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Universal Design for Learning at the University of Northern Iowa

Abstract

Universal Design for Learning has the potential to minimize the need for assistive technologies and to maximize learning opportunities for all. Recognition of diverse learning styles is prevalent in K-12 settings, but rare in higher education, making this an area requiring additional focus. Understanding key principles and specific strategies that can be implemented in a postsecondary setting can significantly influence success in postsecondary and adult learning environments.

This review and the accompanying project defines *Universal Design for Learning*, explains the underlying science, identifies the three guiding principles, and discusses course design methods. Opportunities associated with implementing UDL at postsecondary institutions were explored, with conclusions and suggestions for future research offered. The results of this review and project can be used by instructional designers and instructors to design, develop, and deliver effective professional development opportunities at institutions of higher education, including the University of Northern Iowa

UNIVERSAL DESIGN FOR LEARNING

AT THE UNIVERSITY OF NORTHERN IOWA

Graduate Project Documentation

Submitted to the

Division of Instructional Technology

Department of Curriculum and Instruction

In Partial Fulfillment

Of the Requirements for the Degree

Master of Arts

UNIVERSITY OF NORTHERN IOWA

by

Marty Mark

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Project Documentation by: Marty Mark

Titled: Universal Design for Learning at the University of Northern Iowa

has been approved as meeting the research requirement for the

Degree of Master of Arts.

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Introduction

"Suddenly, the light dawned! We realized that barriers to learning are not, in fact, inherent in the capacities of learners, but instead arise in learners' interactions with inflexible educational materials and methods," explained Rose and Meyer (2002, p. vi). Originally established to eliminate architectural barriers for those with accessibility requirements, educators have recognized universal design as a strategy that can be used to address individual learning styles. Universal Design for Learning (UDL) provides a framework for course structure, individualized instruction, assessment, and academic engagement

Purpose

The purpose of this graduate project was to examine *Universal Design for Learning* and how this design strategy can be used to address differentiated learning needs in a postsecondary setting. A web site was developed that seeks to define *Universal Design for Learning* and to provide the information and strategies essential for the design of quality, standards-based, online professional development opportunities for staff at the University of Northern Iowa (UNI). Project guiding principles and standards included *Universal Design for Learning*, United States Federal Government legislation that establishes accessibility requirements, and the *Quality Matters*[TM] Program.

Universal Design for Learning has the potential to minimize the need for assistive technologies and to maximize learning opportunities for all. Recognition of diverse learning styles is prevalent in K-12 settings, but rare in higher education, making this an area requiring additional focus. Understanding key principles and specific strategies that can be implemented in a postsecondary setting can significantly influence success in postsecondary and adult learning environments.

This review and the accompanying project defines *Universal Design for Learning*, explains the underlying science, identifies the three guiding principles, and discusses course design methods. A web site was developed to serve as a toolkit for instructional designers and instructors to facilitate the design of quality, standards-based, online professional development courses. Opportunities associated with implementing UDL at postsecondary institutions were explored, with conclusions and suggestions for future research offered. The results of this review and project can be used by instructional designers and instructors to design, develop, and deliver effective professional development opportunities at institutions of higher education, including the University of Northern Iowa.

Three research questions guide this review.

- How does *Universal Design for Learning* influence the structure and delivery of online courses?

- How can accessibility barriers be mitigated when developing online course materials?

- Do *Quality Matters* standards and strategies improve student outcomes?

Terms

Accessibility: Accessibility most commonly refers to providing access to environments to all people, including those with disabilities (National Center on Accessible Instructional Materials, 2012).

Assistive Technology: Any item, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities (Assistive Technology Act of 1998).

Instructional Design: The theory and practice of design, development, utilization, management, and evaluation of processes and resources for learning (Seels & Richey, 1994).

Quality Matters Program: Quality Matters (QM) is a faculty-centered, peer review process that is designed to certify the quality of online and blended courses. QM is a leader in quality assurance for online education, and has received national recognition for its peer-based approach and continuous improvement in online education and student learning (*Quality Matters*, 2012).

