RESEARCH STARTERS
ACADEMIC TOPIC OVERVIEWS

Universal Design for Learning

Special Education > Universal Design for Learning

Table of Contents

Abstract
Keywords
Overview
Architecture & UDL
Cognitive Neuroscience & UDL
The Recognition Network of Learning
The Strategic Network of Learning
The Affective Network of Learning
Technology & UDL
Legislation & UDL
Viewpoints
In Conclusion
Terms & Concepts
Bibliography
Suggested Reading

Abstract

This article presents information on the concept of Universal Design for Learning (UDL). UDL is based on knowledge gained from the field of architecture as well as from recent advances in cognitive neuroscience. It capitalizes on the inherent flexibility of technology to meet the needs of diverse learners. The "universal" in UDL does not imply one optimal solution for everyone; rather, it reflects an awareness of the unique nature of each learner and the need to accommodate differences, creating learning experiences that suit individual learners and maximize their ability to progress (Meyer & Rose, 1998; Rose & Meyer, 2002). Recent national legislation calls for an emphasis on Universal Design (UD) in special education.

Overview

Universal Design for Learning (UDL) has its roots in the field of architecture and cognitive neuroscience. It recognizes the promise of technology to meet the needs of individual learners because of the inherent and nearly limitless flexibility of technology itself. National legislation requires attention to Universal Design (UD) in curriculum and assessment development.

UDL principles guide educators in finding innovative ways to make curriculum accessible and appropriate for individuals with different backgrounds, learning styles, abilities, and disabilities in various learning situations and contexts (Rose & Meyer, 2002). This paradigm for teaching, learning, assessment, and curriculum development focuses on adapting the curriculum to suit the learner rather than the other way around. UDL guides teachers and curriculum developers toward creating flexible materials and methods before they are put in students' hands, rather than waiting until students arrive and trying to retrofit inflexible materials to each learner.

Architecture & UDL

The UDL movement in education has roots in the field of architecture. Over 40 years ago, Ronald Mace, an architect and wheelchair user, proposed the revolutionary idea that physical environments should be proactively designed to meet the needs of the broadly diverse individuals who access these spaces. In contrast to the then-prevalent view of disability as an anomaly to design practice and aesthetics, Mace suggested that designers examine the needs of diverse consumers (e.g., young people, elderly people, and those with temporary and permanent disabilities) and use this enhanced awareness to inform product design that is more functional to a broader range of people. The term "Universal Design" (UD) was coined to reflect this approach of proactively incorporating inclusive design features while minimizing the need for individual, retrofitted accommodations (Center for Universal Design, 1997).

Keywords

Access to the General Curriculum

Assistive Technologies

Curriculum Accommodation

Curriculum Modification

Disabilities

Instructional Design

Special Education

Universal Design

Universal Design for Learning

A common observation about universally designed products and environments is that they result in a more functional environment or product for everyone. Examples of universally designed products and settings are increasingly common in our lives. For example, TV captioning which is necessary for individuals with hearing impairments is also helpful to people in a noisy setting such as airports or restaurants, and curb cuts which are required for wheelchair users are handy for kids on bicycles, parents with strollers and travelers pulling wheeled luggage (McGuire, Scott, & Shaw, 2006). The concept of UD goes beyond the mere provision of special features for various segments of the population; instead it emphasizes a creative approach that is more inclusive, one that asks at the outset of the design process how a product, building or public space can be made both aesthetically pleasing and functional for the greatest number of users (McGuire, Scott, & Shaw, 2006). In considering UD as a new paradigm for addressing the instructional needs of students with disabilities and those at risk for learning challenges, "disability" is viewed as a normal phenomenon of human diversity rather than as an aberration.

The Center of Universal Design at North Carolina State University defines UD as the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design. Seven basic principles are provided by the Center:

- **Equitable Use**: The design is useful and marketable to people with diverse abilities.
- **Flexibility in Use**: The design accommodates a wide range of individual preferences and abilities.
- **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.
- **Perceptible Information**: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
- **Tolerance for Error**: The design minimizes hazards and the adverse consequences of accidental or unintended actions.
- **Low Physical Effort**: The design can be used efficiently and comfortably and with a minimum of fatigue.
- **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. (Center for Universal Design, 1997)

Numerous attempts have been made to apply these seven UD principles to learning and assessment, but they aren't a perfect fit. Similar to curriculum and assessments that were designed without consideration for the needs of individuals with disabilities in mind, the foundational UD principles appropriate for architecture and for computer hardware, software, media, and communication devices do not always work well when applied to learning because they were not specifically developed with learning in mind (Hitchcock & Stahl, 2003). A review of the current literature that pertains to UD in educational settings reveals a jumble of acronyms, such as UDI (Universal Design for Instruction), UID (Universal Instructional Design), UDE (Universal Design in Education) and UDL (Universal Design for Learning). UDL has risen to the top of the alphabet soup in educational settings because it is based on recent developments in cognitive neuroscience that are becoming widely accepted views of how the human brain learns.

