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education



PHOTOCOPY
PRESERVATION

**Presentation given by Dr. Anne Meyer at Women's Leadership Forum luncheon
May 14, 1996**

My name is Anne Meyer and I am Co-executive Director of CAST, the Center for Applied Special Technology, an educational technology research organization whose mission is to equalize learning opportunities for students with disabilities through computer technology. CAST develops software, Internet resources, and teacher training based on principle of universal design -- access for all is built in from the beginning.

I will give a quick example and then comment on this administration's educational technology initiatives. Curriculum delivered in print form is inaccessible to students with low vision or blindness, dyslexia, or severe physical challenges. This is because print is inflexible and based on "one-size-fits-all" idea of learning. Curriculum delivered in electronic form can be flexible and can be individualized in the classroom. Text can be read aloud on demand so the blind or dyslexic student can get the information, pages can be turned with an elbow or an eyebrow by the physically challenged, and text can be enlarged and displayed in legible color for those with visual impairments. Two things are necessary to provide this access -- information must be digital and the options must be built in. CAST recently participated in the national Council on Disabilities Summit in Dallas where we made a point I want to make again here.

I am wholeheartedly enthusiastic about the work this administration has done on bringing the White House and the Education System into the information age. If you are serious about the national mission to make every young person technologically literate and to provide access to the information highway for everyone, I believe you must actively address the needs of disabled youth while building the infrastructure. Two things are necessary and may ultimately have to be mandated: all curriculum must be available in electronic form and access options must be built in from the beginning. This is the only cost efficient approach and it has been provided effective, not only for students with disabilities but for all students. Without universal design, technology will be divisive and exclusionary; with it, technology can equalize opportunity and empower everyone.



PROFILE OF CAST

MISSION

CAST's mission is to expand opportunities for individuals with disabilities through innovative uses of computer technology. We pursue this mission through research and product development that further universal design for learning.

SELECTED PROGRAMS

- **Universal Design of Learning Technologies Research & Development.**

When architects follow the principles of universal design, they design buildings that accommodate the abilities of the widest spectrum of users. Such buildings are accessible from their inception and do not necessitate costly, piecemeal retrofitting to incorporate the needs of people with disabilities. Nationally, CAST leads the application of universal design to learning technologies, building flexible access and learning supports into computer tools so that a single curriculum serves a very diverse group of learners. Since CAST and Scholastic released their educationally and commercially successful early literacy curriculum, *WiggleWorks*,TM CAST has developed and published other universally designed learning technologies that support literacy learning, Internet use, teacher training, parent education and involvement, and content area learning. Our work in universal design for learning has earned CAST extensive national recognition as a key innovator in educational technology (see list of recent recognition).

- **Research Demonstrating the Impact of Internet Use on Student Learning.**

A national study, conducted by CAST and sponsored by the Council of Great City Schools and the Scholastic Network, measured the impact of on-line use on student learning. The study tracked 500 students in 28 fourth- and sixth-grade classrooms as they participated in a two-month social studies program focusing on civil rights. The classrooms were located in seven U.S. cities, mostly in low-income neighborhoods. All the children used the same course of study and were encouraged to use multimedia reference materials and videotapes, but only one group had access to information on-line. A summary of the report stated that the students with on-line access showed significantly higher scores on measurements of information management, communication, and presentation of ideas. The study showed benefits of structured on-line use in the context of the curriculum, paired with professional support for teachers. It

underscored the importance of the federal commitment to wiring the nation's schools. Federal Communications Commission chairman Reed Hundt, speaking at a press conference releasing study results, said that the study proved the value of his agency's efforts to require access to such on-line services for schools and libraries throughout the nation.

- **A National Network Using Technology to Promote Family and Community Literacy.** This project supports learning among educationally and economically disadvantaged children and their parents through universally designed computer technologies. The National Network applies lessons learned in a partnership between CAST and North Shore Head Start (NSHS) in Beverly, Massachusetts to other community sites nationwide. At the Massachusetts site, Head Start parents were trained to use early literacy software and other tools to support their children's learning as well as their own literacy skill development. The primary goals of the National Network project are:
 1. To use universally designed technologies to develop adults' and children's capacity to succeed in the complex literacies they need to understand and succeed in an information-based society
 2. To make those technologies accessible to people who would not otherwise have access (e.g., people with disabilities, disadvantaged populations)
 3. To use the capacity of universally designed technologies to create, sustain, and strengthen the school-to-home links that make parents active participants in their children's learning
 4. To create a structure that makes on-line resources readily accessible (in form and content) for adults and children
 5. To structure an electronic environment that will encourage local and regional family and community projects to share resources, expertise, and information and to collaborate on projects
- **Universal Design of Learning Technologies: Upcoming Publication.** The co-executive directors of CAST, Anne Meyer, Ed.D. and David Rose, Ed.D., are creating a publication for dissemination in print, on CD-ROM, and via the World Wide Web on the subject of universal design for learning. This work will present a radically new view of learning, media, technology, and individual differences. Diversity among learners will be explicated through recent brain research based on PET scans and neural network theory. The characteristics of diverse media—including text, image, sound, and video—will be explored as they pertain to learning and learning differences. Principles of universal design for learning will be illustrated with concrete examples from published curricula and with software prototypes. The audience will comprise educators, professionals, government officials, and others who provide leadership in school policy and reform.

RESEARCH INITIATIVES FUNDED BY THE U.S. DEPARTMENT OF EDUCATION

- **WiggleWorks™ Research Project** — Three-year research project on the effectiveness of *WiggleWorks™* for early literacy and inclusion in urban and rural schools.
- **Access through Captioning Project** — Collaborative research and software development project to design an affordable, easy-to-use, desktop system for captioning videotape. System is being published for mainstream education as a multimedia composition environment and to provide access for students who are deaf or hard of hearing.

PUBLIC POLICY INITIATIVES

- **Technology Advisor** — Dr. Anne Meyer is currently serving on a Technology Advisory Committee for Harvard University's Graduate School of Education.
- **Members** — In February, 1996, CAST Co-Executive Directors, Dr. Anne Meyer and Dr. David Rose, began serving on the Texas Task Force on Electronic Textbook Accessibility which is preparing a report for the Texas Legislature explicating the advantages of electronic textbooks for people with disabilities.
- **National Advisor** — In October, 1995, Dr. Meyer served as an advisor to Clinton's Educational Technology Panel, a subgroup of the President's Council of Advisors on Science and Technology. The panel is analyzing the current state of educational technology in the United States and making recommendations for change to President Clinton.
- **National Advisor** — In September, 1995, Dr. Rose began serving as an advisor to the Council for Exceptional Children (CEC) in its efforts to adopt and disseminate the principles of universal design. In 1996, the Council hopes to have developed a set of principles and national guidelines for educators, publishers and policy makers. CAST has been asked to play a leadership role in the formulation of these principles and guidelines.