Universal Design for Learning: Universal Design for Learning (UDL) as a research-based framework for designing curricula; that is, educational goals, methods, materials, and assessments which enable all individuals to gain knowledge, skills, and enthusiasm for learning. This is accomplished by simultaneously providing rich supports for learning and reducing barriers to the curriculum, while maintaining high achievement standards for all students (CAST, 2012).

Literature Review

Postsecondary faculty, student, and staff populations are increasingly diverse, yet research exists suggesting current educational practices do not respond effectively to the varied needs of students. Santangelo and Tomlinson (2009) reported that several factors influence postsecondary learning outcomes, including course design and effective instructional techniques. *Universal Design for Learning (UDL)* is a set of principles and strategies guiding the development of course materials, intended to provide all students with equal opportunities to learn. An understanding of *Universal Design for Learning,* including its origins, science, and principles, can have a significant influence on meeting the needs of a postsecondary student population.

The Origins of Universal Design

Universal Design, created by Ron Mace at North Carolina State University, is an architectural approach to the design of structures. The primary goal of universal design is to create structures that accommodate a wide variety of individuals, including those with disabilities, without the need for special adaptation. By considering the needs of all users at the onset, universal accessibility becomes part of the fabric of building design. Through the use of universal design strategies in architecture, Rose and Meyer (2002) discovered that "addressing the divergent needs of special populations increases usability for everyone" (p. 71). *Universal Design for Learning* extends universal design in two important ways: it applies the idea of built-in flexibility to the education curriculum, and it improves access to information and learning.

The Underlying Science and Guiding Principles

Universal Design for Learning is based on three human brain neurological networks directly involved in learning. Three guiding design principles align with the recognition, strategic, and affective neurological networks to form the foundation of UDL.

The first principle requires that multiple, flexible methods of presentation be used to deliver course content. This includes the use of numerous and varied methods of representing information and transferring knowledge. Rose and Meyer (2002) recommended a variety of techniques including the use of visual, verbal, and auditory formats to represent information, multiple examples, highlighting critical features, and the use of prior knowledge. This principle is supported by the recognition network, responsible for the ability to recognize patterns, objects, and events.

The second principle requires that multiple, flexible methods of expression and apprenticeship be made available to students. It is not enough to acquire information. Expressing what has been learned is essential. Courses must accommodate alternative means for students to express and apply the knowledge acquired. This principle is supported by the strategic network, responsible for the ability to plan, execute, and monitor skills and actions.

The third principle requires that multiple, flexible options for engagement are offered. An environment with a variety of conditions and rewards that motivate and develop student curiosity is supported by the affective network. This network is responsible for emotion and affect, allowing individuals to identify what is important.

The highly individual and specialized processes within each network reveal that each student possesses a unique collection of strengths, weaknesses, and preferences. As a result, there are no typical or normal students and flexible learning environments should be constructed to accommodate all.

Postsecondary Course Design Methods

In the area of course design, *Universal Design for Learning* offers a constructive framework from which unique learning can occur. Researchers have identified key areas to address when developing postsecondary UDL-based courses, including course structure; methods and media; assessment, and scaffolding.

Course Structure

A clearly established course structure is essential for individualized learning, providing students with a broader understanding of course content and how to apply what is learned. Santangelo and Tomlinson (2009) found in their research that distinctly defining the areas of knowledge, understanding, and skills allowed activities to align with course goals,

providing the foundation for successful differentiated learning. Using this information, students are provided with the tools to prioritize and approach course activities in an effective manner. Postsecondary strategies recommended for effective course structure include:

- the establishment of a course syllabus;

- the identification of learning outcomes, objectives, and goals;

- clearly stated course requirements;

- clearly defined assessment strategies and measurements for success;

- the use of consistent navigational techniques;

- a student code of conduct;

- instructor contact information.