Cognitive Neuroscience & UDL

In addition to its architectural underpinnings, UDL theory stems from the field of cognitive neuroscience, which aims to understand how humans actually learn by using brain scanning technology (i.e., PET scans and MRIs). Individual differences in the brain shed light on the incredible diversity of learning styles and preferences. The Center for Applied Special Technology (CAST) in Wakefield, MA focuses its research and development agenda on understanding individual differences in terms of three brain networks: recognition, strategic and affective (Meyer & Rose, 1998; Rose & Meyer, 2002).

The Recognition Network of Learning

According to Meyer and Rose (1998; 2002), the recognition network is the "what" of learning. The question, "What is it?" is associated with recognition. Located in the back of the brain, recognition networks enable us to identify and interpret patterns of sound, light, taste, smell and touch. These networks allow us to recognize voices, faces, letters, and words, as well as more complex patterns, such as an author's style and nuance and abstract concepts like justice. Although human brains all share the same basic recognition architecture and recognize things in roughly the same way, our recognition networks come in many shapes, sizes and patterns. In anatomy, connectivity, physiology, and chemistry, each of us has a brain that is slightly different from everyone else's. For example, most people, when they recognize an object visually, show increased activity in the back part

of their brains; however, the exact magnitude, location, and distribution of that increased activity varies quite a bit. The active area of the cortex may be larger or smaller, more localized to the right or left hemisphere, or more widely or closely distributed. These variations manifest in the way people recognize things in the world—their recognition strengths, weaknesses, and preferences. A UDL curriculum activates diverse learners' recognition networks by offering multiple means of representation (e.g., supplement an oral lecture with visuals) to give learners various ways of acquiring information and knowledge.

The Strategic Network of Learning

The strategic network is the "how" of learning. A classic strategic question is, "How do I do it?" These neural networks are located primarily in the front part of the brain called the frontal lobe. It is through strategic networks that we plan, execute, and monitor our internally generated mental and motor patterns—actions and skills as diverse as sweeping the floor, deciding a chess move, or choosing a college. During some activities, such as playing sports, orchestrating an April Fool's joke, or composing an essay, we may be conscious of applying strategy. What most of us do not realize is that conscious or not, strategy is involved in essentially everything we do. Strategic brain networks vary widely between individuals. For example, a student may be skilled at making a plan but have difficulty self-monitoring when executing the plan. Another student might be an expert at finding information, but have difficulty organizing and keeping track of that information. Recent brain imaging experiments provide a novel illustration of individual differences in strategy. When two people are confronted with the same problem but solve it using different cognitive strategies, the brain images reveal two very different patterns of activity. In order to meet diverse learner's strategic networks, a UDL curriculum allows for multiple means of expression (e.g., have students design a website instead of writing a traditional report) to provide students with alternatives for demonstrating what they know (Meyer & Rose, 1998; Rose & Meyer, 2002).

The Affective Network of Learning

The affective network is the "why" of learning. A commonly-heard affective question posed by learners is, "Why should I do it?" Affective networks are made up of many specialized modules, located predominantly at the core of the brain and associated with the limbic system. Because affective networks are distributed across many modules, learners exhibit vast differences along many continua that influence their motivation to learn and their subsequent and ongoing engagement with learning tasks. The affective network determines whether a student is engaged and motivated depending on the level of challenge, excitement and interest. UDL principles call for the provision of multiple means of engagement (e.g., small group projects instead of individual or whole class activities) to tap into diverse learners' interests, challenge them appropriately, and motivate them to learn (Meyer & Rose, 1998; Rose & Meyer, 2002).

These three brain networks show up clearly on MRI brain scans when people are given learning tasks that are new as well as practiced. When a learning task is novel, the brain "lights up" brightly in all three areas, demonstrating a high level of cognitive activity; conversely, when a learning task is practiced and famil iar, the brain shows much less activity in these areas, because it has developed routines to reduce cognitive load. Interestingly, the brain also appears less engaged when a task is either too hard or too easy, thus supporting Vygotsky's concept of the Zone of Proximal Development (Vygotsky, 1978). UDL principles help educators differentiate their teaching for individual learners according to each of the three brain networks.