CAST'S RECENT RECOGNITION

- **WNET "People in Motion"** — CAST was featured in this public television series which focuses on how people with disabilities use technology. Aired nationally in April of 1996.
- **National Association of Social Sciences Award** — In November 1995, Dr. Anne Meyer received a Gold Medal Award for her work at CAST.
- **Software Publisher's Association's 1995 Excellence in Software CODIES awards** — *WiggleWorks™* (co-developed by CAST and Scholastic Inc.) was nominated for Best Home Learning and Best Early Education Program in the Education Software category.

- **Washington Annenberg Program** — CAST was selected to design and be the featured presentation at a symposium that took place in April of 1994 for The Annenberg Washington Program. Called “Communications for Everyone: Meeting the Challenge of Diversity Through Technology,” one of the unique features of the conference was that the proceedings have been published by The Annenberg Washington Program in print *and on an accessible CD* designed by CAST that includes video, sound bites, graphics, color displays, etc. This makes the CD accessible to those who have a broad range of physical, sensory and learning disabilities.
- **Computerworld Smithsonian Award** — 1993 winner in the Education and Academia category of the Computerworld Smithsonian award for innovation in technology that has a significant positive impact on society. CAST was recognized for our leading-edge computer technology that allows children with learning disabilities, physical challenges, and cultural disadvantages to read, write, illustrate, calculate and create. The work has been included in the permanent collection of the Museum of American History and the Smithsonian Archives.
- **“Scientific American Frontiers”** — CAST was a featured innovator in this PBS series, hosted by Alan Alda, focusing on individuals who extend their capacities through technology.
- **“The Machine that Changed the World”** — This PBS/BBC six-part television documentary highlighted the enormous impact that modern computers are having on nearly every facet of people’s lives, emphasizing the pioneering work of innovators in business, science, defense, communications, art, leisure and education. When the series focused on the impact that computers have had on the lives of people with disabilities, it concentrated on the work being done at CAST.

POPULATION SERVED

CAST serves a national population of children and adults who have learning disabilities, physical challenges, sensory deficits, and who represent a wide variation in socioeconomic status, including those who have been traditionally underserved.

ORGANIZATIONAL STRUCTURE (Board of Directors and Staff)

CAST’s 16-member Board of Directors meets 4 times a year and is the primary vehicle for volunteer involvement. CAST’s staff of 29, headed by two Co-Executive Directors, includes specialists in education, special education, reading and language arts, occupational therapy, neuropsychology, neurology, speech pathology, engineering, and clinical/school psychology, vision rehabilitation, telecommunications and technology policy.

UNIVERSAL DESIGN FOR LEARNING AT CAST

CONCEPT PAPER

JANUARY, 1997



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The Need for New Educational Tools

American schools are in crisis. Teachers are facing twenty-first century challenges with tools and methods that have remained essentially unchanged since the nineteenth century. Many current curricula, learning tools, and teaching techniques are based on two premises: that public education serves a homogeneous student population and that traditional print-based literacy skills are sufficient preparation for the world of work. Yet neither of these premises reflects the realities of our time. In fact, both the students and the literacy skills they need to acquire are far more diverse than current curriculum design would suggest.

Today's teachers must prepare students with highly diverse abilities and backgrounds for a world requiring new and rapidly changing literacy skills. Classrooms include more students with disabilities and represent more cultures and languages than ever before. Further, while the ability to read and write text once constituted literacy, today's workplace also requires the ability to use computers, graphics, and a wide variety of electronic media.

Our educational system needs a whole new approach, one that addresses the rapid ethnographic and technological changes surrounding the school. Key to such an approach is the concept of "universal design." CAST (Center for Applied Special Technology) contends that universally designed curricula are more effective for ALL students; are inclusive of diversity based on ability/disability, language, ethnicity and culture; are more economical for publishers and consumers; and make it possible for teachers to prepare students for the twenty-first century — now only four years away.

The concept of universal design is most easily explained in the context of architecture.

Universal Design in Architecture

Stairs are a technology that provides effective access to public spaces for many people. However, for individuals using wheelchairs, bicycles, walkers, and baby carriages, stairs do not provide access — they create barriers.

As a culture we have recognized the inequity in the exclusive use of stairs, and we have enacted legislation to ensure that alternatives — such as ramps — are provided for all public buildings. The provision of these alternatives, while increasing access, is not without problems. Retrofitting existing structures for ramps or elevators can be functionally inadequate, expensive, and aesthetically disastrous.



The tools and methods of the classroom have remained essentially unchanged since the 19th century.



Today's classrooms include students with highly diverse abilities and backgrounds.



The workplace requires expanded literacy skills, including computers, graphics, and a variety of media.



To prepare diverse learners for the twenty-first century, teachers need universally designed curricular tools and materials.

During the last decade, a new movement has grown within the field of architecture called universal design. *Architects practicing universal design create structures that from the outset are intended to be used by all individuals, including those who have disabilities.* By considering, during design, the varied needs of those who will use their buildings, architects create spaces that are economically viable, aesthetic, and functional for everyone. For example, a button that automatically opens a door makes it possible for an individual who is mobile in a wheelchair to enter the building; this same button eases entry for anyone whose hands are full. Designing such systems into buildings from the outset reduces costs and provides access for those with disabilities and improved functionality for all.

Why We Need Universal Design in Educational Materials

The concept of universal design is increasingly being applied to school buildings, but rarely to the learning materials and tools found in classrooms. Like stairs, predominant educational media offer access for some students and create barriers for others.

Print, for example, is an inaccessible medium for many students — those with dyslexia, blindness, physical and cognitive challenges, limited knowledge of English, or lagging skills due to limited opportunities. Other media used in classrooms, such as video tape and audio tape, share the limitations of print. A video does not bring “Romeo and Juliet” to life for the student who is blind. The power of Martin Luther King’s “I Have a Dream” speech, when conveyed via audio tape, is lost on the ninth grader with a hearing impairment.

The problem with these media is that they provide only a single format, based on a “one size fits all” concept. Providing alternative versions, such as an audio or a Braille version of printed text, is like retrofitting a building with ramps and elevators. Providing these alternatives is costly and time consuming; their design is often poorly integrated with the original text; and they can be awkward and isolating to use. Further, even these accommodations are rarely available, leaving teachers with the complex job of providing the necessary access, support and challenge for each individual student.

The Central Importance of Digital Media

Digital media — the kind of media found within computers — contrast with all other media in two ways: they are versatile and they are malleable.

First, digital media can carry many forms of content — text, graphics, animation, video, and audio. The same content can be available in multiple forms within one document, with the capacity for transformation from one form to another. For example, text can be transformed to speech, speech to text; still and moving images can be described in speech; sign language can be videotaped and displayed as digital video. Thus digital media are versatile and can incorporate all other media.



Stairs are a barrier for some.



Retrofitting can be inadequate.



