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February 2001

Office of Special Education Programs Technology and Media Services Program: A Focus on Implementation and Utilization

This is the full text of the paper cited below. A figure is omitted without loss of information; the content is also expressed in the text.

Office of Special Education Programs. (2000). Office of Special Education Programs Technology and Media Services program: A focus on implementation and utilization. *Twenty-second annual report to Congress on the implementation of the Individuals with Disabilities Education Act* (pp. III-33 through III-49). Washington, DC: U.S. Department of Education.

TECHNOLOGY APPLICATIONS are helpful in solving problems and improving student results in the field of special education. Technology provides a bridge linking students with special needs to the classroom curriculum and environment. While support for technology to address the needs of children with disabilities comes from many sources, including the National Institute for Disability and Rehabilitation Research, this module focuses only on technology activities of the Office of Special Education Programs (OSEP) Technology and Media Services (TMS) program.

Assistive devices have helped students with disabilities increase their independence by learning to communicate more effectively, to control their environments, and to achieve greater mobility (Burnette, 1990; Derer, Polsgrove, & Rieth, 1994; Todis, 1996; Todis & Walker, 1993). Instructional applications of technology have enhanced students' learning and meaningful participation in classroom activities by enabling teachers to tailor instruction to their individual needs and to supplement and/or enhance effective instruction (Higgins & Boone, 1993; Okolo, Bahr, & Rieth, 1993; Woodward & Carnine, 1993; Woodward & Rieth, 1997).

Technology can also support practitioners in administrative and managerial tasks related to quality programming, such as making assessment tasks more precise and manageable (Fuchs, Fuchs, & Hamett, 1993). Technology also shows promise as a vehicle for delivering and

expanding professional development opportunities for practitioners and families (Blackhurst, Hales, & Lahm, 1998; Foegen & Hargrave, 1999; Gallagher & McCormick, 1999; Meyen, Tangen, & Lian, 1999; Paulsen, Higgins, Miller, Strawser, & Boone, 1998).

Congress recognized the potential of technology to enhance educational results for students with disabilities when it passed the most recent amendments to the Individuals with Disabilities Education Act (IDEA) in 1997. The amendments introduced a provision requiring teams responsible for developing an individualized education program (IEP) for a child with a disability to consider whether the child requires assistive technology devices and services. Section 602 of IDEA includes these definitions related to assistive technology:

(1) Assistive Technology Device. The term 'assistive technology device' means any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability.

(2) Assistive Technology Service. The term 'assistive technology service' means any service that directly assists a child with a disability in the selection, acquisition, or use of an assistive technology device. Such term includes --

> (A) the evaluation of the needs of such child, including a functional evaluation of the child in the child's customary environment;
>
> (B) purchasing, leasing, or otherwise providing for the acquisition of assistive technology devices by such child;
>
> (C) selecting, designing, fitting, customizing, adapting, applying, maintaining, repairing, or replacing of assistive technology devices;
>
> (D) coordinating and using other therapies, interventions, or services with assistive technology devices, such as those associated with existing education and rehabilitation plans and programs;
>
> (E) training or technical assistance for such child or, where appropriate, the family of such child; and
>
> (F) training or technical assistance for professionals (including individuals providing education and rehabilitation services), employers, or other individuals who provide services to, employ, or are substantially involved in the major life functions of such child.

Across the country, IEP team members are finding that consideration of technology demands more than a cursory look at the technology available in the district or at a particular technology tool for its own sake. Rather, it involves starting with what is educationally necessary for a child in order for him or her to receive an appropriate education and then determining whether technology is necessary to obtain agreed-upon educational goals (Chambers, 1997; Golden, 1998). IEP team members are not limited by what exists in the district. Indeed, if a technology tool is deemed necessary for a student to achieve his or her educational goals as set forth in the IEP, the district must ensure its availability and utilization.