Technology & UDL

UDL has a prime focus on using computers in the curriculum because, unlike traditional learning materials such as books, computers are uniquely flexible. Through technology, learning materials can instantly be transformed into formats that are better matched with individual learners; for example, text fonts can be enlarged for individuals with visual impairments or even printed out in Braille. Likewise, learners with auditory challenges can have video clips captioned. Students with mild reading disabilities can have words, sentences, or texts read aloud via text-to-speech software, and learners who struggle to comprehend can have metacognitive prompts embedded within the text.

There is a misconception that UDL may eventually eliminate the need for traditional Assistive Technologies (AT) for students with disabilities. This is not accurate, since children with physical or language disabilities will still need properly designed wheelchairs, adaptive switches to control devices and speech synthesizers. Similarly, students with severe disabilities will still need some individualized special education services outside the general education classroom (dressing themselves, eating with utensils, using public transportation, etc.). However, there is an important philosophical difference between an exclusively AT approach and an inclusive UDL approach. A singular emphasis on AT places the burden of adaptation on the individual learner rather than on the curriculum itself. In essence, AT accepts an inflexible curriculum—say, a printed textbook—as a given, and then finds ways to make it accessible to particular learners. In contrast, a UDL approach posits that all aspects of the curriculum should be designed from the outset to be accessible to a wide range of learners rather than retrofitted after the fact.

Concurrent with the increasing focus on developing UDL curricula is a growing awareness that simply providing access to the general curriculum is insufficient to ensure optimal learning (Boone & Higgins, 2007). There is an important distinction between access to information and access to learning (Rose & Meyer, 2002). Therefore, researchers and designers are now emphasizing the need to provide access to learning itself. Just because a student can access a piece of content doesn't automatically mean s/he can understand or make sense of it. Mere access to the content is inadequate unless that access is mediated with instructional design supports appropriate for the specific disability of the user. Since instructional design elements that are suitable for one disability population might not be appropri-

ate for someone with a different disability—the key is to build in maximum flexibility from the start. For example, it is generally

believed that students with learning disabilities should not be exposed to overwhelming or distracting graphics in a computer program; conversely, some students with emotional disabilities prefer strong auditory and visual effects (Boone & Higgins, 2007). However, since there is significant variation even within particular disability populations, assumptions about desirable design features cannot be made with complete confidence.

The design of universally accessible computer interfaces can have a positive social effect on individuals with disabilities. For instance, people with sensory disabilities can use computers in order to achieve face-to-face and remote communication. Personal computers can assist people with severe motor impairments to manipulate their environment and to enhance their mobility through technologies such as smart wheelchairs. In this way they can become more socially active and productive. Accessible interfaces have become so indispensable for personal autonomy and social inclusion that in several countries special legislation protects people from "digital exclusion" (Abascal & Nicolle, 2005).

Legislation & UDL

Both the Individuals with Disabilities Education Act (IDEA 1997/2004) and the No Child Left Behind Act of 2001 (NCLB) recognize the right of all learners to a high-quality standards-based education. The laws preclude the development of separate educational agendas for students with disabilities and others with special needs. They also hold teachers, schools, districts, and states responsible for ensuring that these students demonstrate progress according to the same standards as their peers.

In the 2004 reauthorization of IDEA, references to UD include the definition from the Assistive Technology Act (Section 602 (35)); requirements to support the use of technology based on UD principles to maximize accessibility to the general education curriculum (Section 611 (e)(2)(C)(v)); and the use of UD principles in developing and administering districtwide and alternative assessments (Section 612 (a)(16)(E)). The report of the President's Commission on Excellence in Special Education (U.S. Department of Education, 2002) specifically recommended that "all measures used to assess accountability and educational progress be developed according to principles of universal design" (U.S. Department of Education, 2002, p. 27). In analogous fashion, the New Freedom Initiative (2001) suggested that a key component to providing inclusive instruction was "increasing access to assistive and universally designed technologies" (p. 3).

IDEA 2004 also calls for a National Instructional Materials Accessibility Standard (NIMAS) that requires textbook publishers to use a consistent file format when developing alternate versions of texts (e.g., CD-ROM or web-based) for students with print disabilities. This is an improvement over the earlier Chafee Amendment (1996) that gave permission for special educators to convert copyrighted print materials (e.g., to create Braille, audio, or digital versions), but which placed the burden of responsibility on educators rather than on publishers.

