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## Universal Design Bibliography

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This annotated bibliography provides a list of 62 articles on universal design, including annotations of 22 selected articles. Relevant articles were identified initially through searching electronic databases using the search term “universal design.” Electronic databases searched include ERIC, Education Full Text, Findarticles.com, PsycINFO, PsycARTICLES, Sociological Collection, and Professional Development Collection. We also reviewed the reference sections of this initial group to identify additional articles of interest. Current articles applicable to education were included in the bibliography. Articles fell into six categories:

1. [Universal Design and Curricular Design Strategies](#)
2. [Universal Design Tools and Products](#)
3. [Universal Design Assessment Strategies](#)
4. [Universal Design Supports for Post-Secondary Transitions](#)
5. [Universal Design Physical and Architectural Accommodations](#)
6. [Universal Design Marketing and Dissemination Strategies](#)

### General Universal Design and Curriculum

**Burke, M.D., Hagan, S.L., & Grossen, B. (1998). What curricular designs and strategies accommodate diverse learners? *Teaching Exceptional Children*, 31(1), 34-38.**

This article highlights six features of instructional design that have been developed by the National Center to Improve the Tools of Educators (NCITE). The six features are

- 1) Focusing on the *big ideas* and using them to organize other information to help students determine important topics and grasp big concepts
- 2) A *conspicuous strategy* approach to teach the steps to solve complex problems
- 3) *Primed background knowledge* in which background knowledge that is a component of a new skill or concept is primed prior to learning a new concept,
- 4) *Mediated scaffolding* in which assistance, supports, modeling, etc. from a teacher or tool are used but removed gradually to transition the student to independent learning

- 5) *Judicious review* that provides varied opportunities to apply and generalize concepts over time
- 6) *Strategic integration* in which prior knowledge is integrated into new and more complex concepts. The authors emphasize that the burden of developing instructional tools lies educators who need to demand effective, research based tools, and publishers who need to develop effective tools.

**Chang, B.V., Tremblay, K.R., and Dunbar, B.H. (2000). An experimental approach to teaching universal design. *Education*, 121(1), 153-158.**

This article reflects on the outcomes of teaching universal design principles to 32 college juniors majoring in interior design. The purpose of the research was two fold: (1) measure the effect of the unit on students' knowledge of universal design principles, and (2) determine the impact of the unit on students' attitudes towards people with disabilities. The six week long universal design unit was integrated into an interior design studio course. The unit consisted of three lectures on topics of universal design principles set forth by the Center for Universal Design at North Carolina State University, Americans with Disabilities Act, and demographic information on disabilities. Additionally, community members with disabilities were asked to lead class discussions about disabilities and environmental needs. Based on information gained, students were required to redesign an 11-room motel into housing units for students with disabilities, including a concept statement, scaled floor plans, lighting plan, and selection of colors and materials. Analysis of pre- and post-test results indicated that this unit had significant impact on both students' understanding of universal design and attitude towards people with disabilities.

**Fuchs, L.S.; Fuchs, D. (2001). Principles for the Prevention and Intervention of Mathematics Difficulties. *Learning Disabilities Research and Practice*. 16 (2), 85-95.**

The article identifies and discusses primary, secondary, and tertiary prevention, and intervention principles and strategies, in the field of mathematics for students with learning disabilities. Primary prevention is delivered in the general education setting with effective and research-based methods of mathematics instruction. The authors also stated that primary prevention should incorporate universal design to support the needs of specialized populations while also being beneficial for students without learning disabilities. Based on these criteria, the authors identified four principles of primary prevention:

- 1.) A quick pace, with varied activities and engagement;
- 2.) Challenging standards;

- 3.) Self-verbalization methods; and
- 4.) Physical and visual representations of problems.

