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# Technologies Supporting Curriculum Access for Students with Disabilities

***Teacher Practice***

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# Technologies Supporting Curriculum Access for Students with Disabilities

Prepared by Richard M. Jackson
National Center on Accessing the General Curriculum

## INTRODUCTION

Today, the education of students with disabilities appears to be "everybody's business." In an era of inclusion and collaboration, educators on all levels need information about the myriad ways in which technology can enhance the performance capabilities of these students, facilitate participation in instructional activities, and improve scholastic achievement. This document is intended to provide those who share the responsibility of educating students with disabilities with information critical to building and maintaining technology supports at the local level. Thus, the primary audience for this document is local school personnel. State education agencies, regional resource centers, and technical assistance centers under cooperative agreement with the U.S. Department of Education may also find this document useful in supporting the efforts of local authorities in expanding opportunities for ALL students, including those with disabilities, through technology applications.

## BACKGROUND

The 1997 amendments to the Individuals with Disabilities Education Act (IDEA'97) stipulate that all students with disabilities must have access to the general curriculum and participate in state and district wide assessment systems intended to measure effective progress. Currently, each state identifies standards in core curriculum domains. Within each state, separate school districts put into operation curriculum resources and instructional practices that are targeted at the attainment of state standards. The general curriculum, however, is not limited to each state's set of standards in core areas, but also includes the local options that communities build in to augment state frameworks. Therefore, whatever a school system, or school within a system, makes available to non-disabled students must also be offered to students with disabilities.

Earlier entitlements for students with disabilities focused principally on specialized curriculum and instructional practices (special education) tailored to meet unique needs resulting from the disability. IDEA'97, represents special education as a system of services, supports and ancillary aids enabling students to make effective progress in general education. This law also allows students with disabilities to participate in standards-based reform by prohibiting exclusion from state and district-level accountability systems. Individualized educational programming, as revealed in the IEP for students with disabilities, now begins with an analysis of each student's current level of performance in the general curriculum. This is in stark contrast to the earlier approach to IEP development, which began with an assessment of each student's unique needs arising from the disability. Not such a subtle distinction, the new approach enables IEP team members to identify services, supports and ancillary aids that not only address disability but also enable the student to make effective progress in the general curriculum.

State curriculum frameworks in separate content areas contain standards that are often specified sequentially, including prerequisites and benchmarks. A critical task of the IEP team is to determine the entry points for each student engaging in the general curriculum. The team must examine standards of performance in broad ways, identifying authentic, culminating products as outcomes of instruction. The team must then identify a minimal range of accommodations that allow the student to participate in the curriculum in ways that reduce the impact of disability

without altering standards. Where entry points appear to be far below standards, the team must design curriculum modifications that allow the student to advance toward the standard in increments more appropriate to the student's capabilities. A variety of techniques exists for modifying curriculum so that targets that address the student's disability-related needs can be embedded in the general curriculum. In either case, whether the student's curriculum is modified or the student's disability is accommodated, the general curriculum sets the focus for educational programming. With the ongoing infusion of technology in education, it is now crucially important for stakeholders and decision-makers to consider just how technology solutions can assist with this challenging process. Hopefully, this document will provide much-needed help in this connection.

## APPROACH

Technology can support much of the effort toward curriculum access, participation and progress. Technology increases independence, personal productivity and empowerment. It can facilitate the kinds of interactions that occasion instruction, and it can transform static curriculum resources into flexible digital media and tools.

In educating students with disabilities, the IEP document remains critically important. It details the student's current levels of performance, sets annual goals and delineates the services, supports and ancillary aids necessary to accomplish those goals. With increasing numbers of children served in inclusive settings, the IEP is today framed more in the context of the school and its curricular offerings. This means that the IEP team must not only consider the disability-related needs of the student but also the settings demands of the school. Instruction occurs within a context of space and time in which teaching and learning procedures become routine. While the "I" in IEP remains paramount, IEP team members as well as other school personnel must act proactively by putting policies and practices in place that maximize the accessibility of curriculum and instructional offerings. *Planning curriculum and instruction at the outset—with the widest possible range of students in mind—has the potential of reducing the time, costs and efforts associated with designing a high quality educational program for all students, especially those with disabilities.*

Such a proactive approach should include technology solutions. The range of solutions may vary widely from dedicated communication devices (assistive technologies) to highly conventional personal computers with designed-in accessibility features such as those found in Microsoft's Windows operating system. Technology solutions may also serve to supplement or transform the curriculum itself into flexible and accessible, digital resources following principles of universal design. For a thorough treatment of universal design, the reader may want to visit Rose & Meyer (2002) at http://www.cast.org/teachingeverystudent/ideas/tes/. For an examination of how the framework of Universal Design for Learning (UDL) can transform traditional and even current curriculum offerings into highly flexible and accessible resources for all students, the reader may want to visit Hitchcock, Meyer, Rose & Jackson (2002) at http://journals.sped.org/EC/Archive_Articles/VOL.35NO.2NOVDEC2002_TEC_Article%201.pdf.

In this pursuit, it is critically important to agree that simply purchasing an accessible computer and a talking word processor—while a step in the right direction—barely begins to address the challenge confronting educators today. Technology tools must work for the individual student, but it must be emphasized that technology tools must also work in the context of the classroom and the school. To be sure, technology has dramatically increased independent functioning, but it can go so much further in increasing curriculum flexibility. Challenges of access, participation

and progress must be faced not only on the individual student level but on the curriculum level as well. Universal Design for Learning (UDL) is presented here as a framework for the provision of a more accessible, flexible and equitable curriculum. What follows is a series of questions and answers, which school personnel and other stakeholders can use for structuring increased access to the general curriculum for students with disabilities through the use of technology.

### *In mapping or indexing our school district's curriculum to align with our state's standards, how can we identify and obtain accessible content?*

**Issues in Context**

In standards-based reform, much attention is focused on solving what is known as the problem of alignment. Standards-based assessment systems must align with state standards, which in turn must align with district standards, which in turn must align with district curriculum, which in turn must align with school-based instructional practices. A variety of tools exist for assisting local administrators and curriculum leaders with the process of "mapping" their local practices and resources over their state's curriculum frameworks. Indexing district-level resources helps to identify gaps or omissions that result in misalignment. Where high stakes are attached to state assessment systems, school officials want to ensure that students have the opportunity to learn (OTL) the knowledge and skills indicated in core subject areas. Curriculum resources that are inaccessible—or not readily transformable into accessible media at the point of instruction—deprive students with disabilities of their opportunity to learn in the company of their peers. Such inopportunity in turn can result in lowered performance on mandated assessments and possibly a failure to derive benefit from the offerings of a public education.

Clearly, an accessible curriculum at the point of instruction is in everybody's best interest. Currently, approximately 80% of the curriculum is driven by the ubiquitous textbook, which is generally supplemented with myriad materials also in paper form. Paper and ink make for a static, one-size-fits-all instructional presentation. Yet, the technologies that generate books and materials are by contrast remarkably flexible. Pictures, graphs, charts, tables and text elements are created in digital form with digital tools and subsequently transformed into the static, one-size-fits-all textbook. Once in school, the textbook may be subjected to multiple reverse transformations to render it accessible to, for example, blind or dyslexic students. That is, the textbook must be optically scanned and returned to something resembling its original digital state in order to be rendered in Braille for the blind or speech for the struggling reader. These reverse transformations are costly, labor intensive and frequently do not yield timely delivery at the point of instruction and, therefore, deprive students of their OTL.

A wise and prudent course of action when school personnel undertake the arduous process of mapping local curriculum over state standards would be to put in place a process for identifying and locating accessible digital media. The Web can be searched for free digital content, some of which may be in the public domain. Subscription services exist for Web delivery of accessible content or mail delivery of fixed media such as CD/ROMs. Under certain provisions, publishers are making digital versions of textbooks available for use by qualifying students with disabilities. Educational publishers are also venturing into the realm of digital delivery of all manner of instructional resources. Many of these developments are advancing rapidly, and even those that are historically well established are not widely known or in place.

While ultimately the sale and distribution of digital content as school curriculum will emerge within a combination of business and regulatory educational models, it is important for school personnel who access digital content to become acquainted with fair use provisions under copyright law as well as regulations governing the distribution of content to the so-called "print

handicapped." The 1996 Chafee Amendment to the federal Copyright Act establishes a limitation on the exclusive rights in copyrighted works. The amendment allows authorized entities to reproduce or distribute copies or phonorecords of previously published nondramatic literary works in specialized formats exclusively for use by blind or other persons with disabilities. More information on copyright law as it relates to individuals with disabilities can be found at http://www.loc.gov/nls/reference/factsheets/copyright.html. Related information on copyright and fair use of digital content can be found at http://fairuse.stanford.edu/ sponsored by the Stanford University Library.

**A Range of Solutions**

To the extent that the curriculum can be resourced with public domain literature, tools exist for locating and downloading digital versions for easy transformations into Braille, large print, or synthetic speech. Consider, for example, the Alex Catalogue of Electronic Texts.

http://www.infomotions.com/alex/. "Alex" is a collection of public domain documents from American and English literature as well as Western philosophy. Also, "Favorite Children's Stories" can be located at the American Library Association's "Great Websites for Kids" at http://www.ala.org/ala/alsc/greatwebsites/greatwebsitesfavorite.htm. Additionally, commercial sources of so-called "eBooks" are also searchable and downloadable on the Web http://ncam.wgbh.org/ebooks/comparison.html. To learn more about eBooks, their accessibility and tools for accessing them, visit the National Center on Accessible Media at http://ncam.wgbh.org/.