The elevator in the new entrance to the Louvre is integral to the staircase and to the design of the space itself — an example of universal design.



Current educational media — based on a “one size fits all” concept — create barriers for many students.

Second, unlike any other existing medium, digital media are malleable. Learning materials created with digital media can remain amenable to change by those who use them. For example, the text and images of a story can be edited by a student to create his or her own version.

Universal Design for Learning Tools and Materials

This malleability opens the door for universal design of learning tools and curricula which is currently the focus of CAST's work. With digital media, CAST is creating software for learning in which the format, the content, the means of expression, and the balance of support and challenge are all customizable. Universally designed materials can be shaped by individual teachers and learners to improve the fit between the materials and their own access needs, interests, educational goals, and cultural/linguistic backgrounds. (See Attachment 1 for examples of CAST's Universally Designed Software.)

Limits of Existing Institutions

Currently a limited number of technologies exist that can support universal design, such as tools to transform text into speech. Yet the majority of current computer software does not take advantage of the flexibility inherent in digital media to increase access and provide multiple options for teachers and students. A major research and development effort is necessary in order for this to change.

At present there is no systematic institutional approach to the development of universally designed curriculum. Consequently, curriculum is not keeping up with new technologies or benefiting from universal design. No single institution can provide all of the expertise necessary to make universal design a reality. What is needed is a partnership involving close, ongoing collaboration among universal design specialists, teachers and other school personnel, students with varied needs and backgrounds, and experts in key domains including multimedia, information design, programming, ergonomics, curriculum, assessment, professional development, cognitive science, multicultural and bilingual issues, educational publishing, and each of the specialties of disability. CAST has initiated such a partnership.

The National Universal Design Laboratory at CAST

CAST has established the National Universal Design Laboratory (UDL) to address the urgent need for learning tools and materials that can support diverse students and new literacies. At the Laboratory, experts in education, curriculum, assessment, professional development, design, disability, and technology collaborate with a network of educators and learners to invent a future where everyone will have access to flexible, effective educational materials.



Like clay that has been glazed and fired, print and other media are fixed.



Like clay that has never been fired, digital media can remain forever malleable.



In Wiggeworks, co-developed by Scholastic Inc. and CAST, the display of text and many other features can be changed in the classroom to fit the access needs and preferences of different students. (See Appendix A.)

Purpose

The purpose of the Laboratory is to improve the education of all individuals, including those with disabilities, by advancing the state of the art in universal design through applied research, development, testing, and dissemination of flexible, customizable, software for learning.

Goals

The Laboratory is pursuing four main goals, the focus of which will vary from year to year:

Goal 1. Core Technologies: Develop a series of core technologies, such as tools for converting content from one medium to another, that will provide access and facilitate expression for all learners.

Goal 2. Applied Technologies: Embed core technologies in universally designed software programs that can be used for curriculum, assessment, and professional development.

Goal 3. Dissemination: Disseminate universally designed software programs into schools, homes, communities, and workplaces to equalize and expand opportunities for learning.

Goal 4. Institutional Growth: Build the laboratory so that it can sustain innovative research as a national leader in universal design.

Specific objectives under each goal are formed yearly, determined by educational priorities defined by UDL staff and its partners.

CAST Qualifications

Uniquely positioned to conduct this work, CAST is a leader in articulating and applying the concept of universal design to learning software. CAST's applied research program provides established relationships with a large and varied group of individuals with disabilities, schools, and community organizations. The UDL collaborates closely with this applied research base. (See Attachment 2.) Finally, CAST has a strong record and ongoing partnerships with dissemination organizations including publishers, policy makers, and technology distributors.

Funding

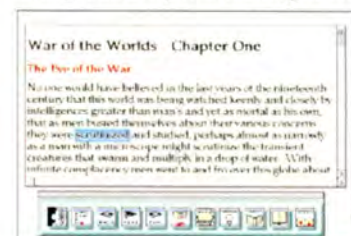
CAST is seeking support from foundations and other sources to help expand the Laboratory and to build new partnerships. Leadership gifts have significant impact because a challenge grant of \$750,000 over three years (96-98) has been offered from the New York Community Trust. (The first year's goal of \$250,000 has been matched and \$37,000 has been raised toward the second installment of \$250,000).



Core Technology Example: Caroline is deaf, making access to classroom video difficult. Captions convey dialog, but not other sound-based information. Children like Caroline need a technology that will transform sound into other media so they can see or feel it.



Applied Technology Example: Mason has a learning disability. Paper and pencil tests pose a barrier. A test that could read text aloud would provide auditory support for reading questions and feedback for checking answers.



Dissemination Example: UDL software will be made available nationwide. Universal Learning Technology, a commercial affiliate of CAST, and Scholastic Inc. are among the publisher partners who will distribute UDL products.



Institutional Growth Example: As part of its long-range institutional strategy, the UDL will build a national network of strategic partners for research and dissemination.

Funding for the UDL will comprise an evolving balance of support from foundations, corporations, individuals, government sources, revenue from products, and royalties from publishers — with decreasing dependence upon foundations, corporations, and individuals as product revenues and royalties increase over time.

CAST's effectiveness in raising funds for the UDL is enhanced by the active participation of our Board of Directors who serve as ambassadors-at-large. Directors advocate for the necessity and economic viability of universal design in their own arenas of education, business, government, and advocacy groups and open doors to foundations, corporations and other funding sources.

CAST's effectiveness in generating revenues and royalties from products is enhanced by the work of its newly established commercial affiliate, Universal Learning Technology, and by CAST's ongoing relationships with Scholastic Inc. and other publishers.

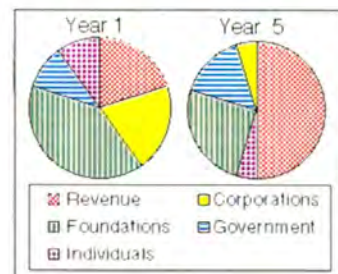
Impact

Success in the UDL will enable educators, publishers, and policy makers to move beyond current ineffective, expensive and inequitable approaches to education of students with disabilities. Such a change would be profound and pervasive — a shift in focus from remediation of deficits in individuals, to remediation of the barriers inherent in classroom materials and methods. The UDL will sustain that change by providing support for universal design at every level.

- *For policy makers* there will be a source of innovative solutions and research data, helping them plan for a future that is fiscally and pedagogically sound for all students.
- *For educational publishers* there will be working models of universal design and specific new features to be incorporated into their materials, improving the cost effectiveness, efficacy, and marketability of their products.
- *For teachers* there will be model classrooms and new tools, raising expectations for what a curriculum can provide and for what both they and their students can accomplish.
- *For ALL students*, not just certain students, there will be accessible curricula, providing an appropriate balance of challenge and support.



A leadership gift will enable CAST to expand learning opportunities for millions of students in need of equal access to curricula.



By Year Five, revenues are expected to provide half of the needed support with a corresponding decrease from other sources.