Peer-Assisted Learning Strategies (PALS) were developed for integrating these principles into general education. When PALS fail, as they do 15% of the time, secondary intervention is necessary. Also called pre-referral intervention, this stresses modifying the general education setting in ways that are feasible, undistruptive, and non-intrusive. Tertiary prevention, also know as intensive intervention, is distinguished from primary and secondary prevention by three research supported principles:

- 1.) The individual student must be the focus of instructional decision making
- 2.) Intensive instructional delivery is necessary
- 3.) Explicit contextualization of skills based instruction is necessary.

**Hehir, T.(2002). Eliminating Ableism in Education. *Harvard Educational Review*, 72, 1-32.**

Ableism is the devaluation of disability and the presence of societal attitudes and practices that advocate for children with disabilities to do things in the same way as their non-disabled peer. The article includes a discussion of the potential for applying universal design principles in the design of instructional programs to support access to general education curriculum for students with disabilities. Hehir cites examples from universal design needs among disability groups (e.g., deaf, blind, and learning disabled). He argues that children with disabilities often experience poor education outcomes because the focus of education was to compensate for specific aspects of their disability and not necessarily on the academic content of the general education curriculum. The article emphasizes that special education needs to be individualized and it should provide students with tools to access the general education curriculum. Hehir cites that standards-based reform will promote higher educational expectations and greater assurances that students with disabilities receive quality programs.

**Hitchcock, C. (2001). Balanced literacy support and challenge in universally designed learning environments. *Journal of Special Education Technology*, 16(4), 23-30.**

This article depicts a futurist view of technology in education in the year 2006. The article suggests that the effectiveness of technology will no longer be doubted, as it is today, because of all the advantages it will provide. The proposed advantages in the article include:

- Ø Easy access and wide availability to technology due to decreased cost and increased effectiveness;

- Ø Content available to the widest spectrum of learners with all materials available in multiple formats and expressions;
- Ø Assessment is an integral part of education ensuing progress and directing further instructional activities;
- Ø Tools, supports, and scaffolds are integrated into all learning tools; and
- Ø Teachers now facilitate learning, rather than simply presenting curricular content.

This author assesses that universal design can enhance learning outcomes of all students, and provides an illustration of the technologies needed to achieve this vision. For example, extensible style sheet language transformations (XSLT) can help students to identify appropriate information on browsers and also generate refreshable braille.

**Hitchcock, C. Meyer, A., Rose, D, and Jackson, R. (2002). Providing Access to the General Education Curriculum. Universal Design for Learning. *Teaching Exceptional Children Nov/Dec.***

This article presents Universal Design for Learning as a framework for curriculum reform that will make the general education curriculum more accessible to students with disabilities. The article points out that, at present, general education curriculum is designed for a core group of learners. This does not account for the learning needs of diverse classrooms. The authors note that “retrofitting” curriculum is more expensive and inefficient than designing curriculum with fewer barriers. The authors suggest that a universally designed curriculum that is composed of the following four components can support diverse learners: 1) goals that are challenging for students, 2) flexible materials with multiple media, 3) flexible methods and pedagogy, and 4) assessment of student progress. Digital media and technology can support the flexibility of curriculum so that it can be transformed for diverse learners. The article also stresses that access to curriculum needs to be tied to the learning goals. Technological supports, such as text to speech or animation, can enhance understanding of content when appropriate, while not undermining goals such as decoding and reading skills.

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

The article suggests that universal design is a framework for responding to individual learning styles through the use of technology. Meyer and O’Neil discuss three neural systems involved in learning: (a) recognition systems that identify patterns and objects, (b) strategic systems which tell us how to do things, and (c) affective systems that determine what is important and provide the motivation for learning. Meyer and O’Neil cite that Universal Design for Learning

provides flexible, multiple media and tools targeted to these systems. They discuss the first two systems in this article.

- 1.) Recognition systems are supported by technology-based curricular materials that allow students to receive information and reinforce important concepts via text, speech, animation, colors, and highlighting. These supports can stimulate recognitions systems in diverse ways.
- 2.) Strategic systems are supported by activities that provide opportunities to practice skills, feedback for students to monitor progress, and multiple ways to express ideas. The article also highlights software, such as *Access to Math* (Don Johnston), which accommodates a wide range of learning styles and supports different strategic systems.