Course materials should be delivered through a variety of media and must directly contribute to achievement of the stated course learning objectives. In support of the second principle, *Universal Design for Learning* goals and objectives must also include an expressive element, providing varied means for students to convey what they have learned and how this knowledge can be applied. Finally, assisting students with determining how they learn at the onset of a course helps students to establish personal learning goals and methods to achieve these goals.

Methods and Media

Universal Design for Learning courses use a variety of methods and media that reflect student levels of readiness, interest, and learning profiles. Audio, visual, graphical, and text-based technologies are selected in support of student collaboration, social networking, scaffolding, and self-expression. While a number of new technology options are now available to course designers, Rose, Harbour, Johnston, Daley, and Abarbanell (2006)

reported that traditional postsecondary courses remain dominated by lectures, textbooks, and discussion. With modification and the use of technology, lectures, textbooks, and discussion can become components of a *Universal Design for Learning* centered course.

An inherent value of the lecture is the ability to include expressive vocal, facial, and body motion elements in the delivery of content, something not easily replicated using the written word. However, the limitations of the lecture result in inaccessibility for a segment of the population that may experience language, cognitive, or physical barriers. In support of the first principle, a course based on UDL concepts provides alternatives or modifications to the standard lecture. Rose, Harbour, Johnston, Daley, and Abarbanell (2006) offered mitigating strategies, including video and posting digital student notes on the course web site. In the area of student notes, universal design concepts are clearly apparent in that students take notes in varying ways, including linear, bulleted outlines, expressive, graphic, and expansive.

Traditional textbooks create barriers to learning for some, yet Rose, Harbour, Johnston, Daley, and Abarbanell (2006) maintained that student choice can be an effective strategy to support differentiated learning. Allowing students the freedom to select one in a series of preapproved course textbooks based on a student's style of learning and preexisting level of understanding can set the stage for individualized learning. In addition, allowing students to select the medium, including printed and digital formats, can accommodate individual circumstances. Choice and flexibility in the use of textbooks supports the UDL principle requiring multiple, flexible methods of presentation.

Student discussion and group collaboration is often viewed as complementary to lectures, assigned readings, and other course activities. Providing flexible, multiple means and methods for discussion supports the UDL principle for student engagement. *Universal*

Design for Learning seeks to engage students through correlating what is learned with personal experience, often in-group or student-directed learning activities. To ensure that discussion is not a limiting method for some learners, Rose, Harbour, Johnston, Daley, and Abarbanell (2006) suggested that discussion be scheduled at varying times throughout the week and that students be allowed to choose their level of participation. Varying types of discussions are also recommended. Review sessions should be offered, providing students the opportunity to ask questions, participate in a review of current content, express concerns, and discuss implications for the material. To reach those students with an advanced understanding of the material, optional discussions should be scheduled to delve more deeply into the content, generating new and stimulating discussion. The medium for participation should vary, with the designer using a variety of tools and services to facilitate discussion.

Assessment

In the area of assessment, *The National Center on Universal Design for Learning* maintained that to establish an accurate measure of knowledge, skills, and engagement, barriers to the demonstration of knowledge must be removed. The organization suggested that the removal of barriers can be accomplished by offering multiple, varied opportunities for the demonstration of knowledge, as well as providing ongoing, timely, and comprehensive feedback to students. Examples of varied means include examinations, group activities, written papers, presentations, audio documentaries, research, multimedia projects, and many others.

These recommendations are substantiated by Dolan, Hall, Banerjee, Chun, and Strangman (2005) in their delayed treatment control group research initiative that measured student scores before and after the application of *Universal Design for Learning* assessment

techniques. Two contrasting testing environments were constructed to deliver a national assessment instrument to students. The assessment was delivered via traditional paper-and-pencil method and then via a computer-based system with optional text-to-speech functionality. The study affirmed the stated hypothesis that applying UDL assessment techniques will increase scores when barriers to the assessment tool are removed.