Success of the National Universal Design Laboratory is providing teachers with essential tools to expand learning opportunities for all students.

**THE ROLE OF ONLINE COMMUNICATIONS IN SCHOOLS:
A NATIONAL STUDY**

10/16/96

designed and conducted by:



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THE ROLE OF ONLINE COMMUNICATIONS IN SCHOOLS: A NATIONAL STUDY

Executive Summary

Overview

"The Role of Online Communications in Schools: A National Study" demonstrates that students with online access perform better. The study, conducted by CAST (Center for Applied Special Technology), an independent research and development organization, and sponsored by the Scholastic Network and Council of the Great City Schools, isolates the impact of online use and measures its effect on student learning in the classroom. The study compared the work of 500 students in fourth-grade and sixth-grade classes in 7 urban school districts (Chicago, Dayton, Detroit, Memphis, Miami, Oakland, and Washington DC) – half with online access and half without.

The results show significantly higher scores on measurements of information management, communication, and presentation of ideas for experimental groups with online access than for control groups with no online access. It offers evidence that using Scholastic Network and the Internet can help students become independent, critical thinkers, able to find information, organize and evaluate it, and then effectively express their new knowledge and ideas in compelling ways.

Online Use Is Growing in Schools

Our nation's schools are rapidly acquiring both computers and network infrastructures. Between 1989 and 1992, for example, schools' inventory of computers increased by nearly 50%. In addition, surveys have confirmed the increasing prevalence of the Internet and other online services in schools. Currently, the U.S. Department of Education reports that 35% of public schools have access to the Internet, and an additional 14% more have access to other wide-area networks such as CompuServe, America Online and Prodigy (Office of Educational Research and Improvement, 1995).

This trend has been encouraged by numerous educators and government leaders, including President Clinton. In his State of the Union speech in January 1996, the President pronounced: "Every classroom in America must be connected to the information superhighway... by the year 2000."

The Need for Measurable Results

Linking the nation's schools to the Internet is a widely held goal. If we provide every student with access to online resources; opportunities to engage with experts, mentors, and peers; and supports to master real-world information and communication skills, we will go a long way toward helping our children succeed in today's society.

This endeavor requires an enormous investment. It is not just a matter of hardware and wires, it requires a new way of teaching and learning. It requires the support of the whole educational community, from the government to superintendents, principals, teachers, and parents.

To succeed in the workplace, children need to become independent, critical thinkers. They must know where and how to find information, organize it, evaluate it, and then effectively express their new knowledge and ideas. They must work cooperatively in teams. Online communications plays a vital role in preparing children for their adult lives. As we fund and implement these new communications technologies, it is important to know whether they actually improve student performance. It is also critically important to know what steps need to be taken in the school, the district, and the community to support their effective use in the classroom.

Goals of the Study

The study began with the premise that providing our nation's schools with computers and Internet access, while necessary, is not sufficient if students and teachers are to reap the benefits of online communications. Current research suggests that new technologies are associated with positive changes in learning activity, but further controlled studies are needed to target the impact of online use in the classroom for teachers and for students. The goals of this study were: (1) to measure the effects of online use on student learning including information processing, communication, and presentation skills, and (2) to gain insights into what it takes to use online communications effectively in school.

Research Design

The study included approximately 500 fourth and sixth graders in 28 elementary and middle school classes from 7 large urban districts across the United States: Chicago, Dayton, Detroit, Memphis, Miami, Oakland and Washington, D.C. The population was divided into two groups: 14 experimental classes (with online access to Scholastic Network and the Internet) and 14 control classes (without online access). In each city, two classes in each of two schools were selected: an experimental and control fourth grade class from one school, and an experimental and control sixth grade class from the other school. Requirements for city participation in the study were designed to encourage district-level and building-based support for participating teachers.

Both experimental and control groups carried out a common unit of study based on the school's curriculum in conjunction with a curricular framework, activities, and worksheets developed by CAST for the study. Civil rights, a familiar interdisciplinary topic for schools, was selected as the instructional focus for the study. The unit was designed to be taught by teachers in both experimental and control groups in their existing classrooms. All classes were encouraged to use technology-based resources such as multimedia reference materials and video tapes for their projects. Both control and experimental classes were advised to use computers whenever appropriate. Only the experimental classes, however, were allowed to take part in online resources, activities, and communication. In both groups, the emphasis was on integrated learning, helping students to see connections among people, their actions, and the real world.

The goal was for all classes to study civil rights according to the preferences of their particular group, while participating in a small set of activities common to everyone in the study. Students engaged in three major learning activities: communications (discussing civil rights issues with peers, teachers, family members, neighbors, people in the community), research (using a variety of media to explore and synthesize information from multiple sources) and creation of a final project. The project was chosen as the final product for the study because it is commonly part of the curriculum in both fourth and sixth grades, and it provides material for performance assessment.

How Student Performance Was Evaluated

Student learning was measured by evaluating students' final projects. These evaluations were based on 9 learning measures. The assignment required students to demonstrate knowledge, apply skills, and illustrate their thinking processes. Student journals and worksheets provided a forum for reflection and self-evaluation. The learning measures used to assess the final projects were built into the worksheets so that students had opportunities to work with them as they built their projects.

An independent evaluator, an experienced school teacher trained in assessment methods, scored the projects. The evaluator had no prior knowledge of either the study or any of the participating schools and was given the mandate to score the projects fairly and without bias. In order to ensure the integrity of the scoring process, a CAST researcher trained the evaluator using assessment consensus strategies. Both the CAST researcher and the evaluator initially scored the same set of five projects, compared their scores, and then

discussed the evaluations each had given. This process along with detailed explanations for each of the 9 learning measures allowed the evaluator to develop a consistent set of standards with which to score the remaining projects.

As an additional means of control, over a quarter of the projects were randomly selected (half from experimental classes, half from control classes) and scored by a second external evaluator. Correlations of the two external evaluators' scores substantiate the consistency of the main evaluator's project ratings.

Teachers submitted both the completed student projects and the materials students used to develop their projects. This work was evaluated on a four-point rating scale (0 to 3) according to the following 9 learning measures:

- Effective of presentation (e.g., interesting, informative, creative)
- Effectiveness of stating a civil rights issue
- Accuracy of information in relation to selected issue
- Presentation of a full picture (e.g., who, what, when, where, why, and how)
- Demonstration of insight into civil rights
- Effectiveness of bringing together different points of view
- Completeness
- Organization
- Demonstration of "best work" (e.g., well planned, neat, showing initiative)

Additional data on student performance and attitudes and teacher behavior and attitudes were collected from pre-study and post-study questionnaires, in-class observations, teacher telephone interviews, and records of time spent online. Use of standardized test scores was not appropriate, given that the core intervention took place over a two-month period and differences in standardized test scores cannot be expected within such a short time frame.