To consider technology in this way assumes an understanding of a full range of technology options -- from low-tech devices such as pencil grips or adaptive tools, to high-tech devices such as multimedia databases or voice recognition systems -- and how they may address a student's needs. Consideration of technology also assumes an understanding of what it takes to ensure that the technology is used in the intended way, by the student and by others in behalf of the student, across educational settings.

Research has pointed to a number of challenges in implementing technology tools with students with disabilities (Hutinger, Johanson, & Stoneburner, 1996; Lesar, 1998; McGregor & Pachuski, 1996; Wehmeyer, 1999). In answering the practical questions related to implementation, technology researchers and developers have often found themselves concerned with the task of studying practice. Specifically, they must look at factors that limit the widespread use of technology (such as lack of awareness, lack of training, lack of funding, lack of administrative support, lack of time) and at strategies that may eliminate barriers. Inquiry regarding what it takes to integrate technology use into the educational setting -- from making sure all parties have an aware-ness of effective tools, to making these tools readily available, to ensuring that all parties have sufficient training and ongoing support to utilize the tools -- has been at the core of special education research in technology for nearly a quarter of a century. This line of research shows promise of ensuring that technology tools are available and are used to their full potential to enhance educational results for students with disabilities.

Prior to the 1980s, research in technology for special education was sparse. Researchers have accomplished a great deal since the middle of that decade, with support from the U.S. Department of Education, Office of Special Education Programs. Research is informing current practices and making it possible for students with disabilities to participate and learn to their potential in classrooms across the country. To that end, this module provides a brief review of how past Federal investments and policy initiatives have been instrumental in advancing knowledge about implementation issues.

CHARTING A NATIONAL AGENDA FOR MAKING SOUND INVESTMENTS: A BRIEF HISTORY OF FEDERAL SUPPORT

Beginning in the mid-1980s, OSEP began to earmark certain competitions specifically for research and development in technology. Recognizing the need for information about the use of technology in achieving educational results for students with disabilities, OSEP focused resources on programs that would study pertinent issues.

In 1990, OSEP established a strategic agenda to guide investments in the TMS program for improving educational results that is still viable today (OSEP, 1992). After involving stakeholders from across the nation in a year-long agenda-building process, OSEP introduced the national technology program agenda. The overarching goals for technology inquiry were identified as: fostering lifelong learning; encouraging participation in diverse educational, domestic, work, and community environments; promoting equity in opportunity for individuals with disabilities; and enabling individuals with disabilities to be productive and independent. To achieve these goals, the agenda put forth four program commitments by which the use of technology would be advanced for all categories of disability. These commitments were:

- Enable the learner across environments by fostering the creation of state-of-the-art instructional environments, both in and out of school;

- Promote effective policy at all levels in government, schools, and businesses;

- Foster use through professional development by training and supporting teachers, administrators, parents, and related-service personnel; and

- Create innovative tools by encouraging the development of varied and integrated technologies, media, and materials.

For nearly a decade, the agenda has served as the cornerstone of OSEP's technology research and development. Special education researchers had long been concerned with using their findings to improve educational results for students with disabilities. Now the agenda signaled the centrality of implementation and utilization issues to the work of technology researchers and developers. It underscored the importance of examining and improving access to information and support.

Using the agenda as a foundation, a series of research projects began exploring issues related to providing innovative technology tools that would enable students to learn across educational and classroom settings. The following examples from OSEP-funded projects exemplify the broad range of technology applications found successful in improving results for students with disabilities. As these examples from OSEP-funded projects illustrate, technology can enhance participation in classroom environments and help students with disabilities learn challenging material.

Providing Access to Participation in Classrooms

Rose, a ninth-grader in the Pacific Northwest, is unable to speak or walk without assistance. With the help of a motorized wheelchair and adapted devices, such as adapted pencils, eating utensils, scissors, and other tools. Rose is able to function quite independently at school. Like her classmates, Rose has been using computers for several years at school. A portable computer mounted on her wheelchair is equipped with software for completing her academic assignments. To accommodate her physical needs, her word-processing program includes a word prediction feature so Rose needs only to type the first letters of a word; she then chooses the desired word from a list. In addition, a voice-output feature, which displays messages on a screen or through voice synthesis, allows Rose to communicate her ideas.

