David H. Rose, Ed.D.

&

Anne Meyer, Ed.D.

Co-Founders

Center for Applied Special Technology

Nominated by

Christopher J. Dede

BROCK INTERNATIONAL PRIZE IN EDUCATION
NOMINATION PORTFOLIO

NOMINEES:

David H. Rose, Ed.D., and Anne Meyer, Ed.D.
Co-Founders, Center for Applied Special Technology

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HARVARD
GRADUATE SCHOOL OF EDUCATION

July 29, 2008

To the Members of the Brock International Prize Jury:

As a juror, I am delighted to nominate Drs. Anne Meyer and David Rose, co-founders of CAST (the Center for Applied Special Technology), for the 2009 Brock International Prize in Education. The Brock International Prize recognizes a "specific innovation or contribution to the science and art of education, resulting in a significant impact on the practice or understanding of the field of education…that has the potential to provide long-term benefit to all humanity through change and improvement in education at any level." Universal design for learning (UDL), the innovation that Anne and David have developed and championed through CAST, has made an enormous difference in the learning and lives of many children and adults worldwide.

UDL is a framework for designing curricula that enable all individuals to gain knowledge, skills, and enthusiasm for learning. Many people bring special needs to their opportunities for learning. These needs can take the form of physical disabilities, such as limited vision; or cognitive challenges, such as dyslexia; or more subtle forms of impairment for which standard medical diagnoses do not yet exist. Emotional/social overlays that hamper motivation and educational achievement frequently are byproducts of these special needs. These students have the same potential to excel as everyone else, but their intelligence and engagement are trapped by being taught in ways that do not provide support for how they learn. This large group of students and informal learners is left at-risk through inadequate instruction, resulting in both individual tragedy and the loss of society of desperately needed contribution and insight.

But UDL is an innovation that goes beyond helping this group to improving the lives of all learners. History shows us that what is good for people with special needs is also valuable for the entire population. For example, the Montessori method, originally developed for students with special needs, now is a powerful model for aiding all types of learners. My colleague Howard Gardner describes multiple intelligences; the flip-side of this construct is multiple disabilities, the concept that all of us are both learning-enabled and learning-disabled, depending on whether instruction builds on those capacities that are our individual strengths – or is limited to attributes that are our personal weaknesses. As a universal method for improving teaching and learning, UDL is changing the learning and lives of everyone.

This packet details the contributions that Anne and David have made over a period of decades to design, develop, and disseminate UDL and many related innovations. Their work exemplifies for me the type of innovation for which the Brock International Prize is uniquely suited: a new suite of technology-enhanced strategies for

teaching and learning that build on the latest advances in neuroscience and cognitive science, are affordable and scalable, and enrich everyone's learning while specifically empowering a long marginalized and at-risk group. I look forward to sharing more about Anne and David's work when we convene in October.

Sincerely,

Christopher J. Dede
Wirth Professor in Learning Technologies

CURRICULUM VITAE

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PROFESSIONAL EXPERIENCE

1987 – Present	**CAST (Center for Applied Special Technology):** ***Chief Scientist, Cognition and Learning*** ***Founding Director*** Wakefield, Massachusetts
1985 – Present	**Harvard Graduate School of Education:** ***Lecturer (Neuropsychology)*** Cambridge, Massachusetts
1983 – 1987	**North Shore Children's Hospital:** ***Director, Medical Educational Evaluation Center*** Salem, Massachusetts
1978 – 1983	**Children's Hospital Medical Center:** ***Psychologist, Dept. of Pediatrics, Developmental Evaluation Clinic*** Boston, Massachusetts
1973 – 1979	**Tufts University:** ***Assistant Professor, Elliot-Pearson Dept. of Child Study*** Medford, Massachusetts

CURRENT & RECENT RESEARCH GRANTS

2007 – 2011	**Chief Scientist, Cognition and Learning: Principled Science Assessment Design for Students with Disabilities.** Funded by the U.S. Dept. of Education's Institute of Education Sciences. SRI International and CAST are pairing UDL with the assessment design techniques and tools of evidence-centered design to develop assessment items that more accurately reflect outcomes for all students on statewide middle school science assessments.
2007 – 2011	**Chief Scientist, Cognition and Learning: The Universally Designed Science Notebook: An Intervention to Support Students with Disabilities in Science Learning.** Funded by the U.S. Dept. of Education's Institute of Education Sciences. CAST, in collaboration with the Lawrence Hall of Science at the University of California-Berkeley, is investigating a universally designed science notebook to support 4th- and 5th-grade students, in particular those with high-incidence disabilities, in learning science.

2007 – 2011	**Principal Investigator: Universal Design of Inquiry-Based Middle and High School Science Curricula.** Funded by the National Science Foundation. CAST, in collaboration with Education Development Center (EDC) and the University of Michigan, is infusing UDL into middle school and high school science curricula and creating systems to support curriculum developers in creating universally designed science curricula.
2007 – 2009	**Principal Investigator: Accessible Instructional Materials (AIM) Consortium:** Funded by the U.S. Dept. of Education's Office of Special Programs (OSEP). CAST is working intensively with 15 states on NIMAS implementation. The Consortium works to improve academic outcomes for approximately 1.3 million K-12 students with print disabilities through the timely acquisition and delivery of high-quality educational materials in accessible formats (audio, Braille, eText, large print).
2004 – 2009	**Principal Investigator: National Instructional Materials Standard (NIMAS) Development Center:** Funded by the U.S. Dept. of Education's Office of Special Programs (OSEP). Center provides national leadership to further the development and maintenance of the NIMAS work and support its large-scale implementation.
2004 – 2009	**Principal Investigator: National Instructional Materials Standard (NIMAS) Technical Assistance Center:** Funded by the U.S. Dept. of Education's Office of Special Programs (OSEP). Center supports the efficient production of baseline NIMAS files and the conversion of these files into alternate formats.
2004 – 2009	**Co-Principal Investigator: AIR Center for Implementation of Technology in Education (CITEd):** Sponsored by the U.S. Department of Education's Office of Special Programs (OSEP). The American Institutes of Research (AIR), CAST, and the Education Development Center (EDC) have established a Technology Implementation Center to provide a cohesive, coordinated system of technical assistance to support SEAs and LEAs in implementing and evaluating selected evidence-based technology practices.
2002 – 2005	**In-House Consultant: Reading to Learn (Investigating General and Domain-Specific Supports in a Technology Rich Environment with Diverse Readers Learning from Informational Text):** Funded by the U.S. Department of Education's Institute of Education Sciences. CAST and the University of Michigan are conducting this research to enhance our understanding of young students' comprehension of informational text and inform teacher practice, the design of texts and technology, and the design of websites.
1999 – 2004	**Principal Investigator: National Center on Accessing the General Curriculum (NCAC):** Funded by the U.S. Dept. of Education's Office of Special Programs (OSEP). Center provides a vision of how new curricula, teaching practices, and policies can be woven together to create practical approaches for improved access to the general curriculum by students with disabilities.

PUBLIC POLICY INITIATIVES

United States Congressional Staff. Briefing on Universal Design for Learning and its Implications for No Child Left Behind Reauthorization. Dirksen Senate Office Building. February 23, 2007.

Commission on No Child Left Behind: Testimony given at a hearing held by the Commission in its efforts to examine the impact of the No Child Left Behind Act (NCLB) toward improving academic achievement for all students and closing the achievement gap. August 2, 2006.

United States Senate Committee on Appropriations, Subcommittee on Labor, Health and Human Services, and Education: Testimony given at a Hearing on Education Technology, July 25, 2001.

Texas Task Force on Electronic Textbook Accessibility: Member of Task Force, which prepared a report for the Texas Legislature explicating the advantages of electronic textbooks for people with disabilities. February 26, 1996.

Council of Exceptional Children (CEC): Advisor to CEC in its efforts to adopt and disseminate principles and national guidelines of universal design in education for educators, publishers and policy makers. September 1995.

RECENT PUBLICATIONS

Books:

Rose, D. H., & Meyer, A. (Eds.) (2006). *A Practical Reader in Universal Design for Learning.* Cambridge, MA: Harvard Education Press.

Rose, D., Meyer, A., & Hitchcock, C. (2005). *The Universally Designed Classroom.* Cambridge, MA: Harvard Education Press.

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

Meyer, A., & Rose, D. (1998). Learning to Read in the Computer Age. In J. Chall (Series Ed.) & J. Onofrey (Ed.), *From Reading Research to Practice.* Cambridge, MA: Brookline Books.

Columns, Chapters and Articles:

Rose, D. & Rappolt-Schlichtmann, G. (in press). Applying universal design for learning with children living in poverty. In S.B. Neuman (Ed). *Educating the other America: Top experts tackle poverty, literacy and achievement in our schools.* Baltimore, MD: Paul H. Brookes Publishing.

Dalton, B., Rose, D., & Christodoulou, J. (in press). *Technology's role in advancing literacy and achievement for diverse adolescent learners.* A report to Carnegie Corporation of New York.

Rose, D. & Dalton, B. (in press). Learning in the digital age. In K.W. Fisher & T. Katzir (Eds), *Building usable knowledge in mind, brain, and education.* Cambridge University Press.

Dalton, B. & Rose, D. (2008). Scaffolding digital comprehension. In C.C. Block & S.R. Parris (Eds.). *Comprehension instruction: Research-based best practices, second edition.* New York, Guilford Publications: 347-361.

Rose, D.H., Harbour, W.S., Johnston, C.S., Daley, S.G., & Abarbanell, L. (2008). Universal design for learning in postsecondary education: Reflections on principles and their application. In Burgstahler, S.E., & Cory, R.C. (Eds.) *Universal design in higher education: From principles to practice.* Cambridge, MA: Harvard Education Press.

Rose, D., & Dalton, B. (2007). *Plato revisited: Learning through listening in the digital world.* Paper prepared for Recording for the Blind & Dyslexic, Princeton, NJ.

Rose, D. (2007). Is a synthesis possible? Making doubly sure in research and application. In K.W. Fischer, J.H. Bernstein, & M.H. Immordino-Yang (Eds.). *Mind, brain, and education in reading disorders.* Cambridge University Press: 281-292.

Rose, D., & Strangman, N. (2007). Cognition and learning: Meeting the challenge of individual differences. *Universal Access in the Information Society,* 5(4), pp. 381-391.

Rose, D. & Rose, K. (2007). Deficits in executive function processes: A curriculum-based intervention. In L. Meltzer (Ed.). *Executive function in education: From theory to practice.* New York: Guilford Publications.

Rose, D., Harbour, W., Johnston, S., Daley, S., & Abarbanell, L. (2006). Universal Design for Learning in postsecondary education: Reflections on principles and their application. *Journal of Postsecondary Education and Disability*; 19 (2), pp. 135-151.

Dalton, B., Rose, D., & Christodoulou, J. (2005). *Technology's role in advancing literacy and achievement for diverse adolescent learners*. Paper prepared for the Carnegie Corporation of New York.

Rose, D., Hasselbring, T. S., Stahl, S., Zabala, J. (2005). Assistive technology and universal design for learning: Two sides of the same coin. In D. Edyburn, et al (Eds). *Handbook of special education technology research and practice*. Whitefish Bay, Knowledge by Design: pp. 549-569.

Stahl, S. & Rose, D. (spring 2003). Moving the promise forward: A national file format for accessible instructional materials. *CounterPoint* (National Association of State Directors of Special Education); p. 14.

Rose, D. & Meyer, A. (2003). Digital learning. *Cable in the Classroom*; 13 (3), pp. 20-23.

Rose, D. & Dalton, B. (2002). "Using technology to individualize reading instruction." In (Eds.) C.C. Block, L.B. Gambrell & M. Pressley, *Improving comprehension instruction: Rethinking*

research, theory, and classroom practice (pp. 257-274). San Francisco, CA: Jossey Bass Publishers.

Hitchcock, C., Meyer, A., Rose, D., & Jackson, R. (2002). Providing new access to the general curriculum. *TEACHING Exceptional Children* 35 (2), pp. 8-17.

Rose, D., Stahl S. & Aronica, M. (2002). Universal design for learning: Digital text in the classroom. *Journal of Special Education Technology*; 17 (2).

Rose, D. (2001). Testimony before the Senate Appropriations Committee. *Journal of Special Education Technology*; 16 (4).

Rose, D. & O'Connell, C. (2001). Looking at textbooks. *Journal of Special Education Technology*; 16 (3).

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

Rose, D. & Meyer, A. (2000). Universal design for individual differences. *Educational Leadership*; 58 (3), pp. 39-43.

Rose, D. & Dolan, B. (2000). Assessment. *Journal of Special Education Technology*, 15 (4).

Rose, D., Grogan, D. & Ruzic, R. (2000). Walking the walk: Universal design on the web. *Journal of Special Education Technology*; 15 (3).

Rose, D., & Meyer, A. (1999). The Future is in the margins: The role of technology and disability in educational reform. U.S. Department of Education. Web site: http://www.air.org/forum/wpapers.htm

Rose, D. & Meyer, A. (1996). Expanding the literacy toolbox: New media in the classroom, *Literacy Research Paper*, New York, NY: Scholastic Inc.

Rose, D. (1995). Apprenticeship and exploration: A new approach to literacy instruction, *Literacy Research Paper*, New York: Scholastic Inc.

Rose, D. & Meyer, A. (1994). The role of technology in language arts instruction. *Language Arts*; 71 (4), pp. 290-294.

Rose, D., Meyer, A., & Pisha, B. (1994). Out of print: Literacy in the electronic age. In N.J. Ellsworth, C. N. Hedley, A. N. Baratta (Eds.), *Literacy: A redefinition* (pp. 55-59). Hillsdale, NJ: Lawrence Erlbaum Associates.

Meyer, A. & Rose, D. (1993). Out of print: Restructuring with multimedia. In Estes & Thomas (Eds.), *Rethinking the roles of technology in education*, proceedings from The 10th International Conference on Technology and Education. Vol. 2, pp. 1293-1300. Austin, TX: The University of Texas at Austin, College of Education.

Meyer, A., Pisha, B., & Rose, D. (1990). Process and product in writing: Computer as enabler. In A. Bain, L. Baillet, & L. Moats (Eds.) *Written language disorders: Theory into practice.* PRO-ED, 8700 Shoal Creek Boulevard, Austin, Texas.

Rose, D., & Meyer, A. (1987). Software and special needs: A needed link. *Masstream* (Council for Exceptional Children Newsletter, Spring).

Rose, D., & Meyer, A. (1987). Summer software for kids: Learn, explore, & create! *The Boston Parents' Paper*, June.

Meyer, A. & Rose, D. (1987) Microcomputers: Changing the message for LD students. *Masstream* (Council for Exceptional Children Newsletter, Winter).

Meyer, A., & Rose, D. (1987) The word processor: A tool for life. *The Exceptional Parent*, October.

Rose, D. (1979) Some functional correlates of the maturation of neural systems. In D. Caplan (Ed.). *Biological studies of mental processes*, MIT Press.

Rose, D. & Wertlieb, D. Maturation and maze behavior in preschool children, *Developmental Psychology*, 1979.

Rose, D. Dentate. (1976) Gyrus granuel cells and cognitive development: Explorations in the substrates of behavioral change. *Doctoral Thesis*, Harvard University, Microfilms.

SELECTED EDUCATIONAL SOFTWARE DEVELOPMENT

ReadAbout. Scholastic Inc. (2007) New York, NY.

Thinking Reader. Scholastic Inc. (2004) New York, NY.

Bobby™, 3.2. Watchfire Corporation (1996-2000) Waltham, MA.

eReader™. CAST, Inc. (1996-2000) Peabody, MA.

ULTimate CaptionWorks™. (1997) Peabody, MA: Universal Learning Technology, Inc.

WiggleWorks: Scholastic Beginning Literacy System. Scholastic, Inc. (1994) New York, NY.

ASSOCIATIONS, BOARDS, AND COMMITTEES

Professional Advisory Board Member. *National Center for Learning Disabilities (NCLD).* October 2005 – Present.

Advisory Board Member. *The Concord Consortium.* June 2005 – Present.

Associate Editor, *Journal of Special Educational Technology.*

Member of the National Committee of Visitors. *National Science Foundation's Directorate of Human Resource Development.* May 3, 2000. Arlington, VA.

KEYNOTE AND INVITED ADDRESSES

Keynote Speaker. What we mean by Learning and what we mean by Design. *Summit on the State of our Children and Dyslexia.* October 26, 2007. Portland, OR.

Keynote Speaker. Meeting the Challenge of Individual Differences: Universal Design for Learning. *Colloquium on Psychopedagogy at Universidad de Monterrey.* September 5, 2007. Nuevo Leon, Mexico.

Keynote Address. *READ 180 National Summer Institute.* July 25-28, 2007. San Francisco, CA.

Keynote Address. Technology's Role in Helping ALL Students Succeed. *MA DOE Annual Technology Conference.* March 21, 2007. Bridgewater, MA.

Universal Design for Learning: Present and Future Directions. *Touching the Future with Technology.* 2007 Michigan Association for Computer Users in Learning (MACUL) Conference. March 14-15, 2007. Detroit, MI.

Keynote Address. *Visions of Community Conference.* Federation for Children with Special Needs Annual Conference. March 10, 2007. Boston, MA.

Re-imagining Images and the Future of Education. *Visual Images in the Internet Times: Images and Persuasion.* Edunova 2006. September 2, 2006. San Jose, Costa Rica.

Keynote Address. Looking for Disabilities in the Curriculum, not the Student — Universal Design for Learning in Science and Mathematics. *Using Technology to Support Universal Design in Mathematics and Science.* ALLTech Universal Design Conference. August 8, 2006. Augusta, ME.

