

Principles of Universal Design and the Implications for Policy Initiatives

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Introduction

Purpose

The purpose of this report is to provide an independent analysis of the principles of universal design as they have been developed and implemented in educational agencies. Specific emphasis will be placed on identifying the language that has been used to describe key concepts and principles associated with universal design applications in education. Particular attention will be devoted to the ways these concepts have (or, could) influence educational policy at local and provincial levels.

Background

The origin of the term "Universal Design for Learning" (UDL) is generally attributed to David Rose, Anne Meyer, and colleagues at the Center for Applied Special Technology (CAST). The principles of UDL were developed following the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA). During the late 1990s there was considerable national interest in the United States about the issue of inclusion. While students with disabilities had gained physical access to the general education classroom, concerns were being raised about how students would gain "access to the general curriculum." The issues associated with access to the curriculum were at the forefront of CAST's work and in 1999 they were awarded a federal grant to establish the National Center on Accessing the General Curriculum that became instrumental in garnering national attention for the potential of UDL.

In a paper that would subsequently serve as a framework for the development of the UDL philosophy, Rose and Meyer (2000) argue that there is considerable historical evidence that developments made for marginalized elements of society (e.g., telephone has originally viewed as a communication device for the hard of hearing) have subsequently had significant impact on the mainstream population. In 2002, Rose and Meyer (2002) published a book that has become the definitive work about UDL. They argue that the basis of UDL is grounded in emerging insights about brain development, learning, and digital media. They observed the disconnect between an increasingly diverse student population and a "one-size-fits-all" curriculum would not produce the desired academic achievement gains expected of global citizens in the 21st century. Drawing on the historical application of universal design in architecture (e.g., curb cuts) and the built-environment, CAST advanced the concept of universal design for learning as a means of focusing educational research, development, and practice on

understanding diversity, technology, and learning. Their insight is commensurate with advances characterized as a major paradigm shift.

CAST's philosophy of UDL is embodied in a series of principles that serve as the core components of UDL:

- Multiple means of representation to give learners various ways of acquiring information and knowledge
- Multiple means of expression to provide learners alternatives for demonstrating what they know, and
- Multiple means of engagement that capture learners' interests, challenge them appropriately, and motivate them in ways that produces deep learning.

Within the 2004 reauthorization of the Individual With Disabilities Education Act (IDEA), the term "universal design" was officially defined within U.S. federal law (20 U.S.C. _ 1401) governing special education:

The term universal design has the meaning given the term in section 3 of the Assistive Technology Act of 1998 (U.S.C. _ 3002).

Following the backward chain of legal reference, the definition of universal design as it was included in the Assistive Technology Act of 1998 is as follows:

The term "universal design" means a concept or philosophy for designing and delivering products and services that are usable by people with the widest possible range of functional capabilities, which include products and services that are directly usable (without requiring assistive technologies) and products and services that are made usable with assistive technologies. (U.S.C. _ 3002)

In less than ten years, UDL has captured the imagination of policy makers, researchers, administrators, and teachers. While initially focused as a strategy for providing access to the curriculum for students with disabilities, it offers simultaneous benefit to many other students. UDL provides a vision for breaking the "one-size-fits-all" mold and therefore expands the opportunities for learning for all students with learning differences. Recognizing and responding to diversity is a core motivation for engaging in UDL practices. The mantra that evolved from our understanding of the value of curb cuts, "good design for people with disabilities benefits everyone," provides a powerful rationale for exploring the large-scale application of UDL in education.

Readers interested in experiencing a universally designed learning environment are encouraged to review the resources outlined in Appendix A.

Task #1 Environmental Scan

To understand the current application of universal design in education, a review of relevant (a) research and professional literature, (b) conference papers and reports, (c) web sites, (d) policy/legal documents, and (e) emerging UDL practices by educational agencies was conducted. The purpose of this task is to identify the scale and scope of the knowledge base concerning universal design in education.

Process

The environmental scan was conducted by engaging in a systemic search for published materials concerning principles and practices of universal design in education. In order to locate research and professional articles, several core resources were reviewed (e.g., Rose and Meyers, *Teaching Every Student in the Digital Age*; Rose, Hasselbring, Stahl, and Zavala's chapter on Assistive Technology and Universal Design; and Edyburn's annual review of the literature). Manual searches of *The Alberta Journal of Educational Research* from the past three years were also conducted. The literature review strategy known as footnote chasing was then utilized to track down relevant materials found in the primary source materials.