**Orkwis, R., & McLane, K. (1998). A Curriculum Every Student Can Use: Design Principles For Student Access. Reston, VA: Council for Exceptional Children. Retrieved November 5, 2002 from: <http://www.cec.sped.org/osep/udesign.html>**

This article is composed of a set of information briefs that discuss the concept of universal design and ways that it can be used to design instructional materials in different media. This media should provide accessibility and involvement for students with a wide range of abilities. The article outlines a set of principles for developers that teachers and administrators at all levels can use in selecting, adopting, and using instructional materials and media. The article provides a brief history of the architectural roots of universal design. It discusses how universal design can support compliance to the Individuals with Disabilities Education Act (IDEA) and other Federal legislation. In addition, it describes curriculum for inclusive classrooms that reflects universally design principles. Finally, it discusses the responsibility of publishers to produce and teachers to select universally designed tools and curriculum.

**Rose, D. (2001). Universal Design for Learning Associated Editor Column. *JSET E Journal*, 16(4). Retrieved November 25, 2002 from <http://jset.unlv.edu/16.4T/tasseds/rose.html>**

This article contains the testimony of David Rose (CAST, Co-Executive Director) before the Senate Appropriations Committee on the future of educational technology. Dr. Rose advocated that digital and other universal designed curriculum can help to reduce barriers for students with disabilities and can save the cost of having to retrofit curriculum. He also suggested to Congress that any educational technology developed with Federal money should be universally designed and that education programs supported by the government should use universally designed educational technology.

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## Universal Design Tools and Products

**Bowe, F. (1995). The political and economic issues that drive and derail assistive technology development. *Generations*, 19(1), 37-41.**

This article presents a perspective on the role of regulatory (e.g., Americans with Disabilities Act) and financing (e.g., Health Care Financing Administration) agencies in the acquisition of assistive technology devices, including those that are considered universally designed. While the overall impact of regulatory agencies has been positive in spurring the development of new products and services, it is perceived that financing agencies stifle end-user acquisition. Furthermore, the barriers presented here are exacerbated by the overwhelming perception that universally designed products are not necessary for people with disabilities because they are sold to the general population as well.

**Eagleton, M.B., and Guinee, K. (2002). Strategies for supporting student Internet inquiry. *New England Reading Association: Computers in the Classroom*, 38(2). Retrieved November 5, 2002 from: <http://www.nereading.org/inquiryarticle/abstract.htm>.**

The article describes how the Internet has provided students with access to more information than ever before. However, it also points out that the Internet can erect barriers to the information for novices, young children, second language learners, and students with learning disabilities. This article presents a concise summary of the skill sets teachers and students need in order to best utilize the Internet to acquire desired information. Teachers need a clear understanding of the educational objectives for the lesson. They need to change from being disseminators of information to facilitators of learning. Teachers also need to create individualized assignments that reflect the strengths and needs of each student in the class. Student skills include (1) understanding the inquiry task or

objective of the assignment, (2) comprehending the nature of categories of information, (3) grasping the vastness of the information space, (4) having the ability to identify precise keywords, and (5) being knowledgeable search engines. The article explains each skill in detail and suggests classroom activities that teachers could implement to enhance student Internet inquiry skills.

**Eagleton, M.B., and Hamilton, M.D. (2002). Using technology to address Language Arts standards. *New England Reading Association: Computers in the Classroom*, 38(1). Retrieved November 5, 2002 from: <http://www.nereading.org/standardsArticle/abstract.htm>.**

This article provides suggestions on how to incorporate computer-based curricula in teaching language arts instruction based on state standards. A framework is provided that enables teachers to match their objectives with students' needs and appropriate software tools. The authors surveyed, interviewed, and observed classrooms of 33 elementary and 5 middle school students and their teachers. Eight potential roles that computers can play in the presentation of the curriculum are identified