For students whose reading challenges arise from physical causation, such as visual impairment, neurological impairment or orthopedic impairment, a vast collection of digital books may be freely obtained through a web-based service at http://www.bookshare.org. Bookshare requires a nominal annual membership fee and authentication of print disability status. School and school district membership plans are also available. Digital content thereafter may be freely downloaded. Bookshare provides quality ratings of its content. Multiple electronic formats are also available such as text only, HTML, Braille (brf), and DAISY.

Human voice recordings (on analogue audiocassettes) of popular magazines and all genres of literature may be freely obtained for qualifying "print handicapped" individuals from the National Library Service's Division for the Blind and Physically Handicapped at http://www.loc.gov/nls/. Voice recorded textbooks for school aged, college level and professionals who qualify as "print handicapped" are also available through Recording for the Blind and Dyslexic (RFB&D) at http://www.rfbd.org/catalog.htm. RFB&D's library of human voice recordings is currently being digitized for distribution on CD/ROM. Sophisticated playback equipment is also available from RFB&D with search capabilities on digitally indexed media.

Increasingly, the World Wide Web serves to deliver multimedia content to support curriculum in core content areas. These rich media sources are accessible to the extent that their hosts adhere to accessibility standards contained in the W3C Accessibility Guidelines http://www.sitepoint.com/article/512, and Section 508 of the Rehabilitation Act as amended in 1988 http://www.section508.com/about/. Compliance with accessibility standards is required on federal government hosted or sponsored websites. State and local agencies are increasingly complying on a voluntary basis. Information traditionally obtained from government printing offices, state and local authorities is increasingly available in digital form on demand. Rapidly

accumulating digital content on the Web can be increasingly incorporated into the lessons and units developed by teachers to align with their state standards.

Of particular importance to educators is CAST's National File Format (NFF) initiative, which pulls together the efforts of a broad base of stakeholders to arrive at a digital format for publishers to use in readying their textbooks for consumption by students with disabilities. The complex process of producing digital textbooks can be examined by visiting the National Center on Accessing the General Curriculum at http://www.cast.org/policy/ncac/index.html. While the immediate use of the NFF is targeted at print disabled students endeavoring to access the general curriculum, the stage is set for the distribution of print media in accessible form to all potential markets. Pearson Prentice Hall claims to be the nation's leading educational secondary publisher of scientifically researched and standards-based instruction materials for today's 6–12th grade classrooms. Their mission is to create exceptional educational tools that ensure student and teacher success in language arts, mathematics, modern & classical languages, science, social studies, career & technology, and advanced placement, electives, and honors.

A glimpse into the future of how educational publishers might assist local schools with procuring digital resources can be captured by visiting Pearson Prentice Hall at http://www.phschool.com/about_ph/. Prentice Hall is a division of Pearson Education, which declares itself to be the global leader in integrated education publishing. With such renowned brands as Pearson Prentice Hall, Pearson Longman, Pearson Scott Foresman, Pearson Addison Wesley, Pearson NCS, and many others, Pearson Education claims to provide "quality content, assessment tools, and educational services in all available media, spanning the learning curve from birth through college and beyond."

A sample of Pearson's digital interactive textbooks can be examined by visiting PHSuccessNet at http://www.phschool.com/successnet/preview_it.html. PHSuccessNet's Teacher Center is the one place, one source, and one login for their interactive online resources to help schools plan, teach, assess, and manage classrooms. Pearson proposes to distribute the same content as its printed textbook with the addition of interactive activities, videos, audio, and self-assessments to engage all learners.

**Summing it up**

This section has identified tools and approaches for resourcing the local curriculum with highly flexible, digital and accessible content. Examining curriculum at the outset on the local level can obviate many of the barriers and challenges in obtaining, producing or procuring accessible curriculum resources that align with state and district standards. Today, the Web increasingly serves as a powerful source of content for local schools. Making the most of this resource will require that this content, which is intended for all learners, be made accessible, flexible and transformable for students with disabilities. Following the UDL framework will increase the likelihood of such an outcome.

### *In our school district's professional development effort, how can we include approaches for preparing classroom materials and other instructional resources in accessible form?*

**Issues in Context**

Beyond textbooks and library resources, classroom practices employ a wide range of methods, media and materials. Teacher decision-making plays a large role in determining how and in what forms lessons and units will be resourced. School cultures emerge with particular ways of doing things in support of the curriculum. The day-to-day demands of classrooms—the work of the

teaching and learning process—mandates a certain degree of efficiency. The necessity for efficiency gives way to uniformity and classrooms soon establish particular ways of getting things done. Media and materials that are static in their form, such as the age old worksheet, like the ubiquitous textbook, constitute a one-size-fits-all approach. Technology tools and digital media can greatly increase the transformability and hence the flexibility of static media and materials. Merely acquiring the technologies to accomplish this degree of accessibility is not enough, however. Schools must adopt a philosophy of instructional inclusion and a guiding framework for moving forward to embrace all learners. It is argued here that universal design for learning provides such a framework. Professional development must focus on helping teachers acquire greater skill and knowledge in the use and integration of technology as well as a disposition concerning the benefits of technology in improving everyday instruction for all students, especially students with disabilities.

**A Range of Solutions**

The need for high quality and carefully planned professional development has perhaps never been greater than it is today. In recent years, state authorities have lessened requirements for new teachers to enter the profession. Emphasis has shifted away from extensive pre-service preparation to support of new teachers through state-mandated induction programs and extended professional development requirements for veteran teachers. In this era of inclusion, collaboration and technology integration, veteran teachers must form professional learning communities that commit to ongoing professional development. State and federal incentives for all teachers to craft professional develop plans that yield improvements in student achievement have also emerged to improve teacher quality. State Improvement Grants awarded to the separate states to assist local authorities with the implementation of the new law (IDEA'97) represent a coherent attempt at systemic change. CAST's UDL professional development institutes, for example, have assisted several state improvement grant programs in applying the UDL framework to classroom practices that increase curriculum flexibility. The reader may learn more about professional development opportunities by visiting CAST's website and linking to http://www.cast.org/pd/index.html.

Linking professional needs with both professional development requirements and opportunities should be undertaken at the local level to ensure relevance and increase the likelihood of effectiveness. Several initiatives call attention to the need for greater technology integration in curriculum and instruction. The National Council for Accreditation of Teacher Education (NCATE) has adopted the technology standards developed by the International Society for Technology Education (ISTE). These National Educational Technology Standards (NETS) can be found at: http://cnets.iste.org/index.shtml. Standards have been developed for students, teachers and administrators. These standards reveal the technology competencies essential for twenty-first century teachers.

Preparing Tomorrow's Teachers to Use Technology (PT3) federal grants have linked teacher preparation institutions and K–12 schools with industry to advance the technology competencies of teacher candidates in preparation and veteran teachers in field settings. Teachers who use technology to increase their own personal and professional productivity are most likely to incorporate technology in the planning and delivery of classroom instruction. The more teachers develop their own "teacher-made materials" in digital form, and the more they resource their units with digital content from the Web, the more flexible, transformable and accessible their curriculum and instruction will be for the widest possible range of learners. Professional development efforts that concentrate on helping teachers create or select digital resources,

following principles of universal design, increase the likelihood of improving results for all students.

Frequent feedback is critical to student learning. Unit tests often come too late in the instructional cycle to be of benefit for students. Classroom formative assessment needs to be ongoing so that students can develop self-monitoring and self-correction skills. Principles of universal design for learning can be applied to assessment as well as to instruction. In fact, increased use of digital resources permits the embedding of assessment within instruction. Keep in mind that the more assessment resembles instruction, the more authentic is the process for determining what students actually know and can do. For example, students who learn to write with computers and word processors ought to be assessed using computers and word processors. If assessments require the performance of tasks by the student that were never taught in the first place, the results of the assessment would at best misrepresent the capabilities of the student. Thus, the technologies employed in the acquisition of knowledge and skill in accessing the curriculum should also be used in the demonstration of what the student has retained or can apply in an assessment situation. In planning for instruction, teachers should consider both instructional and assessment applications as interconnected. Having local capacity to produce both in digital form greatly increases the flexibility and ultimate utility of resources.

Universal Design for Learning (UDL) provides a framework for planning how to present resources, provide opportunities for strategic learning, and arrange environments for maximum engagement. The reader can learn how to apply several evidenced-based classroom practices by visiting the National Center on Accessing the General Curriculum (NCAC) at http://www.cast.org/policy/ncac/index.html . Six effective classroom practices are described at this site. Each of the practices listed below have direct application to universal design for learning:

- Explicit Instruction
- Differentiated Instruction
- Curriculum-Based Evaluation
- Peer-Mediated Instruction and Intervention
- Classroom Management
- Strategic Instruction

Another source for information on the connection between UDL and effective classroom practices can be found at the Access Center for Improving Results for All Students: K-8. Hosted by the American Institutes for Research (AIR), the "Access Center" maintains a website at http://www.k8accesscenter.org/default.asp. The mission of the Access Center is to provide technical assistance to help improve educational outcomes for elementary and middle school students with disabilities by building the capacity of State education agencies, other technical assistance systems, districts, and schools, to help students with disabilities learn from the general education curriculum. In collaboration with CAST, the Access Center has published the following three documents:

- Differentiated Instruction and Implications for UDL Implementation
- Graphic Organizers and Implications for Universal Design for Learning: Curriculum Enhancement Report
- Virtual Reality/Computer Simulations and the Implications for UDL Implementation

These documents, which can be downloaded at http://www.k8accesscenter.org/training_resources/UDAccessCenterCASTresources.asp, complement the "classroom practices" documents described above.

