT applications leads to greater familiarity with technology, less fear of it, and greater opportunities for use of technology applications by the children who can benefit. One staff member responded, *"Parents love it and children enjoy it!"*

Table 4. ACTT Indicators of Impact October 1986 - September 1995

	Oct.1986-Sep. 1989	Oct.1989-Sep. 1992	Oct.1992-Sep. 1995	Total
Awareness				
• Number of persons receiving materials via conference attendance and participation	2,310	2,509	2,346	7,165
• Number of persons requesting awareness materials or information by phone/letter	403	1079	891	2,373
Stimulating High Quality Programs				
• Number of children served at three continuation sites	110	203	204	517
• Number of replication sites	32	27	27	86
• Number of professionals trained on model	86	139	79	304
• Number of children served at replication sites	3,091	2,905	2,147	8,143
Product Development/Distribution				
• Number of products distributed**	1,431	1,135	1,336	3,902
• Number of edited videotapes produced	7	9	8	24
• Number of viewers	3,470	4,460	5,220	13,150
• Number of children served by those receiving project materials	93,200 +	98,750 +	124,140 +	316,090 +
Training				
• Requests for training received	128	308	452	888
• Number of workshops conducted	26	25	25*	76
• Number of professionals receiving training	397	488	908	1,793
• Number of children with disabilities served by number of persons receiving training	5,695 +	6,948 +	24,749 +	37,392 +
Other Technical Assistance Consultation				
• Number of children served with increased high quality services	2,090 +	3,650 +	4,240 +	9,980 +
• Number of persons receiving information and purchasing equipment	108	247	308	663

*One statewide workshop was conducted through teleconference in Florida.
**See Appendix D for breakdown by product.

Young children with disabilities and their families must have equitable access to the same technology used by "typical" children. Lois-ellin Datta (1986), who examined public and private policies that determine computer uses, indicated that educational inequity occurs in small, inconspicuous but cumulative steps. Ten years ago she pointed out that while the debate about the efficacy of computer experiences continues, some children will have opportunities which are denied to others because affluent parents are willing to bet on positive outcomes. ACTT site

surveys indicate that when they use technology, sites gain "enhanced credibility with the school system and professionals," and that it "enhanced visibility in the community."

Parents report the importance of technology to their children. In a recent interview, one mother said, *"I think we all feel that it is going to be a necessary part of her and our lives. Since she's so limited motorically, we'll have to use technology to access and to increase the cognitive level...I think as a parent of a severely handicapped child that anything positive in the computer or anything else is a wonderful expectation for a parent. Because there are very few positives..."* The mother of another child said, when asked about her child's use of technology, *"I think it is good. I think it is very good. I think it is good for all children, but especially Matt, in particular, because he loves the computer. . ."*

Twenty parents (75% of those responding to a site survey) in a Hawaii Birth to 3 replication site whose children were involved with ACTT for six months to a year reported that computer activities were helpful to them and their child. They indicated that they gained knowledge of how a computer works (70%); knowledge of how a computer could help their child (75%); knowledge of computer activities for their child (90%); a better understanding of what their child could do (65%); and skills for working with their child (45%). When asked whether they thought their child's involvement with ACTT computer activities would change their child's opportunities for schooling or a fuller participation in life, 80% answered "yes." Results such as these are similar to results of surveys of parents' perceptions taken during ACTT's model demonstration years.

Parents in ACTT sites were interviewed as part of a qualitative research study (Hutinger, et al., 1994). They indicated that technology provided the greatest benefits in the areas of cognitive, social, and emotional development. Their comments included, *"He's proud of himself;" "He's happier;" "It's that satisfaction of accomplishment;" "He won't fall behind;" "[Technology] has given us more family time together"* (p. 54).

Positive changes in preschool children. A modified longitudinal study of the effects of ACTT demonstrated that assistive technology use has positive effects on children's development, even when they have significant disabilities and when technology experiences are inconsistent as children move from program to program (Hutinger, et al., 1994; Hutinger, Johanson, & Stoneburner, 1996). Children exhibited the greatest improvement in social and emotional development as a result of technology use. Since the ACTT model focuses on helping infants, toddlers, and young children with disabilities successfully establish a sense of control over the environment, as well as a reason to persist in attempts to do so, the finding is not surprising. ACTT's goal is to enhance autonomy and communication.