1. **Recreation** Using computers as a means of recreation (e.g., videogames) appears to be the most common use of computers by children. The use of computers in this manner can assist children in becoming more comfortable and less intimidated with using computers.
2. **Production** Students like being productive. Often typing, rather than handwriting, increases their ability to complete a writing task efficiently and neatly. Additionally, the word processing tools, such as spelling and grammar checks, enable students to edit their writing.
3. **Education** Students like learning new things and believe that the computer can support their efforts. The computer can be used to supplement materials learned in school or on topics of personal interest.
4. **Information** In today's "Information Age" students demand to learn new things. A wealth of information can be tapped through the use of computer reference tools and the Internet. This allows students to direct their own learning and engage in topics of interest.
5. **Exploration** Students want to have new experiences rather than just searching for predetermined information. Through the Internet, students can explore new and unfamiliar information that they may not have previously had the opportunity for exposure.
6. **Communication** Being social is important to children and adolescents. Many students find the computer a more appealing means to communicate with friends and family. Computer-based communication tools include email and chat rooms.

7. **Experimentation** Students enjoy the opportunity to try new things and explore how things work. The computer affords them this opportunity to explore and try new things without consequence.
8. **Construction** Students like to determine their learning path and be engaged in learning activities. Utilization of hypermedia enables students to build upon the other seven areas and develop a product. Students enjoy and appear motivated to complete tasks were there is a tangible end product such as a poster, webzine, or hypermedia presentation.

**O'Neill, L. M. Thinking Readers: helping students take charge of their learning. *The Exceptional Parent*, 31(6) 32-33.**

**O'Neill, L.M. & Dalton, B. (2002). Thinking readers part II: Supporting beginning reading in children with cognitive disabilities. *Exceptional Parent*, 32 (6), 40-43.**

These two articles describe the Thinking Reader program developed by CAST. The program provides age appropriate novels in digital formats. It also utilizes text to speech, illustration, decoding, and other supports to promote reading comprehension and to assist with word recognition. Thinking Reader helps students with reading difficulties understand the content and allows them to participate in class discussions and assignments. The program is based on the reciprocal teaching method (RTM) in which teachers and students summarize, ask questions, clarify and predict the plot based on reading from a common story or novel. There are also supports to help students with decoding word recognition. O'Neil reports that CAST is currently studying the effects of the program's embedded strategy supports on building teachers' capacity to meet the needs of diverse students. Preliminary reports from the teachers indicated that students using this technology are more motivated to read because the content is age appropriate and challenging.

**Pisha, B., & Coyne, P. (2001, November). Jumping off the Page: Content Area Curriculum for the Internet Age. *Reading Online*, 5(4). Retrieved November 25, 2002 from: <http://www.readingonline.org/articles/pisha/>**

This article describes the study of a digital text prototype used with 70 high school students with and without special needs. The purpose of the study was to collect feedback and suggestions about digitized text. Students used the prototype, *American History Exemplar*, to explore the content. Data were collected through observation, interviews, focus groups, and student work samples. Researchers used student and teacher feedback in the first phase of the study to modify and improve the text for a second trial phase. Participants made recommendations in the areas of content presentation, navigation, reference tools, and gathering salient information. Changes that they made to the

prototype were based on this feedback. The study found that that digital format had the following three advantages:

- flexible presentation of content,
- facilitation of searching to assist with fact finding, and
- ease of carry a CD ROM verse a large textbook.

Participants also reported that technical glitches and some lack of access to computers at home were limitations as well. The article discusses how the support and scaffolding in the text were designed in relation to the three learning networks of recognition, strategy, and engagement. The article also links to the digital text, *American History Exemplar*, so that the reader can explore the text and its features.