An important goal of early childhood classrooms is developing independence. For 5-year-old Sabrina, who cannot speak or point, making choices and being able to act on them is a challenge. With the help of an eye-gaze board -- a simple apparatus consisting of a Plexiglas frame with Velcro tabs -- Sabrina is able to communicate with adults and other children in her classroom. For example, during free-choice time, an instructional assistant places the eye-gaze board perpendicular to Sabrina's wheelchair tray and fastens six pictures of her preferred activities around its edges. The aide stands behind the board to gauge where Sabrina's eyes are pointing. By looking directly at one of the pictures, Sabrina chooses to read a book on the computer. The computer is equipped with a feature that turns the pages when Sabrina "hits" a switch, allowing for even more independence. The teacher is especially pleased, as the eye-gaze system is quickly assimilated by Sabrina's peers who use it to interact with her during free time.

Technology can be used to enhance communication and mobility. When students have significant difficulties in communicating or in moving independently, they can be denied access to essential instruction and classroom interactions. Research and development have shown the efficacy of such applications as picture-synthesized and speech-synthesized communication boards, voice recognition systems for communication, screen readers to assist students with visual impairments in learning, and adaptive calculators. Research has considered applications of technology in different settings, such as the use of the Internet to deliver real time captioning in remote classrooms. OSEP also has supported research in the emerging areas of computer simulation and virtual reality technology, which have shown the potential to enable students to move more quickly through complex material. One example is the use of technology to provide safe mobility training to students who are physically challenged.

Helping Students Master Basic Skills

Robert, a student in an urban first-grade classroom, is struggling to learn how to read. He has difficulty sounding out words and recognizing vocabulary. Yet providing the type of individualized instruction and practice Robert needs can prove challenging in a classroom of more than 30 students. In addition to his regular instruction, Robert's teacher supplements his educational program with software that functions as an electronic storybook. During independent reading practice time, Robert uses the software for repeated practice in reading stories at his own pace. The design features of the software directly address Robert's individual needs. By clicking on individual words or phrases with the mouse, Robert can hear them spoken by a recorded voice or can see a picture that illustrates their meaning. With another click of the mouse, Robert can highlight each word as he reads. This technology application has enabled Robert to become a more confident and skilled reader.

Developing reading and decoding skills, learning math skills, and mastering writing skills are areas of great need for students with cognitive and learning disabilities. OSEP has supported numerous projects that have enhanced our understanding of how technology can help students with disabilities master basic skills. For example, researchers have studied how computational instruction can be adapted to individual needs with the aid of technology (e.g., systematically controlling a presentation to ensure that the student is practicing appropriate skills). Researchers also have considered how technology applications, such as word prediction software and speech synthesizers, can help students with writing difficulties to learn skills and complete written assignments in a timely fashion.

Supporting Students in Learning Complex Material

Ms. Brown believes that meeting science curriculum standards is important for all of her students. She has found that technology, media, and materials can enhance learning for her diverse group of fifth graders. For example, the class is taking a field trip to a local pond to study ecosystems. Students will observe different physical elements and collect samples for further study back in the classroom. Rather than exclude several students who, due to their disabilities, find it difficult to participate fully, Ms. Brown incorporates the use of a digital camera. She takes photos of inaccessible areas for students to review later. She also takes photos of students engaged in observation, which she uses later to prompt recall and comprehension. Back in the classroom, students draw on what they have observed. To assist students with visual and perceptual difficulties, Ms. Brown incorporates the use of a projection microscope. Students put an object under the lens of the projection microscope and trace it. To wrap up the session, Ms. Brown uses a software program that allows students to create a web, or cognitive organizer,

of their observations. As students reflect on their webs, they begin to see how their emerging ideas might be presented in an outline for a science report. These technology tools allow students to actively participate and learn in a standards-based science curriculum.