Providing augmentative communication devices and software to children with multiple disabilities enables those who cannot talk to interact with others. Providing switches or other

alternative input devices and appropriate software enables children to play games or engage in drawing activities with other children. Ultimately, computer use can lead older children who cannot use a pencil to word processing; however, at the preschool level, computers provide early childhood experiences that are more developmentally appropriate than word processing. Children who do not communicate, for one reason or another, talk freely about their computer experiences with other children and with adults. Developing individualized child- and situation-specific software using *HyperStudio* provides teachers and families with potent new and exciting ways to provide interesting experiences to children with disabilities. The new interactive multimedia software available on CD-ROM, such as *Just Grandma and Me* and *ArtSpace*, provides children with opportunities to explore and accomplish things independently that they cannot do in another way.

Studies indicate that preschool-aged children with disabilities can not only learn to use technology successfully when presented with the curricular approach provided by ACTT (Hutinger, 1987b; Hutinger & Ward, 1988), but they can also solve problems. Perry, Ward & Hutinger (1987), in an effort to demonstrate the nature of child progress over time, measured the impact of weekly computer interventions with preschool-aged children with disabilities over a six month period. Using a pre- and post-test design, the study focused on children's knowledge of Logo and the ability to apply this knowledge in problem-solving situations. The ACTT children showed significant improvement on a number of effects including maze performance, $F(1,34) = 27.121$, $p < .001$. Maze performance is one way to measure problem solving. These results were repeated in 1989-90 with a group of 115 preschoolers in an urban Head Start setting.

Benefits to infants and toddlers. Using technology devices as learning tools has important curricular implications for birth through 2 programs established through Part H of IDEA as well as the early childhood components of Part B. Replication site staff report that through ACTT, they discover skills hidden in children; that children interact with a computer, other children, and adults; that children can use a variety of learning modes; that technology expands treatment options; that parents respond positively to computer use; and that technology provides another modality to use in intervention services. One set of replication site data demonstrates that when twelve youngsters with mild and moderate disabilities in five Hawaii Birth to 3 ACTT sites were observed using the computer, behaviors changed. Children's behaviors were recorded using categories on the revised BIT (Behavior Interaction Tool) Checklist (Hutinger, Bell, Bond, & Beard, 1995) at the beginning of the year and then six months later. Significant changes in behavior at the .05 level occurred in six behaviors including demonstrating planning abilities while at a computer, a positive computer approach, independent computer use, simple cause and effect relationships between the keyboard and the monitor, appropriate behaviors, and obtaining attention from adults in socially acceptable ways (the latter

represents a gain that could be attributed to participation in other early intervention activities, not technology activities alone).

A single, but representative example of the effects of ACTT intervention on youngsters with severe disabilities is the unsuspected and surprising verbalization of a child with cerebral palsy, cortically blind since birth. During a session involving a computer and communication software using a speech synthesizer, Jordan pressed the switch to signal that he wanted to drink. Then he pressed "eat." Immediately after he heard the synthesizer say "eat," Jordan uttered the word "cookie" for the first time, surprising an ACTT staff member and his mother. The attending pediatrician during Jordan's initial hospital stay told the parents that he would never be able to recognize his mother. When he was eight, we heard him tell his mother, *"I love you."* While we cannot take full credit for his development, access to the computer over time provided Jordan with a sense of autonomy and a means of expression. During Jordan's preschool years, his parents were convinced that technology was a useful tool. Ongoing videotapes show that as long as he has access to regular technology use, Jordan exhibits positive changes in behavior.

Staff and family development. Both staff and family members gain computer competencies as a result of participation in ACTT training, and children benefit directly from their experiences. The highest number of skills is gained by novice technology users because they have so much to learn. For example during outreach training, one group of beginning technology users, on the basis of pre- and post-tests, gained an average proportional increase of 54% during ACTT training while another beginning group gained an average proportional increase of 57%. A third group, composed of experienced technology users, gained an average proportional increase of 19%; however, the participants already possessed a number of competencies and the new skills were more complex than those gained by the first two beginners groups.