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## Universal Design Assessment Strategies

**Brown, P.J. and Augustine, A. (2000). *Findings of the 1999-2000 Screen Reading Field Test. Inclusive Comprehensive Assessment System.* Newark, DE: University of Delaware Education Research and Development Center. Retrieved December, 2002 from:  
<http://www.rdc.udel.edu/docs/t000022.pdf>**

The study evaluated the effectiveness of screen readers in the assessment of students with and without reading difficulties. The authors administered two assessments, one using screen readers and the other with paper and pencil in the subjects of science and social studies. Ninety-six students took both versions of the science exam and 110 students completed the social studies exam. The study found that students' reading scores predicted their performance on the assessments and confounded their scores in the content areas of social studies and science. The authors concluded that screen readers help students with reading difficulties achieve better test scores in content areas.

**Dolan, R. P. and T. E. Hall (2001). Universal Design for Learning: Implications for Large-Scale Assessment. *IDA Perspectives* 27(4) 22-25.**

The article introduces the principles of Universal Design for Learning and the importance of applying these principles to assessments. Students with disabilities may have accommodations in their IEP, such as a read aloud feature, which may compromise the validity of a standard assessment. However, not allowing the accommodations prevents students from demonstrating their knowledge. The

article points out that the most common accommodation is the reading of test questions aloud to students. Other accommodations frequently include test magnification, use of a keyboard to respond to questions, or a bilingual dictionary. In many instruments, assessing content knowledge in areas such as science are often confounded with reading skills. Therefore, reading ability is a predictor of test performance regardless of the area being tested. The authors provide examples of how universal design can be applied to assessments by providing multiple means of recognition, expression, and engagement.

**Thompson, S.J., Johnstone, C.J., & Thurlow, M.L. (2002). *Universal design applied to large-scale assessments* (NCEO Synthesis Report 44). Minneapolis, MN: University of Minnesota, National Center on Educational Outcomes.**

The article describes how universal design principles are being applied to assessment to address the difficulties with “retrofitting” existing assessments to accommodate diverse students. The authors point out that universally designed assessment can ensure the participation of the widest range of students and can address issues of validity and equity by measuring the achievement of all students based on the same standards. The article describes the seven principles of universally designed assessments and details how they are linked to the principle of universal design set forth by the Center for Universal Design at North Carolina State University. The seven principles are 1) inclusive assessment population; 2) precisely defined concepts; 3) accessible, non-biased items; 4) amenable to accommodations; 5) simple, clear, and intuitive instructions and procedures; 6) maximum readability and comprehensibility; and 7) maximum legibility. The article also cites computer-based testing as a good medium for universally designed assessments, because it allows for built in features such as speech to text, electronic reading supports, and alternative access devices. These devices reduce the need for accommodations and assistive technology devices during assessments. However, it may also introduce new barriers for students who are unfamiliar with answering questions on a computer screen. The State Collaborative on Assessment and Student Standards formed by CCSSO is developing a checklist that states and test developers can use to guide them in incorporating universal design principles into the development and implementation of assessments.

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## Universal Design Supports for Post-Secondary Transitions

**Ofiesh, N. (2002). Service delivery postsecondary students with disabilities: A survey of assistive technology use across disabilities. *College Student Journal* March 2002.**

This study used a survey to collect data about the most frequently used assistive technology devices as well as those used across different disability groups. Participants included 366 directors and coordinators of assistive technology services on college campuses. The results showed that voice recognition was the most commonly used AT device. It was used across all disability categories except for individuals with hearing impairments. Reading machines, FM systems, and text enlargement were also in the top four. The results showed that many devices were being used by a wide range of students and by those in disability categories other than the ones for whom the AT devices were originally intended.

**Fichten, C.S., Asuncio, J.V., Barile, M., Genereux, C., Fossey, M., Judd, D., Robillard, C., DeSimone, C., and Wells, D. (2001). Technology Integration for students with disabilities: Empirically based recommendations. *Education Research and Evaluation, 7*, 185-221.**

The article synthesizes the findings of three empirical studies that examined the computer technology needs of nearly 800 college and university students with various disabilities. Results of the three studies indicate that assistive technologies can benefit students, although many barriers still exist to accessing them. Students indicated numerous advantages of using technology, including enhancing access to materials while removing social and academic barriers. Obstacles to the acquisition and utilization of these technologies included cost, user-unfriendliness, rapid obsolescence, and difficulties in meeting individual student needs. To address these issues, the author suggests that all campus technologies and classroom content be made accessible to students with disabilities. The authors argue that to accomplish this goal, colleges and universities must fully embrace the principles of universal design. Additional disability-specific suggestions are provided to better meet the needs of students.