Kettler, Elliott, and Beddow (2009) also confirmed the positive value of UDL-based assessment techniques. The study was conducted to determine whether tests comprised of modified items could help reduce the performance gap between students with disabilities and those without disabilities. Modifications included changes in content, format, and administration procedures. Their randomized experimental comparison study revealed that standardized test items can be successfully modified to improve accessibility to the test while maintaining the reliability and consistency found in the original version of the assessment.

Scaffolding

Scaffolding and student support are essential components of a UDL-based course. Providing gradually released alternatives in content, mentoring, and modeling allow students to gain competency. Postsecondary level scaffolds and supports that instructors can provide include review sessions, opportunities for students to received feedback on assignments prior to submission, and supplemental readings to address learners with advanced prior knowledge.

Accessibility

In addition to addressing the needs of a diverse community of learners, *Universal Design for Learning* offers strategies for adherence to legislation governing accessibility in online learning. The Telecommunications Act, Section 255, the Rehabilitation Act of 1973,

Sections 504 and 508, and the Americans with Disabilities Act stipulated that individuals with disabilities must be provided equal access to programs, services, and activities. While *Universal Design for Learning* compliant courses are designed from the onset to address the needs of all learners, it is imperative that course materials and the technologies used to present information meet operability standards, allowing information to be retrieved and processed by every individual. Technology plays a vital role in education and in providing services to individuals. From ethical and legal standpoints, individuals should be provided equal access to programs, services, and activities.

To facilitate adherence to accessibility legislation, Creagan (2012) offered a number of suggestions to ensure that assistive technologies allow the individual access to information. Strategies include the appropriate formatting of electronic documents, closed captioned videos, video transcripts, proper labeling of images and graphics, a variety of web site accessibility techniques, and the appropriate use of color, contrast, and fonts.

Quality Matters

Universal Design for Learning and accessibility techniques provide a foundation for effective course design, yet it is also important to design online courses that meet quality assurance standards derived from research-driven best practices. Parsal and Riemer (2010) stated that the rapid expansion of online courses and programs, combined with the demand for accountability and transparency, has resulted in the need to establish and maintain a high level of quality. Pape, Reenaugh, and Wicks (2007) further stated that this rapid growth has challenged educational institutions and revealed the lack of consistency across programs. To ensure that positive student outcomes are realized, context, effort, and external validation are required to assess quality.

To meet these challenges and requirements, *Maryland Online*, a consortium of community colleges and senior institutions, received a grant to create a replicable, inter-institutional, continuous improvement model to produce and assess quality online courses (Sener, 2006). The consortium developed the *Quality Matters* (QM) Program, a faculty-centered, peer review process designed to certify the quality of online courses. The program is comprised of a rubric, the peer review process, and professional development. This nationally recognized set of standards assists the instructional designer in the areas of course overview and introduction, learning objectives, assessment and measurement, learner interaction and engagement, technology, learner support, and accessibility. Swan, Matthews, Bogle, Boles, and Day (2012) studied the impact of applying *Quality Matters* standards on existing courses and concluded that QM techniques improve the quality of course design which leads to improved student engagement and outcomes.

Methodology

At the University of Northern Iowa, there was a growing need for the effective delivery of professional development training opportunities for staff. Traditionally, courses had been delivered using a face-to-face, instructor-led model. However, changing demographics of staff, limited resources, legislation, audit recommendations, attrition, and the need to deliver consistent, quality courses resulted in the need to move to an online model. *Universal Design for Learning*, accessibility, and *Quality Matters* concepts were selected to provide the framework from which the online courses will be developed by instructional developers located in the department of Administration & Finance Technology Services (AF Technology Services).