Early intervention **staff** report a variety of gains that have implications for current practice. Survey responses indicate the following. *"Confidence in using the computer for our entire staff;" "A great base of training for computer and ways to integrate it into the curriculum;" "Awareness of the variety of technology available to meet the needs of special needs children;" "Types of adaptive equipment available to use with special needs kids;" "Ability to transfer the skills we have learned to others;" "Satisfaction of knowing that we are able to help children through technology."*

Impact on ACTT Staff

ACTT staff have remained on the cutting edge of technology applications for young children with disabilities and are recognized as leaders in the field. Those who have been with the Project since it began as a model demonstration project in the early 1980's have grown up

with technology and have made a commitment to the Project's philosophy and goals. To maintain their positions as leaders in the field, staff keep abreast of the latest developments in software, hardware, and peripherals. They train themselves on the use of the equipment and ways to make adaptations so they can in turn teach others. Staff have become interested in the use of multimedia and have developed multimedia presentations and applications. They have been involved in the production of videodiscs and a CD-ROM for assessment training.

As more people discover the advantages of technology for young children with disabilities, staff is in greater demand for national and regional workshops, training sessions, conference presentations, and telephone consultations. Time is spent in service to others as resources. Staff serve as consultants on a national level and at a state level work hand-in-hand with the Illinois Assistive Technology Project, providing workshops, resource materials, training on assistive technology for young children. At a local level, one staff member serves on the computer committee for the local school board. Others, at the request of teachers and parents, attend IEP meetings and staffings to advise on a child's use of assistive technology.

Staff members have computers at home—many have more than one! Not only are these computers used for home recordkeeping, correspondence, and staff members' children's use, but staff also use their computers to do Project work at home, creating adaptations or working on a troubleshooting tip in their "spare time."

Impact on Other Projects

Project ACTT's philosophy and practices have served as the basis for at least 10 other national technology-related projects funded through the United States Department of Education and the Department of Health and Human Services.

The MicoApplications Project, 1986 - 1989, was funded to provide technology training via videotape. At least 15 videotaped training modules, varying in length from 15 to 30 minutes, and accompanying manuals were created for distribution. Topics included communication, Logo, switch making, understanding computer basics, and family involvement. Videotapes targeted the birth to three, three to five, and severe disabilities populations.

The PACT-ACTT Partnership Project, Adapting a Computer Curriculum to Head Start, began in 1989 and ended in 1991. The ACTT Computer Curriculum was used in the Head Start programs in Springfield and Jacksonville, IL. Teachers as well as interested parents were trained to use computers in the Head Start curriculum. Children with behavior disorders, language delays, and learning disabilities received computer intervention.

The Technology Team Assessment Project (TTAP), 1989-1992 (Model Demonstration) and 1994 - present (Outreach), was created from the technology assessment component of ACTT and based on the philosophy that technology cannot benefit a particular child unless correct

adaptations and activities are identified and used. The technology asssessment using a team approach (parents, therapists, teachers, and other professionals) was designed to meet the technology needs of each individual child.

The Technology Inservice Project (TIP) began in 1991. TIP provides inservices to teachers, parents, and other professionals in Illinois sites on all aspects of technology applications for young children with disabilities. The second component of TIP focuses on applications for adult productivity using technology.

In 1991 Project CAPSULe began providing technology interventions to children in the Springfield Urban League Head Start sites in Springfield and Jacksonville, IL. Assistive technology interventions and adaptations are used with a select group of children with disabilities. Training is provided to parents, teachers, and support staff so they can continue technology use when the Project ends.

A qualitative research project, Effective Use of Technology to Meet Educational Goals of Children with Disabilities (1991 - 1994) collected data and wrote case studies of children who used technology for a number of years (children who were three and four years old and part of ACTT's model demonstration phase in the 1980's) and of children who were relative new technology users (those who were assessed by Project TTAP during its model demonstrtion phase). The purpose of the project was to find benefits and barriers to technology use.

The Expressive Arts Project for Young Children with Disabilities (1992 - 1994) created an interactive CD-ROM field trip to an art gallery for young children with moderate to severe disabilities. A curriculum guide accompanies the *ArtSpace* CD-ROM and offers suggestions for using *ArtSpace* and integrating art-related activities across the curriculum.