In addition, selected web sites were reviewed (e.g., CAST, <http://www.cast.org>; The Access Center, <http://www.k8accesscenter.org/>; and the Center for Universal Design, <http://www.design.ncsu.edu>). Finally, Google searches were used to identify fugitive literature (e.g., individual web pages, agency reports) and to locate individuals and educational agencies with projects that involved the implementation of UDL.

Findings

The results of the environmental scan were compiled into a bibliography and included in this report as Appendix B. Several observations are provided to summarize the extant knowledge base:

- An analysis of publication dates reveals the precursors to the field in 1998 - 2000 and a pattern of an increasing number of publications about UDL from 2000 through 2005. Further bibliographic analysis of the literature could be used to definitively document the conceptual origins of the field while citation analysis could be used to trace the impact of a few core publications.
- A majority of the articles in the extant literature have been written by CAST staff members (Bridget Dalton, Robert Dolan, Tracy Hall, Chuck Hitchcock, Anne Meyer, Bart Pisha, David Rose, Skip Stahl, and Nicole Strangman). This finding suggests that UDL, as an educational innovation, is still in its infancy as the UDL

apostles have contributed the majority of the literature. However, over time the composition of the literature should change as more works by UDL disciples are published.

- A close reading of the books and articles indicates that the majority of the publications are about the potential of UDL rather than research-based evidence concerning its efficacy. This finding suggests that UDL should currently be viewed as a philosophy rather than an intervention. However, this is likely to change over time as more effort is devoted to implementation and evaluation.
- While the concept of UDL has received considerable attention by many educators, there is also evidence of distortion as the construct is disseminated and adopted. For example, as UDL has been misunderstood in the field of educational technology it is used as a synonym for web accessibility (Holzberg, 2003). In other cases, the core elements have been completely misunderstood: "UDL is just good teaching." "UDL is what you have always done." (Castellani, Mason, & Orkwis, 2005). Similarly, searching ERIC for UDL lesson plans produces bizarre results. As a result, it will be increasingly important to clarify what UDL is and is not.
- To-date, much of the UDL literature has focused specifically on the design of instructional materials and student learning activities. However, the principles of UDL have had strong appeal in the area of assessment, particularly as applied to the development of large scale assessments (Fleming, Kearns, Dethloff, Lewis, & Dolan, 2006; Ketterlin-Geller, 2005; Thompson, Johnstone, & Thurlow, 2002).
- Much of the attention to UDL has been in the K-12 environment but there is some interest in higher education (Scott, McGuire, & Shaw, 2003; Universal Design Education Online, <http://www.udeducation.org/>) and teacher education (Castellani, Mason, & Orkwis, 2005).
- A variety of efforts were identified that illustrate the work of individuals and educational agencies to implement the principles of UDL. Typically, these initiatives have been emerged from assistive technology leaders and organizations (see Appendix B, Section 7, and Instructional Practices).
- No evidence was discovered that documented efforts to implement principles of universal design across the entire educational system (i.e., universal design in education).

Task 1 Summary

The purpose of this task was to identify the scale and scope of the universal design for learning knowledge base. The results are summarized in a comprehensive bibliography

that appears in Appendix B. The origins of the field can be traced to developments prior to 2000. At this point in time, it is important to consider UDL as a philosophy to guide the development of instructional materials and learning environments rather than a research-based intervention. The literature illustrates the considerable interest in UDL but readers are cautioned to be alert to distortions of the key principles.

Task #2 Analysis of Key UDL Principles and Language

Given that construct of universal design for learning (UDL) was initiated in special education, it is understandable that there is some confusion with other forms of technologies (e.g., assistive technology, accessible technology, instructional technology). The purpose of this task was to analyze key principles of UDL and the language that is used to describe it.

Process

The documents collected in Task 1 were reviewed for the purpose of extracting key words and concepts that have been used to describe the attributes of UDL. A list of key terms was prepared and alphabetized.

Findings

Table 1 summarizes some of the high-frequency terms that that have been used to describe UDL. The core concepts, as advanced by CAST, involve issues of flexibility, multiple methods of presenting, and engaging in the essential tasks of education associated with curriculum, teaching and learning (instruction), and assessment. As noted in the Background section, historical issues of access, diversity, and achievement are central to understanding the need for UDL and its potential.