Also available from the Access Center is the Universal Design for Learning (UDL) Training Guide Toolkit. The UDL Toolkit supports professional development providers and other educators with the conduct of workshops on Universal Design for Learning (UDL) by providing resources for face-to-face training sessions and ongoing follow-up support. The toolkit includes information on background and core UDL concepts, examples of UDL applied in classrooms, and guidance for understanding and applying UDL in practice. The toolkit contains slides and strategies for providing interactive training sessions in UDL, including tools, templates, and resources that can be used online or downloaded. All of these resources may be freely downloaded at http://www.cast.org/teachingeverystudent/toolkits/tk_introduction.cfm?tk_id=61. Additionally, visiting the National Consortium on Universal Design for Learning at http://www.cast.org/pd/consortium/ will acquaint the reader with a growing community of educators who inquire into the practices supported by UDL and share their successes with classroom application.

**Summing it up**

This section emphasized the important role professional development plays in improving teacher quality. Efforts at the local level should focus on technology integration and the design of accessible instructional resources to enhance classroom practices. Content from CAST and the Access Center was identified as having particular relevance for targeting and delivering professional development that would increase the accessibility and flexibility of school based instruction.

### *In implementing our district's technology plan, how can we address issues of accessibility in selecting platforms, software, and Web browsers?*

**Issues in Context**

Technology planning is a complex process. Congress launched its third wave of technology planning by passing the Enhancing Education through Technology Act of 2001 under the No Child Left Behind (NCLB) legislation. The primary goal of this part of NCLB is to improve student academic achievement through the use of technology in elementary schools and secondary schools. An additional goal is to assist every student in crossing the digital divide by ensuring that every student is technologically literate by the time the student finishes the eighth grade, regardless of the student's race, ethnicity, gender, family income, geographic location, or disability. Two explicitly stated purposes of the Act are: 1) To provide assistance to States and localities for the implementation and support of a comprehensive system that effectively uses technology in elementary schools and secondary schools to improve student academic achievement; and 2) To promote initiatives that provide school teachers, principals, and administrators with the capacity to integrate technology effectively into curricula and instruction that are aligned with challenging State academic content and student academic achievement standards, through such means as high-quality professional development programs. For more detail on the multiple goals and purposes of the act, readers may want to visit http://www.ed.gov/policy/elsec/leg/esea02/pg34.html. Clearly, key features contained in the act address technology integration, curriculum alignment, standards-based reform and students with disabilities.

In order to participate in the federal programs entitled by the act, state education authorities must develop their own technology plans. Both federal law and state compliance establish a

framework for local education authorities to plan for the acquisition, maintenance, and support of hardware and software as well as networking infrastructure. Planning at the local level also includes the integration of technology into teaching and learning processes in the schools.

A variety of tools exist for assisting local authorities with technology planning. These are found primarily on state education agency websites. For instance, Massachusetts Technology Plan 2003-2006 can be found at http://www.doe.mass.edu/edtech/tplan03_06.html. Websites maintained by federally funded regional resource centers are also helpful resources. For example, the North Central Regional Educational Laboratory (NCREL) hosts Learning Through Technology: A Planning and Implementation Guide at http://www.ncrel.org/tandl/homepg.htm. Useful links include: Perspectives about Education, Planning to Plan, Building a Knowledge Base, Establishing General Directions, Implementing Priorities and Strategies, Evaluating Progress, and Institutionalizing. Also the Southeast Initiatives Regional Technology in Education Consortium (SEIR-TEC) hosts a "Technology Planning" website at: http://www.seirtec.org/techplan.html containing many useful links including sample state and district technology plans and a literature review on the process of technology planning.

The current new wave of technology planning seeks greater alignment with other school improvement planning initiatives. Note how technology is embedded within the key provisions of No Child Left Behind listed below:

- Achieving Excellence Through High Standards and Accountability
- Improving Literacy by Putting Reading First
- Improving Teacher Quality
- Improving Math and Science Instruction
- Moving Limited English Proficient Students to English Fluency
- Promoting Parental Options and Innovative Programs
- Encouraging Safe Schools for the twenty-first century
- Enhancing Education Through Technology
- Providing Impact Aid

In implementing these key provisions, Congress intends to give states and local authorities greater flexibility in the use of federal education funds in exchange for meeting accountability requirements (detailed information on NCLB can be found at http://www.ed.gov/nclb/landing.jhtml). Presumably, fewer bureaucratic requirements will result in more attention to students' needs. Under this comprehensive legislation, schools have more freedom to implement innovations and allocate resources as they determine appropriate. Moreover, states and school districts are given added flexibility in several other areas, including teacher professional development and educational technology. Thus, in the current climate, technology planning should be coordinated with other reform initiatives and planning efforts intended to improve results for all students, including those with disabilities.

**A Range of Solutions**

As part of Massachusetts' efforts to improve education at the local level, school districts are required to develop a District Curriculum Accommodation Plan (DCAP). The statutory basis for the DCAP can be found at http://www.mass.gov/legis/laws/mgl/71-38q.5.htm. According to Section 38Q ½ of Massachusetts Chapter 71:

> *A school district shall adopt and implement a curriculum accommodation plan to assist principals in ensuring that all efforts have been made to meet students' needs in regular education. The plan shall be designed to assist the regular classroom teacher in analyzing and accommodating diverse learning styles of all children in the regular classroom and in providing appropriate services and support within the regular education program including, but not limited to, direct and systematic instruction in reading and provision of services to address the needs of children whose behavior may interfere with learning, or who do not qualify for special education services under chapter 71B. The curriculum accommodation plan shall include provisions encouraging teacher mentoring and collaboration and parental involvement.*

In Massachusetts, each school district must submit to the State Education Agency a three-year Comprehensive District Plan. Each year thereafter, districts must file a District Action Plan, noting progress in improving student achievement in line with the goals of NCLB. Individual schools must also develop annual School Improvement Plans. DCAPS are developed through the coordinated efforts of school improvement councils.

A highly detailed example of a DCAP can be found at the website for Bellingham Public Schools at http://www.bellingham.k12.ma.us/district/Policies%20and%20Procedures/District%20Accommodation%20Plan%20-%20Goal%201%20-%206.htm. Another example can be found at the East Longmeadow Public Schools at http://www.eastlongmeadow.org/Schools/accomplan.htm. In examining these plans, note that DCAP represents a general education response to diversity and a recognition of the need for shared responsibility among general and specialized school personnel. School districts can interrogate their curriculum and instructional practices to provide greater opportunity for access, participation and progress for students with disabilities, students under-performing on standards-based assessments, as well as English language learners. While DCAPs are developed for the district, each school must augment its district's plan with input from its school improvement council, a body which includes the principal and represents students, parents, teachers, and community stakeholders. In this era of aligning and consolidating reform initiatives as inspired by NCLB, state and local improvement planning, technology planning and something akin to Massachusetts' DCAP can go hand in hand to improve results for all students, including those with disabilities.

As technology planning and DCAPs become incorporated into District Comprehensive Planning, school districts and their various stakeholders often debate over platform (e.g., PC versus Mac). As technology advances, interoperability across platforms is increasingly feasible. Thus, support for mixed platforms—while still challenging to maintain—is possible. Whichever approach—mixed or exclusive computing environment—a particular school district may opt for, it is critical to make accessibility a high priority. Knowingly and willfully purchasing technology resources which are clearly inaccessible may constitute a civil rights violation as defined by Section 504 of the Rehabilitation Act and the Americans with Disabilities Act, subjecting the school district to lawsuits and punitive damages. These and other pertinent pieces of legislation are summarized in "A Guide to Disability Rights Laws" published by the U.S. Department of Justice at: http://www.usdoj.gov/crt/ada/cguide.htm. A less defensive and more compelling need for school systems to approach issues of accessibility is that the community of learners who ultimately profit from the curriculum and the technologies that support it will be widened and far more inclusive. Finally, another argument for proactively addressing accessibility is the increased efficiency in labor intensive activities and cost effectiveness that results when technology

resources facilitate independence and limit the number of media transformations that traditional materials would have to undergo to permit routine access.

Technology planners at the local level will need to take into account the "off-the-shelf" accessibility features of the major computer platforms. Apple, Microsoft and Sun Microsystems, for example, have independently pursued programs to render their operating systems (OSs) more user-friendly. In the 1980s, Apple's Macintosh project exploited the intuitive powers of the graphical user interface (GUI) to rapidly accelerate the learning curve for productive and independent computer use. Relying on visual metaphors, users could navigate the Macintosh without need for memorizing command line language. The use of control panels further increased the flexibility of computer operations by enabling such features as text-to-speech functionality, screen magnification and enhancement, and keyboard adaptations. When Microsoft followed Apple with Windows—its own version of the GUI—the intuitive, highly visual approach to computing created new challenges for individuals with vision impairments. While Apple continued following its control panel approach to universal access until the release of OS X, Microsoft left computer adaptations to the assistive technology industry.

Today, with the advent of Apple's OS X and Microsoft's Windows 98, 2000, NT and XP, the two companies appear to have taken different paths on the road to accessibility. Apple has abandoned CloseView, its control panel for individuals with low vision. Screen magnification in OS X no longer supports cursor tracking, a critical element for low vision use of the GUI. However, an anticipated new release of the MacOS, named Tiger, promises dramatic improvements in accessibility with enhanced screen magnification and a talking interface. Microsoft has introduced universal access features in its Windows OS and encouraged applications developers to allow their software to be accessed with user determined accessibility features. Using the Accessibility Wizard in Windows, the user can now set accessibility preferences to appear upon login and also follow through to application launch. Thus, Microsoft Office and Internet Explorer, for example, will "grab" whatever accessibility features the user has selected in the OS. The capacity to link OS accessibility features directly to application software is extremely powerful, and the list of developers who take advantage of this feature is expanding.