The Expressive Arts Project (1992 - present) integrates developmentally appropriate activities in the expressive arts (visual art, music, dramatic play) into early childhood experiences for children with mild to severe disabilities. The Expressive Arts Project's curriculum includes both high tech and low tech adaptations which allow children with physical disabilities to experience activities in the arts.

The Early Childhood Emergent Literacy Technology Project (1994 - present) is developing and researching the effects of an interactive literacy curriculum on the emergent knowledge and abilities of children, ages 3 - 5, who demonstrate mild and moderate disabilities. The curriculum includes both on-computer and off-computer curriculum activities which contain important elements of emerging literacy.

The Early Childhood Comprehensive Technology System (1995 - present) is a collaboration between Macomb Projects and the Just Kids Early Childhood Learning Center in New York. This qualitative study is examining the effects of a comprehensive system providing

technology services (based on elements of TTAP and ACTT) to young children with moderate to severe disabilities.

The Early Childhood Interactive Technology Literacy Curriculum Project (1995 - present) is a model demonstration project that combines interactive multimedia software with emergent literacy experiences for childen ages 3 - 6 who demonstrate mild to severe disabilities.

The Technology Assessment Software Project (1994 - present) is developing a CD-ROM (Something's Fishy) that will feature developmentally appropriate software for use during technology assessments of children ages 18 months to 8 years who have moderate to severe disabilities. The software will assess levels of alternative input, complexity of task, and a child's preferences for size, color, sound, volume, movement, image type, and nature of stimuli (visual, auditory, combination).

Products

A number of products have been developed to help others use the ACTT Model. These include

- eight training modules used during replication training;
- *Building ACTTive Futures: ACTT's Curriculum Guide for Young Children and Technology;*
- *How To's for Apple IIs*, a guide to using Apple II peripherals;
- *Good Leads for Software Needs: Suggested Apple Software for Young Childen,* a guide to early childhood software;
- *Good Leads for Software Needs: Suggested Macintosh Software for Young Children,* a guide to early childhood software;
- *MACcessories: A Guide to Peripheral Devices for the Macintosh*;
- *A Switch To Turn Kids On*, a switch construction manual;
- *The Best of ACTTion News*, a compilation of favorite articles from ACTT's newsletter;
- *ACTTive Technology*, a quarterly publication containing articles, curriculum ideas, timely hints, and software reviews;
- videotapes (an overview and specialized tapes, such as *The Latest Technology for Young Children,* showing various computer applications); and
- software, including
  - the *CORE* (Computer Oriented Record Keeping Enabler) which can be used as a framework to plan and customize individual activities for very young children with disabilities;
  - *Master Blaster,* a switch game for two players designed to reinforce audio and/or visual attending; and
  - *Switch 'N See*, record-keeping software designed for the cognitively young child to reinforce cause and effect relationship to a switch press.

Another technology product to come out of our work was the establishment of a Macomb Projects home page on Western Illinois University's World Wide Web site. Our home page has been accessible since the summer of 1995. Information about projects and products is available by contacting our page at http:/www.ECNet.Net.users/mimacp/wiu/index.html We are currently in the process of establishing an independent site on the World Wide Web that does not require access through Western Illinois University's site.

Macomb Projects' products are updated regularly to keep them current according to the developments in the computer marketplace. Persons wishing information about Macomb Projects' products, about ACTT training, or about other technology workshops should contact Macomb Projects, 1 University Circle, 27 Horrabin Hall, Western Illinois University, Macomb, IL 61455; 309/298-1634 (phone); 309/298-2305 (fax).

Future Activities

Project ACTT's funding period ended in January 1996. As their schedules permit, our staff of assistive technology experts continue to offer much-needed services for technology workshops, presentations, and training to schools and individuals. Summer 1996 technology training is also offered at the Macomb Projects headquarters in Horrabin Hall at Western Illinois University. ACTT staff hope to continue Outreach efforts during 1996-97 at sites which supported our recent funding proposal to the Early Education Program for Children with Disabilities.