Keynote Address. From Unique to Universal: Systemic Issues in Universal Design for Learning. *Empowering Students through Universal Design for Learning.* University of Louisville Summer Institute. June 20-21, 2006. Lexington, KY.

Teaching Every Student: Universal Design for Learning in the Digital Age. *Futures of Learning Lecture Series.* Stanford Center for Innovations in Learning, Stanford University. April 5, 2006. Stanford, CA.

Keynote Session. Universal Design for Learning. *2006 NSF K-12 Math, Science, and Technology Curriculum Developers Conference.* The American Geological Institute. February 26-March 1, 2006.

Keynote Address. *Increasing Participation and Persistence: Universal Design for Learning in Postsecondary Instruction.* The Gloria Duclos Convocation 2005-2007. University of Southern Maine. February 10, 2006. Portland, ME.

Keynote Address. No Curriculum Left Behind: Early Interventions for Disabled Curricula. *PATINS 2005 Collaborative State Conference.* PATINS Project, Project Vision, and Indiana Educational Resource Center. November16-17, 2005. Indianapolis, IN.

Universal Design for Learning. *Art Beyond Sight: Multi-modal Approaches to Learning Conference.* Art Education for the Blind (AEB), the Metropolitan Museum of Art and the Museum Access Consortium. October 14, 2005. New York, NY.

Every Student Counts: Universal Design in Mathematics. *CITEd Summer Institute: Making Technology Count for K-8 Mathematics.* August 1-2, 2005. Merrimack, NH.

Creating and Maintaining Systemic Change through UDL Implementation in KY Schools. *UDL Summer Institute.* University of Louisville. June 9-10, 2005. Lexington, KY.

Keynote Address. Universal Design. *Universal Design for STEM Education.* Chemical Heritage Foundation. April 29, 2005. Philadelphia, PA.

It's the Curriculum that's Disabled! Using Modern Technology and Neuroscience to Design Effective Learning Environments for all Learners. *Learning & the Brain Conference.* Public Information Resources, Inc. April 27-30, 2005. Cambridge, MA.

Universal Design for Learning. *Research on Supporting Reading Achievement.* Reading First and Ohio Department of Education cosponsored Faculty Learning Seminar. February 17-18, 2005. Columbus, OH.

Brain Behavior of Struggling Readers. *Videoconference for TIES (Technology and Information Educational Services).* February 10, 2005. St. Paul, MN.

Keynote Address. *Technology Use Symposium on Intellectual Disabilities—User Characteristics and Features of Technology.* The Arc of the United States. November 17, 2004. Boston, MA.

Keynote Address. Powering Up for Reading Comprehension. *Powering Up with Technology Conference.* Prince George's County Public Schools. November 13, 2004. Hyattsville, MD.

Universal Design for Learning: Embedded Scaffolds for Executive Function Directly into Learning Materials and Technologies. *Learning Differences Conference 2004.* Harvard Graduate School of Education. November 11-12, 2004. Cambridge, MA.

Use of Cognitive Science and Neuroscience to Frame Learning Differences and Build Tools to Support Learning. *Building Usable Knowledge in Mind, Brain and Education.* Harvard Graduate School of Education. October 6-8, 2004. Cambridge, MA.

New Ideas from Neuroscience and Technology. *Heidelberg Model Schools Partnership (HMSP) Summer Workshop.* U.S. Department of Defense Schools. August 26-27 and 30-31, 2004. Heidelberg, Germany.

The Challenges and Implications of Universal Design. *Improving Student Resources and Accountability in Times of Scarce Resources.* Harvard University's Annual Summer Institute on Critical Issues in Urban Special Education. Harvard Graduate School of Education. August 2-6, 2004. Cambridge, MA.

Universal Design and the Future of Learning Technologies. *25th Annual National Educational Computing Conference (NECC).* June 20-23, 2004. New Orleans, LA.

Beyond the Limits of Print: Rethinking "Learning Disabilities" in a World where Curricula are Less "Teaching Disabled." *25th International Conference on Learning Diabilities. Achieving Success in High-Stakes Environments: Effective Assessment and Intervention Practices.* October 9-11, 2003. Seattle, WA.

Keynote Speaker. Low Incidence Disabilities and Universal Design—New Directions. *Research Conference 2003: All Learners, All the time.* The National Center on Low-Incidence Disabilities at the University of Northern Colorado. October 2-4, 2003. Denver, CO.

Keynote Address. Far Beyond Gutenberg: Celebrating the CRL in a Digital World. *2003 International SIM Conference.* University of Kansas. July 14-15, 2003. Overland Park, KS.

Teaching Every Student in the Digital Age: Universal Design for Learning. *Focus on Accountability.* The Principals' Center Summer Institute. Harvard Graduate School of Education. July 11, 2003. Cambridge, MA.

Keynote Address. Development and Application of Technology to Expand Opportunities for Students with Disabilities. *Beyond Compliance. The University of Pennsylvania's 2nd Annual Learning-Disability Symposium.* April 4, 2003. Philadelphia, PA.

Teaching Every Student in the Digital Age: Universal Design for Learning. *Kentucky Teaching and Learning Conference.* March 7, 2003. Frankfort, KY.

Resources and Barriers in Practicing Universal Design for Learning. *Kentucky Teaching and Learning Conference.* March 7, 2003. Frankfort, KY.

e-Publishing: Opportunities and Challenges. *Association of American Publishers School Division 2003 Annual Meeting.* February 6, 2003. Naples, FL.

Keynote Speaker. *University of Oregon's Oregon Conference 2003.* January 30, 2003. Eugene, OR.

Accessing the General Curriculum: Realizing the Vision. *TASH 2002 Annual Conference.* December 11, 2002. Boston, MA.

Teaching Every Student in the Digital Age. *2002-2003 Distinguished Authors Series.* The Principals' Center. Harvard Graduate School of Education. November 7, 2002. Cambridge, MA.

Teaching Every Student in the Digital Age: Universal Design for Learning. *Changing Faces: The New American Classroom.* The Principals' Center Fall Institute. Harvard Graduate School of Education. October 24-25, 2002. Cambridge, MA.

Universal Design: Harnessing the Technology to Reach All Learners. *Grantmakers for Education's Closing the Gap Conference.* October 8, 2002. Denver, CO.

What Are the Lessons from the Neurosciences for Pedagogy in a World of New Media Technology? *Harvard University's Connecting the Mind, Brain, and Education Conference.* June 25, 2002. Cambridge, MA.

Keynote Address. Universal Design for Learning. *Interdisciplinary Conference on Disability.* Harvard Graduate School of Education. May 10, 2002. Cambridge, MA.

Recent Advances in the Neurology and Technology of Reading: Developing Strategic Readers in the Digital Age. *International Reading Association's 47th Annual Conference Preconference.* April 28, 2002. San Francisco, CA.

Rethinking Learning Abilities and Disabilities in the Age of New Media. *MICCA 2002 Conference.* March 20, 2002. Baltimore, MD.

Keynote Address. Rethinking Learning Disabilities in the Digital Era. *LDA International Conference.* February 15, 2002. Denver, CO.

Universal Design for Learning. *Harvard Literacy Institute.* Harvard Graduate School of Education. January 12, 2002. Cambridge, MA.

The Neuropsychology of New Media: Toward a Universal Design for Leaning. *Eunice Kennedy Shriver Center's Psychology Colloquium Series.* January 11, 2002. Waltham, MA.

Challenging the Brain's Neural Networks through Networked Learning Technologies. *Harvard University's Learning & the Brain Conference.* November 3, 2001. Cambridge, MA.

The National Summit on Shared Implementation of The Individuals with Disabilities Education Act. June 20-23, 2001. Washington, DC.

The Brain's Recognition Processes and their Application to Comprehension Instruction. *International Reading Association's 46th Annual Convention Preconference.* April 29, 2001. New Orleans, LA.

Can We Harness Technology's Promise? *The Learning Disabilities Network's 2001 Conference.* April 3, 2001. Randolph, MA.

Students with Disabilities & Universal Learning Design. *How do we Best Address and Teach Students? Innovations in Language, Learning, and Assessment Conference.* Harvard Graduate School of Education. March 8, 2001. Cambridge, MA.

Keynote Address. *Bethlehem School District's Staff Development Day.* October 27, 2000. Delmar, NY.

Keynote Address. Technology & Learning: Can We Harness The Promise for Students with LD? *The Learning Disabilities Network 18th Annual Conference.* April 3, 2000. Randolph, MA.

PANELS, PAPERS AND SYMPOSIA DELIVERED AT PROFESSIONAL CONFERENCES

Co-presenter. Implementation in Real World Settings: Learning from Multiple Fields. *NCTI Innovators Conference.* November 15, 2007.

Panelist. Education and the 21st Century Student: Why Universal Design for Learning (UDL) is Hot on Capitol Hill. *International Dyslexia Association Annual Conference.* November 3, 2007. Dallas, TX.

Presenter. Beyond Bridges Made of Paper: The Relationship Between Neuroscience and Education in a World of Modern Technologies. *International Mind, Brain, and Education Society Conference.* November 2, 2007. Fort Worth, TX.

Presenter. Reaching Every Student in a Digital World: Universal Design for Learning. *AECT Annual Convention.* October 25, 2007. Anaheim, CA.

Panelist. *CEOSE Mini-Symposium on Institutions Serving Persons with Disabilities in STEM.* October 15, 2007. Arlington, VA.

Presenter and Discussant. Universal Design for Learning (UDL). *National Science Foundation 2007 Annual Meeting (JAM).* August 13, 2007. Washington, D.C.

Presenter. Brain, Mind, and Education: Teaching Every Student. *OSEP Personnel Preparation Grantees Annual Meeting.* July 18, 2007. Washington, D.C.

Presenter. Universal Design for Learning, Digital Technologies and Accessible Curriculum. *Summer Seminar at the Complutense University of Madrid.* July 3, 2007. Madrid, Spain. Presenter.

Presenter. Universal Design for Learning (UDL): Is it like old wine in new bottles, new wine in old bottles, or not like wine at all? *CEC's Annual Convention & Expo.* April 20-21, 2007. Louisville, KY.

Presenter. Finding New Routes: Meeting the challenge of non-standardized students in a world of standards-based reform. *Celebration of Teaching & Learning Conference.* Thirteen/WLIW. March 23-24, 2007. New York, NY.

Presenter. Universal Design for Learning: How to ensure that all students meet AYP. *Webinar Series by Don Johnston, Inc. and Center for Implementing Technology in Education (CITEd).* March 21, 2007.

Co-Presenter. Accessible Materials Strategies for Non-Chafee Students: What Now? *ATIA 2007 Conference and Exhibition.* Assistive Technology Industry Association (ATIA). January 24-27, 2007. Orlando, FL

Presenter and Discussant. Universal Design for Learning: Towards a Technical Education for All. *National Advanced Technological Education (ATE) Conference.* October 19, 2006. Washington, DC.

Panelist. Software-based Learning Supports for LD Students in the General Ed Classroom. *Web conference sponsored by the National Center for Learning Disabilities, the Council for Exceptional Children, and the Arizona Literacy and Learning Center.* October 3, 2006.

Co-Presenter. Pathways to Literacy Achievement for High Poverty Children. *University of Michigan Ready to Learn Workshop.* October 1, 2006. Ann Arbor, MI.

Moderator. From Unique to Universal: Technology, Disability, and the Future of Education. *OSEP's Project Directors' Conference.* July 31-August 2, 2006. Washington, DC.

Panelist. Neuroscience of Learning. *Technology for Improving Cognitive Performance.* Interagency Committee on Disability Research (ICDR) and its Subcommittee on Technology (IST). June 28-29, 2006. Washington, D.C.

Emerging Scientific Findings in Adolescent Brain Development: Applications for Student Learning, Behavior and Well-Being. Ninth Annual Meeting of the National Coordinating Committee on School Health and Safety (NCCSHS). May 17, 2006. Arlington, VA.

Co-Presenter. *University Teaching and the Challenge of Universal Design: Making Knowledge Accessible in the Digital Age.* Universal Design Forum. Harvard Graduate School of Education. April 18, 2006. Cambridge, MA.

Co-Presenter. New Developments in Assistive Technologies. *Celebration of Teaching & Learning Conference.* Thirteen/WLIW. March 24-25, 2006. New York, NY.

Co-Presenter. NIMAS Possibilities: NIMAS as a Foundation to Increased Student Achievement. *ATIA 2006 Conference and Exhibition.* Assistive Technology Industry Association (ATIA). January 18-21, 2006. Orlando, FL

Participant. NCDAE/AccessIT National Luncheon Discussion. National Center on Disability and Access to Education (NCDAE) and AccessIT. November 18, 2005. Washington, D.C.

Panelist. Universal Design for Learning and Innovation. *NCTI's Annual Technology Innovators' Conference.* National Center for Technology Innovation (NCTI). November 17-18, 2005. Washington, D.C.

Cognition and Learning: Meeting the Challenge of Individual Differences. *IBM Symposium on Cognitive and Learning Difficulties Affecting the Use of Information Technology Systems.* IBM Accessibility Center. October 6-7, 2005. Hawthorne, NY.

Participant. *OSEP's Comprehensive Plan for Part D of IDEA '04 Workgroup Meeting.* The Study Group Inc. October 3-4, 2005. Washington, D.C.

Moderator. Science Learning and Teaching: A Case of Online Professional Learning. *Usable Knowledge Conference: Evolving a Research Agenda for Online Teacher Professional Development.* Harvard Graduate School of Education. September 7-9, 2005. Cambridge, MA.

The Impact of Software on Preschool Literacy. *PBS Ready to Learn Summer Institute: Technology Use in Preschool Education.* August 9-10, 2005. Arlington, VA.

NIMAS and Beyond: Accessible and Strategic Learning Technologies for Improved Outcomes. *OSEP's Research Project Directors' Conference.* July 25-27, 2005. Washington, DC.

Panelist and Discussant. *First International Conference on Globalization and Learning.* March 17-18, 2005. Stockholm, Sweden.

Reaching and Teaching Every Student: The Role of Universal Design in Classroom Practices and State Policy. *The 57th Annual Meeting of the American Association of Colleges for Teacher Education.* February 20-23, 2005. Washington, D.C.

Teaching Every Student in the Digital Age: Universal Design for Learning. *Webinar Series for the Pennsylvania Department of Education.* Chester County Intermediate Unit. January 25, 2005. Downington, PA.

Beyond Bricks and Mortar. *Designing for the 21st Century III.* Adaptive Environments' International Conference on Universal Design. December 7-12, 2004. Rio de Janeiro, Brazil.

Panelist. Policy and Progress: Critical Issues Facing the Disability Community. *OSEP 7th Annual Technology Innovators' Conference.* November 15-17, 2004. Washington, D.C.

Panelist. Improving Reading Comprehension in the Digital Age. *The 55th Annual Conference of the International Dyslexia Association.* November 3-6, 2004.

Moderator. Universal Design and Accommodations. *NECC 2004: ISTE Assessment and Technology Forum.* June 19, 2004. New Orleans. LA

Panelist. Debunking Universal Design—Assistive Technology Myths: Complimentary Sides of the Coin. *CEC's Annual Convention & Expo.* April 15, 2004. New Orleans, LA.

Participant. Using Assistive Technologies for Empowerment. *CoSN K-12 Conference & International Symposium*. March 2-4, 2004. Arlington, VA.

Panelist. Ensuring Accountability for All Children in an Era Standards-Based Reform. *Policy Symposium of the Educational Policy Reform Research Institute (EPRRI)*. February 4-6, 2004. Arlington, VA.

Technological Innovations and Universal Design in High Stakes Testing Environments. *Testing Agencies Disability Forum*. December 8, 2003. Philadelphia, PA.

Series Advisor. Universal Design for Learning. The Learning Chronicles. *Kartemquin Films and Vulcan Productions Learning Series Brain Trust Meeting*. November 18, 2003. Chicago, IL.

Teaching Every Student in the Digital Age: Universal Design for Learning. *Harvard University's ABCD Technology in Education (TIE) Meeting*. Harvard Graduate School of Education. November 3, 2003. Cambridge, MA.

Panelist. *National Symposium on Learning Disabilities in English Language Learners*. Sponsored by OSERS/OELA/NICHD. October 14-15, 2003. Washington, DC.

Panelist. Universal Design and Students with Disabilities: The National File Format. *OSEP's Research Project Directors' Conference*. July 9-11, 2003. Washington, DC.

Discussant. *Scaling up Success: Lessons Learned from Technology-Based Educational Improvement Conference*. Harvard Graduate School of Education. March 20-21, 2003. Cambridge, MA.

Reaching and Teaching All Students...Universal Design for Learning. *Association for Supervision and Curriculum Development's 2003 Annual Conference*. March 10, 2003. San Francisco, CA.

Assistive Technology and Universal Design for Learning. *TAM-Kellar Conference 2003*. February 9, 2003. Reston, VA.

Participant. *Reading Roundtable on Adolescent Struggling Readers*. September 30, 2002. Washington, DC.

Access by Design, not Afterthought: Advances in UDL. *OSEP's Capacity Building Institute*. July 10, 2002. Washington, DC.

Teaching Every Student in the Digital Age. *Focus on Accountability*. The Principals' Center. Harvard Graduate School of Education. June 27, 2002. Cambridge, MA.

Universal Design. *National Education Association's Forum on Technology*. May 9, 2002. Washington, DC.

Universal Design: A Vision for Learning in the Digital Age. *Center for Leadership in Education's 2002 Conference*. April 11, 2002. Elyria, OH.