Several observations are worth noting about the key principles, language, and concepts associated with descriptions of the potential of UDL:

- Concern has been noted about the relationship between assistive technology and UDL and the potential confusion about these constructs relative to policy and service delivery (Edyburn, 2005; Rose, Hasselbring, Stahl, & Zabala, 2005). For example, if a building has an electronic door sensor to open the front door automatically, is it reasonable to conclude that wheelchairs will no longer be needed?
- UDL is fundamentally about instructional design. That is, insight about the special needs of learners will inform the proactive development of instructional options and supports so that academically diverse students will be successful in mastering a given objective.

- Technology is essential for the success of UDL; however, UDL is more than a technology initiative for schools. Some will argue that historical educational methods and materials are a reflection of the technologies of the day that only permitted a one-size-fits-all approach to instruction. In contrast, current technologies provide more options and greater flexibility. For example, when the curriculum provides digital text, the size and font of the text can be altered, the text can be copied into a text-to-speech program or rendered into a MP3 file so that the student can listen to the information, or pasted into a web site that provides language translation so that a student can read the information in a second language. The glamour of the technologies that make these transformation possible may blind us to the essential change: Breaking out of the one-size fits all mentality of historical educational methods and materials by offering multiple/flexible options for receiving information, engaging in learning, and demonstrating what one knows, appears to be an important pedagogical advance.
- A claim of a product or intervention being UDL often involves the designation of a targeted specific disability need and then a secondary (transfer) impact population. For example, designers of the zero-entry swimming pool created a means for a person in a wheelchair to enter a pool. However, the secondary impact was that very young children could enter the pool at a comfort level of a fraction of an inch to a few inches to much deeper. In education, text-to-speech products were original developed for blind students but have had a much larger impact on the population of struggling readers in the general education classroom.
- Many examples of UDL current express the potential of UDL in terms of designs that address physical or sensory disabilities but have secondary impact for many other individuals. For example, a digital book that offers readers the opportunity to change the font size is critical for students with visual impairments but also has potential value for many students in a general education class. Less common are examples of UDL that address cognitive impairments that interfere with academic performance such as short and long term memory deficits, thinking and problem solving strategies, and reading. Thus, there appears to be some tension between the use of assistive technology and UDL for low incidence disabilities vs. assistive technology and UDL for mild/moderate learning disabilities.
- Tomlinson's (2002) work in differentiated instruction outlines a conceptual framework she refers to as equalizers (e.g., continuums of critical instructional factors: knowledge representation: abstract/concrete). Edyburn (2005) has noted that such a metaphor is powerful for instructional designers. However, the term also introduces notions of social justice and equity into the conversation. Thus, some applications cause a negative reaction as they raise questions about fairness and grading when the intervention is perceived as "too helpful or supportive."

- Another means of understanding UDL is to examine what it is not. Statements like "universal design for learning is just good teaching," or "it is like what you have always done" are patently false and reflect fundamental misunderstandings. UDL is not access alone (access is not learning). Finally, UDL is not simply offering more choices (more options alone does not enhance student learning).
- The concept of engagement appears to be underdeveloped in most UDL conversations and is of primary importance to educators. Research has demonstrated the relationship between deep learning and high levels of performance and expertise (Csikszentmihalyi, 1990; Schlechty, 2002). However, the notion of applying a computer interface to a digital body of knowledge, then allowing the student to manipulate the information in ways that make it cognitive accessible, at a level of appropriate challenge, has everything to do with process of developing expertise. That is, when interest that is sustained over time, self-efficacy is nurtured, developed, and rewarded through engagement with increasingly challenging and interesting material. Indeed, this is the recipe for producing high levels of achievement and expertise.