The Trace Center at the University of Wisconsin maintains a Web page called "Accessible Software Guidelines." Located at http://trace.wisc.edu/world/computer_access/software/index.htm, the page provides linked lists of application software guidelines from multiple entities. Each includes information useful for designing accessible software applications. Several of the links provide specific guidance on software accessibility while others provide general user interface design guidance.

The bright side of these developments in the computer industry is that conventional technology is becoming increasingly more accessible. When the designed-in accessibility features of OSs and supported software applications do not suffice, special or adapted technologies, called assistive technologies, must be considered. The Assistive Technology Industry Association (ATIA) hosts a website at http://www.atia.org/. The mission of ATIA is to serve as the collective voice of the Assistive Technology industry so that the best products and services are delivered to people with disabilities. ATIA represents the interests of its members to business, government, education, and the many agencies that serve people with disabilities. "AT Compatibility Guidelines" that assist software developers concerned with accessibility can be downloaded at http://www.atia.org/AT_Compatibility_Guidelines_v1.05.pdf. This document, developed under the umbrella of the ATIA, contains guidelines set out by assistive technology developers. It is

intended to help mainstream Electronic & Information Technology vendors make their products more compatible with current and future Assistive Technology. Finally, The Alliance for Technology Access (ATA) has developed in collaboration with WestEd RTEC, "Selecting Software for Young Learners." Authored by Kirsten Haugen of KidsCan!, the guide offers ten tips to facilitate the selection of accessible software. See http://www.ataccess.org/resources/atk12/selectsoft.html.

**Summing it up**

Thus, in selecting hardware, software, web browsers and mail clients, technology planners and other stakeholders at the local level should consider both OS accessibility and software compatibility with OS accessibility features. See Appendix for additional links to sites hosted by Microsoft Corporation, Apple Computer, Sun Microsystems, IBM, Adobe Systems and Macromedia that should prove particularly helpful in this effort.

### *In establishing building-based technology support policies, how should we involve special education personnel and other stakeholders?*

**Issues in Context**

At the local level, schools may implicitly embrace a philosophy of inclusion, but vestiges of the ways schools traditionally operate present barriers to full participation by students with disabilities. Only a few short years ago, students with disabilities began to be *physically* included in general classrooms. More recently, interactions with non-disabled classmates led to *social inclusion*. Today, the challenge is to promote *instructional inclusion*. To address this challenge, general and special education personnel must recognize common goals for all students and agree to share responsibility for pursuing and attaining those goals. This requires that practitioners possess skill in process of collaboration and administrators allocate time for the essential activities of co-assessing and co-planning.

In many local environments, educational technology specialists may be a few steps removed from actively and effectively engaging in this process. If they are strictly hardware and software focused, they may be concerned about maintenance and security and consequently less open to installing and supporting assistive or adaptive technologies. Technology specialists also may have difficulty integrating technology into curriculum and instructional practices at the classroom level. However, they do bring highly specialized expertise in technology at the building level on-site where it is needed. General education classroom teachers add their own expertise from the curriculum in terms of planned units and lessons that are aligned with state and district standards. Special educators contribute knowledge of the functional implications of disabilities, individualized assessment techniques and how to adapt instruction. Many special educators also contribute knowledge of assistive technologies. In establishing building-based technology support policies, it is critically important for all voices to be heard. Principals and teacher leaders can help with this process. Principals can create time for collaborative teams to meet setting a clear agenda of what is to be accomplished. Teacher leaders can help promote the trust and mutual respect that must accompany the collaborative process. Indeed, for effective and inclusive policies to emerge, there is much inertia to overcome.

**Working toward Solutions**

At times it appears as a closely guarded secret that special education is no longer considered as a place or a separate system. Rather, special education is today a system of services and supports for general education. Yet, as technology resources and supports have emerged in schools as a result of waves of technology planning at the state and district-level, those who set up, operate and maintain technology resources, and—more importantly—those who would supervise them,

may feel little ownership over, or shared responsibility for, insuring that all members of the school community equally benefit from what technology has to offer. Therefore, including special education personnel in the planning and ongoing development of technology integration is crucial. Schools create technology cultures and the technology used by students with disabilities must fit into that culture. To this end, technology should not be isolating; rather technology should be inclusive and liberating. Students with disabilities should not use dedicated devices (i.e.- pieces of hardware and software) unless conventional technologies can be shown to be inappropriate. Students should use the least restrictive, isolating and stigmatizing resources available. Listening to the voices of special educators and advocates for the disabled at the outset should minimize this all-too-common occurrence.

Special educators should also be encouraged, even expected, to advocate during the IEP planning process so that students with disabilities will receive an assistive technology evaluation as required by IDEA'97. The Individuals with Disabilities Education Act (IDEA), a federal law reauthorized in 1997, requires schools to consider a student's need for assistive technology devices and services whenever an IEP is written. In addition, the Americans with Disabilities Act (ADA) and Section 504 of the Vocational Rehabilitation Act require schools to provide assistive technology for students with disabilities, if needed to assure equal access to the school's programs and services. IDEA'97 mandates that districts provide assistive technology to all students with disabilities if it is needed for them to receive a free, appropriate public education (FAPE). The IEP team is charged with the responsibility for determining a student's individual need for assistive technology in order to benefit from his or her education and to have access to the general curriculum. If it is determined that assistive technology devices and/or services are necessary, the IEP must specify the devices and services.

The Massachusetts Department of Education has developed a very useful guide to assist local authorities in following through with their obligations under the law regarding the provision of assistive technology services. Known as the "AT Guide", this resource can be accessed from http://www.doe.mass.edu/edtech/teacher/ATguide.pdf. There are many factors that need to be examined when assistive technology devices and services are being considered for a student—including educational goals, personal preferences, social needs, environmental realities, and practical concerns. A careful evaluation of the options will help schools avoid spending money on devices and services that do not meet a student's needs. The AT Guide is helpful in the way in which it places assistive technology planning in the broader context of school improvement planning, alerting stakeholders to the benefits of listening to the expertise of special education personnel.

Boston Public Schools' Access Technology Center, located at http://www.boston.k12.ma.us/teach/technology/emmanuel.asp, has developed and field tested a useful approach for gaining input from special educators as well as general educators in the formulation of technology supports for students with disabilities. The Center's website details a process yielding the Student Access Map (SAM). Four documents, downloadable from the Center's website, describe the process for completing SAM:

1. ***Student Access Map Instructions***—provides a detailed explanation of the information sought in each of five sections of the map.
   Standard/Goal/Activity: Curriculum entry point/task to be performed
   Student: Strengths/Needs/Interests
   Barrier: Factors impeding participation

Supports: Tools/Strategies

Plan: Action steps/Timelines/Persons responsible

2. ***Student Access Map fill-in chart***—arranges the five sections of the Map from left to right and allows room to fill in information under each heading.
3. ***Sample SAM***—shows two completed versions of this chart.
4. ***Supports***—contains a set of categorized lists of tools and strategies for supporting students' specific areas of need, including no-tech, low-tech, mid-tech, and high-tech ideas.

This "Support" document can be used to help with the completion of SAM or as a separate instrument for discovering new ideas for incorporating assistive technology into students' learning environments. The value of the Center's approach is that it starts with the curriculum in terms of goals or standards to be attained as entry points into the process. The individual student is then considered in the context of the classroom where barriers are addressed and a range of solutions are considered.

A similar approach, developed and widely applied by Joy Zabala, is the SETT framework, which can be accessed at http://www.joyzabala.com/. SETT is not an assessment protocol but rather a system to guide the team in making collaborative decisions in the context of the home, school and classroom. The framework supports the team in pursuing the following questions obtained from Joy Zabala's website:

***The Student***

- What does the Student need to do?
- What are the Student's special needs?
- What are the Student's current abilities?

***The Environment***

- What materials and equipment are currently available in the environment?
- What is the physical arrangement?
- Are there special concerns?
- What is the instructional arrangement?
- Are there likely to be changes?
- What supports are available to the student?
- What resources are available to the people supporting the student?

***The Tasks***

- What activities take place in the environment?
- What activities support the student's curriculum?
- What are the critical elements of the activities?
- How might the activities be modified to accommodate the student's special needs?
- How might technology support the student's active participation in those activities?

***The Tools***

- What no tech, low tech, and high tech options should be considered when developing a system for a student with these needs and abilities doing these tasks in these environments?

- What strategies might be used to invite increased student performance?
- How might these tools be tried out with the student in the customary environments in which they will be used?

**Summing it up**

The education of students with disabilities can be improved one school at a time. Each school must have an improvement plan and a means of measuring, monitoring and reporting on progress. Plans for curriculum accommodations, instructional support, technology integration and professional development must all coalesce at the local level. This section identifies a number of resources for bringing together special educators, general educators and other stakeholders into collaborative arrangements that result in the establishment of sustainable policies and practices for supporting students with disabilities through the application of technology.

### *How can we best integrate technology with core subject areas to reveal authentic student progress?*

**Issues in Context**

As schools and school districts pursue their third wave of technology planning, emphasis must shift to the identification of instructional practices that incorporate the use of technology to help all students reach and exceed state standards. Inappropriate or inadequate alignment of adaptive and assistive technology with the general curriculum can lead to two types of problems. First, a poor alignment may restrict a disabled student's ability to access the general curriculum. Second, the alignment may allow access to the curriculum, but make it difficult or impossible to make an accurate assessment of the student's learning. Curriculum mapping or indexing as discussed earlier can assist local authorities with the process of aligning their curriculum with state curriculum frameworks in a truly effective manner. Good local technology planning can help if it supports teachers in designing units and lessons that put technology into practical use. The local technology curriculum should not exist in isolation from the rest of the school offerings or it may cause as many problems as it solves. Rather, the technology curriculum should ensure that both students and teachers acquire the knowledge, skills and disposition to use digital media and digital tools to follow through with activities that accurately demonstrate the attainment of standards in core subject areas through the use of technology. This is critically distinct from the concept of simply assessing whether or not the student can use the technology itself. The question to assess is whether or not the student can use the technology as a tool to increase his or her understanding of all the curriculum subjects that are part of a school's high standards. A failure to assess this important synthesis between the technology and the content can lead to serious, unrecognized gaps in the learning of disabled students.