Viewpoints

Ideally, a UDL curriculum is designed, developed, and validated to meet the needs of the full range of students who are actually in our schools—students with a wide range of sensory, motor, cognitive, linguistic and affective abilities and disabilities rather than just the narrow range of students in the middle of the bell curve. UDL goals, methods, assessments and materials offer ways to think about planning, methods for developing appropriate goals that do not confound the ends with the means, ways to enhance learning with strategy instruction, ways to develop and obtain accessible learning materials that are usable by most, if not all students, and methods for providing assessments that are accessible and appropriate for all learners (Hitchcock & Stahl, 2003).

However, educators should be cautioned not to overstate the promise of UDL in educational settings. While the concept of UDL is intuitively appealing, it has not yet been fully researched across multiple instructional environments and with multiple populations (Boone & Higgins, 2007; McGuire, Scott, & Shaw, 2006; McKenna & Walpole, 2007). As noted by McGuire, Scott, & Shaw (2006):

> In the field's excitement about the possibilities of UD, extreme statements are often made, including such comments as "UD will address the needs of all students" or "UD will eliminate the need for special education services." However, looking back at the roots of UD in the physical realm is instructive. Architects and designers implementing UD do not make claims of creating totally inclusive products and environments (p. 171).

Further, there are limits on what modern technologies can accomplish to date. Most notably, speech recognition software has not yet reached its potential in educational environments because many children have difficulty "training" the software and there is often ambient classroom noise that interferes with the process. Regrettably, although many software publishers know that they should consult educational experts during the design process and are required by law to take into consideration how their software will interface with AT devices, many do not (Boone & Higgins, 2007). There are also limits on what teachers and special educators can provide for students in terms of time, training, and funding (McKenna & Walpole, 2007).

In Conclusion

Therefore, a more realistic perspective is to recognize that no single solution will provide all the accessibility and learning supports necessary for every learner. A combination of UDL and AT along with curriculum accommodations, curriculum modifications, and differentiated instruction will continue to play a role in the education of learners with disabilities. Ronald Mace, the architect and wheelchair user who introduced UDL, noted that the use of the term "universal" is somewhat unfortunate, because "nothing can be truly universal; there will always be people who cannot use an item no matter how thoughtfully it is designed.

However, we can almost always improve on the things we design to make them more universally usable" (as cited in McGuire, Scott, & Shaw, p. 172).

Terms & Concepts

Access to the General Curriculum: The notion that students with disabilities should, whenever possible, participate in the same core curriculum (e.g., math, language arts, social studies, science) as their peers rather than being taught in a specialized class with different learning objectives.

Assistive Technologies (AT): Any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve the functional capabilities of a person with a disability.

Chafee Amendment: A 1996 amendment to the Copyright Law which allows educators to copy and adapt published materials to use with blind students and students with identified print disabilities.

Curriculum Accommodation: A change made to the teaching or testing procedures in order to provide a student with access to information and to create an equal opportunity to demonstrate knowledge and skills. Accommodations do not change the instructional level, content, or performance criteria for meeting the standards. Examples of accommodations include enlarging the print, providing oral versions of tests, and using calculators.

Curriculum Modification: A change in what a student is expected to learn and/or demonstrate. A student may be working on modified course content, but the subject area remains the same as for the rest of the class. If the decision is made to modify the curriculum, it is done in a variety of ways, for a variety of reasons, with a variety of outcomes.

Differentiated Instruction: A teaching theory based on the premise that instructional approaches should vary and be adapted in relation to individual and diverse students in classrooms.

Individuals with Disabilities Education Act (IDEA): A law passed in 1997 and reauthorized in 2004 that is designed to protect the rights of people with disabilities and mandates how, what, and where students with identified disabilities should be taught.

Instructional Design: An interdisciplinary field devoted to systematically developing learning objectives based on analyzing learners' needs, and regularly evaluating the effectiveness of a given instructional approach.

National Instructional Materials Accessibility Standard (NIMAS): Helps facilitate timely access to alternate and consistent formats of instructional materials for learners with visual impairments or other print disabilities.

No Child Left Behind Act (NCLB): An extensive set of laws passed in 2001 that aim to improve student achievement.

Universal Design (UD): An approach to the initial design of products, services, and environments to made them usable by as many people as possible regardless of age, ability, or circumstance.

Universal Design for Learning (UDL): An approach to curriculum design that emphasizes flexible goals, methods, assessments, and materials so as to decrease the barriers that typically limit student access to learning.