Design

To facilitate the design and development of effective online learning environments, it was determined that a web site should be developed to deliver conceptual information and specific strategies necessary for the design of quality, standards-based, online professional development courses. The site is intended to guide the instructional designer through the process of developing online courses that adhere to UDL, accessibility, and *Quality Matters* principles. Prior to development of the site, an outline was constructed and specific resources were selected to support the processes and procedures instructional designers will use. Primary units of the site include:

- *Universal Design for Learning*
- Accessibility Legislation
- *Quality Matters*
- Course Development Process

- Developer Toolkit

Development

Google Sites was selected as the web platform to provide information to instructional designers at the University of Northern Iowa. The web site is titled "Universal Design for Learning @ The University of Northern Iowa" or UDL@UNI. A logo was developed to brand the site and will be used to label online courses that were developed using UDL@UNI strategies. The UDL@UNI site will ultimately become a component of the AF Technology Services web site and, as a result, consistent fonts, background image, and colors were selected. Introductory text was developed and a welcome video was recorded, closed captioned, uploaded to YouTube, and embedded in the home page. Google Drive and Design were also used to support components of the site.

Instructional strategies used by UNI Department of Curriculum and Instruction were incorporated into the site including relevant videos, Twitter feeds, images, and external links to related sites. In addition, materials obtained from Instructional Technology coursework were incorporated into the site, including a syllabus template, a course design template, checklists to ensure that guiding principles have been addressed, web 2.0 technologies, copyright, and ethical use information.

The following techniques were used to ensure that the UDL@UNI site adheres to the standards that it encourages instructional designers and instructors to incorporate into their learning environments:

- Color contrast analysis

- Audio recordings of each web page

- Closed captioned video

- Written transcripts of each video and instructional image

- Microsoft Word accessibility techniques

- Web accessibility techniques (i.e., alt tags for images, section headers, table headers)

- Consistent site format and navigation

- WAVE accessibility analysis (http://wave.webaim.org/)

Management

The resources selected for the project were obtained from a variety of sources, including printed and digital materials, interviews, social media, and conference presentations. Online databases and tools used to locate resources include: the University of Northern Iowa's Panther Prowler search engine, the *Education Resources Information Center (ERIC/EBSCO)*, the *Center for Applied Special Technology (CAST)*, the *National Center on Universal Design for Learning, Google Scholar*, the *Social Science Citation Index*, the *Remedial and Special Education Journal, Google Alert, Facebook, Blogs,* and *Twitter.* Printed materials were obtained from the University of Northern Iowa Rod Library collection.

Key word searches were used to locate relevant, peer-reviewed materials for use in this analysis. Descriptors used include differentiated learning, universal design, UDL, postsecondary, accessibility, assessment, accommodations, *Quality Matters*, and higher education. Sources cited in selected research were examined, with relevant materials analyzed and cited. The names of recognized experts in the field of *Universal Design for Learning* were also used as keywords, including Anne Meyer and David H. Rose.

The criteria for selecting materials consisted of relevance to topic, content quality, author(s), and the year of the publication. To ensure that the most recent findings were examined, materials published within the last five years were targeted. Finally, materials recognized by the educational community as being authoritative, or cited by related research, were reviewed.

During the final selection process, the abstract and findings sections of each article were analyzed to gain an overall understanding of the content. Publications that addressed at least one of the established research questions posed in this review were then read thoroughly. An outline of each article was created and key information was recorded. Finally, a research table was created containing detailed and summary information related to each publication. Data elements in the table include title, author(s), publication date, web site address, area of focus, and a broad summary of the content.

In addition to literature research, personal interviews were conducted with leaders in the fields of *Universal Design for Learning*, accessibility, and *Quality Matters*. Those interviewed from the University of Northern Iowa include: Dr. Deborah Gallagher, Professor, Special Education; Therese Callaghan, Employee Disability and Leave Coordinator, Human Resource Services; and Belle Cowden, Director, Continuing and Distance Education/*Quality Matters* Institutional Representative.

On October 10, 2012, the University of Northern Iowa hosted the Iowa Regents Institutions Disabilities Awareness Summit. During the summit, numerous presentations were attended, including the keynote address titled "Accessible Technology: Section 508 and Section 255", delivered by Timothy Creagan, Senior Accessibility Specialist, United States Access Board.