As students increasingly access the general education curriculum, they are expected to understand complex subject matter. Among other things, students are expected to comprehend written text, assemble complex information, and develop active learning skills. OSEP has funded numerous projects that have added to the knowledge base on how technology can help students with disabilities learn complex subject matter. Some examples are technology applications to enhance reading comprehension with hypertext and hypermedia software programs, improve fluency with speech recognition applications, and help engage students with limited math skills in higher-order problem solving with the aid of a spreadsheet. In addition, research has looked at how technology might help engage students in instructional practices used to promote higher-order thinking (e.g., project-based instruction, inquiry-based strategies, and curriculum-based units).

Over the years, the pattern of inquiry has evolved from looking at technology in isolation from the complex educational environment to exploring what it takes -- with regard to curriculum, professional development, technical support, administrative support, and policy issues -- to implement innovative tools and services across settings. The next section of this module reviews how early studies set the stage for current investigations into the complex nature of technology as an intervention and what that means for implementation.

RETROSPECTIVE STUDIES

OSEP commissioned a group of researchers to review past TMS project investments in order to improve future practice (Okolo, Cavalier, Ferretti, & MacArthur, 1995). The researchers identified five broad areas of research focus:

- Assistive technology: Projects that look at how to compensate for or otherwise address special student needs;

- Technology and instruction: Projects related to instructional design, literacy, mathematics, social studies, science, and early childhood education;

- Technology and assessment: Projects about assessment of academic skills, videodisc assessment, behavioral assessment, expert systems for decision support, and ecobehavioral assessment;

- Future applications: Projects that analyze trends in hardware and software developments for individuals with disabilities; and

- Implementation and dissemination of technology applications and services: Projects that examine how technology is used in educational and clinical settings, models of technology integration, centers to disseminate information about technology, and staff development efforts.

Within the implementation and dissemination category, which included findings from 36 projects, the researchers cited numerous research studies documenting the under-utilization of assistive and instructional technology in schools, clinics, and work settings. Further, they noted a consistent finding throughout the projects: the fallacy of the belief that simply placing an

innovative technology tool in the student's proximity would lead to improved educational results. The researchers reported:

> Just about all new developments in assistive and instructional technology appear to have followed this pattern -- much promise, much promotion, and little attention to the factors that influence how well technology is used and the range of effects it can have . . . Adding a computer to a classroom or giving a student an assistive device does not guarantee that these tools will be used appropriately, or that they will have any effect on teaching or learning. (Okolo et al.,1995, p. 54)

Okolo and colleagues synthesized several elements related to implementation that projects identified as keys to success. These were:

- Administrative leadership and the need for adequate funding;
- Technical support and collaboration; and
- Teacher preparation and released time to implement technologies.

The researchers concluded that technology was only one part of a complex micro-educational environment that includes many interacting variables. Lack of attention to these variables, in deference to simple solutions, would impede the effective use of technology.

This reference to the complex nature of implementing technology became a theme throughout many subsequent OSEP technology research projects. It surfaced again in a review of five collaborative technology research projects that was initiated by OSEP in 1995. These projects set out to study technology strategies that support access to the general education curriculum. Each project implemented technology-based strategies that helped students achieve meaningful participation and independence across various educational environments; promoted effective policy, planning, and practice to ensure accessibility, availability, and effective application for the full range of technology; and fostered the use and integration of technology through professional development.

A unifying framework emerged through cross-project analysis. Components of the framework, each of which was considered vital to effective technology utilization and integration, were:

- Technology planning;
- Professional development;
- Planning for individual students;
- Integrating technology and curriculum;
- Technical assistance to staff, students, and families;
- Student outcomes;

- Evaluating technology initiatives;
- Sustaining and institutionalizing change; and
- Integrating instruction about technology into special education teacher education programs.

It is important to point out the inter-relatedness of each component. Each component is necessary to promote best practice, to support the seamless integration of technology across educational environments, and to sustain innovation and growth for the teaching and learning experience.