Task 2 Summary

Technology is central to the implementation of UDL and thus serves to explain why this development is occurring now and did not emerge 25-50 years ago. Given the origins of the UDL construct in special education there has been some confusion about the relationship between UDL and other forms of technology like assistive technology. The problem is likely to continue to challenge educational leaders due to the fact that some products (e.g., Inspiration, the concept mapping software program) may be utilized as *instructional technology* when the teacher uses this product as an alternative to outlining), or utilized as *assistive technology* as a support for an individual student, or utilized as *universal design* as a tool explicitly implemented to support and engage diverse learners in a task that is often difficult for many students. Tomlinson's concept of *equalizers* has much to offer the application of UDL design efforts relative to the educational outcomes of chronically underachieving students. As a result, it is important to consider UDL as an instructional design methodology that focuses on the special needs of diverse learners as a primary design target that also yields secondary impact for many other students. To-date, applications of UDL have focused on physical and sensory impairments but much work remains to be done relative UDL applications in cognitive tasks. The UDL principle of engagement is clearly aligned with recent advances in school reform and insights about human learning and thus holds considerable promise as a mechanism for demonstrating enhanced learning outcomes.

Task #3 Implications of Universal Design for Educational Policy Initiatives

The final task for this report involves an evaluation of the implications of universal design for education relative to policy initiatives. In this section the implications of universal design for educational policy initiatives are discussed relative to future policy, regulations, and/or administrative actions for Alberta Learning.

Process

In order to understand the current educational policy climate in Alberta, the author reviewed the following policy documents:

Regulation and Policies

http://www.education.gov.ab.ca/k_12/legislation/

Guide to Education

<http://www.education.gov.ab.ca/educationguide/guide.asp>

Alberta Business Plan

<http://www.education.gov.ab.ca/departments/businessplan/bp2005-08.pdf>

Recommendations

Based on the review outlined in this report, little evidence has been found to suggest that the principles of UDL have been into the fabric of the entire educational system. As a result, some may argue that such efforts are premature. However, others will argue that adoption of the core principles of UDL into the values, policies, procedures, and systems of the educational system is the work of visionary leaders. Efforts by Alberta Learning to infuse principles of UDL throughout the educational enterprise are consistent with its stated mission of being the premier education system.

Since educational change occurs as a result of both top-down and bottom-up strategies (McLaughlin, 1990) the following recommendations are outlined to foster conversations about UDL action planning with particular emphasis on educational policy.

1. Vision

Goal: Define a vision of 21st century education that demonstrates how all students will have equitable access to digital learning resources in ways that yield quantifiable increases in the academic achievement of every student.

Rationale: A number of indicators suggest that technology is changing the nature of what is worth knowing. Whereas our parents needed to memorize the names of the planets or countries of the world, such information is now quickly, easily, and accurately retrieved via the Internet. When our children have access to vast information

stores beyond what any local library can hold, will the data overwhelm them or inform them? How will the power of technology be harnessed in ways that contributes to the lifelong learning of every citizen?

Action Items

- Provide forums that enable various stakeholder groups (e.g., taxpayers, parents, students, teachers, staff, administrators, boards of education, Ministry of Education, curriculum developers, legislature, etc.) to experience UDL and understand the importance of the UDL philosophy for addressing critical issues of access, diversity, and achievement. Gather input for use in developing a provincial UDL policy agenda.
- Commission a report that analyzes the fundamental changes that must occur in education to prepare our children for living and working in a global information-based society. Such a report must address critical policy issues such as chronic underachievement and school failure, knowledge that is known versus information that is retrieved, and the role of technology in high performance environments.
- Convene a high-level task force or blue ribbon committee that is charged with assessing the current technology infrastructure in Alberta and developing various models that create rich technology environments for student learning. Attention must be given to the technology infrastructure (e.g., hardware, connectivity, software, etc.) that will be required to enable all students to utilize digital curricula in pursuit of achieving high academic standards.

2. Design for Diversity

Goal: Require each educational unit to identify dimensions of learner diversity that they will consider when designing educational policies, procedures, learning environments, instructional materials, and performance outcomes.

Rationale: As society recognizes that diversity is a positive attribute, it must cease its thoughtless one-size-fits-all responses. The historical lesson of failing to meet the needs of every student is well-documented in the context of the achievement gap that demonstrates how certain groups of students chronically under-achieve. Efforts to acknowledge the many forms of academic diversity are an essential prerequisite for creating UDL learning environments and materials and require the commitment of all divisions/units.

Action Items

- Require each educational unit to paint a portrait of diversity. Proactively valuing diversity requires a deeper understanding of student's needs, interests, strengths, and

challenges. When an educational unit paints a portrait of diversity, they will have accomplished a necessary prerequisite for their subsequent efforts to implement the principles of UDL.