Isolated technology curriculum focused on hardware management, operating systems and keyboarding skills. Integrated curriculum allows students to employ technology in ways that enhance learning. When properly integrated, technology can assist with data acquisition, analysis and the graphical display of results. Technology can run complex simulations of science experiments that could previously only be done by hand in elaborate laboratory settings. Technology can support library research and the entire writing process. The more educators integrate technology into the core curriculum, the more opportunities for genuine learning they can create for students with disabilities. Digital content and tools in a virtual world remove or make more manageable many barriers imposed on the student by physical books, libraries and laboratories. It is in the use of the technology as a facilitation device for acquiring general knowledge that its greatest value lies.

As technology becomes increasingly infused in instruction for the general student population, the options for curriculum access, participation and progress increase for students with disabilities. A blind student, for example, who accesses print solely with the support of a live reader and creates text only with the aid of a live scribe has very little independent access to the curriculum. Learning to read and write Braille would increase independence tremendously, but still presents some barriers. By integrating technology into the learning process through the use of a laptop computer with speech output and a Braille display for accessing print materials, the student can dramatically increase independence and productivity and, ultimately, employability. Again, it is important to emphasize that learning the technology of the laptop and its specialized software is not the end; it is the means to the true end, which is to give the student the ability to independently access a wide range of resources for use in any curriculum subject.

With the use of technology our blind student would be able to independently create authentic materials revealing a high level of productivity by anybody's standard. Without a technology curriculum aligned with core subject areas, acquiring the skills necessary to operate and incorporate the technology in the context of the classroom would prove daunting at best. The solution is to have a sequenced technology curriculum that can also support the use of special technologies such as those described above. It is vital to avoid the quandary of a blind student who learns to use the adapted technology in isolation, without any connection to or incorporation with the actual classroom instruction.

**A Range of Solutions**

There are a variety of resources that can help with this process. For example, the Michigan Association of Intermediate School Administrators, the REMC Association of Michigan, and the Great Lakes Educational Network (GLEN) sponsor the "Best Practices of Technology Integration in Michigan site" at http://www.remc11.k12.mi.us/bstpract/bstpract.html. This website hosts lesson plans that have been written by practicing teachers and "kid tested" to work in the classroom. All lessons have been aligned with the Michigan Framework Document. The lessons are offered as examples of how technology can be used as a valuable tool in classroom instruction.

Another example can be found at http://www.mtnbrook.k12.al.us/tech/tech.htm where the Mountain Brook City Schools in Birmingham, Alabama host the "Technology Integration Site." Links by both subject area and grade level are provided in addition to a technology integration evaluation rubric based on the ACOT integration stages (Apple Classroom of Tomorrow). The widely used ACOT tool can also be found at http://www.apple.com/education/planning/profdev/index4.html. Finally, the Kent School District in the State of Washington maintains a site titled "Technology Integration: Unit Planning" at http://www.kent.k12.wa.us/curriculum/tech/proj_plan.html. This site provides a unit planning form and many links to resources for integrating technology into instructional practice.

There are myriad ways in which technology can be integrated into classroom practices. Many real world experiments can be simulated using software in the sciences. Massive amounts of data can be displayed graphically and manipulated at lightning speeds. Remote databases can be queried and reports generated. Library research can be conducted on line and compiled locally. Classroom presentations can be enlivened with multimedia. These applications clearly enrich classroom instruction. Ultimately, technology's payoff occurs when authentic products can be independently generated by students accurately evidencing the attainment of high standards. Instructional units that culminate with student-generated products evaluated with rubrics can

align well with some state assessment systems. States that test for problem solving and higher order thinking skills using open response items are good examples.

In the Wellesley Public Schools of Massachusetts, wireless laptops have been used as part of writers' workshops. Students authentically engage in the writing process, as would mature accomplished writers, using word processors and other writing tools. The intent of this innovation is to help students reach world class standards in the English/Language Arts framework. When writing was assessed using pencil and paper, the students instructed in twenty-first century writing did not do as well as when they were tested using computers. The implication is that students should be tested as they are instructed. Perhaps, more importantly, students should be instructed authentically in real world tasks.

But what does this have to do with students with disabilities? Technology tools can serve as "reasonable accommodations," removing or reducing the impact of disability from the performance of authentic tasks without altering standards of excellence. In this way, technology is often credited with having the potential to level the playing field for students with disabilities. Technology tools and digital media, it has been stressed throughout, can improve curriculum access, participation and progress. First, however, students with disabilities must be taught to use and apply technology in highly personalized and authentic ways. Technology tools can only be viewed as reasonable accommodations when such tools are incorporated in everyday instruction. Technology planning that identifies a sequence of tools and skills needed by all students to demonstrate what they know and can do in every grade will provide a framework for the inclusion of students with disabilities. Student support or IEP teams can examine such a skill sequence and determine for each student with a disability the extent to which conventional, universally designed technologies will work or what sort of assistive or adaptive technology will be required. In this manner, technology tools and curriculum can be aligned with state and district-wide standards.

Not all states, however, embrace world class standards with broadly stated outcomes. Many states adopt broad-scale assessment techniques that rely on content sampling in separate curriculum domains to estimate what students know and can do as a result of instruction. To the extent that content sampling is employed by the test makers, the more assessment must rely upon inference in order to reach valid conclusions about student performance. Often, test items require the expression of behaviors that unintentionally discriminate against individuals with disabilities. An example might be when a blind student is asked to discriminate from within an array of tactile graphic renderings of three-dimensional objects as in a test of solid geometric reasoning. The test maker naively assumes that visual-to-tactile transformations are easily accomplished by blind students. Thus, the tactile presentation of items is considered to be a reasonable accommodation for blind test takers. However, students born without benefit of sight cannot appreciate linear perspective on two-dimensional, tactile displays in the same way that sighted students perceive tri-dimensionality on flat visual displays. A more direct approach, and one that would rely less on inference, would be to use solid objects to elicit responses about solid geometry. There are many other examples that reveal the extent to which the constructs being measured on tests are invalidly presented to students with disabilities, yielding results that fail to indicate the true performance capabilities of students with disabilities.

**Summing it up**

Administrative convenience and funding priorities seem to explain the wide-spread reliance upon paper and pencil procedures and content sampling of curriculum domains for assessment. Yet the more that a test employs performance-based tasks or open response items, the more authentic the

assessment will be. Students with disabilities who learn to read and write with the aid of technology should always be tested with that technology. Genuine assessments should tap higher order thinking skills and problem-solving abilities in all students. Proper use of technology during instruction prepares disabled students to do their best work independently. Ultimately, a state and local assessment system will have to account for all students' opportunities to learn and apply the technologies that generate authentic assessments that in the final analysis truly reflect the outcomes of a public education.

### *How do we ensure that the technology-related needs of students with disabilities are assessed in a high quality manner?*

**Issues in Context**

High quality assessment of technology related needs will depend greatly on the composition, qualifications and collaborative skills of building support or IEP teams. Classroom teachers can communicate the demands of the setting (instructional tasks to be completed by students); they can also describe how such activities align with their state and district standards. Special education teachers can identify the accommodations necessary to allow students to participate in instruction and assessment activities. They can also determine the needs of students arising from disability and interfering with curriculum access. In all cases, the team must begin with an analysis of the curriculum in terms of the challenges it presents to the student with a disability. The more the curriculum has been resourced with technology tools and digital media, the more accessible, flexible and transformable it will be for all students, particularly those with disabilities. This is the value added contribution of UDL, described earlier.

High quality assessment will be more achievable when general classroom teachers are knowledgeable about technology integration and can appreciate the use of technology in creating authentic products. Special educators, too, need to be knowledgeable about technology. All members of the team should have some familiarity with the district's technology plan and school improvement plan and how the two shall coincide. However, it is crucial that the team include persons knowledgeable about educational technology in general and assistive technology in particular. Where such individuals are not present in the school, they need to be consulted in order for the team to render appropriate decisions about the student's need for and use of technology.