These projects demonstrated that technology as an educational intervention is complex. Its implementation requires more than attention to one or two elements if enduring change is to be realized. It is not enough to look only at gaining the support of the administrator, or to training a teacher. While each element is essential, each is also part of a more comprehensive framework of related elements that must be addressed in the course of implementation. In most cases, the full implementation of technology requires a comprehensive and complex look at integrating the technology into the curriculum, into instruction, and into the educational setting with substantive policy and professional development support.

INNOVATIVE ACTIVITIES

While research and development efforts have provided considerable evidence to document the positive results of technology and have suggested implementation approaches, questions remain regarding utilization of technology. To address these issues, a number of OSEP's current investments are building upon past work in their exploration of technology as an intervention. Technology-based strategies that assist students in achieving meaningful participation and independence are being considered across various educational settings. These strategies emphasize how technology is integrated into the full range of school-related activities -- its use, the effects of using assistive and instructional technology on a broad range of results, and how the environment of schools either facilitates or hinders the use of technology. This means looking at change on multiple levels -- not just in the classroom, but throughout the entire educational system, including the school, district, State, and Federal levels (Means et al., 1993). At the local level, this may include the perspectives of curriculum, professional development, and technical assistance. Systemic factors may include the extent to which policy and planning support accessibility, availability, and effective application of the technology.

The pattern of looking at technology as an intervention has emerged in current projects in a variety of ways. The following are examples of innovative OSEP-funded efforts that hold promise of shaping the future.

Stepping Stones of Technology Innovation for Students with Disabilities

A grant competition under this priority category has been conducted annually since 1998. Projects in this priority are designed to focus research on implementation, as well as effectiveness and sustained use of a technology-based approach. The stepping stone framework embodies the notion of technology as a complex intervention by building into its design an understanding of implementation and the work that needs to be done to ensure utilization. There are three phases of possible work:

- Phase 1 -- Development: Projects develop and refine a technology-based approach and test its feasibility for use with students with disabilities.

- Phase 2 -- Research on Effectiveness: Projects select a promising technology-based approach that has been developed in a manner consistent with Phase 1, and subject it to rigorous field-based research and evaluation to determine effectiveness and feasibility in educational or early intervention settings.

- Phase 3 -- Research on Implementation. Projects select a technology-based approach that has been evaluated for effectiveness and feasibility, and study its implications in multiple settings to acquire an improved understanding of the range of contexts in which the approach can be used effectively and the factors that determine the effectiveness and sustain ability of the approach in that range of contexts.

Projects funded under this competition have the potential to chart a new course of inquiry as it relates to implementation issues.

The Center to Link Urban Schools with Information and Support on Special Education and Technology (LINK*US)

In previous years, the approach to dissemination and follow-up support was primarily one of supplying information, in print, media, and electronic formats, to the targeted audience. The current approach resolves around providing schools with sufficient technical assistance to support large-scale implementation efforts. The complex nature of the present activities typically includes integrating technology into the curriculum through professional development and ongoing professional support.

An example of this emerging pattern of work is the LINK*US Center at the Education Development Center, Inc., a five-year project funded by OSEP. The overall project goal is to improve outcomes for students with disabilities by having general and special education teaching personnel integrate a range of technology tools into a standards-based curriculum. LINK*US provides key school district personnel with technical assistance to design, conduct, and evaluate ongoing professional development. Technical assistance is guided by the following principles:

- All professional development activities must be aligned with key district initiatives (e.g., language and literacy improvement).

- All activities must be directed at improving results for students.

Collaboration between general and special education teaching personnel is encouraged. Such collaboration is supported by district facilitators, administrators, and related service providers. Collaborative school-based teams design, implement, and reflect on the best methods and procedures to integrate technology into ongoing instruction. Teams use an established process for looking at the work of three focal groups of students (students with IEPs, students at risk of failure, and typically developing students) over time. The process involves determining each student's abilities and needs, identifying clear goals related to standards, generating instructional strategies that meet the needs of diverse learners, and determining how technology can support learning, and designing assessments. The project will determine the extent to which teachers institutionalize this process and sustain the use of technology over time.