Assurance Statement

One copy of this full final report has been sent to ERIC. Copies of the title page and abstract from this final report have also been sent to NEC*TAS, the National Clearinghouse for Professions in Special Education, NICHCY, the Technical Assistance for Parent Programs Project, the National Diffusion Network, the Child and Adolescent Service System Program, the Northeast Regional Resource Center, the MidSouth Regional Resource Center, the South Atlantic Regional Resource Center, the Great Lakes Area Regional Resource Center, the Mountain Plains Regional Resource Center, the Western Regional Resource Center, and the Federal Regional Resource Center.

References

Abrahamsen, A.A., Romski, M., & Sevcik, R.A. (1989). Concomitants of success in acquiring an augmentative communication system: Changes in attention, communication, and sociability. *American Journal on Mental Retardation, 93*(5), 475-496.

Ameritech (1993). Superschools: Education in the information age and beyond.

Bailey, D. (1989). Issues and directions in preparing professionals to work with young handicapped children and their families. In J. Gallagher, P. Trohanis, & R. Clifford (Eds.), *Policy Implementation and P.L. 99-457: Planning for Young Children with Special Needs* (pp. 97-132). Baltimore, MD: Paul H. Brookes.

Becker, H. (1990). How computers are used in United States' schools: Basic data from the 1989 I.E.A. Computers in Education Survey. *Journal of Educational Computing Research, 7,* 385-406.

Beckhard, R. & Pritchard, W. (1992). *Changing the essence: The art of creating and leading fundamental change in organizations.* San Francisco: Jossey-Bass Publishers.

Beeson, B.S., & Williams, R.A. (1985). The effects of gender and age on preschool children's choice of the computer as a child-selected activity. *Journal of the American Society for Information Science, 36,* 339-341.

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

Behrmann, M., & Lahm, L. (1983, December). Multiply handicapped babies on-line with Apples. *Washington Apple Pi,* pp. 24-25.

Behrmann, M., & Lahm, L. (1984a). Babies and robots: Technology to assist learning of young multiply disabled children. *Rehabilitation Literature, 45*(7-8), 194-201.

Behrmann, M., & Lahm, L. (1984b). Critical learning: Multiply handicapped babies get on-line. In *Proceedings of National Conference in Special Education* (pp. 181-193). Reston, VA: Council for Exceptional Children.

Behrmann, M., & Lahm, E. (1994). Computer applications in early childhood special education. In June L. Wright and Daniel D. Shade, (Eds.),*Young Children: Active Learners in a Technologiceal Age* (pp. 105-120). Washington, DC: NAEYC.

Bents, R., & Howey, K. (1981). *Staff development--a change in the individual.* Staff Development/Organization Development ASCD 1981 Yearbook. Alexandria, VA: Association for Supervision and Curriculum Development.

Brinker, R.P. (1984). *The microcomputer as perceptual tool: Searching for systematic learning strategies with handicapped infants.* Princeton, NJ: Division of Education Policy Research and Services, Educational Testing Service, Haworth Press.

Brinker, R.P., & Lewis, M. (1982). Making the world work with microcomputers: A learning prosthesis for handicapped infants. *Exceptional Children, 49*(2), 163-170.

Buckleitner, W. (1996). The case for computers. *Early Childhood Today, 10*(5), 25-27.

Butler, C. (1988). High tech tots: Technology for mobility, manipulation, communication and learning in early childhood. *Infants and Young Children, 1*(2), 66-73.

Campbell, P., & Fein, G. (Eds.). (1986). *Young children and microcomputers.* Englewood Cliffs, NJ: Prentice-Hall.

Clements, D.H., & Nastasi, B.K. (1992). Computers and early childhood education. In M. Gettinger, S.N. Elliot, & T.R. Kratochwill (Eds.), *Advances in school psychology: Preschool and early childhood treatment directions* (pp. 187-246). Hillsdale, NJ: Lawrence Erlbaum.

Clements, D.H., Nastasi, B.K., & Swaminathan, S. (1993). Young children and computers: Crossroads and directions from research.*Young Children, 48*(2), 56-64.

Clements, D.H., & Swaminathan, S. (1995). Technology and school change: New lamps for old? *Childhood Education, 71*(5), 275-281.

Datta, L. (Fall/Winter 1986). Benefits without gains: The paradox of the cognitive effects of early childhood programs and the implications for policy. *Special Services in the Schools, 3*(1-2), 103-126.