- Require new policies, products, and initiatives to include a UDL disclosure statement. The UDL disclosure statement should explicitly articulate the targeted special needs that were considered in the process of designing new educational policies, procedures, learning environments, instructional materials, and performance outcomes as well as the secondary benefit that is expected to result. (For example, providing text in alternative formats, while designed explicitly for students who are blind, will have secondary impact for students not reading at grade level, multilingual students, and students with learning disabilities.)
- Sponsor an annual provincial UDL Design Fair. Invite students, teachers, administrators, publishers, curriculum designers and other appropriate stakeholders to a venue that serves as a focal event for sharing knowledge and skills about UDL design. As one component of the Design Fair to consider involves a design contest that requires participants to create a solution for a contemporary problem relative to accessing and benefitting from instruction.

3. Definition of Basic Instruction

Goal: Revisit the tenets of classroom teaching and learning.

Rationale: Traditional instruction is predicated on a knowledge transfer process between teacher and student. Current classroom management procedures (e.g., age/grade level grouping, fixed units of time per topic, single textbook) belie an assembly line model for producing student achievement. Historically, failure to learn was viewed as a problem within the student rather than a shortcoming of the teaching, instructional methods, or instructional materials. Recent advances in the areas of brain research, cognitive psychology, culturally sensitive pedagogy, motivation, poverty, technology enhanced performance, and virtual learning environments suggest there is much that should be done differently in classrooms to produce high levels of learning within all students. New efforts are needed to focus on understanding how to move beyond one-size-fits-all models of pedagogy to just-in-time personalized learning systems that produce the desired learning outcomes within all students.

Action Items

- Convene a provincial task force to examine the tenets of classroom teaching and learning. When time is fixed and all students are expected to achieve high academic standards, what role should flexible technologies play to enhance student performance?

- Fund a pilot a research project that examines differences in various interventions in order to answer the question: What works, for whom, and under what conditions? (For example, in a study of student comprehension of a literature book, different classrooms could use the traditional book, book on tape, book on CD, MP3, DVD movie of the book, and a book summary to make comparisons about the effectiveness of each format for various groups of students.)
- Support the development of a digital learner profile that analyzes student learning strengths and weaknesses that could subsequently be used to distribute personalized learning materials.
- Support the development of an instructional design wizard that matches student learning profiles with digital learning resources.

4. Programs of Studies and Learning Resources

Goal: Engage in a series of activities that involve evaluating existing Programs of Studies and Learning Resources through the lens of UDL principles to ascertain opportunities to strengthen and/or modify curriculum and instruction.

Rationale: High standards are sometimes used to disguise efforts to implement a one-size-fits-all curriculum. Periodic review of the Programs of Studies to ascertain how well the existing curriculum captures what's worth knowing is an essential function of the educational community. Using the lens of UDL to review the Program of Studies and Learning Resources will provide an opportunity to proactively design for diversity.

Action Items

- Review each Program of Study with the lens of UDL to ascertain the degree to which the curriculum provides multiple means of representation, multiple means of expression, and multiple means for engagement.
- Review a representative sample of Learning Resources with the lens of UDL to ascertain the degree to which print and digital instructional materials provide multiple means of representation, multiple means of expression, and multiple means for engagement.
- Convene a group of curriculum specialists, teachers, technology specialists, assessment specialists, and administrators to identify a selected sample of academic tasks that typically challenge many students and then create an equalizer that alters the difficulty of the text or level of support needed for all students to achieve the desired outcome within fixed time constraints.

- Consider the UDL design principle, multiple means of representation, as an essential first step in implementing a UDL agenda by focusing on UDL access to text-based information. For example, is there a core set of alternative formats that should be provided with all instructional materials and resources? What would it cost to provide these multiple formats? How would they be disseminated and accessed? What instructional value would be obtained if students had routine access to text materials at multiple reading levels, with enhanced supports, in multiple languages, in various media (e.g., print, digital, Braille, MP3)? What are the implications of this initiative relative to Canadian copyright? Should copyright alternatives be explored (e.g., creative commons, copy left, open source)? Should policies require alternative formats for text or should we seek voluntary marketplace solutions?
- Fund a model demonstration project that provides selected instructional materials in (1) tiered levels (i.e., instructional content is presented at multiple levels to address students varied interest and skill levels) and (2) multiple formats (e.g., print, audio, Braille, multimedia, multilingual). Evaluate the cost/benefit outcomes of this activity and estimate the costs associated with scaling up the effort.