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Donavon, M.C., & Macklin, S. (1999). New learning technologies: One size doesn't fit all. *Planning for Higher Education, 28*, 10-18.

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### **Universal Design Physical and Architectural Accommodations**

**Center for Universal Design (1997). *What is universal design?* Center for Universal Design, North Carolina State University. Retrieved December, 2002, from the World Wide Web:**

**[http://www.design.ncsu.edu:8120/cud/univ\\_design/princ\\_overview.htm](http://www.design.ncsu.edu:8120/cud/univ_design/princ_overview.htm)**

In 1997, the Center for Universal Design at North Carolina State University coordinated the development of seven principles of universal design. The principles reflect the work of a group of architects, product designers, engineers, and environmental design researchers. The seven principles are intended to guide a wide range of fields and assist with the evaluation of designs and education of designers and consumers about universally designed products. They are also intended to influence the design of new

products. In addition, the article provides brief guidelines on methods to implement and achieve the goals of the principles. The seven principles are

**Principle 1: Equitable Use.** The design is useful and marketable for people with diverse abilities

**Principle 2: Flexibility in Use.** The design accommodates a wide range of individual preferences and abilities.

**Principle 3: Simple and Intuitive Use.** Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

**Principle 4: Perceptible Information.** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

**Principle 5: Tolerance for Error.** The design minimizes hazards and the adverse consequences of accidental or unintended actions.

**Principle 6: Low Physical Effort.** The design can be used efficiently and comfortably with minimum fatigue.

**Principle 7: Size and Space for Approach and Use.** Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility.

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## Universal Design Marketing and Dissemination Strategies

Using Market Research for the Dissemination and Utilization of Disability Research (2000) *Research Exchange* 5(2). Retrieved in December, 2002 from <http://www.ncddr.org/du/researchexchange/v05n02/tools2.html#choice>

The article describes three marketing strategies and concepts-- choice modeling, usability testing, and surveys-- and how these can be used by the research community to promote optimal dissemination and usability of research and information. These strategies and concepts are illustrated by a National Institute on Disability Rehabilitation Research-funded project coordinated by the Center for Universal Design to promote the use and awareness of universal design through these marketing strategies. Choice modeling is a process of assessing components of a product or service to determine the user's perceptions of the value and usability of each part. Usability testing involves a pilot or field test of a product and research information to assess that participants can effectively use the product or understand the information. The article provides tips for designing surveys, steps for conducting choice modeling and usability testing, and ways that these strategies can assist researchers in determining effective methods of dissemination and packaging of information.

Follett, M. Marketing Related Activities Conducted As Part of "Promoting the Practice of Universal Design," a Field-Initiated Project *Research Exchange* 5(3). Retrieved in December, 2002 from <http://www.ncddr.org/du/researchexchange/v05n03/relact.html>

This article describes a National Institute on Disability Rehabilitation Research-funded field initiated project designed to promote and market the concept of universal design. The project developed and tested universal design Performance Measures for consumers and designers of four common household products. In the first year of the project, a set of draft performance measures were refined based on feedback from consumers, designers, and marketers. In year two, one set of universal design Performance Measures was tested on 60 consumers, while a separate set were tested on designers of products. In the final year, the project aimed to meet the following three goals through dissemination and marketing activities: 1) improve consumer's ability to recognize universal design; 2) improve designers ability to meet the needs of a diverse consumers; and 3) support other efforts to market universal design. The article also details the types of dissemination activities that were used to meet these goals.

## Other Relevant References

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