**Moving Toward Solutions**

A variety of external sources exist for recognizing and/or certifying the qualifications of providers of assistive technology assessments and services. The Council for Exceptional Children has identified knowledge and skill competencies for technology specialists. These are competencies beyond what a beginning special educator should know and be able to do. The delineation of competencies for technology specialists can be located at http://www.cec.sped.org/ps/perf_based_stds/knowledge_standards.html. Additionally, certification as an Assistive Technology Practitioner (ATP) is awarded by the Rehabilitation Engineering and Assistive Technology Society of North America (RESNA) through an examination and review process. Details of the process can be located at http://www.resna.org/PracInAT/CertifiedPractice/GettingCertificate/Getting.html. The University of California at Northridge's (CSUN) Center on Disabilities offers training programs leading to certification in assistive technology applications. Details can be located at http://www.csun.edu/codtraining/. Finally, the Research Institute for Assistive and Training Technologies (RIATT) at the National Association of State Directors of Special Education offers distance education and conference-based training in assistive technology leading to certification. Details can be found at http://www.nasdse.com/. Once the technical qualifications of team

members is established, controls need to be set up to ensure that high quality assessment procedures and services are in place. Several sources of guidance exist to aid in making this determination. As noted earlier, the consideration of assistive technology devices and services is required during the development of the IEP. IDEA '97 requires that each team that plans for the education of a child with a disability document any assistive technology devices and/or services the child may need. Despite this requirement, no clear consensus exists regarding a definition or description of high quality assistive technology services by which schools could measure their compliance. To this end, the Quality Indicators for Assistive Technology (QIAT) Consortium has been established to define a set of descriptors that serve as over-arching guidelines for quality assistive technology services. The by-category indicators for high quality assistive technology services and supports that have been extracted from QIAT's home page at http://sweb.uky.edu/~jszaba0/QIAT.html are as follows:

***Quality indicators for administrative support:***

1. The education agency has written procedural guidelines that ensure equitable access to assistive technology devices and services for students with disabilities, if required for FAPE.
2. The education agency has clearly defined and broadly disseminated policies and procedures for providing effective assistive technology devices and services.
3. The education agency has written descriptions of job requirements, which include knowledge, skills, and responsibilities for staff members who provide assistive technology services.
4. The education agency employs a range of personnel with competencies needed to provide quality assistive technology services within their areas of primary responsibility.
5. The education agency includes assistive technology in the technology planning and budgeting process.
6. The education agency provides continuous learning opportunities about assistive technology devices, strategies and resources for staff, family and students.
7. The education agency uses a systematic procedure to evaluate the components of assistive technology services to ensure accountability for student progress.

***Quality indicators for consideration of assistive technology needs:***

1. Assistive technology devices and services are considered for all students with disabilities regardless of type or severity of disability.
2. The IEP team has the knowledge and skills to make informed assistive technology decisions.
3. The IEP team uses a collaborative decision making process based on data about the student environment and tasks to determine assistive technology needs.
4. A continuum of assistive technology devices and services is explored.
5. Decisions regarding the need for assistive technology devices and services are made based on access to the curriculum and the student's IEP goals and objectives.
6. Decisions regarding the need for assistive technology devices and services and supporting data are documented.

***Quality indicators for assessment of assistive technology needs:***

1. Assistive technology assessment procedures are clearly defined and consistently used.
2. Assistive technology assessments are conducted by a multidisciplinary team that actively involves the student and family or caregivers.
3. Assistive technology assessments are conducted in the student's customary environments.

4. Assistive technology assessments, including needed trials, are completed within reasonable timelines.
5. Recommendations from assistive technology assessments are based on data about the student, environments and tasks.
6. The assessment provides the IEP team with documented recommendations about assistive technology devices and services.
7. Assistive technology needs are reassessed by request or as needed based on changes in the student, environments and/or tasks.

***Quality indicators for documentation in the IEP:***

1. The education agency has guidelines for documenting assistive technology needs in the IEP and everyone on the IEP team is aware of them.
2. Assistive technology is included in the IEP in a manner that provides a clear and complete description of the devices and services to be provided and used.
3. Assistive technology is used as a tool to support achievement of IEP goals and objectives as well as participation and progress in the general curriculum.
4. IEP content regarding assistive technology use is written in language that describes measurable and observable outcomes.
5. All services needed to implement assistive technology use are documented in the IEP.

***Quality indicators for assistive technology implementation:***

1. Assistive technology implementation proceeds according to a collaboratively developed plan.
2. Assistive technology is integrated into the curriculum and daily activities of the student.
3. Team members in all of the child's environments share responsibility for implementation of the plan.
4. The student uses multiple strategies to accomplish tasks and the use of assistive technology may be included in those strategies.
5. Training for student, family and staff is an integral part of implementation.
6. Assistive technology implementation is initially based on assessment data and is adjusted based on performance data.
7. Assistive technology implementation includes management and maintenance of equipment and materials.

***Quality indicators for evaluation of effectiveness:***

1. Team members share clearly defined responsibilities to ensure that data are collected, evaluated, and interpreted by capable and credible team members.
2. Data are collected on specific student behaviors that have been identified by the team and are related to one or more goals.
3. Evaluation of effectiveness reflects the objective measurement of changes in the student's performance (e.g., student preferences, productivity, participation, independence, quantity, quality, speed, accuracy, frequency, or spontaneity).
4. Effectiveness is evaluated across environments including during naturally occurring opportunities as well as structured activities.
5. Evaluation of effectiveness is a dynamic, responsive, ongoing process that is reviewed periodically.
6. Data collected provides a means to analyze response patterns and student performance.

7. The team makes changes in the student's educational program based on data.

An additional resource is available from LD OnLine. A. R. Beigel describes a context sensitive, assistive technology assessment http://www.ldonline.org/ld_indepth/technology/at_assessment.html. Discussed in detail are key questions under three strands of the assessment process: the learner, the school environment, and the devices. The goal of the assessment process is to match the learner's strengths and challenges with particular AT devices in the different contexts of home and school environment.

**The Learner**

1. What purposeful motoric movement does the individual have?
2. How willing is the learner in trying new activities or tasks?
3. What does the learner desire from the use of AT?
4. What supports will the learner require in using the device?
5. What level of training will the learner and others who interact with the learner need?
6. What impact will the learner's socioeconomic status and cultural background have on the use of AT?

**The School Environment**

1. How do the teachers of learners using AT present information to the learners?
2. What is the preferred learning-teaching interaction style of the classroom—a cooperative learning style, an individualized style, project driven, or small independent and dependent groups?
3. What is the primary method of assessment in the classroom?
4. How receptive is the teacher to having a learner who uses AT in the classroom?
5. What is the physical structure of the classroom and school?

**The Devices**

1. How durable is the device?
2. How easy is the device to update and/or repair?
3. What is the willingness of the vendor of the device to provide a trial or loaner period of use for the learner?
4. What is the general reputation of the company in terms of construction, service, training, and reliability?
5. Does the AT user have the psychomotor skills needed to use the device in a functional manner where benefit is gained, or merely on an operational level where the learner can turn the device on and off?
6. Is the device aesthetically acceptable to the learner?
7. Will the device meet the needs of the individual in the school environment in a manner that is transparent or easily understood by those who interact with the learner?
8. How portable is the device?

**Summing it Up**

This section addresses the challenge of ensuring that students with disabilities have access to high quality assessments and services. Resources for determining the competencies of individuals performing assessments and providing services are discussed. Quality indicators of appropriate assistive technology services are delineated. An approach for conducting a context sensitive assistive technology assessment is described. Assistive technology must be viewed as

hardware and software tools that must be considered when universally designed solutions are either unavailable or unworkable.

### *How can we support the development of curriculum and instruction following the Universal Design for Learning framework?*

**Issues in Context**

As NCLB brings various reform initiatives in education under a comprehensive umbrella of commitments to support all learners, a single, standards-based curriculum must be available to all. In the past, and to some extent remaining today, separate, deficits-oriented programs served to isolate and marginalize diverse learners. The traditional, one-size-fits-all curriculum necessarily resulted in a "blame-the-victim" perspective to explain school failure and excuse the culprits. Now innovations in technology hold the promise for facilitating a radical shift in thinking away from a fix the learner perspective to a fix the curriculum outlook. In responding to the mandate for curriculum access, participation and progress for students with disabilities, an opportunity to improve the quality and outcomes of education for all learners presents itself.

This document has laid the groundwork for transforming the general curriculum into flexible, accessible and user-friendly media and materials using technology developed according to the principles of Universal Design for Learning (UDL). This document has also acknowledged the value of, and need for, assistive technologies, where universally designed resources do not yet exist. UDL and AT are not competing interests but complementary in the form of a continuum from which assessment team members choose options for optimal access and learning.

**Working Toward a Range of Solutions**

According to the principles of UDL, technologies supporting curriculum access must offer multiple forms of representing information. Technologies must provide multiple means for students to express what they know and can do. Technologies must also provide multiple means of engagement that offer learners appropriate levels of challenge and support. Acquiring digital media, developing accessible classroom materials, and selecting appropriate technology tools are all essential tasks for local teams of school personnel to undertake. These tasks are pursued most effectively when a UDL framework is adopted. In this era of inclusion, collaboration and technology integration, it will be crucial for local stakeholders to connect with networks undertaking the ongoing development of learning environments following the UDL principles.

One way of remaining connected with UDL advancement is to join the National Consortium on Universal Design for Learning at http://www.cast.org/pd/consortium/. Launched in 1999, the Consortium is a partnership of general and special educators, schools, and experts who are committed to improving educational outcomes for ALL students, including those with disabilities, through the application of UDL to classroom practice. The Consortium fosters shared responsibility and accountability for the education of all children in the general education classroom through the collective expertise of its members, and activities that include research, professional development, demonstration of promising educational practices, and collaboration with experts.

The goals of the National Consortium are to:

1. Create a community of educators, connected virtually, that works in conjunction with the National Center on Accessing the General Curriculum (NCAC) to advance the understanding and practice of UDL.
2. Research and develop promising instructional strategies, curricula, technology tools, and instructional and professional development models.

3. Implement promising instructional approaches and materials in Consortium classrooms.
4. Evaluate these models in terms of their feasibility, replicability, and expected outcomes.
5. Disseminate promising practices and models to schools and educational professionals through NCAC and other vehicles.

In addition to joining the National Consortium, readers of this document may consider creating a MyTES account at the CAST website at: http://www.cast.org/teachingeverystudent/mytes/index.cfm?loginfrom=http%3A%2F%2Fwww%2Ecast%2Eorg%2Fteachingeverystudent%2Findex%2Ecfm. The Teaching Every Student (TES) section of the CAST website supports educators in learning about and practicing Universal Design for Learning (UDL). MyTES can be used as a companion to the Rose & Meyer (2002) text:

Rose, D. H. & Meyer, A. (2002) *Teaching Every Student in the Digital Age: Universal Design for Learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

The text may be obtained in hardcopy or accessed freely online at http://www.cast.org/teachingeverystudent/ideas/tes/. A MyTES account enables readers of this document to compile resources and interact with a variety of learning communities online. The home page for TES can be accessed at http://www.cast.org/teachingeverystudent/, where several links can be followed as described below.