Family Center on Technology and Disability

As technology is implemented across settings, the perspectives of multiple stakeholders regarding its usability may affect success. As researchers and developers create new technology approaches, the needs and abilities of every individual whom the child will encounter while using the technology must be addressed.

One of the most significant stakeholder groups is the child's family. The potential of technology may be hindered when families are not trained to integrate the use of the assistive device in naturally occurring activities. Professionals are responsible for helping children and their families to select and acquire assistive technology devices and services, as well as instructing them in their use.

The Family Center on Technology and Disability, housed at the United Cerebral Palsy Association, is an example of an OSEP center designed to support families by providing readily accessible information about technology. At the core of the center's approach is a partnership with other national organizations that serve families of children with disabilities. Rather than serving families directly, the center's emphasis is on identifying partners who, through their ongoing work with families, can serve as intermediaries in dissemination. These partners disseminate information and provide support to their constituents, thereby broadening the reach of the center.

Additional OSEP Efforts

OSEP is undertaking a variety of tasks to study how technology is being used, or might be used, for students with disabilities. Following are examples of selected initiatives:

* Children from birth to 3. Technology can play a significant role in early intervention programs and services for children from birth to age 3. IDEA has promoted the use of assistive technology services for young children through the Infants and Toddlers Program (Part C). Technology enables children to engage in the same activities as their peers who do not have disabilities. As a result, technology acts as an equalizer and further enhances opportunities for children with disabilities to be educated in less restrictive settings. A major initiative being undertaken in this area is the Birth to 3 Project. In addition to looking at effective technology for this age group, researchers also will look at the feasibility of using such technologies.

* Futures studies. OSEP conducted the first "futures" study in 1984 to investigate how technologies from other sectors (e.g., medical, business, military) might be adapted to benefit students with disabilities. This initiative has been revisited every three to five years in order to identify trends and plan new directions. In the current initiative, the emphasis is on the near future. Papers are being commissioned that focus on how technology may affect students with disabilities in typical settings. These papers will be given to global futurists who will be asked to draw implications for research and practice.

* Synthesis on the selection and use of assistive technology. To ensure that research is disseminated fully to the field, an initiative is being undertaken to synthesize information from projects that have developed and/or studied approaches to selecting and using assistive technology, training parents, and providing local programs to support the appropriate uses of assistive technology. Information from the synthesis will form the basis for a video-based package that will be disseminated to both professional and nonprofessional audiences.

SUMMARY

The IDEA provision to consider assistive technology reflects a growing body of knowledge demonstrating the power and potential to enhance the lives of children with disabilities by providing them with access to the classroom and to learning. However, to guarantee that technology will be used consistently and effectively for its intended purposes often requires much more than simply recommending a particular tool, putting the tool into the student's or teacher's hands, or providing an after-school staff development workshop for teachers. In many cases, particularly with more high-tech applications, technology implementation takes considerable effort and knowledge. The consideration of technology assumes an understanding of how those technologies will interact with myriad contextual factors, including stakeholders, the environment, policies, curriculum, families, and the students themselves.

The TMS program has produced a strand of inquiry that has evolved from a focus on usefulness -- the potential of technology to alleviate a student need -- to a focus on usefulness and utilization. TMS research has followed a pattern that is illuminating many of the contextual factors that both impede and facilitate its use. The success of technology in helping students progress ultimately will be contingent on how well these contextual factors are addressed. With OSEP's support, appropriate technology and media have been and continue to be researched, developed, demonstrated, and made available in timely and accessible formats to parents, teachers, and other personnel who provide services to children with disabilities.

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The Alliance Project (#8029K4085) is supported by the U.S. Department of Education, Office of Special Education Programs (OSEP). Opinions expressed herein are those of the sources and do not necessarily represent the position of the U.S. Department of Education.