Accessing the General Curriculum: What We Know Now and Where We Are Headed. *CEC's Annual Convention & Expo*. April 6, 2002. New York, NY.

Neurons, Networks, and New Literacy: Universal Design for Learning. *ASCD's 2002 Annual Convention*. March 10, 2002. San Antonio, TX.

Panelist. *OSEP's Research Project Directors' Conference*. July 10-13, 2001. Washington, DC. *OSEP's Annual Leadership Conference*. April 25, 2001. Washington, DC.

Providing Access to the General Education Curriculum. *CEC Annual Convention and Exposition*. April 19, 2001. Kansas City, MO.

Universal Design for Leaning: A Framework for Teaching and Learning. *ASCD's 56th Annual Conference*. March 18, 2001. Boston, MA.

Human Cognition. *IDEA's 4th Technology Project Directors' Meeting*. February 1, 2001. Washington, DC.

Accessing the General Curriculum. *ASPIRE/ILIAD Partnership 1st Annual Cadre Winter Institute*. January 25, 2001. Washington, DC.

Universal Design for Learning. *Improving America's Schools Conference*. December 13, 2000. Washington, DC.

Roundtable participant. *25 Years of IDEA Symposium*. October 5, 2000. Washington, DC.

Faculty focus group member. *A Multi-disciplinary Approach to Disability. Harvard University Student EMPOWER Group Meeting*. September 26, 2000. Cambridge, MA.

Accessing the General Curriculum: Promoting a Universal Design for Learning. *American Youth Policy Forum*. November 3, 2000. Washington, DC.

UDL in the Classroom: Applying New Brain Research and Next-Stage Technologies to Teaching and Learning. *CEC Stakeholders Meeting*. George Mason University. October 12, 2000. Fairfax, VA.

Participant. *7th Annual Regional Conferences on Improving America's Schools Conference*. U.S. Department of Education. September 18, 2000. Sacramento, CA.

Presented to the *Curriculum and Supplemental Materials Commission*. California Department of Education. July 21, 2000. Sacramento, CA.

Participant in the Universal Design Symposium. *AHEAD Conference 2000*. July 15, 2000. Kansas City, MO.

Innovative Dissemination Strategies. *OSEP's Project Directors' Conference*. July 13, 2000. Washington, DC.

National Center on Accessing the General Curriculum. *OSEP's 10th Annual Technical Assistance and Dissemination Conference*. June 13, 2000. Washington, DC.

Accessing the General Curriculum: Promoting Universal Design for Learning. *Annual OSEP Transition Project Directors' Meeting*. June 12, 2000. Washington, DC.

Accessible Science: Universal Design and the Teaching of Science in the Digital Age. *National Association for Research in Science Teaching (NARST) Conference*. April 28, 2000. New Orleans, LA.

Universal Design for Learning: Technology in Inclusive Classrooms. *CEC Annual Convention*. April 8, 2000. Vancouver, BC.

Literacy and Technology in the 21st Century: Electronic Books that Talk, Listen, and Think (K-12). *The 32nd Annual Conference on Reading and Writing*. Rutgers University. March 17, 2000. New Brunswick, NJ.

Students with Disabilities and Universal Design for Learning. *Responding to MCAS: Innovations in Language, Learning, and Assessment Conference*. Harvard Graduate School of Education. February 29, 2000. Cambridge, MA.

PRE-2000: ADDRESSES, PANELS, PAPERS AND SYMPOSIA DELIVERED AT PROFESSIONAL CONFERENCES

Learning and Living in the Digital Age: from Special Effects to Special Technology. *ASHA's Annual Convention*. November 18-21, 1999. San Francisco, CA.

Homework in the Computer Age: More Supports, Flexible Systems, Higher Standards. *15th Annual Learning Disorders Conference*. Harvard University Graduate School of Education. November 10-11, 1999. Cambridge, MA.

Navigating New Terrain: Learning to Read in the Electronic Age. *California Reading Association 33rd Annual Conference*. November 4-6, 1999. Long Beach, CA.

Neural Networks and Networked Media: Education in the Balance? *The Mind & Brain in Education Lecture Series*. Harvard Graduate School of Education. October 21, 1999. Cambridge, MA.

2nd Annual Urban Symposium. National Institute for Urban School Development. October 1-2, 1999. Denver, CO.

Outreach member. *CEO Forum on Education & Technology*. September 14-15, 1999. Washington, DC.

Assessment Issues for Special Education. *Standards and Accountability: Their Impact on Teaching and Assessment*. The Principals' Center Summer Institute. Harvard Graduate School of Education. July 18-23, 1999. Cambridge, MA.

New Technologies and Environments for Learning and Assessment for all Children. *Harvard University Professional Development Series*. April 29-30, 1999. Cambridge, MA.

Brain Research, New Media, and Universal Design: Foundations for an IDEA that works. *CEC Annual Convention*. April 14-17, 1999. Charlotte, NC.

Literacy Unbound: Intelligent Textbooks for Intelligent Teaching. *SkyLight 5th International Teaching for Intelligence Conference*. April 18, 1999. San Francisco, CA.

Learning to Read in the Computer Age. *Michigan Reading Association Conference*. March 15, 1999. Grand Rapids, MI.

Keynote Address. Learning to Read in the Electronic Age. *Annual West Coast Reading Recovery Conference*. March 7, 1999. Anaheim, California.

Plenary Address. Learning to Read in the Electronic Age. *National Reading Conference 48th Annual Meeting*. December 2-5, 1998. Austin, Texas.

Is the Literacy Express on the Right Track? Learning to Read in the Digital Age. *California Reading Association 32nd Annual Conference*. November 5-7, 1998. Sacramento, CA.

Learning Disorders: Can we Create a Synthesis? *Brain Bases of Learning Disorders: The Case of Reading*. Mind/Brain/Behavior Interfaculty Initiative. Harvard University. October 15-16, 1998. Cambridge, MA.

Making the Possibilities Possible for Everyone. *Leadership and the New Technologies: Strategies for the Schools of Tomorrow*. The Principals' Center Summer Institute. Harvard Graduate School of Education. July 19-25, 1998. Cambridge, MA.

Distributed Intelligence: Learning and Literacy in the Digital World. *The 4th International Teaching for Intelligence Conference*. April 21-26, 1998. New York, NY.

Technology in K-12 schools: Steak or Sizzle? *Annual Meeting of the Harvard University Committee on University Resources*. Cambridge, MA. April 17-18, 1998.

www.dickandjane.edu. *New York Branch of the Orton Dyslexia Society, Inc. 25th Annual Conference*. March 7-9, 1998. New York, NY.

Keynote Address. www.dickandjane.edu: Learning to Read in the Electronic Age. *13th Annual Ohio Reading Recovery Conference and National Institute*. January 31-February 3, 1998. Columbus, OH.

Universal Design for Curriculum. *The ERIC/OSEP Special Project at The Council for Exceptional Children's Stakeholder Conference.* November 11, 1997. Washington, DC.

New Technology in the Classroom: More Support for Students with Learning and Attention Problems. *13th Annual Learning Disorders Conference* sponsored by the Harvard Graduate School of Education and the Research Institute for Learning and Development. November 8, 1997. Cambridge, MA.

Supporting all Learners: Literacy and the Digital World. *31st Annual California Reading Association Conference.* November 6-8, 1997. San Diego, CA.

New and Current Literacy Issues. *Scholastic University.* July 6-10, 1997. Boulder, CO.

Dick and Jane go Digital: Language and Literacy Learning with New Technologies. *14th Annual Language Learning Disabilities Institute.* Emerson College. June 23-27, 1997. Boston, MA.

Apprenticeships in Literacy: Dick and Jane go Digital. *International Reading Association 42nd Annual Convention.* May 4-9, 1997. Atlanta, Georgia.

Multimedia and New Literacy. *Metropolitan Reading Council of Omaha.* April 17, 1997. Omaha, NE.

Modern Multimedia to Support all Learners. *The Principals' Center Conference.* Harvard Graduate School of Education. April 2-4, 1997. Cambridge, MA.

High Standards, High Supports: Universal Design in Educational Multimedia. *California State University, Northridge 12th Annual Conference, Technology and Persons with Disabilities.* March 18-22, 1997. Los Angeles, CA.

Joint US/Japan educational technology dialogue. *Hawaii Assistive Technology Training – Common Agenda Conference.* Honolulu, Hawaii. March 1, 1997.

Technology in the classroom. *Colorado Council International Reading Association.* February 6, 1997. Denver, CO.

Keynote Address. Innovative Applications of Technology. *5th Annual Technology Leadership Academy.* December 5, 1996. Fresno, CA.

Technology as a Tool for Literacy. *Mississippi Reading Association.* December 4, 1996. Biloxi, MS.

Improving America's Schools for Every Child: the Role of Technology in an Inclusive Education. *U.S. Department of Education's Improving America's Schools Conference, Working Together: All Children, High Standards.* November 20-22, 1996. Atlanta, GA.

Keynote Address. Apprentices in the New Literacy: Dick and Jane go Digital. *New York State Reading Association.* September 20, 1996. Albany, NY.

Endnote Address. *Avios Pre-conference 1996: Solutions for Persons with Disabilities a VoiceInput/Output Technology Fair. The 15th Annual Iinternational Voice Technologies Applications Conference.* September 9, 1996. San Jose, CA.

Every Child a Successful Reader: Focusing on Results for All. *1996 International Reading Association, Scholastic Literacy-in-Action Breakfast Forum.* April 29, 1996. New Orleans, LA.

Keynote Address. Beyond Assistive Technology: Universal Design goes to School. *ASSETS '96.* April 11, 1996. Vancouver, BC.

The Results are In: Universal Design and Education for All. *CSUN Eleventh Annual Conference, Technology and Persons with Disabilities.* March 19-23, 1996. Los Angeles, CA.

Show & Tell: Demonstrations of Working Examples of Universal Design. *Universal Access Project Forum on Universal Design of Telecommunications and Information Systems.* October 23, 1995. Boston, MA.

Rethinking Literacy and Learning Disability in the Age of New Media. *The 5th New England Joint Conference on Specific Learning Disabilities.* October 13-14, 1995. Marlborough, MA.

Making Meaning in a Media-rich World. *International Reading Association Conference.* May 1-4, 1995. Anaheim, CA.

Expanding Literacy: New Media for the Inclusive Classroom. *What is Inclusion Anyway? Recognizing Talent in the Classroom.* The Principals' Center Spring Conference. Harvard Graduate School of Education, April 28, 1995. Cambridge, MA.

Integrated Language Arts: Moving beyond Lip Service. *National Association of Elementary School Principals.* April 9, 1995.x San Diego, CA.

Dick and Jane go Digital: Literacy in the Electronic Age. *Iowa Reading Association State Conference.* April 6-8, 1995. Des Moines, IA.

Apprenticeship. *Scholastic Symposium.* March 31-April 1, 1995. Tampa, FL.

Keynote Address. *International Reading Association Conference.* March 17, 1995. Raleigh, NC.

Dick and Jane go Digital: Learning Disabilities in the Age of Multimedia. *10th Annual Harvard Learning Disorders Conference, Strategies for Success: Balancing Priorities in the Classroom.* November 11, 1994. Cambridge, MA.

New Tools for Literacy. *International Reading Association.* May 8, 1994. Toronto, Canada.

Power in the Mainstream: Using New Technology to Provide Accessible Curriculum. *Communications Technology for Everyone: Implications for the Classroom and Beyond.* The Annenberg Washington Program. April 11, 1994. Washington, DC.

Ramps for the Digital Highway: Multimedia Tools for Education. *The New Multimedia Mix: Microchips, Markets and Madonna*. Center for Strategic & International Studies. March 31, 1993. Washington, DC.

Emerging Technologies: Ramps on the Digital Highway. *RESNA Technical Assistance Project, Leadership Training Institute*. March 24, 1993. Boston, MA.

Out of Print: Restructuring with Multimedia. *The 10th International Conference on Technology and Education: Rethinking the Roles of Technology in Education.* Massachusetts Institute of Technology, March 22, 1993. Cambridge, MA.

Out of Print: New media for Literacy. *Education for the Future: Literacy Perspectives, The Annual Reading Institute*. Fordham University. July 7, 1992. New York, NY.

Out of Print: Accessible Curriculum for the Mainstream. *The 3rd New England Joint Conference on Specific Learning Disabilities*. October 19, 1991. Framingham, MA.

We'll Wait for the Elevator: A Case Study in Mainstreaming. *Technology and Persons with Disabilities, California State University-Northridge, 6th Annual Conferen*ce. March 22, 1991. Los Angeles, CA.

Out of Print: Accessible Curriculum for the Mainstream. *Technology and Persons with Disabilities, California State University-Northridge, 6th Annual Conferen*ce. March 20 1991. Los Angeles, CA.

Out of Print: Mainstreaming Tools for the 90's: Action Lab. *Association for Supervision and Curriculum Development, 46th Annual Conference*. March 19, 1991. San Francisco, CA.

Out of Print: Mainstreaming Tools for the 90's. *Association for Supervision and Curriculum Development, 46th Annual Conference*. March 17, 1991. San Francisco, CA.

Design for Learning: Principals for Good Design. *Apple Education Development Forum*. March 14, 1991. San Jose, CA.

Out of Print: Making Literacy Accessible to Learning Disabled Students through Technology. *Leaning Disorders: Focus on Strategies. Harvard Graduate School of Education and the Institute for Learning and Development, 6th Annual Conference*. November 12, 1990. Cambridge, MA.

Computers and Writing for Students with learning Disabilities. *Harvard Graduate School of Education, with Collette Daiute*. May 1990. Cambridge, MA.

An Integrated Approach to Reading and Writing with the Macintosh Computer. *The Orton Dyslexia Society, Inc. 7th Annual Conference*. March 1990. New York, NY.

Keynote Address. *Learning Disabilities Association of America Annual Conference.* February 23, 1990. Anaheim, CA.

Beyond Remediation: Computers for Learning Disabled Students in the 90's. *Learning Disabilities: Progress in the 80's – Prospects for the 90's.* Tufts University School of Medicine, November 18, 1989. Boston, MA.

MACCESS: Macintosh Access to Curriculum – Preconference Workshop. *Closing the Gap.* October 25, 1989. Minneapolis, MN.

Presider. *National Educational Computing Conference.* June 20, 1989.

Adaptive Equipment for the Individual with Cerebral Palsy. *Disorders of Brain Development and Cognition: Prevention of Mental Retardation.* Harvard Medical School/Eunice Kennedy Shriver Center for Mental Retardation. May 10, 1989. Waltham, MA.

Using the Computer to Teach Reading Comprehension. *The Orton Dyslexia Society, Inc. 16th Annual Conference.* March 1989. New York, NY.

Reading and Writing: The Power of the Computer for Elementary Aged LD Children. *MASTAC (Massachusetts Special Technology Access Center).* February 27, 1989. Boston, MA.

Use of Computer Technology in Developmental Disabilities. *Harvard University Graduate School of Education.* February 24, 1989. Cambridge, MA.

New Developments in Technology for Disabled Children. *Developmental Grand Rounds.* North Shore Children's Hospital. November 2, 1988. Salem, MA.

The Use of Computers in the Educational Rehabilitation of Persons with Head Injury. *Mass. Head Injury Association Conference.* October 30, 1988. Marlborough, MA.

Learning Disorders: Cognitive Linguistic and Developmental Variations. *Harvard Graduate School of Education.* October 20, 1988. Cambridge, MA.

Flash Gordon, Not Flash Cards. *Closing the Gap.* October 1988. Minneapolis, MN, with Ann-Patrice Hickey.

Adaptive access. *2nd Annual Seminar on Microcomputers in Special Education.* Memphis State University. August 10, 1988. Memphis, TN, with Margaret Coyne.

Leadership Institute in Special Technology. *Harvard Graduate School of Education.* July 1988. Cambridge, MA.

Keynote Address. Making Technology a Solution – Not a Problem. Co-sponsored by the Society for Augmentative and Alternative Communication of British Columbia and Technical Aids Interest Group in Education and Rehabilitation. May 27, 1988. Vancouver, B.C.

Making the Most of Technology for Special Needs Students. *Applefest 1988*. May 21, 1988. Boston, MA, with Grace Meo, M.Ed.

Integrating Reading and Spelling Software into the Special Needs Curriculum. *Educational Computing Conference*. April 14, 1988. Philadelphia, PA, with Anne Meyer.

Beyond the Uncluttered Screen: Choosing Software for the ADD Student. *Council for Exceptional Children*. January 1988. Baltimore, MD.

Spelling Software in the Special Needs Curriculum. *Closing the Gap*. October 20-24, 1987. Minneapolis, MN, with Anne Meyer.

Just as Much Help as You Need. *MASTAC Seminar (Massachusetts Special Technology Access Center)*. October 15, 1987. Boston, MA.

Keynote Address. Software Tools for the Attention Deficit Disordered Student. *New Tools: Computer Technology in the Special Needs Curriculum*. The Principals' Center Summer Institute. Harvard Graduate School of Education. July 20-31, 1987. Cambridge, MA.

New Technology for Developmental Disabilities. *Developmental Evaluation Clinic*. Children's Hospital Medical Center. February 26, 1987. Boston, MA.

CAST and Special Needs Students. *The Boston Computer Society*. November 20, 1986. Boston, MA.

Writing Disabilities: Computers as a Compensatory Tool. *3rd Annual Conference*. Sponsored by the Division of Ambulatory Pediatrics. The Children's Hospital, Boston and the Harvard Graduate School of Education. November 10-11, 1986. Cambridge, MA, with Anne Meyer.

Community Living: Medical and Technologic Issues. *Developmental Disabilities: Fitting the Pieces Together*. A Forum for Human Service Providers. North Shore Children's Hospital. November 5, 1986. Salem, MA.