The Results

Two main research questions underlie the investigations of the study.

1. What is the impact of online use on student performance and attitudes?
2. What is the impact of online use on teacher behavior and attitudes?

Student performance and attitudes were clarified by looking at the effects of online use on: a) student projects, b) student perceptions as reported on questionnaires, and c) teacher reports of student performance. Teacher behavior and attitudes were clarified by looking at the effects of online use on: a) teacher perceptions as reported on questionnaires, and b) teacher reflections as reported in phone interviews.

Student Projects

Overall, students with access to Scholastic Network and the Internet produced better projects than students without online access. They received higher scores in all 9 learning measures. The higher scores were statistically significant for 5 of the 9 measures. In particular, students with online access were more effective in their ability to: present their work, state a civil rights issue, present a full picture (who, what, when, where, why, how), bring together different points of view, and produce a complete project.

These results are particularly striking because both experimental and control classes undertook the same projects and both were encouraged to take advantage of computer tools and resources in the Civil Rights Unit. Teacher reports and the makeup of the projects submitted confirm that students in the control group did use computers although they did not go online. This targets online use as a key differentiating factor in student performance within this study.

Online Use Improved Student Learning

Project mean scores of experimental and control groups on 9 measures of learning

Student Project Learning Measures (Scale 0 to 3)	n = 66 Experimental Means	n = 38 Control Means	Difference between Exp. and Control Means	t-Test Probability
Effectiveness of presentation	1.42	1.11	.31*	.0300
Effectiveness of stating a civil rights issue	1.26	1.00	.26 [†]	.0755
Accuracy of information in relation to selected issue	1.70	1.61	.09	.5174
Presentation of a full picture (who, what, when, where, why, how)	1.31	.87	.44***	.0007
Demonstration of insight into civil rights	.82	.74	.08	.6336
Effectiveness of bringing together different points of view	.57	.29	.27*	.0472
Completeness	1.41	1.18	.23*	.0502
Organization	1.27	1.26	.01	.9556
Demonstration of "best work"	1.95	1.87	.08	.5735
Aggregate of mean scores	11.73	9.92	1.81 [†]	.0749

***p < .001 *p < .05 [†]p < .10

Student Perceptions

The positive impact of online communications on student learning is corroborated by analyses of student reports on pre-study and post-study questionnaires. Mean ratings of selected items in the pre-study questionnaire were compared with mean ratings of the same items in the post-study questionnaire in order to determine the change in students' perceptions from the beginning to the end of the study.

Students who used online access became more confident and students without online access became less confident, over the course of the study, in carrying out and presenting a research project. Unrelated competencies, such as basic skills in reading, writing, arithmetic, did not show similar boosts in confidence.

The impact of online use on student performance is further supported by student responses to questionnaire items rating the frequency with which students used computers for different types of school work. Students in the experimental group reported significantly increased use of computers in four different areas – gathering information, organizing and presenting information, multimedia projects, and help with basic skills. Once students with online access had completed their projects, they reported an increase in how much they use the computer for the types of activities that are most closely related to a project-based unit of study and for which online use is well suited. In contrast, there is a decrease in the control group's reports of using computers for the same activities.

Online Use Increased Students' Reports of Using Computers for School Work

Changes in students' ratings between pre-study and post-study questionnaires reflecting their frequency of using computers to do different types of school work

Questionnaire Items on Student Use of Computers (Scale 0 to 3)	n ~ 154 Experimental Mean Dif.	n ~ 137 Control Mean Dif.	Difference between Exp. and Control Mean Dif.	t-Test Probability
To help with basic skills (reading, writing, arithmetic)	.28	-.36	.64***	.0001
To gather information	.60	-.27	.87***	.0001
To organize and present information	.25	-.10	.35*	.0194
For writing	.09	.21	-.12	.4399
To do multimedia projects (writing, pictures, sounds)	.35	-.21	.56***	.0002
To make pictures, cards, banners, signs, etc.	-.06	-.23	.17	.2526
As a reward for good behavior, finishing work etc.	.01	-.05	.04	.6758

***p < .001 *p < .05

Teacher Reports of Student Behavior

Telephone interviews with participating teachers at the end of the study provide rich anecdotal evidence of greater learning for students with online access. Teachers in the experimental group reported that during the study their students found information more quickly, drew resources from a larger number sources in a wider variety of formats, and dealt with information in ways that made the material more relevant to their lives. Teachers felt that e-mail and message boards helped their students learn from other students, teachers and the community at large.

Changes in Teacher Behavior

Teacher reports on the pre-study and post-study questionnaires provide information on changes in teachers' behavior. Due to the low number of teachers (28) and missing data on many of the items, results from analyses of the teacher questionnaires can only suggest trends. They are presented in conjunction with anecdotal reports from telephone interviews to lend insight into possible effects of online use on teachers' behavior and attitudes and to provoke further inquiry.

Data from the questionnaires on the amount of time teachers use computers in school indicate differences between the experimental and control groups. Even though all classes were encouraged to use computers in the Civil Rights Unit, teachers with online access appear to have increased their use (mean change of .70) from the beginning to the end of the study, whereas teachers without online access appear to have made no change (mean change of .00).

Over the course of the study, teachers with online access indicated more frequent use of computers with students for the types of activities that are related to a project-based unit. The experimental group had a sizably greater increase in use of computers than the control group for gathering information, multimedia projects, and creative expression. In contrast, the control group had a sizably greater increase in use of computers than the experimental group for skill reinforcement and reward or motivation.

Although the small number of respondents limits the significance of these findings, they suggest that online use changed teachers' perceptions of the role of technology, and their own behavior in using it with their students. The direction of change for the experimental teachers was toward using technology in the way that literate adults use computers – to enhance performance directly in gathering, organizing, and presenting information. The direction of change for control teachers was, from an educational standpoint, more traditional. They increased the use of computers as teaching devices – using them to teach basic skills, or merely to reward other kinds of skill development.

The telephone interviews give further insight into the effects of online use on teacher behavior. Teachers in the experimental group in contrast to the control group reported that they dealt with a wider range of information and personally learned more about the topic of civil rights. They attributed most of this learning to having access to online resources; however, they also reported acquiring more information from their students than did the control teachers. Teachers with online access also reported more positive interactions with parents than did teachers without online access including: more effective teacher conferences, more parents visiting the classroom, and communication with parents online.

Changes in Teacher Attitudes

Questionnaire ratings provide insight into teachers' perceptions of the building-based assistance they received during the study. In contrast to control teachers, who reported increasing satisfaction with support from administrators and technology staff over the course of the study, the experimental teachers reported decreasing satisfaction. Because they were being challenged to learn how to do new things, they needed additional support and did not find existing supports sufficient. At its most positive, this is a problem of rising expectations. It is when apprentices begin to learn most that they require the most from their mentors.