5. Progress Monitoring, Assessment, and Accountability

Goal: Explore the application of UDL to the routine monitoring of student performance, periodic normative assessment of student progress, and accountability reporting systems.

Rationale: Some educational leaders view UDL as an educational initiative that is in conflict with the purposes of standardized assessment that seek to reduce error variance through rigid implementation of one-size-fits-all testing procedures. However, UDL is highly compatible with adaptive testing models of assessment and new advances in psychometrics, like dynamic norming, that aggregate and disaggregate students scores based on the digital supports that were accessed by the student in order to understand the context of the students best performance. If UDL is to be more than a passing educational fad, it must discover ways to document claims of enhanced student performance. In particular, attention must be devoted to documenting the academic growth of diverse students that have been historically marginalized by ineffective schooling practices.

Action Items

- Convene a provincial meeting of assessment experts and UDL experts to define a research and development agenda relative to assessments designed in accordance with UDL principles.

- Issue an RFP for developing a UDL standardized assessment prototype. Evaluate the cost/benefit outcomes of this activity and estimate the costs associated with scaling up the effort.
- Commission a report concerning new advances in psychometrics relative to adaptive testing that have application for the design of UDL assessments.

6. Professional Learning Communities

Goal: Sponsor a network of professional learning communities to foster meaningful opportunities to learn about the principles of UDL and how to implement UDL practices within ones school or educational agency.

Rationale: Educational innovations like UDL require a tremendous commitment to the professional development of in-service teachers, administrators, and related services personnel as well as a means to impact pre-service preparation of new educators. The challenges associated with this goal will require the Ministry to understand the nature of its commitment to a UDL agenda.

Action Items

- Convene a workgroup of Ministry officials to analyze the principles of UDL in relationship the Alberta Ministry of Education. The purpose of these efforts is to identify critical leverage points where UDL could strategically influence policy, regulations, and practice. For example, UDL might be a targeted initiative for discretionary grants. Or, the UDL principle of multiple forms of representation might be codified into provincial and local guidelines relative to the acquisition of instructional materials. Or, should UDL philosophy/skills be targeted as a core competency in hiring new teachers, administrators, or other personnel? As appropriate, recommendations from this workgroup should be targeted for inclusion in periodic revisions of the Alberta Initiative for School Improvement framework, Guide to Education, and appropriate policy and regulation updates.
- Sponsor conference sessions and workshops that will assist educators in building knowledge and skills relative to UDL.
- Create online learning communities where educators can gain technical knowledge and expertise in UDL.
- Work with university-based personnel preparation programs to infuse UDL principles and practices within the curriculum so that new educators are effectively prepared to implement UDL strategies within their school.

7. The Business Case for UDL

Goal: To-date, inadequate attention has been devoted to measuring the outcomes of UDL. Common sense standards seem to prevail suggesting that it is less expansive to design multiple alternatives at the beginning rather than to make accommodations after students have failed. Indeed, little is known about the costs and efforts needed to capture the promise UDL as touted by its advocates.

Rationale: The immediate benefits of UDL are not apparent given that many costs associated with curriculum modifications and accommodations are not counted. The time a teacher spends creating specialized materials or scanning a textbook to make an accessible version of a reading assignment are frequently expenses that are overlooked in current education finance models. Likewise, there is little effort to measure the benefit other students gain from having alternative access to instructional materials in multiple formats. As a result, considerable effort is needed to properly account and evaluate the business case for UDL.

Action Items

- Fund pilot demonstration projects that will provide anecdotal, qualitative, and quantitative evidence about the development, implementation, and outcome of UDL initiatives. Particular attention is needed to assess primary and secondary benefits to students as well as development costs and implementation issues in order to understand the true costs and benefits of UDL.
- Issue an RFP for (1) making an existing learning resource accessible and (2) developing a new learning resource that is accessible by design. Require the contractor to document the time, efforts, and costs associated with accessible design under each condition. Evaluate the cost/benefit outcomes of this activity and estimate the costs associated with scaling up the effort.

Conclusions

The purpose of this report was to provide an independent analysis of the principles of universal design as they have been developed and implemented in educational agencies. The construct of UDL has captured the imagination of educational leaders and policy makers as a promising practice for enhancing the educational achievement of an increasingly diverse student body. However, much work remains to be done to infuse the core principles into the daily workings of educational agencies.