New Applications of Computers for Learning Disabled Children. *Annual Conference*. Tufts University School of Medicine. November 1, 1986. Medford, MA.

EDUCATION

1976	**Harvard University, Graduate School of Education**, Cambridge, MA Ed.D., Human Development & Reading
1968	**Reed College**, Portland, OR M.A., Teaching
1967	**Harvard College**, Cambridge, MA B.A., Psychology

CURRICULUM VITAE

ANNE MEYER
CAST, Inc.
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Wakefield, MA 01880
781-245-2212 ameyer@cast.org

EDUCATION:

1983	**Harvard University, Graduate School of Education,** Cambridge, MA Ed.D., *Human Development and Reading*
1975	**Harvard University, Graduate School of Education,** Cambridge, MA M.Ed.
1969	**Radcliffe College,** Cambridge, MA B.A.

PROFESSIONAL EXPERIENCE:

1993-Present	**CAST, Inc.:** ***Founder, and Chief of Education Design*** Wakefield, Massachusetts 1990-1993 Associate Executive Director 1984-1990 Program Director
1984-1986	**North Shore Children's Hospital:** ***Staff Psychologist*** Salem, Massachusetts
1980-1984	**Hillel Academy:** ***Consultant*** Swampscott, Massachusetts
1979-1986	**North Shore Children's Hospital:** ***Psychoeducational Diagnostician*** Salem, Massachusetts
1977-1979	**Harvard University Medical School:** ***Clinical Fellow in Psychology*** Cambridge, MA
1977-1978	**Harvard University:** ***Research Assistant*** Learning Disabilities Study - Jerome Kagan Cambridge, Massachusetts
1976-1977	**North Shore Guidance Center:** ***Intern in Clinical Psychology*** Salem, Massachusetts
1976-1977	**Harvard University Graduate School of Education:** ***Teaching Fellow*** Cambridge, Massachusetts

1976-1977 **Children's Hospital Medical Center:** ***Reading Specialist***
Boston, Massachusetts

1970-1974 **Landmark School:** ***Tutor, Classroom Teacher, Co-director of Summer Sailing Program & Supervisor***
Prides Crossing, Massachusetts

SELECTED PROJECTS:

Principal Investigator, The Universally Designed Science Notebook: An Intervention to Support Students with Disabilities in Science Learning: Collaborates with the Lawrence Hall of Science/University of California-Berkeley, in developing and investigating a universally designed science notebook to support 4th- and 5th-grade students with high-incidence disabilities. Funded by the U.S. Department of Education Institute for Educational Sciences (2007-2011)

Sr. Instructional Designer, Universal Design of Inquiry-Based Middle and High School Science Curriculum: A collaborative curriculum development project with EDC and University of Michigan to develop UDL exemplars of their NSF-funded science curriculum and create systems for others to develop UDL supports for science. Funded by the National Science Foundation (2007-2011).

Project Director, Sr. Instructional Designer, Universal Design for Learning Editions, Google Literacy Project: A collaborative effort with Google Literacy to create a series of state-of-the-art digital texts for students with a wide range of abilities, disabilities, and cultural backgrounds; enhancing public domain texts with embedded learning supports and access tools in support of UDL principles. Funded by the Carnegie Corporation of New York and other private funders (2007- 2008).

Sr. Instructional Designer, TelecomPioneers' ***Power Up To Read***: Web-based reading program for volunteer tutors to use with grade 4-5 students. Funded by the TelecomPioneers of America (2006-2007).

Project Director, Sr. Instructional Designer, Think Like a Historian: Prototype supporting students' use of primary sources using an inquiry-based approach to guide students through the process of investigating a historical event or issue using embedded supports, prompts and tools. Privately funded (2006).

Project Director, Sr. Instructional Designer, Book Builder™: An interactive online tool that enables educators to develop their own digital books to support reading instruction for children aged 3-10. Teachers can create, edit, and save universally designed texts that support diverse learners. Funded by the Massachusetts Department of Education and private foundations (2005-2007).

Sr. Instructional Designer, E-Trekker: A software tool to guide middle school students in inclusion classrooms to help them develop Internet research skills by providing supports for planning a project, generating research questions, selecting key search terms, and evaluating

sites. Funded by the Office of Special Education Programs, U.S. Department of Education and private foundations (2000 to 2002).

ADDITIONAL INSTRUCTIONAL DESIGN/SOFTWARE DEVELOPMENT

Bobby™: An online tool for checking the accessibility of web sites (1996-2000).

CAST eReader™: Text-to-speech software with synchronized highlighting (1996-2000).

ULTimate CaptionWorks™: Software for captioning movies (1997).

ULTimate KidBooks™: Software for creating multimedia electronic talking books (1997).

WiggleWorks®: A multi-media software development project integrating leveled books with technology and instruction to help beginning readers become more successful readers and writers. Co-developed with Scholastic, Inc. (1994-1995).

Communications Technology for Everyone: Implications for the Classroom and Beyond: (Accessible CD-ROM). Funded by the Annenberg Washington Program (1994).

SELECTED AWARDS:

November, 1995: Gold Medal Award from the **National Institute of Social Sciences**. The award was given in recognition of "extraordinary contributions to American education."

SELECTED PUBLICATIONS:

Strangman, N., Meyer, A, Hall, T., & Proctor, P. (2008). Improving foreign language instruction with new technologies and universal design for learning. In E. Hamilton, & T. Barbieri, (Eds.), *Worlds apart: Disability and foreign language learning.* New Haven, CT: Yale University Press.

Meyer, A., & Rose, D. (Eds.). (2006). *A practical reader in universal design for learning.* Cambridge, MA: Harvard Education Press.

Rose, D., Meyer, A., & Hitchcock, C., (Eds.). (2005). *The universally designed classroom: Accessible curriculum and digital technologies.* Cambridge, MA: Harvard Education Press.

Rose, D., & Meyer, A., with Strangman, N., & Rappolt, G. (2002). *Teaching every student in the digital age: Universal design for learning.* Alexandria, Virginia: ASCD.

Hitchcock, C., Meyer, A., Rose, D., & Jackson, R. (2002). Providing new access to the general curriculum. *Teaching Exceptional Children* (Council for Exceptional Children), *35*(2), 8-17.

Rose, D., & Meyer, A. (2000). Digital learning. *Cable in the classroom*, *13*(3), 20-23.

Meyer, A., & O'Neill, L. (2000). Beyond access: Universal design for learning. *Exceptional Parent.*

Rose, D., & Meyer, A. (2000). Universal design for individual differences. *Educational Leadership*, *58*(3), 39-43.

Rose, D., & Meyer, A. (2000). Universal design for learning. *Journal of Special Education Technology, 15*(1), 67-70.

Meyer, A., Pisha, B., & Rose, D. (2000). More than words: Learning to write in the digital world. In A. Bain, L. Baillet, & L. Moats (Eds.), *Written language disorders: Theory into practice.* Austin, TX: PRO-ED.

Rose, D., & Meyer, A. (2000). The future is in the margins: The role of technology and disability in educational reform. *U.S. Department of Education.* Available at: http://www.air.org/forum/wpapers.htm

Meyer, A., & O'Neill, L. (2000). Tools and materials that support the learning brain. *Exceptional Parent, 30*(5), 60-62.

Meyer, A., & Rose, D. (1998). *Learning to read in the computer age.* Cambridge, MA: Brookline Books.

Pisha, B., & Meyer, A. (1998). Smart uses of the smart machine: Computers and your child's learning. *Journal of the Learning Disabilities Association of Massachusetts Gazette, 8*(3) & *8*(4).

Pisha, B., & Meyer, A. (1998). Universal design in the classroom. *Edutopia,* Summer, 4-6.

Rose, D., & Meyer, A. (1996). Expanding the literacy toolbox: New media in the classroom. *Literacy research paper.* New York, NY: Scholastic Inc.

Rose, D., & Meyer, A. (1994). The role of technology in language arts instruction. *Language Arts, 71*(4), 290-294.

PUBLIC POLICY INITIATIVES:

Member of *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. (1996)

Advisor to *President Clinton's Educational Technology Panel,* a subgroup of the President's Council of Advisors on Science and Technology. The panel analyzed the current state of educational technology in the United States and provided the President with information and guidance about the country's educational technology policies. (1995)

PROFESSIONAL AFFILIATIONS:

American Education Association; American Psychological Association; Association for Supervision & Curriculum Development; Phi Delta Kappa; International Reading Association; Society for Research in Child Development.

CERTIFICATIONS:

Licensure in Clinical Psychology, Commonwealth of Massachusetts, January 2, 1985.

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Jefferson County Public Schools
Shaping the Future

July 28, 2008

Members of the Jury
Brock International Prize in Education
c/o Trent E. Gabert, Ph.D.
Associate Dean
College of Liberal Studies
University of Oklahoma
1610 Asp Ave., Suite 108
Norman, OK 73072-6405

Dear Dean Gabert and Members of the Jury:

I am pleased to express my strong support for the nomination of David Rose and Anne Meyer for the Brock International Prize in Education. The work David and Anne have carried out over the past quarter century has laid a foundation for profound changes in education for decades to come. The approach they have pioneered for making curricula accessible to all learners—Universal Design for Learning, or UDL—reframes in fundamental ways how we think about teaching and learning. It is changing all we do in education now, and has set in motion significant changes in how we think about instruction and develop curriculum.

With UDL, David and Anne have challenged basic assumptions about educational reform and our efforts to raise achievement levels. The children we're educating represent a diverse range of intellects, talents, abilities, and disabilities. Until recently, content has been regarded as fixed and static, and struggling learners needed to adapt to the curriculum in order to succeed. UDL stands that perspective on its head by raising the possibility that the child is fine and that the problem is rooted in our methods of instruction and our current design of curriculum. It forces us to refocus and to ask how our curriculum and instruction can be accessible to all. UDL opens up the possibility not just of differentiating instruction, but of tailoring instruction to individual needs. Its promise is the change of textbooks from static documents to dynamic interactive tools that place learners at the center of the educational process with options, choices, and some genuine control of their learning.

In CAST (Center for Applied Special Technology), David and Anne have founded and nurtured an organization that has addressed these issues in a number of significant ways. Their work in developing innovative and award-winning learning tools—such as WiggleWorks,® Bobby,™ and Thinking Reader,™—would be enough to warrant this prize. These products demonstrate in very practical ways that by designing for those at the margins, we can create more effective learning tools for all. They set a new standard that is revolutionizing the development of instructional materials.

But there's more. David and Anne have also shown extraordinary leadership in public policy, resulting in the development of a National Instructional Materials Accessibility Standard (NIMAS) that promises to transform the speed and effectiveness with which curricular materials, especially textbooks, are delivered to students with disabilities. For example, NIMAS makes it possible for blind or low-vision students to get the same standards-based curricular materials as their peers at the beginning of the school year rather than mid-year. This work alone will greatly enhance opportunities to learn for students with disabilities—and will likely lead to the development and distribution of universally designed curricular materials that help tailor instruction to meet the learning needs of *all* students.

Recognizing the promise of UDL, the National Science Foundation has enlisted CAST in a number of projects designed to infuse UDL in science curricula across grade levels and states. NSF is investing millions of dollars to ensure that the next generation's science classrooms reflect the inclusive and transformative principles of Universal Design for Learning, as articulated by David Rose and Anne Meyer and their colleagues at CAST.

In 2007, I had the opportunity to join David and Anne at the first National Summit on Universal Design for Learning. An extraordinary group of 85 change-agents gathered that day, including senior representatives of major education organizations; state and local school administrators; publishers; technologists from corporations such as Microsoft, Intel, and IBM; professors
of teacher education; university researchers; and state and federal education officials. The participants came to work—to roll up their sleeves and figure out how to implement UDL in effective ways across terrains of policy, research, and practice. The vigor with which this extraordinary group set to working was itself a resounding acknowledgement of the impact David and Anne are having on the field of education. One of the significant results of this summit was that David and Anne, through CAST, were asked to provide national leadership for moving this field forward.

As the superintendent of the 26th largest school district in the country, I can attest to the innovativeness and the power of UDL to transform our thinking about instruction and to provide the tools to begin bringing its potential to life in the classroom. I believe there will be no more influential innovation in education than UDL. It finally gives us the insight and the tools to address the needs of all children, but particularly those for whom our traditional methods have not yielded success. It gives teachers the knowledge and skills to differentiate their classroom instruction to reach those children. And it gives administrators a new way of thinking about instructional design that enables them to provide serious leadership in closing achievement gaps. David Rose and Anne Meyer would be exceptionally worthy and appropriate recipients of the Brock International Prize in Education.

Sincerely,

Sheldon H. Berman, Ed.D.
Superintendent

SHB:sf

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MARTHA L. MINOW
Jeremiah Smith, Jr. Professor of Law

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July 16, 2008

Members of the Jury
Brock International Prize in Education
c/o Trent E. Gabert, Ph.D.
Associate Dean
College of Liberal Studies
University of Oklahoma
1610 Asp Ave., Suite 108
Norman, OK 73072-6405

Dear People:

I write with enthusiastic support of the nomination of David Rose and Anne Meyer for the Brock International Prize in Education. David and Anne have integrated cutting-edge research on brain development, learning theory, new technologies, and curricular innovations while also creating one of the most effective educational change-agent nonprofit organizations around. Their work has had an amazing and significant impact on education for children with disabilities, and it is also influencing education for all children.

In the early 1990s, David, Anne, and their colleagues at the Center for Applied Special Technology (CAST) developed the idea that learning materials and instruction can and should be designed for all kinds of children—including those with disabilities—much the way that buildings can be designed for use by all kinds of people, including those with disabilities. This idea, Universal Design for Learning (UDL), challenges the assumption that children must adapt to inflexible educational settings and if they fail, it is their fault. Rather, UDL shifts the burden to the curriculum—and the adults who implement it—to ensure that children have equal access to educational opportunity.

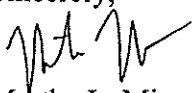
Their work demonstrated that educational materials designed for use by students with physical and mental impairments can open up learning opportunities and generate remarkable levels of achievement for students. Their research demonstrates that students with special needs can learn the curriculum established by state standards for all students if they are provided with accessible materials and supports. Along the way, they have shown that many of these materials make a vital difference for students without disabilities—including English language learners, and students who are disengaged from the classroom.

I have worked with David and Anne on the policy implications of this exciting research, and together we have addressed the legal, economic, and political obstacles to getting accessible materials and supports to all students. Because of their vision and persistence, we have gathered together publishers, technology experts, educators, and representatives of disability groups to make effective changes in opening the curriculum to all students. This work has influenced the creation of a voluntary standards-setting group to develop guidelines for formatting instructional materials (the National Instructional Materials Accessibility Standard, or NIMAS)—and a provision adopted by the Congress in 2004 and signed by the President in 2005 to make those guidelines an important part of the law and practice in our nation's schools. NIMAS promises to revolutionize the speed and effectiveness with which all students, but especially those with disabilities, gain access to core curricular materials that are necessary for academic achievement.

David Rose and Anne Meyer have shown vision, imagination, and leadership that directly improve the educational chances for students. They have created settings where stakeholders from varied communities work together. Their passion for children, their willingness to revise ideas, their openness to honest debate, and their focus on the interests of children have inspired many others while generating practical results in schools and in the nation.

Universal Design for Learning is truly one of the big and transformative ideas to emerge in education over the past two decades, and David and Anne's creativity and persistence in taking it to scale in policy, research, and practice is equally impressive. I cannot imagine a better choice for the honor of the Brock International Prize in Education.

Sincerely,



Martha L. Minow
Jeremiah Smith, Jr. Professor of Law
Harvard Law School

SCHOLASTIC

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July 18, 2008

Members of the Jury
Brock International Prize in Education
c/o Trent E. Gabert, Ph.D.
Associate Dean
College of Liberal Studies
University of Oklahoma
1610 Asp Ave., Suite 108
Norman, OK 73072-6405

Dear Members of the Jury:

It is my pleasure to write in support of David Rose and Anne Meyer's nomination for the Brock International Prize in Education. I have known David and Anne for nearly two decades. During that time, they and their colleagues at CAST have made the prospect of truly inclusive classrooms—where students of all abilities and backgrounds are given the chance to excel in challenging, standards-based environments—a realistic prospect.

The emergence of personal digital technologies in the 1980s provided a means to greatly expand access to the general curriculum to struggling students, including those with significant disabilities and other learning challenges. What was lacking was any comprehensive framework for how to integrate such innovations into curriculum and instructional materials. Universal Design for Learning, the framework defined by David and Anne in the 1990s, provided both a vision *and* a practical strategy for designing inclusive products and instructional practices.

I got to know David and Anne more than 15 years ago when they worked with Scholastic to develop WiggleWorks, the first universally designed literacy system for beginning readers and writers (preK-3). This research-based literacy system is proven to raise children's reading and writing scores by enabling teachers to customize and adjust learning and motivational supports to meet individual needs. CAST developed Thinking Readers with Tom Snyder productions to provide high-quality middle-school literature in universally designed formats.

These multimedia tools translate leading edge educational research into powerful classroom tools that can reach a large market. In this way, the work of David Rose and Anne Meyer has improved the educational experiences of millions of students—and provided models for publishers and educators in how to take full advantage of technology in the service of children. Their articulation of Universal Design for Learning has inspired our work at Scholastic. We embrace UDL's moral message and we also embrace its business practicality. We are a diverse nation and world where every educational environment can and should provide learners the opportunity to soar. Anne and David taught us this, and we know it to be true.