Online Use Affected Teachers' Perceptions of the Support They Received

Changes in teachers' ratings between pre-study and post-study questionnaires of the building-based support they received

Questionnaire Items on Building-based Support for Teachers (Scale 0 to 3)	n ~ 9 Experimental Mean Dif.	n ~ 6 Control Mean Dif.	Difference between Exp. and Control Mean Dif.	T-test Probability
Administrative support availability	-.50	.67	1.17*	.0174
Administrative support effectiveness	-.60	.60	1.20*	.0373
Technology support availability	-.13	1.00	1.13*	.0492
Technology support effectiveness	-.13	1.00	1.13 [†]	.0954
School staff development availability	.10	.86	.76	.2006
School staff development effectiveness	-.30	1.00	1.30*	.0439

*p < .05 [†]p < .10

Successfully Implementing Online Communications in Schools

The study results offer insights into what it takes to effectively use online communications in schools. In addition to support at the school to insure that new technologies such as online access are actually working, teachers need training and ongoing support to help them use this technology effectively and integrate it into their classroom teaching.

Curriculum and Teacher Supports

The Civil Rights Unit was designed to allow teachers the flexibility to teach a unit of study that they most likely had taught in the past and it provided teachers with suggestions for activities and ways to help students organize their work. The curriculum supports helped students and teachers develop strategies for analyzing and synthesizing information. An often-heard criticism of online use in classrooms is that the amount of resources available can easily overwhelm students and teachers, thereby doing more harm than good. The unit's curricular framework and worksheets offered strategies to help students identify key elements of their topic, to organize the information they found into categories, and to structure their ideas into a compelling presentation for their project.

Scores on student projects, student and teacher questionnaire responses, and teachers' interview statements, show that curriculum and ongoing teacher supports combined with online use had positive effects on student learning and on teacher practice. Evaluations of student projects offer the most significant support for the importance of a curriculum that can adapt current practices to the inclusion of online activities and resources. Many teachers reported in their phone interview that the curriculum framework, lesson plans, activities, and worksheets for the Civil Rights Unit were useful. In addition, teachers in the experimental group relayed the importance of online communications in supporting their teaching efforts. They spoke about the help they received from peers and experts online, the community-building interactions they had with other teachers and community mentors, and the benefits of the wide range of resources available on Scholastic Network and the Internet. As a result, teachers themselves became engaged in learning.

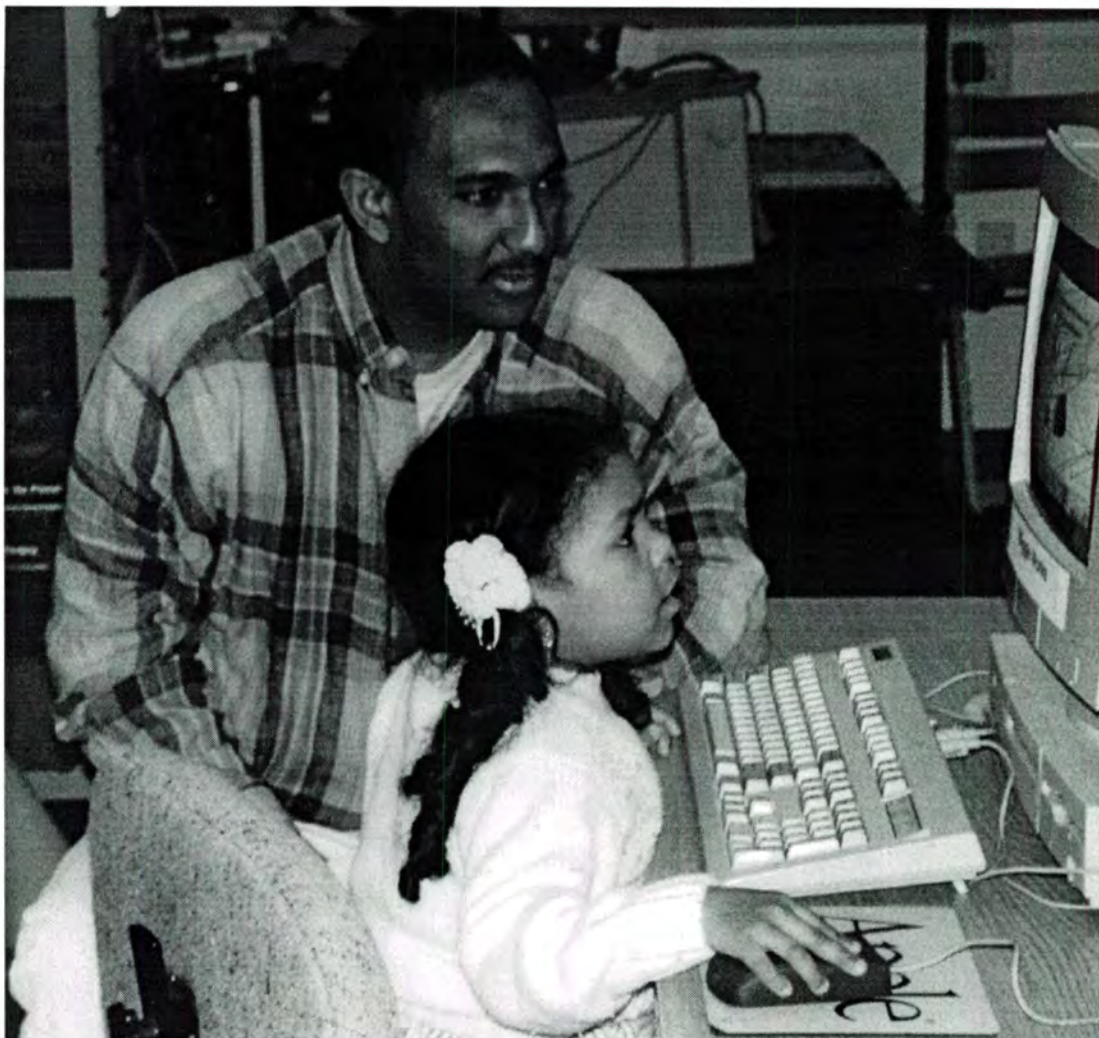
Summary

This study represents an important step in investigating whether online use will lead to increased learning. In our world of rising demands for literacy, and particularly for literacy that extends beyond print literacy, we will need to engage both students and their teachers in becoming independent, critical thinkers. Students and teachers will need to become active learners who can find information, organize it, evaluate it, and then effectively express their knowledge and ideas. The results of this study suggest that online use can be an important tool for both.

About CAST

CAST, the Center for Applied Special Technology, is a nationally recognized, independent educational research and development organization based in Peabody, Massachusetts. CAST has been identified by *The New York Times* as one of the key organizations reshaping American education.