Utilization

Instructional designers are encouraged to follow a five-stage, cyclical course development and delivery process, based on the ADDIE Instructional Design Model (Boling, Easterling, Hardre, Howard, & Roman, 2011). The UDL@UNI site includes a comprehensive workflow diagram that defines each stage of the process and steps the designer through the course development process. The site defines each stage and provides detailed instructions for completing each stage. Stages include:

- Planning

  During the planning stage, learning goals are established and *Universal Design for Learning*, *Quality Matters*, and accessibility techniques are selected using a design matrix that is posted on the UDL@UNI site.

- Development

  During the development stage, the course is created in the University's learning management system, content is created, and technologies are selected.

- Evaluation

  During the evaluation stage, the course is assessed using UDL, *Quality Matters*, and accessibility checklists. The course is then piloted and adjustments are made.

- Delivery

  During the delivery stage, the course is released to students for use.

- Refinement

  At the conclusion of the course, effectiveness is evaluated and the instructor returns to the design stage to make any necessary adjustments.

While developing course content, the instructional designer was advised to consider the 1996 version of the Bloom's Taxonomy pyramid, which classifies levels of intellectual learning (Fallahi & LaMonaca, 2009). UDL@UNI briefly defined each level of thinking skills and included images that depict the learning pyramid and the pyramid applying web 2.0 tools.

In addition to guiding the instructional designer through the development process, UDL@UNI also offered a toolkit that includes specific instructions for ensuring course materials adhere to legislated accessibility requirements. UNI licensed technologies were listed with information that assists the designer with locating the tools selected for use. Specific *Universal Design for Learning* techniques in the areas of representation, expression, and engagement were detailed. Copyright and fair use information was presented, including copyright and fair use checklists.

Evaluation

The UDL@UNI site was designed using methods and techniques that were revealed during the research process, concepts learned through academic experiences in the UNI Instructional Technology master's program, and knowledge acquired during the development of online, professional development courses at UNI. Formative and summative evaluations were conducted, resulting in various adjustments to the site. A pilot project, during which a UNI AF Technology Services staff member used the site to design an online, financial course for the University community, was conducted. Feedback from the instructional designer was considered and adjustments were made.

The Project

The UDL@UNI web site is accessible by individuals affiliated with the University of Northern Iowa. To access the site, the visitor opens the site's Uniform Resource Locator (URL) http://www.vpaf.uni.edu/udl-uni with preferred web browsing software. The site navigational menu, which can be found on all web site pages, is located on the left side of the screen.

The home page of the site states the purpose and intended use of the site. A closed captioned welcome video is available for viewing. Links to the University of Northern Iowa Instructional Technology Program and graduate project documentation are available.

The *Universal Design for Learning* page of the site defines UDL, describes its origins, details the guiding principles and underlying sciences, and explains the benefits of UDL for a diverse population. Three videos produced by CAST, a nonprofit research and development organization that works to expand learning opportunities through the use of *Universal Design for Learning*, are embedded in the page. The videos introduce the viewer to UDL, including an interview with its co-founder, David Rose. CAST and National Center on UDL Twitter feeds also appear on the page and are continuously updated with the latest posts and links to information.

The Legislation web page, lists United States Federal Legislation governing accessibility and describes its relevance for education. Links to United States Government information pertaining to legislation are included.

The *Quality Matters* page briefly describes the online course quality review and assurance program. The 2011-2013 rubric standards are listed and University of Northern Iowa contact information is displayed.

The Course Development Process page describes the five-stage online course development and delivery process. Workflow diagrams that depict specific steps in the process are provided. Many of the steps link to accompanying templates or documents that the designer can use to guide their work.

The Tools@UNI series of web pages assist the designer during the Planning and Design stages of course development. Strategies and techniques combine to help produce online learning environments that adhere to UDL, accessibility, and quality standards. Bloom's Taxonomy is introduced as the basis for ensuring that higher order thinking skills are targeted and that technologies selected provide appropriate support. Technologies available to the designer are listed with AF Technology Services licensing information included.

Fundamental to the site is a *Universal Design for Learning* and *Quality Matters* Design Matrix that offers specific instructions for addressing UDL's principles of representation, expression, and engagement. The UDL strategies listed in the matrix are also associated with specific *Quality Matters* standards.