I hope you'll consider the nomination of David Rose and Anne Meyer most favorably.

Sincerely,

Margery Mayer
President, Scholastic Education
Executive Vice President, Scholastic, Inc.

CAST
Universal Design for Learning

www.cast.org

An Overview of CAST's Mission and Work under the Leadership of David Rose and Anne Meyer

HISTORY & MISSION

1984 was a year of exceptional promise in technology and education. Personal digital technologies like the Apple Macintosh computer began to reshape everyday life and work. At the same time, school reform became a hot topic in the United States in the wake of *A Nation at Risk*, with special emphasis on educating all learners to high standards.

That year, education researchers David Rose and Anne Meyer founded the Center for Applied Special Technology, or CAST, to explore ways of using new technologies to give students with disabilities greater access to the general curriculum. Early on, they realized that the solution to educating students with disabilities lies in fixing the curriculum, not "fixing" the students.

As they tested and refined their vision and principles during those early years, they came to a new understanding of how to individualize education. They called their framework Universal Design for Learning.

Today, under David and Anne's leadership, CAST has become an internationally renowned nonprofit organization that:

- Researches and develops innovative learning tools and strategies to support diverse learners;
- Leads trailblazing policy-and-practice initiatives that contribute to more effective and inclusive practices;
- Provides professional preparation and development for education practitioners;

- Publishes articles, books, and free online learning tools for practitioners; and
- Partners with districts, states, research organizations, universities, publishers, and leading technology corporations to develop and promote innovative educational solutions.

In November 2007, David and Anne gave the keynote presentation at the first-ever National Summit on Universal Design for Learning in Washington, DC. Nearly 100 top leaders from states and districts, federal agencies, education advocacy groups, teacher preparation programs, publishing houses, and technology companies gathered together identify new directions in education through UDL.

Diversity strengthens our society, schools, and workplaces—a belief that is central to David and Anne's work in Universal Design for Learning.

WHAT IS UNIVERSAL DESIGN FOR LEARNING?

In our 21st century schools, the mix of students is more diverse than ever. While educators are challenged to teach all kinds of learners to high standards, a single classroom may include students who struggle to learn for any number of reasons, such as:

- Learning disabilities, such as dyslexia
- English as a second language
- Emotional or behavioral problems
- Lack of interest or engagement
- Sensory and physical disabilities

Teachers want their students to succeed. And they know that each student is unique. Neuroscience shows that the way we learn is as individual as DNA or fingerprints. So how can teachers respond to individual differences? A traditional, one-size-fits-all approach simply does not work.

As David Rose and Anne Meyer have described it, Universal Design for Learning (UDL) is "a framework for designing educational environments that enable all learners to gain knowledge, skills, and enthusiasm for learning.

This is accomplished by simultaneously reducing barriers to the curriculum and providing rich supports for learning." UDL addresses instructional goals, methods, materials, and assessments.

"Universal" does not imply a single optimal solution for everyone. Instead, it underscores the need for multiple approaches to meet the needs of diverse learners.

UDL mirrors the universal design movement in architecture and product development. Think of speakerphones, curb cuts, and close-captioned television—all universally designed to accommodate a wide variety of users, including those with disabilities.

In the same way, UDL leverages technology's power to make education more inclusive and effective. UDL helps educators customize learning to meet individual needs by providing:

- *Multiple means of representation*, to give learners various ways of acquiring information and knowledge,

- *Multiple means of action and expression*, to provide learners alternatives for approaching tasks and demonstrating what they know,

- *Multiple means of engagement,* to tap into learners' interests, challenge them appropriately, and motivate them to learn.

In developing the UDL framework, David and Anne have blended insights from neuroscience about individual learning differences with research-based "best practices" of teaching, learning, and assessment.

David and Anne's work is rooted in their work with schools and students. Because of this, they have created many working partnerships with schools, universities, publishers, and others to identify and implement UDL-based answers to educational challenges.

Through these strategic collaborations, CAST is seeding the fields of curriculum planning, software development, state and national policymaking, teacher preparation and support, and research with UDL solutions.

In the pages that follow, you'll learn more about the work of CAST since 1984 under David and Anne's leadership.

RESEARCH & DEVELOPMENT

In their early work with children, David and Anne found that printed text—the predominant technology of classrooms—simply does not

work for many students. It certainly doesn't work for students who cannot turn the pages of a book or see printed words, or read and understand English because of specific learning disabilities or language barriers. And print is not always the best way to convey certain kinds of content, such as Science.

Capitalizing on the flexibility inherent in computer technology, David and Anne envisioned the creation of new kinds of "books"—computer-based texts that could be customized to fit the learning needs of students with disabilities, and indeed, of *every* student.

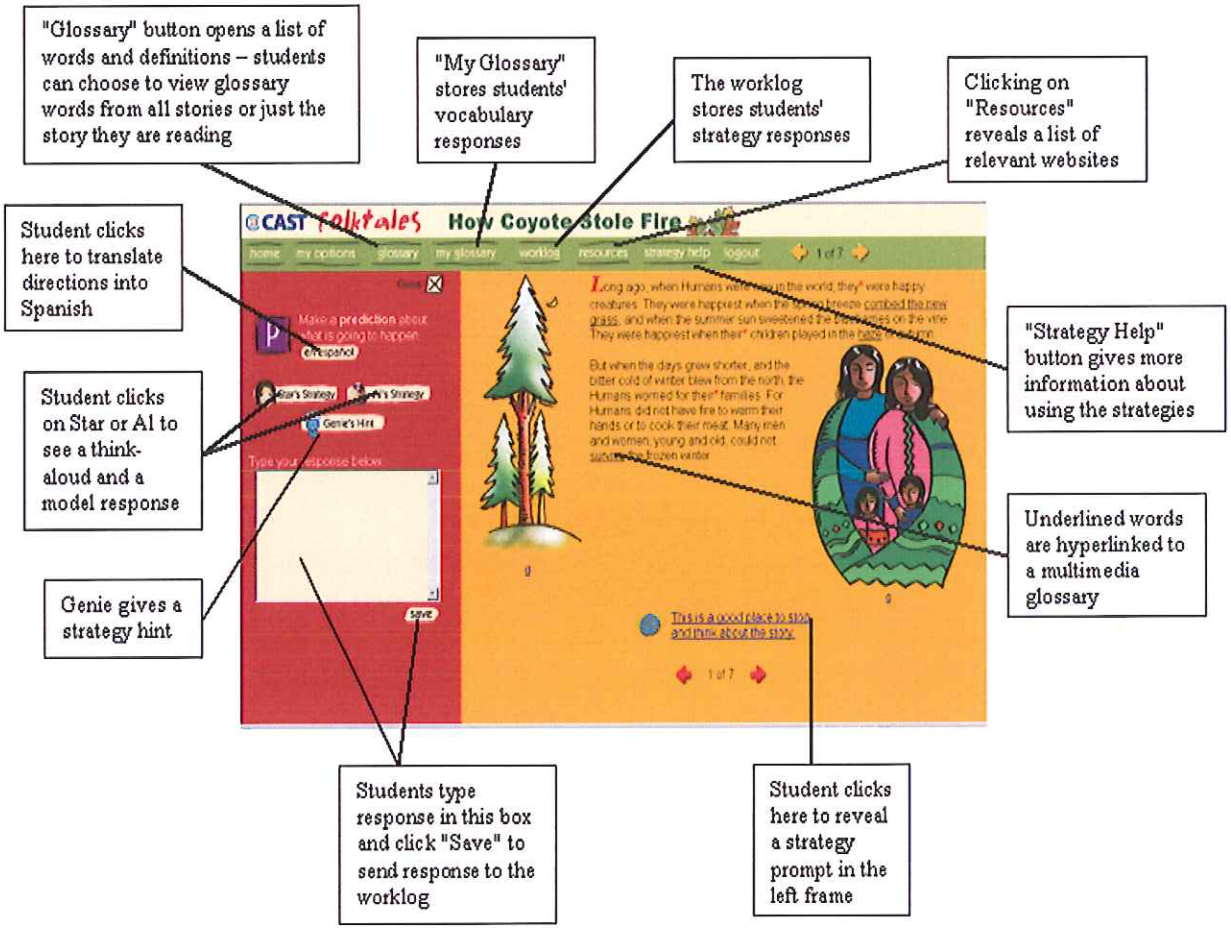
In conducting its research, CAST has partnered with leading researchers in the field. For example, David and Anne, along with CAST literacy expert Bridget Dalton, worked with AnneMarie Palincsar to apply her reciprocal teaching model (Brown & Palincsar, 1984) to digital environments. Positive research results and an award-winning literacy program, *Thinking Reader*, resulted.

With the aid of sophisticated tools that measure readers' eye movements, CAST is researching how the design of textbooks, websites, and other educational materials may affect learning—determining the impact of illustrations, diagrams, charts, and other graphics on reading and concentration.

UDL literacy research at CAST has earned sustained support from the USDOE Institute of Education Sciences, the USDOE Office of Special Education Programs, and the National Institutes of Health, as well as several private foundations such as the Carnegie Corporation of New York, the Hewlett Foundation, and the Emily Hall Tremaine Foundation.

Across the United States, CAST works with states and test developers to apply Universal Design for Learning to large-scale assessments so they will do a better job of determining what students really know. CAST is also working to incorporate curriculum-based measurement (progress monitoring) into UDL environments.

Figure 1 A universally designed "book"



In recent years, CAST has extended its research beyond literacy to include content areas such as history and science. In fact, the National Science Foundation has launched a multimillion dollar research effort

for the next several years to integrate Universal Design for Learning into the science curricula it funds.

David Rose and Anne Meyer are each leading multiyear projects with researchers and curriculum developers from around the country to explore new ways of conveying essential science content.

In all of its projects, CAST connects to the concerns and needs of real-world schools, working in a variety of school settings to test and refine UDL tools and strategies. In this way, CAST is sure to learn firsthand from the teachers and learners of the 21st century.

POLICY

Rose and Meyer's work led them into policy work at both the state and federal levels. CAST facilitates state and federal initiatives that improve education for all students, especially those with disabilities, and spread the principles of Universal Design for Learning.

In the 1990s, Anne Meyer served as a National Adviser to President Bill Clinton's Education Technology Panel. Both David and Anne also served on the Texas Task Force on Electronic Textbook Accessibility. In this decade, David Rose has addressed the US Senate, the NCLB Commission, and Congressional staff on the promise of Universal Design for Learning for all students.

For example, in the U.S. Department of Education, in recognition of UDL's potential, designated CAST as the lead agency of the National Center on Accessing the General Education Curriculum (NCAC), a five-

year initiative to provide leadership in improving learning opportunities for students with disabilities.

As Principal Investigator of the (NCAC), David Rose and colleagues led a group of diverse stakeholders—including publishers, technologists, disability advocates, and educators—in writing the National Instructional Materials Accessibility Standard (or NIMAS), which became law in 2006. NIMAS is:

- A method for publishers and others to develop accessible materials (such as Braille and text-to-speech) quickly and accurately using a flexible electronic format,
- A way to address longstanding information access barriers and enrich learning experiences for students with print disabilities,
- A standard endorsed by the U.S. Department of Education,
- A key element in the 2004 Individuals with Disabilities Education Improvement Act passed with bipartisan support by the U.S. Congress.

Following this work, David Rose was named Principal Investigator of multiyear federal projects to implement and further develop the Standard: the NIMAS Technical Assistance Center and the NIMAS Development Center (2004-2009).

In addition, David is also Principal Investigator of a new federally funded, 15-state AIM Consortium to explore ways to develop and more efficiently deliver accessible instructional materials (or AIM) to states and local education agencies.

Thanks to David and Anne's leadership, other organizations are now taking up the banner of UDL in public policy. In 2006, representatives of more than two dozen national education and disability organizations formed the National Universal Design for Learning Taskforce in Washington, DC, to raise awareness of UDL among national, state, and local policy makers.

These organizations—including the National Schools Boards Association, the National Education Association, the Council of Chief State School Officers, and others—are working together to see that Universal Design for Learning is incorporated in major education legislation for both K-12 and postsecondary and in their own organizations' work.

PROFESSIONAL DEVELOPMENT

Each year, thousands of teachers, administrators, and professional development specialists learn from David Rose, Anne Meyer, and CAST's professional development team in presentations, online courses, and seminars.

These include state and district-level UDL initiatives across the country, including Kentucky, Indiana, Massachusetts, Michigan, and Ohio.

David and Anne are both experienced teachers and professional developers. Anne taught at the Landmark School, a school specifically designed to serve students with learning disabilities, and David has taught for more than 20 years at the Harvard Graduate School of Education.

CAST also reaches teachers via its website *Teaching Every Student* (www.cast.org/teachingeverystudent)—a companion to David and Anne's book of the same name. The site provides interactive tutorials of UDL-in-action, model lessons, curriculum resources, and interactive other tools for applying UDL in the classroom. Anne Meyer is the principal author of TES Web content.

LEARNING TOOLS AND PRODUCTS

In an effort to make its research-based solutions available on a large scale, CAST will sometimes partner with leading publishers to develop commercial versions for classroom use. CAST also publishes a number of learning tools online that educators can freely use.

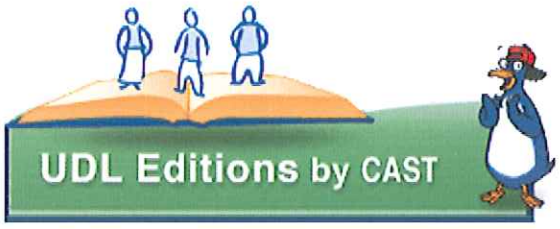
In the 1990s:

- **WiggleWorks**, the first universally designed literacy program for beginning readers (K-2), distributed by Scholastic;
- **CAST eReader**, one of the first text-to-speech software programs that read aloud all forms of electronic text, including Web pages;
- **Bobby**, an award-winning, free online resource for novice and professional Web designers to evaluate accessibility barriers to Web users with disabilities.

In the 2000s:

- **Thinking Reader** (Tom Snyder/Scholastic), a unique literacy software program to help struggling middle-school readers develop key reading-comprehension strategies;

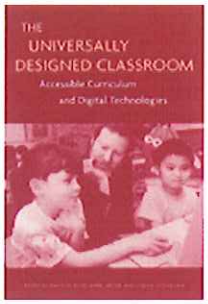
- **UDL Book Builder**, a free online tool for practitioners to design and publish their own universally designed books;
- **UDL Lesson Builder**, a free service to guide teachers in crafting universally designed lessons;
- **UDL Curriculum Self-Check**, a free online evaluation tool to help practitioners assess their curriculum using UDL principles;
- **Power Up to Read**, a multimedia literacy environment for use with 4th and 5th-grade readers across North America by TelecomPioneers, a 600,000-member volunteer organization with afterschool tutoring programs;
- **Strategy Tutor**, a free resource for teachers and students to turn the information-rich Web into a resource that's rich in learning;
- **UDL Editions**, a free collection of classic texts that are rendered in digital UDL environments with rich reading comprehension supports, launched in partnership with Google Literacy Project to celebrate World Book Day in 2008.



David and Anne are also leading CAST in a number of partnerships with large national organizations and corporations to bring Universal Design for Learning to the broader marketplace. In recent years, CAST has partnered with Google, Microsoft, IBM, PBS, SRI, and others on UDL-based projects.

PUBLISHING

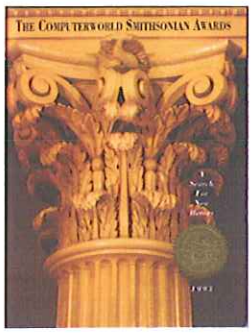
CAST also publishes articles, books, videos, websites, and other media to communicate research results and provide practical advice on UDL implementation. Books by Rose and Meyer include:



- *Learning to Read in the Computer Age* (Brookline, 1998)
- *Teaching Every Student in the Digital Age: Universal Design for Learning* (ASCD, 2002)
- *The Universally Designed Classroom: Accessible Curriculum and Digital Technologies* (Harvard, 2005)
- *A Practical Reader in Universal Design for Learning* (Harvard, 2006)

AWARDS

Awards for CAST under David and Anne's leadership:

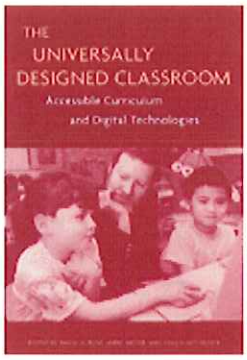


- Gold Medal Award, National Institute of Social Sciences (to Anne Meyer) for "extraordinary contributions to American education"
- Computerworld/Smithsonian Award for Innovation in Education and Academia (twice)
- Tech Museum of Innovation Laureate
- EdNET HERO Award for Non-Profits (from the educational technology industry association)
- Access Advancement Award from the American Association of Engineering Specialists
- Ron Mace Designing for the 21st Century Award from Adaptive Environments
- Finalist, SAP/Stevie Wonder Vision Awards
- LD ACCESS Foundation Innovation Award

The Future is in the Margins: The Role of Technology and Disability in Educational Reform

By Anne Meyer, Ed.D., and David Rose, Ed.D.

Excerpted from:



The Universally Designed Classroom

Accessible Curriculum and Digital Technologies

Edited by David H. Rose, Anne Meyer, and Chuck Hitchcock

The Universally Designed Classroom addresses crucial questions about how to create full access to the general education curriculum for children with disabilities. Based on years of research and innovation at CAST (The Center for Applied Special Technology), the book provides a helpful overview of the digital solutions that are at the forefront of efforts to create universal access. It also looks closely at the major policy and practice issues connected to this initiative.