The Family and Community Literacy Project: Empowering Communities for the 21st Century



Concept Paper
Prepared by
CAST, Inc.
(Center for Applied Special Technology)
39 Cross Street
Peabody, MA 01960
January 13, 1997

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Anne Meyer, Ed.D.
Co-Executive Directors
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THE FAMILY AND COMMUNITY LITERACY PROJECT: Empowering Communities for the 21st Century

The Problem Being Addressed

In the 21st Century, literacy will mean much more than traditional reading and writing skills. As we move into an increasingly technological age, parents who have failed to acquire both traditional literacy skills and the new technological literacy skills will be unable to navigate the complex information society in which they live or to help their children develop both of these literacies.

CAST recognizes the problem of access to information and to technology among educationally and economically disadvantaged children and their families, many of whom have undiagnosed learning disabilities, and is addressing it through the Family and Community Literacy (FCL) Project.

Goal

This project will establish four model Family Learning Centers, two in the greater Boston area and two in strategic locations in other parts of the country.

Piloted over the last three years, the goal of the project is to provide parents who are educationally and economically disadvantaged with access to computer technology in order to:

- Support the emerging literacy of their children;
- Acquire literacy skills for themselves;
- Achieve a successful family transition into elementary school;
- Foster and support links between preschools and elementary schools.

Although there are a number of successful family literacy programs that work directly with children and parents, the FCL Project is unique because it focuses on the multiple issues of professional development of teachers and other caregivers, disability as a barrier to literacy, and the effective use of technology. For parents and children who have difficulty acquiring literacy skills using conventional methods and materials, learning to use multimedia computer technology can provide a powerful solution.



In establishing Four Family Learning Centers that will serve as models for national replication, the Project will ensure that parents who are educationally and economically disadvantaged have access to new 21st century computer technology tools so they can improve their own literacy skills and those of their children.



By providing training and access to cutting-edge computer-based tools, parents can participate in their children's emerging literacy development.

The FCL Project meets a variety of learning needs, beginning with the needs of learners with disabilities — who provide the focus for all of CAST's work. By developing supports that are essential for learners with disabilities, CAST has been able to address the needs of a variety of other learners as well.

Description

Pilot Phase:

This innovative project was piloted over the last three years as a collaboration among CAST, the North Shore Massachusetts Head Start Program which serves five towns, and the public school systems of Salem, Peabody and Beverly.

Preschool and elementary schools participated in this project, and parents and teachers attended classes together. They began by learning to use pre-literacy and early literacy software, and then they progressed to using word processing. In this way, parents and teachers collaboratively learned to support children's reading literacy and computer skills. Additionally, parents who have not been successful in their own learning have found success through the gradual increase in skills that they have gained. The Project also prepares parents and teachers to become trainers for their peers.

The impact of the three-year Pilot Phase has extended far beyond the 22 participating parents and their own children: to date, over a thousand preschool and primary school children, ages 3 to 8, have benefited directly from the 50 teachers who have participated in the project. And because the skills and concepts which these teachers learn transform their classroom practice, each year hundreds more children will benefit.

Implementation Phase

The proposed project will allow the current partners to build on their successes in the Pilot Phase, beginning with the North Shore Family Learning Center which opened in October, 1996. This center is a model for designing other centers where training and support can be sustained by local community agencies. In March of 1997, CAST will establish an urban site in Boston, most likely in one of the Boston or Cambridge community schools, in an existing parent center, or in a community-based agency such as one of the Multi-Service Centers.

The third and fourth sites will be in other parts of the country, one tentatively scheduled to be on the combined campus of the Taos Pueblo



Although there are a number of successful family literacy programs that work directly with parents and children, none focus on the multiple issues of professional development of teachers and caregivers, disability as a barrier to literacy, and the effective use of technology.

Head Start Program and the Taos Pueblo Day School in New Mexico (a rural site serving Native Americans), and the fourth in another remote site still to be identified. The long-distance sites will be established through a combination of initial site visits and ongoing telecommunications with CAST and the Boston-area centers. Once the long-distance model is developed, it will demonstrate the capacity for replicating the Family Learning Center at any site, regardless of its proximity to the agency that develops it.

The four Family Learning Centers will thus serve a variety of communities; both recent immigrant populations and traditionally excluded populations; and a range of second-language learners. At least two (and possibly three) of the four sites will be operated in Head Start Programs.

Head Start was chosen as a principal partner because, at its best, it recognizes and builds on the strength of families and children; views the support, development, and empowerment of parents as integral to its mission; and creates a supportive and nurturing environment for parents, a significant number of whom are in their teens, who may lack the confidence to avail themselves of other resources. Furthermore, Head Start already has a national network for serving children and families who are most at risk. This provides a ready vehicle for effective dissemination of the project.

While all these reasons make Head Start sites ideal for replication of this project, CAST believes this model will work in other types of agencies as well. Therefore, the Boston or Cambridge site (being selected through an application process) will be a local community-based organization, thus providing an opportunity to do a comparative analysis of the conditions that promote successful replication. When the FCL Project is fully developed and evaluated, it will be replicable in schools and communities throughout the country.

The Family Learning Centers will be equipped with computers, CD-ROM drives, printers, scanners, digital cameras, modems, phone lines, and software that support literacy development in young children and their parents. An example of this type of software is the *ULTimate Reader*, a multi-media application developed by CAST, that reads text aloud in English and Spanish. Using this program and others, parents can gain access to information that would otherwise not be available to them. They can also use software such as *Wiggleworks™*, an early literacy software product developed by CAST and Scholastic Inc., to guide their children through many important early language and reading activities.



By training the teachers in the elementary schools into which Head Start centers and other preschool agencies feed, children and parents will continue to receive the benefits from the project after graduating from these programs.

The budget for the two-year Implementation Phase of the project is \$731,380. The Hasbro Children's Foundation has provided a leadership grant of \$100,000 for the first year with an invitation to return for a second year of funding. An additional \$100,000 has been raised from the John W. Alden Trust and the Richard Robinson and Helen Benham Foundation. Funding proposals are being submitted to numerous Massachusetts-based foundations, but we are also looking to key national foundations for a significant portion of the remaining \$531,380 over two years.

Although this proposal covers a two year period (July 1996—August 1998), it is anticipated that the Family and Community Literacy Project will continue for a third year in which the focus will be on supporting replication and dissemination of the model.

Impact

The most significant outcome of the Family and Community Literacy Project will be broadened opportunities — and aspirations — for educationally and economically disadvantaged young children and parents nationwide. At the North Shore and Taos sites alone, the Project has the potential for directly impacting the emerging literacy of 1,448 children and their families within the first year of operation at the two sites.

The establishment of the four well-equipped model Family Learning Centers will provide children and parents with access to powerful new electronic tools for literacy as well as guidance in using these tools effectively. This will offer children a “head start” in the literacies that they need for the 21st Century while helping parents learn to support their children’s emerging literacy. By creating structures that both sustain this support and create access to other kinds of information and services, the project has shown that it can give families assistance in surmounting the barriers they face.