***Ideas & Information***

Publications, presentations, and other online resources related to UDL.

Highlight: UDL Book: *Teaching Every Student in the Digital Age: Universal Design for Learning*, ASCD, 2002

Highlight: Case Stories:

- Reading Challenges in Social Studies
- Engaging High School Students in Writing
- Teaching Probability in Middle School

***Tools & Activities***

Web-based and downloadable tutorials, tools, templates and activities to help you put the ideas of UDL into practice.

Highlight: Activity: Getting to Know You the UDL Way

***Community & Support***

Opportunities to collaborate, communicate, and obtain support from other educators exploring and teaching with UDL.

Highlight: Forum: Standards and Diversity

***UDL Toolkits***

Apply UDL principles in classrooms with model lessons, interactive activities, tools, and curriculum resources.

Highlight: UDL Toolkits:

- Planning for All Learners (PAL)
- Digital Content in the Classroom
- UDL Training Guide

Finally, readers will want to visit the Professional Development section of the CAST website at http://www.cast.org/pd/index.html for opportunities to address the challenge of improving curriculum access, participation and progress to advance the goals of Universal Design for Learning.

**Summing it up**

Much of this document has stressed the importance of universal design in designing or selecting curriculum resources at the local level. Curriculum add-ons, retrofits and material transformations are both costly and likely not to arrive at the point of instruction. This section presents several resources for guiding the development of curriculum resources following the UDL framework. These resources, moreover, connect the reader with a growing network of educators engaged as professional learning communities sharing what each has learned from the adoption and application of the principles of universal design for learning.

### *How can we keep up with technology developments that potentially support students with disabilities in accessing the general curriculum?*

**Issues in Context**

This document has pointed the reader to multiple sources of information on laws, digital media, operating systems, accessibility, technology planning, universal design, assistive technology, and professional development—to name just a few. With technology advancing at such a rapid pace, staying up-to-date with developments can prove to be a daunting task. No one person at the local level should be expected to remain abreast of all developments needed to support access to the curriculum for students with disabilities. This is why it is so important to reform school cultures into learning communities that promote and sustain the application and integration of technology for all learners. Classroom teachers, special educators, technology specialists, curriculum supervisors and administrators all need to collaborate in ways that make the curriculum accessible, instruction participatory and assessment fair and equitable.

**Staying in Touch with Solutions**

Throughout this document, many of the technology tools and resources referenced can be found at the Center for Applied Special Technology (CAST) website at http://www.cast.org. CAST, founded in 1984, is a not-for-profit education research and development organization that uses technology to make education more flexible and accessible for all students, especially those with disabilities. The impact of CAST's work is evident at every level of education, including classroom teaching and learning; federal, state, and local policymaking; scholarly research; and commercial products used in classrooms nationwide. Frequent visits to the CAST website keep the reader abreast of advancements in the application of the Universal Design for Learning (UDL) framework. In particular the reader will want to visit the home of the National Center on Accessing the General Curriculum at http://www.cast.org/ncac.

Another National Center of particular relevance to this document is located at the University of Kentucky. The National Assistive Technology Research Institute (NATRI) can be found at http://natri.uky.edu/. NATRI conducts research related to the planning, development, implementation, and evaluation of assistive technology (AT) services in schools. Research is intended to identify promising practices in the delivery of AT services and to disseminate research findings and information about promising practices in ways that will assist school personnel to develop or improve AT policies and practices for students with disabilities. A research agenda has been framed by NATRI, and the following topics are currently under investigation:

1. The status of AT use in schools and the role that AT provides in the education of students with disabilities.
2. The policies, procedures, and resources that school districts use to develop and deliver AT services to their students.
3. The ways that AT decisions are made by teams of people who develop Individualized Education Programs (IEPs) for students enrolled in special education programs.
4. The training and technical support that is needed by individuals who are involved with planning and implementing the use of AT devices and services with students.
5. The integration of AT into learning environments and the ways that AT devices and services are used to facilitate instruction and access to the curriculum.
6. The effects that the use of AT devices and services have on the academic, social, and functional performance of students who use them.
7. The extent to which institutions of higher education are developing AT knowledge and skills in those who are preparing for professional positions in schools.

NATRI has already produced a number of highly useful resources for readers of this document. This includes: AT fundamental concepts; research reports, checklists, self-assessments, and other documents generated by NATRI; links to online AT resources, information databases, AT vendors, and assistive device locator systems; videos of AT devices; and AT training resources. These resources can be found at http://natri.uky.edu/resmenu.html. The research at NATRI is ongoing. The reader can register with the Center to receive email alerts about future findings and reports.

The Trace Research and Development Center, a pioneer in the field of technology and disability since 1971, is located at the College of Engineering, University of Wisconsin–Madison. Capitalizing on the opportunities presented by current and emerging information and telecommunication technologies, the Trace Center seeks to remove barriers by helping to create a world that is as accessible and usable as possible for as many people as possible. Thus, Trace is clearly committed to universal design. Work underway at Trace is focusing on ways to make standard information technologies and telecommunications systems more accessible and usable by people with disabilities. This work is primarily funded by the National Institute on Disability and Rehabilitation Research (NIDRR) (U.S. Department of Education), through the following center grants:

1. Rehabilitation Engineering Research Center (RERC) Program
2. RERC on Universal Interface and Information Technology Access
3. RERC on Telecommunications Access

*Trace's extensive website can be located at http://www.tracecenter.org/.*

Several links from Trace's home page may be of particular relevance to readers of this document. Designing More Usable Documents, for example, can be found at http://www.tracecenter.org/world/doc_access/. This page lists a number of interrelated efforts and projects with links describing cooperative efforts toward the design of more usable digital documents for all. Designing More Usable Websites, located at http://www.tracecenter.org/world/web/, is another highly relevant page for readers. Listed and linked are a number of cooperative efforts toward building a more usable Web for all users of the internet. Additionally, the Trace website maintains Designing More Usable Computers and Software at http://www.tracecenter.org/world/computer_access/. This page also lists links to

several cooperative efforts by many of the major computer and software developers towards making computers and software more usable for everyone.

While there are an abundance of nationally relevant resources, readers will have local concerns that may be best addressed through state resources. Each state department of education (DOE) maintains a website with pointers to technology planning timelines and procedures. The federal Department of Education (ED) maintains an Education Resource Organizations Directory (EROD) at http://wdcrobcolp01.ed.gov/Programs/EROD/index.cfm. This database has very powerful search capabilities. One of the links allows the user to search within a particular state or territory for both public and private resources of interest.

The Association of Tech Act Projects (ATAP) maintains a website at http://www.ataporg.org/. By collaborating with individuals with disabilities and others at the national level, ATAP seeks to increase the availability and use of assistive technology devices and services for all individuals with disabilities in the United States and territories. ATAP identifies four purposes:

1. To promote public awareness of assistive technology at the national level.
2. To provide training and education about assistive technology on a national basis for stakeholders, including other national social service and business organizations, members of the insurance and healthcare industry, and public office holders/policy makers.
3. To develop positions on a full range of national assistive technology and disability related issues and to share these positions with other organizations or policy makers, as needed, to ensure that the views of the states and territories and their consumers with regard to assistive technology service delivery are adequately represented.
4. To provide a forum for exchanging information and promoting the system change accomplishments and activities of the Tech Act Projects.

A very useful feature of the ATAP website is a linked list of contact information for all state assistive technology projects funded under the Technology-Related Assistance for Individuals with Disabilities Act of 1998 http://www.ataporg.org/all%20at%20projects.htm.

Another source of up-to-date information is the Technical Assistance Project at http://www.resna.org/taproject/about/about.html. This project is funded to provide assistance to all Tech Act grantees in the areas related to universal design, state procurement actions, and funding of AT. Four major components make up the Project's plan for the provision of technical assistance:

1. Capacity Building and Advocacy Activities
2. Program Management
3. Communication and Collaboration
4. Continuous Quality Improvement

The Technical Assistance Project maintains a comprehensive library at http://www.resna.org/taproject/library/index.html in which the following resource categories are linked:

1. Information from the Federal Government
    - Legislative
        - Laws & Related Regulations
        - Congressional Hearings

- Judicial
  - Supreme Court Rulings
- Executive
  - Office of the President
- Federal Budget
- Reports & Guidelines
  - Access Board
  - Department of Commerce
  - Department of Education
  - Department of Health & Human Services
  - Department of Justice
  - Equal Employment Opportunity Commission (EEOC)
  - Federal Communications Commission
  - National Council on Disability
  - Presidential Task Force on Employment of Adults with Disabilities
  - Social Security Administration

2. Bibliography on Assistive Technology
   - AT Use
   - Barriers & Needs
   - Aging
   - Education
   - Employment
   - Health
   - Housing
   - Libraries
   - Telecommunications/Information Technologies
   - Universal Design
3. Publications of RESNA Technical Assistance Project
   - Accomplishments of the Assistive Technology Act Projects Series
   - State Legislative & Policy Reports
   - TAP Bulletins
   - AT Quarterlies
4. Training Materials
   - AT Act Projects

The reader will find the Technical Assistance Project's library as exhaustive as it is comprehensive. Up-to-date information on a wide range of topics can be easily accessed by following the links provided by category.