Gates, B. (1995). *The Road Ahead.* NY: Viking Penguin.

Glickman, C. (1985). *Supervision of instruction: A developmental approach.* Boston, MA: Allyn & Bacon.

Guskey, T.R. (1986). Staff development and the process of teacher change. *Educational Researcher, 15*(5), 5-12.

Haugland, S.W. (1992). The effect of computer software on preschool children's developmental gains. *Journal of Computing in Childhood Education, 3* (1), 14-30.

Haugland, S.W., & Shade, D.D. (1990). D*evelopmental evaluations of software for young children, 1990 Edition.* Albany, NY: Delmar Publishers.

Herman, L., & Herman, B. (1989). Elena and her technology. *Exceptional Parent, 19*(7), 35-36.

Holder-Brown, L., & Parette, Jr., H.P. (1992). Children with disabilities who use assistive technology: Ethical considerations. *Journal of Special Education, 21*, 122-132.

Hutinger, P. (1986a). *New Outreach: ACTT Outreach, Activating Children Through Technology* (Continuation Proposal). Macomb, IL: Western Illinois University.

Hutinger, P. (1986b, August). *Strategies for evaluating computer applications for children, teachers and parents.* Paper presented at Communications Through Technology for Exceptional Students Summer Institute, Merritt Island, FL.

Hutinger, P. (1987a). Computer-based learning for young children. In J.L. Roopnarine & J.E. Johnson (Eds.), *Approaches to Early Childhood Education* (pp. 213-234). Columbus, OH: Charles E. Merrill.

Hutinger, P. (1987b, May). *The effects of LOGO on preschool handicapped children.* Invitational Research Symposium on Special Education Technology, Center for Special Education Technology, Council for Exceptional Children, Washington, DC.

Hutinger, P. (1994). Integrated program activities for young children. In L. Johnson, R.J. Gallagher, M. LaMontagne, J. Jordan, J. Gallagher, P. Hutinger, & M. Karnes (Eds.), *Meeting Early Intervention Challenges.* Baltimore: Brooks Publishing.

Hutinger, P. (in press). Computer applications in programs for young children with disabilities: Recurring themes. *Focus on Autism and Other Developmental Disabilities.*

Hutinger, P., Bell, C., Bond, J., & Beard, M. (1995). *BIT: Behavior interaction tool.* Macomb, IL: Macomb Projects, Western Illinois University.

Hutinger, P., Hall, S., Johanson, J., Robinson, L., Stoneburner, R., & Wisslead, K. (1994). *State of practice: How assistive technologies are used in educational programs of children with multiple disabilities.* Final Report. Macomb, IL: Macomb Projects, Western Illinois University.

Hutinger, P., Johanson, J., & Clark, L. (1993). Illinois Head Start children achieve computer literacy. *Early Childhood Report, 4,* 6-8.

Hutinger, P., Johanson, J., & Stoneburner, R. (1996). Assistive technology applications in educational programs of children with multiple disabilities: A case study report on the state of the practice. *Journal of Special Education Technology, 13*(1).

Hutinger, P., Robinson, L., & Johanson, J. (1990). Adapting a computer curriculum to Head Start. *Children Today, 19,* 31-33.

Hutinger, P., & Ward, E. (1988). *Technology for the preschool handicapped classroom: New learning tools to assist the teacher.* Paper presented at CEC/TAM Conference on Special Education and Technology, Reno, NV.

Jones, E., & Lowe, J. (1990). Changing teacher behavior: Effective staff development. *Adult Learning, 1*(7), 8-10.

Kristeller, J. (1996). The age of multimedia. *Early Childhood Today, 10*(5), 2.

Knowles, M.S. (1978). *The adult learner: A neglected species.* Houston, TX: Gulf Publishing.

Knowles, M.S. (1980). *The modern practice of adult education: From pedagogy to andragogy.* Chicago: Association Press Fallete.

Kulik, J.A. (1986). Evaluating the effects of teaching with computers. In P. Campbell & G. Fein (Eds.),*Young Children and Microcomputers* (pp. 159-169). Englewood Cliffs, NJ: Prentice-Hall.