Praise:

"Over the past decade, researchers at CAST pioneered the concept of Universal Design for Learning. *The Universally Designed Classroom* is a timely and comprehensive examination of the issues pertaining to UDL, from definition and conceptualization to implementation. This book is a blueprint to turn promise into reality."
--Michael L. Wehmeyer, University of Kansas, and Director, Kansas University Center on Developmental Disabilities

"*The Universally Designed Classroom* provides a rich understanding of how and why all classroom instruction can be fully accessible to every child. Finally, we have a complete reference on what UDL means, why it is important, and how to use its principles in designing curriculum and instruction."
--Patti Ralabate, Senior Professional Associate for Special Needs, National Education Association

Introduction

New technologies are often heralded with great fanfare and elaborate claims of their transformative power. Educational technologies, notably the personal computer, are a case in point. Scattered examples can be found across education of productive uses of new technologies: the use of the World Wide Web to connect students from around the globe in international learning communities; online learning projects that give rural, homeschooled, or night school students access to courses at distant schools or at odd hours; use of handheld computers for data collection on field trips. Yet some 25 years after the first computers found their way into schools, their anticipated role in expanding opportunities for teachers and students alike remains largely elusive. Despite their promise, these technologies still are used largely to support old goals, methods, and assessments that shut out students with disabilities from the general education curriculum.

In this chapter we examine some reasons for the slow progress towards educational innovation and change that continues to seem just around the corner as the power of computers and networks increases exponentially. We posit that students "on the margins," for whom current curricula are patently ineffective, can actually lead the way to true reform because they help us understand weaknesses in our educational system and curricula that impede teaching and learning for all. Through the framework of Universal Design for Learning (UDL), we articulate a new view of the nature of learner diversity and show that designing digital tools and content to respond to that diversity yields a viable blueprint for change.

Impediments to change

One reason that computers have not yet fulfilled their transformative promise in education is, paradoxically, their incredible power and versatility. When technologies with radically new capacities are introduced, it takes people a long

time to realize how to use those capacities creatively and productively. Indeed, the capacities themselves often change the very enterprise for which they are designed, requiring a shift of viewpoint that can only happen when users have had time to experiment with the new tools.

The early days of film offer a good example. The first moviemakers simply transferred stage productions such as plays and stand-up entertainment onto film by setting the camera in one place in front of a stage. It took nearly 20 years for filmmakers—notably D.W. Griffith in 1913—to start experimenting with multiple camera angles, zooming, panning, and many other techniques made possible by film and video media (Stephens, 1998). The technology to do these things was in place early, but people needed time to discover the capacities of movie cameras and to shift their mind-set away from the old, more limited methodologies of the stage.

Looking back even further, Ruth Cowan (1983), in her remarkable work of social history called *More Work for Mother: The Ironies of Household Technology from the Open Hearth to the Microwave*, examines the effects of new technologies in the kitchen. When stoves were invented in the 18th century, they were embraced very slowly. Two things slowed their acceptance. On one hand, there were widespread fears about their deleterious effects on health and family life (similar, in fact, to early fears about computers in the home or classroom). On the other hand, stoves seemed to provide only a marginal improvement over the open hearth—especially since they were initially used only to cook in the same old way: mixing and heating food in a large pot hung over the fire. However, the great flexibility of stoves eventually became apparent and stoves ultimately transformed our culture's concept of what constituted a meal, what was meant by cooking, and even what a kitchen was for. Most important, Cowan writes, the new technologies of the kitchen democratized cuisine, bringing meals that were more nutritious, more differentiated (multiple dishes, multiple courses), and more attractive to a large number of households where such meals had been previously unavailable.

Although it seems that computers have been in the classroom for a long time now, as a technology they are still relatively young. Like most technologies in the early stages of application, classroom computers are mostly being used in traditional ways—new tools to do old things. Word processors, calculators, and learning games have been assimilated into conventional curriculum to support and augment traditional instructional activities (Reinking, Labbo, et al., 2000).

These tools provide improvements in efficiency over print-based technologies (pencils and paper), but the ways in which they are predominantly being used do not fundamentally change the nature of the educational enterprise. The core components of the curriculum—its goals, media and materials, teaching methods, and assessments—remain essentially as they always have been; in particular they still rest on a print-based set of assumptions (Smagorinsky, 1995; Pailliotet, Semali, Rodenberg, Giles, & Macaul, 2000). Computers are widely used to help students become more proficient with comprehending, interpreting and analyzing, and expressing themselves with printed text.

The second reason that computers have been slow to bring about change is, again ironically, the incredible power of the technology of printed text. The advent of printed text revolutionized communication by enabling permanent recording, mass production, portability, and, at least by the 20th century, affordability. Print made possible the very idea of education for everyone, and became its cornerstone. Learning to read and write text, to interpret, organize, and apply information encoded in text have been the key to learning and to citizenship, and have therefore been at the core of the educational system. These assumptions are of such long standing that they are almost invisible, and so entrenched that to consider dislodging them seems radical and possibly dangerous. Why should we dislodge the print-centric curriculum, and what will bring it about?

First precipitant to change: The needs of students "in the margins"

The urgency for change stems in part from schools' inability to meet the needs of increasing numbers of students "in the margins"—those for whom the mastery of

printed text is difficult or impossible. A significant minority of people can be considered "print disabled," because of visual impairments, learning and other cognitive disabilities, sensory or motor disabilities, and many other reasons. The medium of printed text can be partially or totally inaccessible, or simply not the optimal medium for learning and expression. One urgent reason for change derives from the rapidly increasing diversity of learners in our classrooms and the limited capacity of printed media to respond to that diversity.

Printed text is inaccessible for students who cannot see; those who have difficulty recognizing phonemes, letters, letter-to-sound correspondences, words, or sentences; or have trouble distinguishing different print formats and their associated reading conventions (Adams, 1990; Anderson, Hiebert, Scott, & Wilkinson, 1985). In addition, because reading is not only an act of recognition but also one of strategy (Anderson, et al., 1985; Graves & Levin, 1989; Richek, List, & Lerner, 1989), printed text can also be a challenge for students who have strategic difficulties (Rayner, 1986). Difficulty setting a reading goal, interpreting structural cues and meaning within text, making connections to background knowledge, self-monitoring, all exemplify strategic weaknesses that can make printed text a barrier. Moreover, learners who cannot readily decode the words must recruit strategic resources for the task, limiting the availability of those resources for the construction of meaning. Printed text can also inhibit those who do not have disabilities *per se* but could be considered to have print disabilities. For example, English language learners in the United States often lack the vocabulary or background knowledge they need to succeed in a learning environment dominated by printed text (Proctor, Carlo, August, & Snow, 2005).

Beyond issues of skill and access, emotional and motivational issues can inhibit progress in learning. Students whose failures with printed text have caused them to build negative associations with the medium can become discouraged and lack the confidence that further efforts will yield progress. Finding the will to persist further with an unforgiving and unsupportive medium can be daunting (Richek & McTague, 1988). And students for whom printed text is just not an optimal medium can also

become disaffected in a print-centric classroom. These students may flourish when provided with other presentational and expressive options, such as multimedia or the arts. For example, filmmaker George Lucas, creator of *Star Wars* and *Indiana Jones*, admits he was not very engaged in school, in "memorizing isolated names and facts." But his obvious gifts in the medium of film made him realize that other avenues for success are highly legitimate. These insights motivated him to establish an educational foundation to explore new ways of teaching and learning using multimedia (Lucas, 2002).

Many kinds of learners may share the same classroom; all may struggle to learn the same material. Yet the heterogeneity of their learning needs contrasts with the monolithic label of "struggling learner." The students struggling with text may actually have little in common and be inappropriately grouped under any kind of label. The common barrier they face is a curriculum based in printed text. The fundamental quality of printed text that renders it inaccessible and unforgiving is its fixed nature. Printed materials cannot be modified from their original format (unless an enterprising teacher takes out scissors and tape!), nor can printed content be enhanced or modified to make it supportive in diverse ways for diverse learners. Until the advent of computers and digital media, there was really no workable alternative to print- and text-centric curriculum.

Disenfranchised students "in the margins" of our educational system provide the needed challenge for curriculum designers, administrators, policy makers, and teachers. They help us to see and understand the opportunities offered by computers and digital media. With the federal mandate of the Individuals with Disabilities Education Act and No Child Left Behind to provide access, participation, and progress in the general education curriculum to all students (Hitchcock, Meyer, Rose, & Jackson, 2002; Karger, 2004), schools face intense pressure to succeed with diverse learners, yet many of these learners cannot thrive in a print-based classroom. This pressure drives us to examine the qualities and capacities of new media in light of the needs of diverse learners, and to forge a path to significant change that ultimately helps all learners.

Second precipitant to change: The capacities of computers and digital media

Of profound significance for education is the unequaled flexibility of digital media. Unlike fixed printed media, digital media (if so designed) are malleable: they can be transformed, marked, linked, networked, and customized for each individual learner.

New media (digital text, digital images, digital audio, digital video, digital multimedia, hypertext, and hypermedia) are notable for their malleability. While, like print, they can provide a permanent representation, they do not have print's fixed quality—they are more like raw clay than fired pottery. The malleability of digital media (when the materials are designed well) translates to enormous flexibility for teachers and learners: "Teaching is all about responsiveness, adaptability, and multiple strategies and resources, so the computer's flexibility—rather than any one particular feature—is what gives it so much potential as a teaching tool" (Meyer & Rose, 1998, p.83).

Digital text separates the content from the display, which can then be flexible in several key ways. Content can be displayed in a variety of media (onscreen or printed text, speech, still images, video, animation, simulations, or combinations of these; Heimann, Nelson, et al. 1995; Mayer, 2003). Transformations can occur both within and between these media (e.g., text-to-speech, speech-to-text, text-to-American Sign Language (ASL), text-to-Braille; Elbro, Rasmussen, et al. 1996; Hasselbring & Williams-Glaser, 2000; Loeterman, Paul, et al. 2002). Within a medium, the presentation of content can be altered in a variety of ways to suit the individual (changes can be made to type face, font size, font color, sound volume, presentation rate, conversational versus formal style, and difficulty of information; images can be turned on or off; main ideas can be highlighted (Elkind, et al. 1993; Hay, 1997; Edyburn, 2003; Mayer, 2003). The networked nature of digital media adds further flexibility, enabling the insertion of hyperlinks to learning supports

such as multimedia explanations, maps, and encyclopedias; email, which provides an opportunity to consult with peers and experts; and even weblogs.

The provision of such customized, multimedia content—or even just digital text as an entry point—can reduce barriers to learning for many students. Beyond reducing barriers, it can also improve learning by allowing for multiple representations of meaning that may be used redundantly for clarity, complementarily for enhanced meaning, or even discordantly for multiple meanings (e.g., multiple soundtracks carrying dramatic content as well as directors' narrations that offer alternate links to background knowledge or points of view).

Digital media's tremendous flexibility enables teachers to differentiate their approaches in a way that is simply not feasible when restricted to traditional media such as print, speech, and images. With traditional media teachers would have to create or assemble a huge assortment of materials. With digital media one piece of curriculum can be designed with built-in customization features so that it can be adapted to suit many different students (MacArthur & Haynes, 1995; Hay, 1997; Erdner, et al. 1998; Edyburn, 2003). The capacity to use multiple media leads to a more diversified, flexible palette for communication—a palette that takes advantage of the varied strengths and weaknesses of each medium and enables teachers to select the medium best suited to a particular student and learning task.

The Change: Universal Design for Learning

The needs of diverse learners who have until now been disenfranchised in a print-centric world can drive us to discover, develop, and apply the astonishing power of new media to expand educational opportunities. Learning is supported and facilitated by the interaction between the learner and the curriculum. When that support and facilitation is missing, "learning disabilities" arise. If the curriculum can be flexibly designed, it can meet more learners where they need to be met. It can challenge and support the vast variety of needs, skills, and interests arrayed in a diverse classroom. Using new tools to support traditional, print-based curriculum has taught us some important things. But like other early-stage uses of new technologies, this approach has not really taken advantage of the true power of

digital tools and media, nor has it provoked fundamental and significant change in education. With the early stages of educational technology adoption behind us, we are ready to take full advantage of the power and flexibility that digital tools and content offer, and to envision new ways for teachers to teach and learners to learn.

How can we make sense of these complex changes, and move forward responsibly and quickly? At CAST we have been researching and developing a framework to guide such an effort: Universal Design for Learning. UDL is based on our two decades of research into the nature of learner differences, the capacities of new media, the most effective teaching practices, and assessments that, while based on high standards, are fair and accurate measures of student learning (Meyer & Rose, 1998; Rose & Meyer, 2000, 2002). It provides a research-based framework for applying insights about students "in the margins" to the design of curriculum. UDL's basic premise is that barriers to learning occur in the interaction with the curriculum—they are not inherent solely in the capacities of the learner. Thus, when education fails, the curriculum, not the learner, should take responsibility for adaptation. With the UDL framework, curriculum designers anticipate and reduce or eliminate barriers by making curricula flexible.

UDL is an educational extension of the universal design movement in architecture. Originally formulated by Ron Mace at North Carolina State University, universal design's objective is to build innately accessible structures by addressing the mobility and communication needs of individuals with disabilities at the design stage, a practice that has spread to areas such as civic engineering and commercial product design. Designs that increase accessibility for individuals with disabilities—those who are typically "in the margins"—tend to yield benefits that make everyone's experience better.

A good example from product development is television captioning. When captioning first became available, it was intended for people with hearing impairments, who had to retrofit their televisions by purchasing expensive decoder boxes to access the captions. Later, decoder chips were built into every television,

making captioning standard and available to all viewers. This universal design feature now benefits not only those with hearing impairments, but also exercisers in health clubs, travelers in airports, individuals working on their language skills, and couples who go to sleep at different times. Further, as a built-in feature, access to television captioning costs a few cents rather than several hundred dollars.

The development of UDL was also driven by the needs of individuals in the margins, for whom regular curriculum often does not work, and by an appreciation for the flexibility of new digital tools. Early experiences with flexible technologies revealed that addressing the needs of special populations improved opportunities for everyone. With the help of UDL, next-stage educational technologies will go beyond providing better access to existing methods and materials; they will embody fundamentally different concepts of learning and thus teaching (Dalton, Pisha, Coyne, Eagleton, & Deysher, 2001; Pisha & Coyne, 2001; Rose & Meyer, 2002). Applying the increasing power of emerging technologies—including tools used in modern brain research, and guided by the needs and talents of diverse learners—UDL can help us move past the early-stage, old-use applications of new learning technologies, and change the outdated, print-centric assumptions underlying current educational practice.

What assumptions need to be re-evaluated to reap the true benefits of digital technology and really reform education? First and foremost, our understanding of learner differences. A new understanding of these differences emerges from advances in digital technologies that are parallel to those in instruction, specifically the improvements in brain research fueled by digital imaging technologies.

UDL and Learning: A New View of Learner Differences

Computer-driven technologies such as positron emission tomography (PET), functional magnetic resonance imaging (fMRI), and quantitative electroencephalography (Qeeg) are revolutionizing the study of learning as it happens in the brain. These new tools and methodologies allow us to "see" the brain as it learns by performing enormously complicated computations on subtle

changes in brain activity that are then displayed on a computer screen. Insights gleaned from these new techniques do not support traditional views of learners' abilities that are based on global measures such as IQ or that segregate people into simple categories such as "the learning disabled."

Brain research and more recent theories of intelligence such as those of Howard Gardner (1983, 1999) are showing that learning ability is far more diversified than was previously described. There are many different elements to learning, each one subject to individual differences. As a consequence, we can expect that students can be intelligent, or less so, in a nearly endless number of ways. Indeed, teachers today are beginning to discover a far more elaborate spectrum of learning ability in their classrooms.

Through new brain imaging techniques, we can actually see activity in three elaborate sets of nerve networks that play a primary role in learning. We refer to them as recognition, strategic, and affective networks to reflect their individual specializations. Briefly, the recognition networks are specialized to receive and analyze information (the "what" of learning); the strategic networks are specialized to plan and execute actions (the "how" of learning); and the affective networks are specialized to evaluate and set priorities (the "why" of learning). Collectively, these networks coordinate how we work and learn (Dolan & Hall, 2001; Rose & Meyer, 2000, 2002).

The dominant impression from computed brain images is how modular learning seems to be. To take recognition as an example, there is not one recognition center in the brain but many different areas managing different aspects of recognition. Brain imaging techniques reveal that we learn about the motion, shape, orientation, and color of an object using different parts of our recognition networks (Tootell, Reppas, Kwong, Malach, Bor, Brady, Rosen, & Belliveau, 1995; Wallis & Bulthoff, 1999). Similarly, our brains process the word "cat" in different regions when the word is presented in print versus speech, and we use an entirely different brain area to compose the word "cat" for speaking (Kent, 1998; Petersen, Fox, Posner,

Mintun, & Raichle, 1988). Brain imaging studies also reveal that reading is the result of interplay between multiple brain areas managing different types of processing (Nichelli, Grafman, Pietrini, Clark, Lee, & Miletich, 1995). For example, one area is required to discriminate fonts, another to process grammar, another to interpret meaning, and another to identify the story's moral.

Different aspects of learning are distributed across numerous brain regions—each module highly specialized for learning about specific aspects of the world. Each of the three learning networks has a large number of such distributed modules that work in parallel, simultaneously, to coordinate the complex task of learning. Thus, even the simplest task activates multiple modules in our learning networks. The pattern of activity across different modules depends on the task—a different set of modules is active when one listens to a speech versus a symphony, for example. In a general sense, there is a signature of brain activity that corresponds to the task being performed. The distribution of activity varies not only across task but also across individuals (Xiong, Rao, Jerabek, Zamarripa, Woldorff, Lancaster, & Fox, 2000). The relative size of modules and their placement can differ from person to person, and for a given task each brain exhibits a unique map of activity, distinguishable from others by the precise set of modules involved and/or the extent of their activity (Schlaug, Jancke, Huang & Steinmetz, 1995).