In addition, detailed instructions for creating accessible course materials are provided. Technologies and formats addressed include web sites, Adobe PDF, video, audio, fonts, color and contrast, Microsoft Word, Excel, and PowerPoint.

Copyright and Fair Use information can also be found in the Tools@UNI series of web pages. Copyright, Fair Use, the Digital Millennium Copyright Act (DMCA), the TEACH Act, Public Domain, Creative Commons are addressed. A Fair Use Checklist and Copyright Decision Tree are intended to guide the designer in assessing appropriate use of materials.

Conclusions and Recommendations

Universal Design for Learning (UDL) encourages course designers and educators to view barriers to learning as environmental, rather than individual. It offers options and perspectives that ultimately benefit all students, regardless of circumstance. Given the increasingly diverse needs of the postsecondary student population, accessibility is no longer enough. Successful learning requires that information be provided to students using a variety of methods, allowing students to act upon the information in an engaging and motivating manner. Fundamental areas to address when developing UDL-based courses include course structure, methods and media, assessment, and scaffolding.

Traditional postsecondary courses typically include fundamental structural elements including a course syllabus; learning outcomes; objectives; goals; course requirements; assessment strategies and measurements for success; a code of conduct; and instructor contact information. While these are important elements in any learning environment, they are essential in the support of individualized learning. Providing students the means by which they can establish individual learning goals, self-evaluate progress, communicate effectively with others, clearly express what they have learned, and apply knowledge is the essence of *Universal Design for Learning*. Delivering this information to students in a clear and concise manner at the onset of a course helps lay the foundation for learning expectations and student success.

The emergence of distance education and blended courses presents an ideal opportunity to implement *Universal Design for Learning* strategies supported by new technologies. Technology allows information to be presented in multiple formats, using multiple media, resulting in a differentiated learning environment. Rose, Harbor, Johnston,

Daley, and Abarbanell (2006) reported that postsecondary courses continue to be dominated by lectures, textbooks, and discussion. Through the use of new technologies, instructors can modify these delivery methods and include them as components of courses adhering to the principles of *Universal Design for Learning*. Through varied delivery methods and mediums, traditional barriers presented by these instructional techniques are removed, providing students with an engaging, personal learning experience.

Constructing a varied, effective, and engaging learning environment requires a significant amount of instructor time, effort, and dedication. The ability to make adjustments as a course progresses is necessary to address the individual needs of learners and the scaffolding of content. It is important that additional research be conducted to help substantiate positive learning outcomes, encouraging postsecondary institutions to invest further in *Universal Design for Learning*. The following are recommendations for future research and UDL@UNI enhancements:

Universal Design for Learning must do more than provide students with alternatives; its effectiveness must be measurable. Research that answers the following questions is recommended. Can a standardized mechanism be developed to measure effectiveness through student performance? What standards allow one to recognize when UDL is present or absent?

Edyburn (2010) indicated that the implementation of *Universal Design for Learning* appears to be increasing, yet a need exists to build design blueprints or templates based on research that identifies and measures successful strategies. Research that clearly defines the strategies and methods used in support of *Universal Design for Learning* is necessary.

Given the complicated and comprehensive nature of UDL-based course design, it is

important that a study of the required design skills and time requirements be completed. This information will help to define staffing requirements, the role of the instructor in the process, and the structure needed to effectively support this environment.

In the future, it is recommended that courses developed using the UDL@UNI toolkit be analyzed for effectiveness. Using analysis results, appropriate site changes should be made. It is also recommended that examples of courses designed using UDL@UNI concepts be posted to the site to serve as reference.

Universal Design for Learning, Quality Matters, and accessibility techniques combine to offer a standards-based framework from which individualized learning can take place. Acceptance and adoption of *Universal Design for Learning* principles in the design of learning environments can have a profound impact on students. It is anticipated that the results of this project might be successfully applied to professional development opportunities at institutions of higher learning.

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