Bibliography

Abascal, J., & Nicolle, C. (2005). Moving towards inclusive design guidelines for socially and ethically aware HCI. *Interacting with Computers, 17*(5), 484-505.

Boone, R., & Higgins, K. (2007). New directions in research: The role of instructional design in assistive technology research and development. *Reading Research Quarterly, 42*(1), 135-140.

Center for Universal Design (1997). *The Principles of Universal Design, Version 2.0*. Raleigh, NC: North Carolina State University. Retrieved July 12, 2007, from http://www.design.ncsu.edu/cud/about_ud/udprinciples.htm

Chafee Amendment to the Copyright Act. P.L. 104-197, 17. (1996).

Hitchcock, C., & Stahl, S. (2003). Assistive technology, universal design, Universal Design for Learning: Improved learning opportunities. *Journal of Special Education Technology, 18*(4), 45-52.

Individuals with Disabilities Education Act Amendments of 1997, 20 U.S.C. §1415 et seq.

Individuals with Disabilities Education Improvement Act of 2004, P.L. 108-446, 20 U.S.C. §1400 *et seq.*

McGuire, J. M., Scott, S. S., & Shaw, S. F. (2006). Universal design and its applications in educational environments. *Remedial & Special Education, 27*(3), 166-175. Retrieved July 12, 2007, from EBSCO Online Database Education Research Complete. http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=20725192&site=ehost-live

McKenna, M. C., & Walpole, S. (2007). Assistive technology in the reading clinic: Its emerging potential. *Reading Research Quarterly, 42*(1), 140-145.

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

National Instructional Materials Accessibility Standard (2003). *NIMAS Report Executive Summary: National Instructional Materials Accessibility Standard Report – Version 1.0*. Retrieved July 12, 2007, from http://nimas.cast.org/about/report

New Freedom Initiative. (2001, February). Retrieved July 12, 2007, from http://www.whitehouse.gov/news/freedominitiative/freedominitiative.html

No Child Left Behind Act of 2001, P.L. 107-110, 107th Congress, 1st Session. Retrieved July 12, 2007, from http://www.ed.gov/policy/elsec/leg/esea02

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal Design for Learning.* Retrieved July 12, 2007, from the Association for Supervision and Curriculum Development http://www.cast.org/teachingeverystudent/ideas/tes.

U.S. Department of Education, Office of Special Education and Rehabilitation Services. (2002). *A new era: Revitalizing special education for children and their families*. Washington, DC: Author.

Suggested Reading

Fisher, D., & Frey, N. (2001). Access to the core curriculum. *Remedial & Special Education, 22*(3), 148-157. Retrieved July 12, 2007 from EBSCO Online Database Education Research Complete. http://search.ebscohost.com/login.aspx?direct=true&db=ehh&AN=4503417&site=ehost-live

Follette-Story, M., Mueller, J. L., & Mace, R. L. (1998). *The universal design file: Designing for people of all ages and abilities*. Raleigh, NC: NC State University.

Hall, T., Strangman, N., & Meyer, A. (2003). *Differentiated instruction and implications for UDL implementation*. Retrieved July 12, 2007, from the National Center on Accessing the General Curriculum http://www.cast.org/publications/ncac/ncac_diffinstructudl.html

Mace, R. (1998). Universal design in housing. *Assistive Technology, 10*(1), 21-28.

Rose, D. H., Hasselbring, T. S., Stahl, S., & Zabala, J. (2005). Assistive technology and universal design for learning: Two sides of the same coin. In D. Edyburn, K. Higgins, & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 507-518). Whitefish Bay, WI: Knowledge by Design.

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

Wehmeyer, M. L. (2006). Universal design for learning, access to the general education curriculum, and students with mild mental retardation. *Exceptionality, 14*, 225-235.

Essay by Maya Eagleton, Ph.D.

Maya B. Eagleton is an Adjunct Assistant Professor in Language, Reading, and Culture at The University of Arizona, where she teaches courses in traditional literacies, electronic literacies, and qualitative research methods. Previously, she served as a Senior Research Scientist for CAST (Center for Applied Special Technology), where she researched and designed literacy software prototypes for students with learning disabilities. Dr. Eagleton has extensive K-12 classroom experience, particularly with struggling readers and writers, and has served as a K-5 Title I coordinator and a Reading Recovery teacher. She provides reading tutoring services, consults with school districts, presents at educational conferences, publishes journal articles, and co-authored a 2007 text for teachers entitled Reading the Web: Strategies for Internet Inquiry, available from Guilford Press.