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Table 1
Language Commonly Associated With Universal Design for Learning.

academic diversity
adaptation
access
accessibility
accommodation
accountability
assistive technology
assessment

brain development
brain research
brain structure

challenge
challenging content
classroom instruction
curriculum
customized

design for diversity
differentiated instruction
digital media
digitized materials
diversity
diversity blueprint

educational reform
embedded supports
engagement
equalizers
expertise

flexible

impact on learning
individualize
instructional design
interactive

knowledge

learner differences

learning

learning theory

multiple means of representation

multiple means of expression

multiple means of engagement

outcome

performance

performance support

scaffolding

sliders that alter difficulty

standards

strategic learning

struggling students

teaching

Appendix A

Explorations in Universal Design for Learning

The resources on this page provide a glimpse of how the principles of UDL have been used to design instructional materials in ways that proactively anticipate and support academic diversity so that students experience success from the outset.

1. Before/After

Visit the following web page to explore how academic access problems have interfered with student learning and how proactively providing accessible tools makes it possible for students to engage and achieve.

The Florida Universal Access Project
<http://www.paec.org/fdlrstech/ua/ua.html>

2. Brief Scenarios

a. Talking Web Pages

Many students have difficulty accessing information in print formats. Consider the following example where web designers included speech so that visitors to every level one page can listen to the text being read:

StarChild
<http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html>

b. Tiered Multilingual Web Pages

Given the academic diversity in every classroom, here is an example of information presented at multiple levels so that students can select the level that interests them. Clicking on a language link will present the information in English or Spanish.

Windows to the Universe
<http://www.windows.ucar.edu>

c. Embedded Supports

Thinking Reader is a new software product that provides text to speech support for all students and layers instructional supports based on the level of support that each student needs.

Thinking Reader

<http://www.tomsnyder.com/products/product.asp?SKU=THITHI>

Appendix B Resources

1. Books

Castellani, J., Mason, C., & Orkwis, R. (2005). *Universal design for learning: A guide for teachers and education professionals*. Arlington, VA: Council for Exceptional Children.

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5. Web Sites

Australia

State Disability Liaison Office: How to Produce Accessible Materials
<http://www.ecu.edu.au/equity/accessedu/staff-howto.php>

Canada

Creating Barrier Free Broadband Learning Environments
<http://www.barrierfree.ca/>

Designing Accessible Curriculum
http://snow.utoronto.ca/prof_dev/ict/access/contents.html

Scotland

The Teachability Project at the University of Strathclyd
<http://www.teachability.strath.ac.uk/>

United States

CAST
<http://www.cast.org>

The Center for Universal Design
<http://www.design.ncsu.edu/cud/>

National Alternate Assessment Center
<http://www.naacpartners.org/>

National Center on Educational Outcomes
<http://education.umn.edu/nceo/>

NIMAS
<http://nimas.cast.org>

Universal Design Education Online
<http://www.udeducation.org/>

6. Legal/Policy Documents

Arizona 2004 Textbook Accessibility Law
<http://www.azdisabilityadvocacy.org/ProgramNewsArticle.cfm?articleID=746>

State-by-state Chart of Braille Laws
<http://www.afb.org/Section.asp?SectionID=44&TopicID=192&DocumentID=2986>

U.S. States and Territories Accessible Curriculum Survey: A Summary of State and Territory Laws Pertaining to the Provision of Accessible Materials for K-12 Students with Print Disabilities
<http://nimas.cast.org/about/resources/statessurvey.html>

7. Educational Practices

A Primer on Universal Design in Education
<http://www.uwm.edu/~edyburn/ud.html>

Access Ed Project
<http://www.uwm.edu/CHS/r2d2/access-ed/>

Florida Universal Access Project
<http://www.paec.org/fdlrstech/ua/ua.html>

Illinois Infinitec UD Lesson Plans
<http://www.infinitec.org/programsservices.htm>

Kansas Infinitec UD Lesson Plans
<http://ks.myinfinitec.org/>

PATINS Universal Design for Learning Project

http://www.patinsproject.com/universal_design_for_learning_project.htm

UDL in New York State

<http://trecenter.org/udl/index.html>