Another interesting—and significant—insight gleaned from brain imaging is that the map of activity changes as a person learns. Recent research has shown that novices and experts use very different sets of modules to perform the same task. For example, when professional piano players and non-musicians perform the same finger tapping task, the distribution of activity in their brains is quite different (Hund-Georgiadis & von Cramon, 1999). Both the intensity of brain activation and the set of modules engaged may vary according to the degree of experience with a learning task (Shaywitz, 2003).

New brain imaging technologies allow us to actually watch the brain as learners develop expertise and see it shift from using one set of modules to another. The

new technologies have also shown that the size of an individual processing module can grow (and others can shrink) with experience, even in adults (Raichle, Fiez, Videen, MacLeod, Pardo, Fox, & Petersen, 1994; Karni, Meyer, Jezzard, Adams, 1995; Merzenich & Jenkins, 1995; Turner & Ungerleider, 1995; Petersen, van Mier, Fiez, & Raichle, 1998). For example, the brain is able to generalize, expending less effort to process the demands of a task similar to one it has dealt with many times before. Because the brain is highly impressionable and plastic, repetition and practice produce changes not only at the behavioral level, in the form of improved performance, but also at the neural level.

This new brain research is yielding an increasingly clear articulation of the concept of learning—revealing not one, two, or three generalized learning capacities, but many different modules and distributed processes for learning within the same brain, all of which may differ from person to person and as a function of experience. Furthermore, it is becoming clear that individual brains differ from each other not in a general ability (like IQ) but in many different kinds of specific abilities. One consequence of this fact is that students that we think of as disabled because of the deficits that we see in one area may in fact have exquisite strengths in other areas. In the same context, myriad differences emerge between learners formerly classified in the category of "normal"—differences in ability to recognize patterns, concepts, and information; differences in strategic and processing abilities; and variations in engagement and motivation (Vygotsky, 1962).

The categories we have used for so long belie a far more elaborate spectrum of learning ability than is typically assumed in the classroom. Continuing the pioneering work of Gardner and others, research continues to show that there is not one typical learner with a limited number of variants but instead a great variety of learners—as many as the interactions among modules in our brains (Gardner, 1983, 1997; Gevins & Smith, 2000; Habib, McIntosh, & Tulving, 2000; Rypma & D'Esposito, 1999).

Against this backdrop, individuals with disabilities fall along a spectrum of difference, and the convention of the regular student disappears as a normative model:

> One of the clearest and most important revelations stemming from brain research is that there are no "regular" students. The notion of broad categories of learners—smart, not smart; disabled, not disabled; regular, not regular—is a gross oversimplification that does not reflect reality. By categorizing students in this way, we miss many subtle and important qualities and focus instead on a single characteristic (Rose & Meyer, 2002, p.38).

In addition, the more differentiated use of media for instruction reveals that individuals who are defined as learning disabled within print-based learning environments are not the same individuals who are defined as learning disabled within video- or audio-based learning environments. Such revelations splinter the old categorical divisions between disability and ability and create new descriptors that explicitly recognize the *interaction between student and environment* in the definition of strengths and weaknesses.

Given these revelations, educators now take more notice of the strengths of individuals with disabilities—e.g., the prodigious feats of visual memory in a child with autism, the strong visual/artistic or visual/expressive skills in a student with dyslexia, or the extraordinary capacity to recognize facial expression in an individual with aphasia. Thanks in part to new technologies, we can appreciate more fully every student's uniqueness and the importance of considering each one's strengths and needs.

UDL and Teaching: Designing Curriculum to Reach Diverse Learners

Changing concepts of learning and individual differences compel more flexible and diversified teaching so that all learners can be appropriately challenged, supported, and engaged. UDL turns the knowledge that has been gained from brain research into a guide for differentiating instruction to accommodate many different modes of

learning. The UDL framework is structured around the three sets of learning networks. Each of its three guiding principles calls for a kind of flexibility that will support individual differences relating to one of these sets of networks: differences in how students recognize essential cues and patterns, master skillful strategies for action, and engage with learning. UDL helps teachers meet every student's needs and preferences by guiding flexibility in the way teachers present information, offer opportunities for skill building and expression, and engage students (Rose & Meyer, 2002).

In support of diversity in *recognition networks*, a UDL curriculum provides *multiple means of representation*. UDL materials reflect the knowledge that there is little value in a single canonical representation of the information in any particular task or problem. Instead, we should assume that to provide basic access for students with sensory disabilities or other challenges and multiple routes to meaning for all students (e.g., representing a math concept both in text and graphically), it is necessary and preferable to provide multiple, redundant, and varied representations of concepts and information.

To support diversity in *strategic networks*, a UDL curriculum provides *multiple means of expression*, giving students flexible models of skilled performance to learn from, opportunities to practice skills and strategies in a supported environment, relevant and ongoing feedback, and flexible opportunities for demonstrating skill using a variety of media and styles. While many students may write (or type or dictate) essays, other alternatives may include rich mixes of writing, illustrating, speaking, animating, and video-making. With UDL, the method of evaluation suits the task and the means. Students are required to meet a higher standard of expressive literacy—knowing in what contexts (for which purposes and for which audiences) to use text, images, sound, video, or combinations of media At the same time, these options enable students for whom one medium may be a barrier to find a more effective and engaging medium for their purpose.

In support of *affective learning*, a UDL curriculum provides *multiple means of engagement*. This recognizes the centrality of motivation in learning and the individual differences that underlie motivation and engagement. Offering a choice of content and tools, providing adjustable levels of challenge and support, offering a variety of rewards or incentives, and offering a choice of learning context are effective strategies to support affective learning. Of course, there is no single solution to the problem of engaging students because of individual differences—there are many different reasons for students' lack of engagement. Students with disabilities, as usual, highlight the issues. The same design that would likely engage a student with Attention Deficit Hyperactivity Disorder (a high degree of novelty and surprise, for example) would be absolutely terrifying (and thus disengaging) to a student with Asperger's Syndrome or autism, for whom predictability is paramount.

Figure 1

PRINCIPLES OF UNIVERSAL DESIGN FOR LEARNING

Principle 1: To support recognition learning, provide multiple, flexible methods of presentation

Principle 2: To support strategic learning, provide multiple, flexible methods of expression and apprenticeship.

Principle 3: To support affective learning, provide multiple, flexible options for engagement.

Source: Rose & Meyer (2002)

As a fundamental component of the learning environment, instructional media can tremendously impact how a student fares. Because printed text, images, and speech make unique demands on learners, different strengths and needs may surface depending upon the medium that a student encounters (Rose & Meyer, 2002). In a UDL curriculum, teachers consider the instructional media during the

evaluation of ability. Rather than retrofit inflexible materials, the flexibility and interactivity inherent in digital media provide the basis for more flexible educational designs that can anticipate students' different experiences of instructional media. A UDL curriculum provides a rich enough set of options to optimize every student's learning.

Universal designs reflect a more articulated understanding of learning and contextualize presentational environments (like books and lectures) in a broader palette of truly instructional environments where students are consistently supported in learning how to learn—mastering skills and strategies, not merely consuming information. Individualizable challenges and supports are built into every element of the curriculum and every learning experience. Skill-development materials, for example, can be designed to provide built-in models of performance, opportunities for supported practice, immediate feedback, and extended communities of practice (Dalton, Pisha, Coyne, Eagleton, & Deysher, 2001). In that respect, these new environments more closely resemble traditional models of apprentice learning than book-learning (Meyer & Rose, 1998). A teacher in a large classroom will be able not only to model a process for a student but to provide the kind of customized attention necessary to maximize a student's progress, delivering personalized feedback, practice, and scaffolds.

All of these methods are facilitated and enriched by the use of digital materials and tools (Meyer & Rose, 1998; Rose & Meyer, 2002). Teachers can expand their options for presenting information, for student expression, and for engaging students by assembling a variety of different software tools, digital content, and World Wide Web resources. Even now, new media and electronic tools are being used to construct curricula with the built-in flexibility to support differences in recognition, affect, and strategy.

UDL and Assessment: Improved Accuracy and Instructional Relevance

Print-based assumptions and practices underlie traditional assessments, making them especially inaccurate for students in the margins. A very big problem with

traditional assessments is that students' capabilities with the learning task are often confounded with their ability to use the medium of assessment: "Traditional assessments tend to measure things that teachers aren't trying to measure (visual acuity, decoding ability, typing or writing ability, motivation),thus confounding the results and leading us to make inaccurate inferences about students' learning" (Rose & Meyer, 2002, p. 143). Because the expressive medium used for an assessment can influence performance independent of students' knowledge of the content or a skill (Russell & Haney, 1997, 2000), evaluation must be sensitive to its true purpose, and to the strengths and weaknesses of the learner that may not be germane to the learning being assessed. For example, the creative expression or knowledge gained by students with motor difficulties will not be accurately evaluated via handwritten assessments. For another, the acquisition of content knowledge in social studies or mathematics will not be measured accurately on a print-based multiple choice test for a student with decoding difficulties. A more flexible approach is needed not only to improve the accuracy of assessments for students on the margins but also to enhance the meaningfulness of assessments for all students:

> Technology also offers the opportunity to assess skill learning in a deeper and more meaningful way. For example, science students might conduct virtual lab experiments, in which their actual manipulations of data, technologies, and substances would demonstrate their understanding of processes, methods, and outcomes more clearly than any written or verbal responses could (Rose & Meyer, 2002, p. 148).

Universally designed assessments will also gain accuracy from the capacity to evaluate performance under varying conditions—ranging from conditions where the student's performance is constrained by barriers inherent in specific modes of representation, expression, or engagement, to conditions where appropriate adaptations and supports are available to overcome those barriers. In this manner, it will be possible to identify with more specificity the source of difficulty for a

student, yielding more effective measures of student performance and the learning process underlying that performance.

Another problem with traditional assessment is that the *outcomes* of learning are measured—the number of science facts recalled, the percentage of words spelled correctly—rather than the *processes* of learning. Such traditional outcome measures are poorly-designed and ill-timed to inform instruction. In contrast, the interactive capacity of new technologies allows us to embed assessment dynamically within instruction—providing an enhanced basis for curriculum-based measurement and progress monitoring practices that have been linked to improved instructional decision making and student performance (Espin & Foegen, 1996; Fuchs, Butterworth, & Fuchs, 1989; Fuchs, Fuchs, & Hamlett, 1989; Fuchs, Fuchs, & Stecker, 1989). By tracking what supports a student uses, the kinds of strategies that he or she follows, the kinds of strategies that seem to be missing, and the aspects of the task environment that bias the student toward successful or unsuccessful approaches, the teacher gains information about students as learners. Embedded UDL assessment provides timely information that can inform teaching, and differentially for each student. It also ensures that students have available the same supports during assessment that they have during learning.

UDL Applied: A Research-Based Learning Environment

An example of a UDL environment with built-in flexibility for instruction, learning, and assessment is that of Thinking Reader, a computer-based, networked program designed to improve reading comprehension (Dalton, et al., 2001). Developed by CAST over several years in federally funded research projects, Thinking Reader combines the research-supported techniques of strategy instruction and reciprocal teaching (Palincsar, 1986, 1998; Palincsar & Brown, 1984) with versatile technologies. The Thinking Reader prototype—which has been developed and commercially distributed for classroom use by Tom Snyder Productions—consists of digital versions of high-quality children's literature embedded with tools and prompts that can be adjusted to respond to learner differences in decoding, comprehension strategies, vocabulary knowledge, visual acuity, and many others.

Age-appropriate, appealing literature with supportive features such as text-to-speech capability; built-in logs for monitoring progress; flexibility in visual or oral presentation of text—these all ensure that students are supported and prepared to learn.

In such an environment, they are ready to learn effective strategies for active reading and individualized strategy instruction is delivered through prompts embedded within the text, and models and hints offered by animated characters. The prompts ask students to apply one of multiple, research-supported strategies: predict, question, clarify, summarize, visualize, describe your personal reaction, or reflect on your progress. These prompts are leveled so that teachers and students can select the degree of challenge that best supports progress. The results of controlled experiments show that Thinking Reader was superior to traditional strategy instruction in elevating reading comprehension for middle school struggling readers (Dalton, et al., 2001). More recent work focuses on improving results in the same way for students with cognitive disabilities (Literacy by Design, Dalton, B., & Zeph, L., 2003, with the University of Maine) and students who are English Language Learners (Thinking Reader for English Language Learners, Dalton, B., 2003).

Conclusion: Students in the Margins, Technology, and Educational Reform

Innovations in educational technologies are driven by the needs of students in the margins, those for whom present technologies are least effective—for example, students with disabilities or exceptional talents. These more conspicuous needs highlight the curriculum's failings. However, as new technologies help us to appreciate the full extent of learners' diversity and the variety of ways in which they can be unique, it will become apparent that the curriculum itself can be improved to the benefit of all students.

This will require a significant change in mind-set about the possibilities of new technologies for education and ultimately about our educational goals. There is understandable resistance to change, as entrenched approaches to curriculum

design, assessment, teaching, and even the structure of schools and classroom practices are firmly rooted in the venerable and powerful traditions of printed text. While the hegemony of this medium has already disappeared in such high-impact fields as advertising, entertainment, and communication in the culture at large, the legacy of print continues in schools. While computers offer tremendous power for learning with text, their capacity reaches well beyond text to facilitate teaching and learning with varied media and to offer customizability. Yet by analogy with film, we are still in the era of the camera sitting on a stage and filming from one angle, basing our assumptions on one set of goals, tools, methods, and assessments that is expected to—but does not—work for all learners.

Students in the margins must be served, and the technology is here now to serve them effectively. UDL—including its framework and tools for learning—transforms the pressures of diversity into opportunities for all learners because it does not resist diversity, as traditional curriculum centered around printed text does—insisting that all learners "fit the mold." Rather, UDL recognizes the fact that diversity in learning abilities and styles can be a tremendous asset if we are willing to reconsider the way curricula are designed and the way schooling is practiced from the "margins" perspective.

Of course, such a change will inevitably result in changed goals. The implicit goal of education will change from homogenization (all students pointed toward one outcome and measured by one yardstick) to diversification, identifying and fostering the inherent diversity among all learners, identifying new kinds of learning, new kinds of teaching, and new kinds of success. The ultimate educational goals will no longer be about the mastery of content (content will be available everywhere, any time, electronically) but about the mastery of learning. At commencement, we will graduate students who are "expert learners." They will know their own strengths and weaknesses; know the kinds of media, adaptations, strategies, and external technologies they can use to overcome their weaknesses and extend their strengths; and know what kinds of colleagues are likely to complement their own patterns of learning and performance. They will be prepared

for a changing world, not a static one—prepared for the world in which they will actually live. As in any revolution, students in the margins are likely to lead the way, precipitating the shifts in thinking that will open vast opportunities for educational reform. They have much to offer in this enterprise; we all have much to gain.

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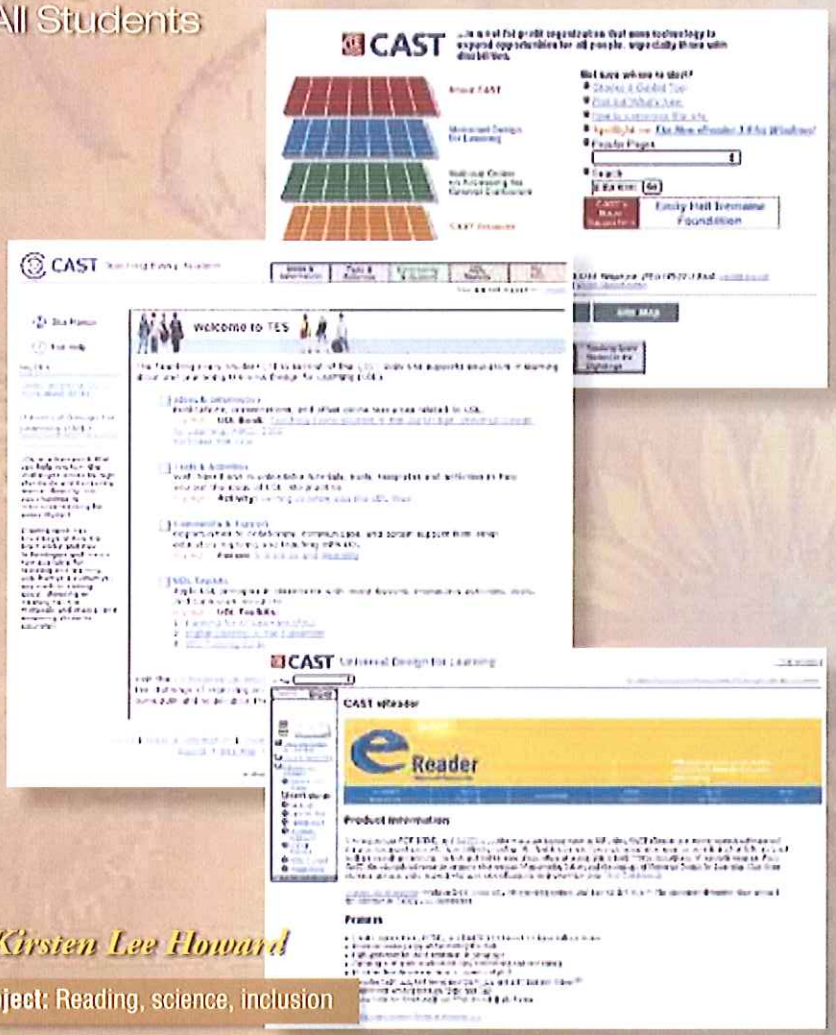
Universal Design for Learning

Meeting the Needs of All Students



By Kirsten Lee Howard

Subject: Reading, science, inclusion

Audience: Teachers, teacher educators

Grade Level: K–2 (Ages 5–7)

Technology: eReader

Standards: *NETS•S* 3; *NETS•T* II (http://www.iste.org/standards)

I recently saw an advertisement that said, "How can you hold thirty hands when you only have two?" It reminded me of Lev Vygotsky's theory of the Zone of Proximal Development, which I learned about while reading his book *Thought and Language* in my teacher education classes. I connected immediately with Vygotsky's idea that each individual has his or her own unique learning zone and how this theory seeks to teach students in their own individual zones. For learning to take place, the material must be challenging enough to engage students' interest, but not so challenging that they become frustrated and give up. My challenge was to figure out how to make this teaching method a reality in my classroom of 21 diverse first graders with many different learning styles. How can I figure out how to make the curriculum accessible to each student? How can I deliver on Vygotsky's 21 individual zones of proximal development? The answer for me is Universal Design for Learning (UDL).