The Implementation Phase of this innovative parent education model can help narrow the gap between those who are using the powerful new technology in schools, careers and daily life and those underserved populations who continue to lack access to it.



The Family Learning Centers will offer parents and children a “head start” in the literacies that they need in the 21st century.

Anne Meyer EdD
Co-Executive Director

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January 17, 1997

Melanne Verveerm, Deputy Chief of Staff to the First Lady
Nicole Rabner, Assistant to Deputy Chief of Staff to First Lady ✓
Office of the First Lady
Room 100
OEOB
Washington, DC 20500

Dear Melanne:

When I had the pleasure of meeting Mrs. Clinton at the Women's Leadership Forum luncheon on May 14, 1996, I gave a short presentation about CAST's work in universally designed technology, the text of which is enclosed. Mrs. Clinton expressed interest in a follow-up presentation and demonstration to be given to herself and to others working on related policy issues. She reiterated this interest when I spoke with her on Tuesday, January 7, 1997, at the White House reception for members of the Women's Leadership Forum.

CAST's work in the universal design of educational technology relates directly to many Goals 2000 initiatives, including: access for students with disabilities and disadvantages; effective Internet use in schools; early literacy skills for children ages 0-6; parent involvement and literacy development for economically disadvantaged families; and the application of new research on neural networks to the design of educational technology. Enclosed is a summary of CAST's extensive national recognition such as the Computerworld Smithsonian Award for innovation in technology. (See http://innovate.si.edu/history/oh_hist.htm)

Following are short summaries of four CAST initiatives that are germane. I have enclosed concept papers or executive summaries for each initiative.

- **Universal Design of Learning Technologies Research & Development.** Nationally, CAST leads the application of universal design to learning technologies, building flexible access and learning supports into computer tools so that a single curriculum serves a very diverse group of learners. CAST is committed to ensuring that no child is denied access to learning because of inaccessible curriculum.
(See <http://www.cast.org/uid.html>)
- **Research Demonstrating Impact of Internet Use on Student Learning.** A national study, conducted by CAST and sponsored by the Council of Great City Schools and the Scholastic Network, isolated the impact of on-line use and measured its effect on student learning in the classroom. Underscoring the importance of the federal commitment to wiring the nation's schools, the study showed that structured on-line use significantly improved student learning when combined with professional support for teachers and presented in the context of the curriculum. This landmark study is the first in the nation to demonstrate the educational benefits of on-line use.
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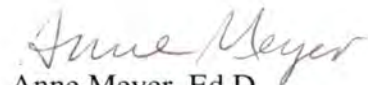
- **A National Network Using Technology to Promote Family and Community Literacy.** This project supports learning among educationally and economically disadvantaged children and their parents through universally designed computer technology. Partnerships between parents and teachers are fostered to maintain parental involvement during the transition from early childhood programs, such as Head Start, to public schools.
(See <http://www.cast.org/famlit.html>)
- **Universal Design of Learning Technologies: Upcoming Publication.** Principles and applications of universal design for learning will be explicated and illustrated in a publication created by the co-executive directors of CAST, Anne Meyer, Ed.D. and David Rose, Ed.D., for dissemination in print, on CD-ROM, and via the World Wide Web. Recent brain research on neural networks will form the basis of new theories for designing flexible learning materials.

We would be glad to provide a presentation highlighting the principles of universal design for learning, demonstrating universally designed learning tools for literacy and Internet access, and illustrating the power of universal design when applied in the context of family and community literacy. We believe that this succinct presentation would offer important insights for those working on policy, infrastructure, funding, and program implementation in educational technology, the Internet in education, and family and community literacy.

CAST will also be presenting to officials at the US Department of Education at the invitation of Dr. Linda Roberts in the near future.

I will telephone you soon after the inauguration and hope that we can schedule a 30-minute presentation to Mrs. Clinton and others working on related policy issues.

Sincerely,



Anne Meyer, Ed.D.
Co-Executive Director

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Enclosures

cc: Carol Pensky
10100 Logan Drive
Potomac, MD 20854



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AM/lmb

Enclosures

cc: Carol Pensky
10100 Logan Drive
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Interfaces

the newsletter of



Spring/Summer 1996

Volume 3, Number 1

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LITERACY RESEARCH PAPER

VOLUME 11

Expanding the Literacy Toolbox

Why we must broaden our definition
of literacy and incorporate new media
in the classroom

David Rose and Anne Meyer

For over a century we have been striving to reach the goal of universal literacy. Although more children can read and write than ever before, there is growing concern that we are no longer making progress. Worse, there is widespread alarm that we are losing ground. A recent survey measuring international literacy shows that although the United States can claim a large number of adults (19 percent) who scored at highest levels of literacy, 24 percent scored at the lowest levels, just above Poland, the industrialized nation that ranked the lowest (Organization for Economic Co-operation and Development; 1995).

We have made progress. In the 1920s, only one in four Americans went to college. In the 1950s, it was one in two. In the 1990s, it is three of four. The paradox of

such progress is that it isn't good enough. Americans are entering a changed and competitive workforce that requires new sets of skills to succeed. Our increasingly information-based culture demands correspondingly increased levels of knowledge and skill. More centrally, the definition of what constitutes literacy in our culture is changing dramatically. The kind of literacy now required for satisfactory performance in business, industry, academia, and government is not the kind of literacy toward which schools have been striving.

We cannot achieve the goal of universal literacy by continuing to rely on current approaches and technologies. This paper traces the development of communications technologies and their relationship to pedagogy over the centuries. It also makes an urgent case for applying new technologies

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LITERACY RESEARCH PAPER

VOLUME 6

Apprenticeship and Exploration: A New Approach to Literacy Instruction

David Rose

I can still remember the rich mixture of excitement and terror as I perched on the wobbly seat of my big sister's red and white Schwinn bicycle, pointing down the lawn toward the driveway.

My father firmly held me and the bike upright as he began to push gently forward. We were moving, gaining momentum, my legs still limp on the pedals. As he had carefully warned, he ran alongside, gradually letting go of the handlebar, then of the seat itself — and I was solo, a bike rider at last!

Or sort of. Ten yards later, out of momentum and still not pedaling, I fell.

Nonetheless, I was soon a bike rider, and an expert at that.

About a year later, at age seven or eight, I discovered the family record player. I don't remember being particularly interested in any of the music on our records, but I loved playing everything at the wrong speed.

Soon I discovered that I could drag my

thumb on the side of the turntable and slow the speed to just about anything I wanted. A short step from that was placing my index finger on the center of the record and spinning faster and faster. None of this did much for music appreciation, but I learned a lot about the properties of speed, sound, rotation, relative pitch, acceleration, constancy, and fragility (of the record player, which finally wore out).

I learned, for example, that

This research paper is adapted from a speech Dr. Rose delivered at the May 1994 International Reading Association meeting in Toronto. Scholastic is pleased to make it available as part of the Scholastic Literacy Research Papers series.

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