A number of regional organizations maintain very useful websites for technical assistance. The Regional Technology in Education Consortium (RTEC) at WestEd is an excellent example. RTEC's mission is to help improve education through technology integration for students who are disadvantaged by attending the lowest performing schools in their region (Arizona, California, Nevada, and Utah). RTEC partners with private enterprises, education agencies, institutions of higher education, and professional organizations to pursue the following goals:

1. Disseminate information about promising practices and quality benchmarks for technology use in a variety of learning environments.
2. Provide technical assistance, professional and leadership development, and collaborative efforts that seek to improve technology use by students, parents, teachers, administrators, and policymakers.
3. Assist with technology planning and policy issues, and conduct research and development activities that enable educators and developers to more effectively employ a variety of technologies for improved educational decision-making, enhanced student achievement, and quality lifelong learning.

*RTEC's website is located at http://rtecexchange.edgateway.net/cs/rtecp/print/rtec_docs/59, where many of the products developed in pursuit of these goals can be freely accessed.*

A particularly valuable national resource is the Alliance for Technology Access (ATA) at http://www.ataccess.org/default.html. ATA is an ever-expanding national network of technology resource centers, organizations, individuals and companies. ATA's focus is the empowerment of individuals with disabilities to attain full community participation. ATA provides public education, information and referral, capacity building in community organizations, and advocacy/policy efforts, enabling millions of people to achieve their dreams through the acquisition and use of standard, assistive, and information technologies. A powerful feature of ATA's website is an interactive information service that provides quick and efficient access to information on assistive technology tools and services to consumers, families and service providers worldwide. The ATA Assistive Technology Hub can be found at http://www.ataccess.org/hub/.

Closing the Gap at http://www.closingthegap.com/home/aboutctg2.html is a widely recognized and highly praised company that focuses on computer technology for people with special needs. An annual international conference, Computer Technology in Special Education and Rehabilitation, is held each fall in Minneapolis, MN, exploring the many ways in which technology is being used to enhance the lives of people with special needs. Closing The Gap also publishes (by subscription) a bimonthly electronic newspaper highlighting hardware and software products appropriate for people with special needs. The February/March issue of the newspaper, the annual Resource Directory, is a guide to the selection of the latest computer-related products available for people with special needs. The website offers an extensive array of information on technology applications for individuals with disabilities.

The Technology and Media (TAM) Division of the Council for Exceptional Children (CEC) works to promote the effective use of technology and media for individuals with exceptional educational needs. TAM can be accessed at http://www.tamcec.org. The site includes information on conferences and professional publications including an online version of the Journal of Special Education Technology (JSET), TAM's professional journal. JSET can be accessed at http://jset.unlv.edu/. A regularly appearing column in JSET focuses on Universal Design for Learning (UDL).

**Some Final Thoughts**

Increasingly, the education of all students, including those with disabilities, is a local and a shared responsibility. Fiscal resources available from state and federal government are contingent upon on local participation in accountability systems aimed at producing measurable and sustainable results. Universal Design for Learning (UDL) was introduced in this document as a framework for increasing curriculum flexibility and therefore accessibility not only for

students with disabilities but also for all students. Curriculum flexibility is greatly enhanced with the use of digital media and technology tools, and UDL provides direction for infusing the curriculum with technology resources. Just as various reform initiatives have been aggregated under NCLB, so must the separate activities of planning be combined to comprehensively address the challenge of increasing academic achievement for all students. This means that school improvement planning, curriculum accommodation planning and technology planning must all align in ways that make the best use of local talent. Students, parents, teachers, administrators and community stakeholders must work together as collaborative members of learning communities to establish policies and practices that enable all students to have access to and participation in the general curriculum. As learning communities come together at the local level, it is hoped that the resources contained in this document will prove helpful in pointing the way toward technology solutions that support authentic and meaningful progress.

## APPENDIX

**Microsoft Products and Accessibility**
**Microsoft Accessibility Technology for Everyone: Overview of Microsoft Products and Resources**
http://www.microsoft.com/enable/products/default.aspx

This website provides an overview of accessibility information of numerous Microsoft products, including operating systems, internet technologies, office and productivity software, and the related resources, such as accessibility documentation, keyboard assistance, accessibility tips and tricks, and technical support information. The section of Microsoft products links to the sites which provide the accessibility features, installation tips, and upgrade considerations of various products along with additional information of Microsoft's accessibility development.

**Microsoft USA Government: Microsoft & Section 508**
http://www.microsoft.com/usa/government/section508.asp?V=T.

This website provides the information of Microsoft's commitment to their accessibility development and Section 508 compliance. The information includes the links to some articles regarding Microsoft's stance on Section 508 and additional sites regarding more detailed information of Section 508. This site also contains the listing of the Section 508 VPATs (Voluntary Product Accessibility Template) of various Microsoft products.

**Microsoft Developers Network (MSDN) Accessibility**
http://msdn.microsoft.com/library/default.asp?url=/nhp/default.asp?contentid=28000544

The MSDN provides developers essential resources regarding Microsoft tools, products, and technologies. This accessibility site introduces the explanation of a COM-based product, Microsoft active accessibility 2.0. This site also contains some links to software development kit and related information of this product.

**Apple Computer: People with Special Needs**
http://www.apple.com/disability/

This website contains latest information on Apple products with accessibility features to support various types of disabilities. Five sections categorized based on the types of disability—vision, hearing, physical/motor, literacy and learning, language and communication—guide viewers to the sites which provide Apple solutions, third party solutions, and a database for further product searches for the particular type of disability. This website also provides links to the sites with the information of other services and Web resources, and a direct link to the database of Apple products with assistive technologies, including software, general hardware, and input devices.

**IBM Products and Accessibility**
**Accessibility Center: Integrating Usability and Accessibility**
http://www-306.ibm.com/able/index.html

This website provides an overview of IBM's accessibility commitment, including their product compliance and global accessibility services. The sections in this website include: solution offering; product accessibility information; developer guidelines; laws, standards, and regulations; accessibility education; events; resources; and accessibility at IBM. The information on particular IBM products with accessibility features, such as ThinkPad X, T, R, and A series notebooks, can be obtained through the section of solution offering.

**Sun Microsystems: Products and Accessibility**
**Sun Microsystems Accessibility Program**
http://www.sun.com/access/index.html

This website contains five main sections which provide a comprehensive overview of Sun accessibility programs. The five sections include: general information; downloads; developer information; articles, talks and papers; and section 508. Each section links to numerous sites regarding Sun products, accessibility projects, and services.

**The GNOME Project—Disability Access to GNOME**
http://developer.gnome.org/projects/gap/

This website provides overall information of the GNOME Accessibility Project. The information includes latest news of the project, downloads section for the GNOME themes, related documents, audio links of presentations, background information, and architecture of the project. The navigation section links to more sites regarding accessibility, including assistive technology, understanding disabilities, and design guidelines, as well as to the general information sites of the GNOME project, which is designed to provide an intuitive and attractive desktop and an extensive framework for building applications for the desktop.

**Adobe Systems**
**Acrobat solutions for accessibility**
http://www.adobe.com/products/acrobat/solutionsacc.html

Adobe Systems Incorporated is committed to providing solutions that improve accessibility. The new Adobe® Acrobat® 6.0 product family offers a number of capabilities that increase the accessibility of both the software and the information included in Adobe Portable Document Format (PDF) files. Adobe Acrobat 6.0 is continuing proof of that commitment.

**Overview of Acrobat products and accessibility**
http://www.adobe.com/products/acrobat/access_overview.html

- Adobe® Reader® 6.0
- Adobe Acrobat® Elements
- Adobe Acrobat 6.0 Standard
- Adobe Acrobat 6.0 Professional
- Adobe Acrobat Capture 3.0
- Adobe Acrobat Capture 3.0 Agent Pack with Adobe PDF Forms Access
- Detailed feature comparison table for Adobe Reader and the Acrobat 6.0 family

**Macromedia Accessibility**
Accessible Rich Media Content with Flash MX 2004

Build Flash content that meets policy and accessibility requirements.

Build Accessible Web Content with Dreamweaver MX 2004

Learn about improvements for users of assistive technologies and for developers building Web applications.

Solution for Policy Compliant Websites

Create and manage rich Web content that meets accessibility, data transfer, security, and management standards.

Captioning Macromedia Flash movies with Hi-Caption SE (PDF, 4K)

Learn how to add closed captions to your Flash movies quickly and easily with Hi-Caption SE.

Retrofitting Director MX content for Accessibility

Learn how to use the Accessibility Behavior library in Director MX to update existing Director movies for accessibility.

Alberta Easter Seals March of Dimes

Read how Alberta Easter Seals created a professional, well-designed site that was accessible, engaging and easy to use—while still meeting the strict budget requirements of a non-profit.

**Products for Accessibility**

Dreamweaver MX 2004

The most complete set of tools available for building, editing, and maintaining accessible websites and Web applications.

Macromedia Flash MX 2004

The industry standard for creating accessible, rich, effective Web and learning content.

Contribute 2

Establish and maintain site accessibility with a set of tools for the website administrator and web-content contributor.

Breeze

Author accessible online presentations to help make your ideas available to all, regardless of disability.

ColdFusion MX 6.1

The most accessible server available to build and deliver rich, dynamic Web applications.

Director MX/Shockwave Player

Build accessible, self-voicing multimedia experiences for CD/DVD-ROMs, kiosks and the Web.

Authorware 7

The solution dedicated to creating accessible, rich-media e-learning content.

**White Papers**

- Best Practices for Web Accessibility Design and Implementation (PDF, 228K)
- Building Accessible Dynamic Websites with Macromedia ColdFusion MX (PDF, 1.6MB)
- Macromedia Accessibility Project (MAP): A Collaboration of the League for Innovation in the Community College, Macromedia, Inc., and Pima Community College (PDF, 1MB)