Fundamentals of UDL

I learned the fundamentals of UDL at a professional development institute offered by the Center for Applied Special Technology (CAST), a not-for-profit educational research organization located in Wakefield, Massachusetts. (***Editor's note:*** Find this and other URLs under Resources on p. 29.) CAST developed UDL as an approach to teaching, learning, and assessment. UDL focuses educators on developing flexible curricula that provide students with multiple ways of accessing content, multiple means

for expressing what they learn, and multiple pathways for engaging their interest and motivation. This, in turn, allows teachers a multidimensional view of their students as learners, and offers teachers unique insights into assessing student's knowledge, interest, and understanding. Although UDL is by no means a simple way of thinking about and planning curriculum, I try to begin each planning session with a few simple questions to guide my planning:

- What is the basic idea that the students need to learn?
- What are different ways to learn this idea: demonstration? games? shared experience?
- If there is reading involved, do they have to read it by themselves, or can they use other tools and strategies to get the information?

I think about assessment in the same way:

- Is a test the best way to find out whether students learned the information?
- In what different ways can students show their understanding? Which will be meaningful for them?

CAST's dream of UDL is for each student to have access to the curriculum in a way that promotes the most learning for that individual. Most educators wish to teach every student in the way that allows for the best access to learning. I am always looking for practical ways to make this happen in my classroom. CAST invited me to share a few successes I have had in the hopes that I can help inspire ideas that will work in other classrooms.

My First-Grade Classroom

The design of a first-grade classroom must take into account the most pressing challenges facing its students. I wanted to use the lens of UDL to address skill imbalance and attention span.

My first graders have plenty of ability to comprehend text and ideas, but not all of them have the skills to decode at as high a level as they can comprehend. I have found that there is a dangerous tendency, especially when teaching struggling readers, to focus only on decoding skills and conduct most instruction using simple text. Selecting learning materials solely on the basis of students' decoding ability rather than their ability to comprehend the content can create an imbalance in students' reading skills as they get older.

Another thing I needed to keep in mind was my first graders' limited attention spans. They need engaging and interesting content provided in a flexible curriculum. They need the chance to ask questions, notice, and observe in a hands-on environment. If they lack these essentials, their motivation to learn often drops off.

With these challenges in mind, I changed my instructional practice to reflect UDL principles, and I integrated technology into our guided reading time. Combining the principles of UDL and computer technology with my assessment of each student yielded some results of which I think Vygotsky would be proud.

UDL in Practice

Part of our first-grade curriculum is an exploration of the needs of living things. We begin this study by learning about the needs of seeds and plants. Some wonderful children's fiction and nonfiction literature is available on this subject. It occurred to me that I ought to try to integrate the reading of science material into our literacy teaching. Typically, much of our science reading takes place during science time and comes in the form of read-alouds. I have shied away from reading science content material during guided reading time in the past because it is often very difficult for many of my students to decode. I thought it would be interesting to approach this from a UDL perspective: figuring out how to break the decoding barrier and provide the students with appropriate supports to focus on the content.

I chose four books at different reading levels: *I'm a Seed* by Jean Marzollo, *Growing Vegetable Soup* by Lois Ehlert, *Diary of a Sunflower* by Carol Pugliano, and *How a Seed Grows* by Helene J. Jordan. I placed the books at four stations around the classroom. I told the students they would be reading one of these books at guided reading time the next day, but I wanted their help in deciding who would read which book. Students had about five minutes at each station to look through each book. Their job was to think about how well they could read it by themselves, whether it interested them, and if they would learn something new from the book. Students then ranked the books from their first through fourth choice. I told them I would look at their choices, try to give all students their first or second choice, and assign books to students for the following day. My task seemed clear: In assigning the students to the

The more ways I find to use UDL in the classroom, the more often I see my students' individual needs being addressed.

different books, I needed to figure out how to let each access his or her first choice, whether it was a book he or she could independently decode.

Some of the division was simple; I assigned several students to their first choice knowing that they would be able to read it independently. Other students I put into pairs. I knew that their reading skills would complement each other and they would be able to decode and comprehend the book well together. For those students, I had allowed access to the content in their zone of proximal development by selecting one child who would scaffold the other's reading, a key component of Vygotsky's zone of proximal development theory.

The next steps required some ingenuity. How could I provide scaffolds for students to read the books? I recorded each book on a cassette tape, reading slowly and encouraging the readers to follow along with their fingers. I also stopped every few pages with questions for them to think about or important points for them to notice.

The books chosen by a few of my students on individual education plans (IEPs) required the most preparation. One student has a documented print-based disability, and a few students needed more intense scaffolds than those provided in the audiotaped book. Using a scanner, I created computer image files of the book's pictures. Next, I typed the text for each page into a software program for creating Web pages. I chose to use this type of program because it would allow me to "link" the pages together and students could navigate forward and backward through this program, just like a book. My school owns copies of Dreamweaver, so I used this software, although many others are available. Into each page, I imported the picture that I'd scanned previously, creating a "page" that was very similar to the corresponding page in the book. I then linked each page together. (This "digitizing" of copyrighted material that the school owns a legal copy of is permissible when used for instruction of students with special needs as long as the digitized copy indentifies the copyright owner, includes the original date of publication, and contains a notice that further reproduction may infringe on the copyright owner's rights.) I then opened this new document using the CAST eReader, a software program that reads text out loud while highlighting the word or phrase that is being read. The end result was a virtual book for students to use on the computer. With this digitized book and eReader, students are able to read independently, either by highlighting unfamiliar words and having eReader read the words to them, or by having the entire page read to them and then trying it on their own.

The next day was the real test. Would multiple means of engagement make the difference? Would all of my students be able to answer the science questions posed to them? Would decoding problems cease to be a barrier to understanding the content? Had I truly "universally designed" the Guided Reading time?

At the beginning of our Guided Reading time, I posed two questions:

- What do seeds need so they can grow?
- What do seeds grow into?

Each question was written in a different color and posted in three spaces around the room. I gave students sticky notes to mark the places where they found answers to those questions in their book. I worked with the students reading digitized books to capture their answers. The sticky notes matched the color of the question, so an answer to a purple questions was marked with a purple note, and green question with a green note. I also asked the students to write their answers on the sticky notes when they had finished reading and to stick the notes on chart paper under the appropriate question. I encouraged the students to listen to and read their assigned book as many times as they wished.

I was amazed at the way the guided reading time turned out. All of my students were focused, engaged, and curious. It was a bit louder than I had anticipated, but all of the noise was purposeful. Students were discussing the questions with their partners, pointing out things they noticed, and asking each other questions. During our wrap-up time, when we shared what we learned from the books, students saw what their classmates were reading and learning. The students that I assigned to use the digitized

book with eReader were able to find examples to support each of the questions and to participate in our discussion. They were using eReader to read aloud the words they did not know and then to read on their own. Many asked if they could read the other books the next day. Because I had provided multiple scaffolds for the books, students were able to read the other books when they wanted, either independently, with a partner, on audiotape, or on the computer.

I have only one computer in my classroom, so I need to be strategic about allowing all students access to it. I solve this by assigning the computer to certain students when there are specific projects and work on which the computer can support them. The different software is available to everyone during our "free times" and "workshop times." I am very careful to make sure all students get turns using the computer and the various software tools in the beginning of the year and throughout the year when we use new software. This way students know that they will get chances to use the computer at other times during the day when they are not directed to use the computer during a particular time.

My reflection on the success of the Guided Reading time led me to a few conclusions. I was providing practice in both comprehension and decoding and integrating other learning content into a reading instruction time. Students were able to see that learning happens across all areas—it is not compartmentalized so you only learn about science during science time. Students also seemed to be inspired by this investigation into the texts—they were continuing to find answers to the questions in other books about seeds at other times during the next few weeks. At the end of the unit, and even well into a different study, my first graders still retained the knowledge they had gained.

The preparation was time consuming—3–5 hours. However, the time spent was well worth it, and I have everything ready for future use—as well as for use by other teachers. There are many ways to reduce the time, such as inviting families or older students to read the books on tape or to scan in pictures and type in text. We teachers tend to be very creative in finding ways to get all of our tasks done!

Another benefit is that I am able to allow all students access to different types of support. When they get the chance to experience each of the tools, they begin to learn what works for them and what does not. Students want to be independent learners. Generally, if they do not need the support of an audiotape, they don't use it that often. Students who are consistently drawn to a particular tool are usually those who need it.

How UDL Addressed the Issues

The more ways I find to use UDL in the classroom, the more often I see my students' individual needs being addressed. Using a UDL model to plan instruction helps me address many of the issues present in a first-grade classroom.

During guided reading, I addressed skill imbalance by supporting my students in accessing content they could comprehend but not yet decode. This allowed them to develop their comprehension skills using engaging and meaningful content. The multilevel structure of the activity (allowing the students to choose from four books with different levels of scaffolding) provided them with the flexibility they needed to read the book they chose, to answer questions that would help them in their future science work, and to be invested in what they were doing because they were part of the planning process.

When reading books they chose and knowing that they had ways to get help on words they didn't know, my students, attention spans improved greatly. My first graders also love post-it notes, so having the opportunity to use the notes to mark parts of the book made them want to find answers to the guiding questions.

You can find practical tips on integrating UDL into your teaching and assessment in David H. Rose & Anne Meyer's book *Teaching Every Student in the Digital Age: Universal Design for Learning,* published in 2002 by the Association for Supervision and Curriculum Development (ASCD), and on the Teaching Every Student Web site.

As a first-grade teacher, I am blessed with brilliant students who have an insatiable and a voracious thirst for learning. Many of my students pick up books that I consider too hard for them; they do this because they really want to read them. They know the work is hard, but they don't see it as a deterrent to their learning. Before my experiences with UDL and different software tools, I was unsure how to let them proceed. Now, with UDL as a viable tool, who am I to stand in their way?

Resources

CAST: http://www.cast.org
Dreamweaver: http://www.macromedia.com/software/dreamweaver/
eReader: http://www.cast.org/ereader
Teaching Every Student: http://www.cast.org/teachingeverystudent/

Kirsten Lee Howard taught kindergarten and first grade for seven years at the Young Achievers Pilot School in Boston and is currently a Special Educator in Springfield, Virginia. She is dedicated to creating critical thinkers, building peaceful classrooms, and integrating all learning styles into her teaching. Kirsten has presented workshops on conflict resolution and educational technologies.

setsig *Cindy Anderson and Joan Thormann, representing ISTE's Special Interest Group for Special Education Technology (SETSIG), contributed to the development of this article.*

EDUCATION WEEK October 31, 2007
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'Universal Design' Concept Pushed for Education

By Christina A. Samuels

The same design principles that brought Braille panels to public elevators and curb cuts to city sidewalks should be imported to the classroom and used to transform lessons and textbooks, says a coalition of education groups.

Called "universal design for learning," the philosophy advocates creating lessons and classroom materials that are flexible enough to accommodate different learning styles.

The coalition has drafted language it wants to have included in federal education law. A requirement for states to "develop a comprehensive plan to address the implementation of universal design for learning" is in the draft bill for reauthorizing the No Child Left Behind Act released in August by the House Education and Labor Committee.

Universal design for learning, or UDL, is also supported in a reauthorization measure sponsored by Sen. Joseph I. Lieberman, I-Conn. and co-sponsored by Sens. Norm Coleman, R-Minn., and Mary L. Landrieu, D-La. Much of the Senate bill includes language taken verbatim from the coalition's materials.

According to the tenets of UDL, lessons should be designed with accessibility in mind, instead of retrofitting existing materials in an attempt to accommodate students with learning differences. While the early days of UDL focused on helping students with disabilities, supporters say it has benefits for any student, including those who are learning English, gifted students, or students who simply learn better through methods other than a teacher's lecture.

Sometimes, accommodating different learning styles can be achieved through the use of technology. For instance, computer devices can "read" a book aloud to a student who is blind.

Point of Agreement

However, low-tech methods can be valid applications of UDL as well. An example of a simple application is allowing a student to create a poster that visually depicts the main ideas in a classroom reading assignment, rather than asking the student to write a book report, if he or she has difficulty with written language. Developing alternate methods for students to show they've mastered a concept is an integral part of UDL.

Support for the concept has linked several education and disability-rights organizations, even those that have been in disagreement over other aspects of the No Child Left Behind law. Some groups call for softening or eliminating some of the sanctions imposed on schools when students in any of various subgroups, including students with disabilities, do not make adequate yearly progress under the law. Other groups fear that removing such sanctions would mean students with disabilities might not get access to rigorous instruction.

But 28 organizations have put aside those differences and come together in support of UDL, including the National Education Association, the National School Boards Association, the Council for Exceptional Children, and a host of groups that work to help children with specific disabilities.

"I don't see how it can fail to be compelling," said RickiSabia, the associate director of the national-policy center of the National Down Syndrome Society, in New York City, and one of the main drivers behind including UDL language in the reauthorized federal school law. "There's only one thing in NCLB that we're all in agreement on."

The school boards' association supports UDL because it can help all students, said Reginald M. Felton, the director of federal relations for the Alexandria, Va.-based group.

"Everyone realizes if both the special education and regular education communities can talk about the same goals, they have a lot more chance of being successful," he said.

The education groups are currently working to include more of the coalition's UDL language in the House education committee's draft reauthorization bill, including a precise definition of the educational philosophy.

Universal design for learning does not represent an educational package, or a simple set of techniques, according to practitioners. Rather, it is a variety of solutions to different problems, and can be compared to accessibility in the physical environment. Some sidewalk-design elements, such as curb cuts, were originally meant to accommodate people who use wheelchairs. Television closed-captioning was intended to aid people who are deaf.

Over time, those accommodations have become useful to people who do not have mobility or hearing problems, advocates point out. And both are so common now that they're practically invisible, said David H. Rose, a co-founder of the **Center for Applied Special Technology**, in Wakefield, Mass. Founded in 1984, CAST has spearheaded the development of classroom materials based on universal-design principles.

Removing barriers from learning materials seems just as logical when people take the time to think about the idea, Mr. Rose said. But instead, he said, people have tended to depend on the use of technology so students can access existing lessons or materials, rather than rethinking the lessons to make them more readily accessible in the first place.

CAST itself first focused solely on creating so-called assistive technology to allow student with disabilities to work with existing lesson plans. But the center's experts learned that making classroom materials accessible doesn't always mean students are learning the lessons teachers are trying to impart, Mr. Rose said.

"The view was more like, you fix this kid so they can fit in better," Mr. Rose said. "The more we did it, the more we could see it wasn't working."

For example, highlighting key words in a text for a student isn't helpful if those words represent the lesson students are supposed to be learning on their own. True universal design requires that educators think deeply about what each lesson is about. Those goals then guide how UDL is implemented, Mr. Rose said.

CAST'S mission still includes developing software and hardware solutions for meeting the needs of students with disabilities, Mr. Rose said. But the organization also offers classes and consulting services that teach educators how to rethink their lessons and customize them for students with different needs.

State Initiatives

Some states have already moved to implement UDL on their own. For four years, Indiana has provided grants to schools that write detailed proposals for how they would use its principles in their classrooms. School staff members also have to spend time learning about UDL, and at the end of each school's grant, report on their achievements.

Vicki Hershman, the state project director of the program that oversees the grants, said educators at first saw UDL as a way to get technology dollars for their schools. Now, they understand that the intent is to transform the way lessons are developed and taught. She agrees with the goal of having UDL language written into the No Child Left Behind law.

"The UDL project supports all the other general education and special education initiatives we have going on," Ms. Hershman said.

Under the grant program, one school developed a Civil War module for middle school students that included audiotapes and text-to-speech software. Another school that received a grant created a 4th grade lesson on long division that included an opportunity for students to work together in small groups to create a rap song about division, using free Web-based software.

Michigan is in the early stages of trying to start its own statewide UDL initiative, said Jeff Diedrich, who oversees the adaptive technology division for the state department of education. The state is proceeding slowly, though, Mr. Diedrich said. Proponents don't want to present UDL as a product that can be purchased, or as a fad initiative that quickly fades.

"I'm seeing UDL get more and more attention, but it's a danger that once something reaches the status of buzzword, it's on the way out," Mr. Diedrich said. "But if you can start people thinking about the curriculum as having a disability, instead of the student having a disability, it'll be worth it."

Coverage of new schooling arrangements and classroom improvement efforts is supported by a grant from the Annenberg Foundation.

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