Locke, P.A., & Mirenda, P. (1988). A computer-supported communication approach for a child with severe communication, visual, and cognitive impairments: A case study. *Augmentative and Alternative Communication, 4*(1), 15-22.

Meyers, L. (1984). Use of microprocessors to initiate language use in young non-oral children. In W. Perkins (Ed.), *Current Therapy of Communication Disorders* (pp. 42-55). New York: Thieme-Stratton.

Meyers, L. (1990, Autumn). Technology: A powerful tool for children learning language. *OSERS News in Print!* pp. 2-7.

Mohlman, G. (1982). *Assessing the impact of three in-service teacher training models.* Paper presented at the annual meeting of the American Educational Research Association, New York.

Muhlstein, E.A., & Craft, D.J. (1986). *Using the microcomputer to enhance language experiences and the development of cooperative play and preschool children.* (Unpublished manuscript). DeAnza College, Cupertino, CA. (ERIC Document Reproduction Service No. ED 269 004).

Nastasi, B.K., & Clements, D.H. (1993). Motivational and social outcomes of cooperative computer education environments. *Journal of Computing in Childhood Education, 4*(1), 15-43.

Nastasi, B.K., Clements, D.H., & Battista, M.T. (1990). Social-cognitive interactions, motivation, and cognitive growth in Logo programming and CAI problem-solving environments. *Journal of Educational Psychology, 82*, 150-158.

Parette, Jr., H.P., Dunn, N.S., & Hoge, D.R. (1995). Low-cost communication devices for children with disabilities and their family members. *Young Children, 50*(6), 75-81.

Parette, Jr., H.P., & VanBiervliet, A. (1991). Rehabilitation assistive technology issues for infants and young children with disabilities: A preliminary examination. *Journal of Rehabilitation, 57*(3), 27-36.

Perry, L., Ward, E., & Hutinger, P. (1987). *Effects of ACTT microcomputer interventions on preschool handicapped children.* Macomb, IL: Macomb Projects, Western Illinois University.

Podmore, V.N., & Craig, B.H. (1989). *Study 9: The impact of microcomputer on teachers and on the observable behaviors of children ages four to seven years.* (Final Report: Evaluation of Exploratory Studies in Educational Computing). Wellington, New Zealand: New Zealand Council for Educational Research. (ERIC Document Reproduction Service No. ED 328 361).

Robinson, L. (1986a, December). Computers provide solid learning base for pre-school children. *Closing the Gap, 5*(5), pp. 1, 18, 25.

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

Rosenberg, S., & Robinson, C. (1985, March). *Final report: Development of a microprocessor-based work station for severely/profoundly multi-handicapped students.* (Field Initiated Research Studies Program, Grant #G008300312). Omaha, NE: University of Nebraska at Omaha.

Sartorio, V.J. (1993). Effects on computer-based learning on the language development of preschoolers in special education classrooms. *Dissertation Abstracts International, 54*(6)A.

Shade, D., & Watson, J.A. (1990). Computers in early childhood: Issues put to rest, theoretical links to sound practice, and the potential contribution of microworlds. *Journal of Education Computing Research, 6,* 375-392.

Shane, H.C., & Anastasio, V. C. (1989, June). Augmentative communication considerations in pediatric otolaryngology. *Otolaryngologic Clinics of North America, 22*(3), 501-517.

Sivin-Kachala, J., & Bialo, E. (1996). *Report on The Effectiveness of Technology in Schools, '95-'96.* Washington, DC: Software Publishers Association.

Speigel-McGill, P., Zippiroli, S.M., & Mistrett, S.G. (1989). Microcomputers as social facilitators in integrated preschools. *Journal of Early Intervention, 13*(3), 249-260.

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.

Thornburg, D. (1994). *Education in the Communication Age*. USA: Thornburg & Starsong Publications.

Wolfe, B. (1990). Best practices in Head Start inservice training. *Monthly Resource, 5*(5), 1-7.

Wright, J., & Samaras, A. (1986). Playworlds and microworlds. In P. Campbell & G. Fein, (Eds.), *Young Children and Microcomputers* (pp. 74-86). Englewood Cliffs, NJ: Prentice-Hall.

Wright, J.L., & Shade D.D. (1994). *Young Children: Active Learners in a Technological Age.* Washington, DC: NAEYC.