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Chapko, Nancy A. ***An Investigation into the Application of Universal Design for Learning Techniques by Wisconsin Technical College System Faculty and Staff***

Abstract

Rapid growth in the number of adult learners combined with an increase in their demand for online learning has intensified the need for high quality online course content that is designed for the largest possible audience of learners. Without physical and cognitive access to content, learning cannot occur. Universal Design for Learning (UDL) is an approach to course development that provides multiple means of representation, multiple means of action and expression, and multiple means of engagement. UDL is based on a set of principles for developing curriculum that provides all individuals equal opportunities to learn. Applied to the online learning environment, these UDL principles support techniques that eliminate physical and cognitive barriers to online course content. Those who create online learning content should consider the purpose of the content and the intended audience. Online instructors should acquire skill in the application of UDL principles to course design, development, and delivery to meet the needs of increasingly diverse online adult learners.

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Chapter I: Introduction

In a scene repeated countless times a day in schools, homes, and the workplace, an adult learner logs into a computer-based Learning Management System (LMS) to access an online class. Learning online is an attractive option for adults with their many competing priorities. Unencumbered by constraints of time and space that characterize the traditional classroom, the digital delivery of course content may provide online learners with much-desired flexibility.

Valued by adult learners, flexibility is one of the top three attributes considered by adult learners selecting a program or course (Eduventures, 2008). Almost half of adult learners considering non-traditional course delivery are likely or very likely to enroll in a course or program delivered online exclusively (Eduventures, 2008). In its report of online learning statistics (Online learning: By the numbers, 2010), The Chronicle of Higher Education described the growth in enrollments of students taking at least one online course. In 2003, 12% of all learners surveyed took at least one online course. By 2008, that number more than doubled, increasing to 25% of all surveyed learners. Another study found (Allen & Seaman, 2011) that, among higher education students, 31% now take at least one course online.

Aslanian and Giles (n.d.) characterized online learning as growing dramatically and having a profound effect on adult education. In fact, traditional learning shows every sign of becoming far less traditional. A number of institutions of higher learning, among them the University System of Maryland and the Minnesota State Colleges and Universities System, require their learners to complete at least a prescribed portion of coursework in alternative delivery modes, including online learning (Parry, 2010). The delivery of adult online learning is rapidly transforming, and this has implications for those who design, develop, and deliver adult learning.

Adult demand for online learning has increased, and so has the number of adult learners demanding it. Aud et al. (2011) noted that between 2000 and 2009 undergraduate enrollment in degree-granting postsecondary institutions increased by 34%, from 13.2 to 17.6 million students. Post-baccalaureate enrollment has increased every year since 1983, reaching 2.9 million students in 2009 (Aud et al., 2011). Projections indicate that demand for both undergraduate and post-baccalaureate programs will continue to increase. Undergraduate enrollments are predicted to reach 19.6 million students in 2020, and enrollment in post-baccalaureate programs is projected to increase through 2020 to 3.4 million students (Aud et al., 2011).

Bringing their unique skills, experiences, and learning styles to the online classroom, adult learners benefit from courses developed according to UDL principles (Engleman & Jeffs, 2008). Originally a concept applied to physical architecture (Coombs, 2010), universal design fosters the creation of buildings and objects that are accessible to the largest audience of individuals possible. In the context of online learning, universal design extends to course design, development, and delivery through the application of techniques that support the principles of UDL: provide multiple means of content representation, learner action and expression, and learner engagement (CAST, 2012c). Universal Design for Learning promotes strategies and techniques, such as the use of electronic textbooks, to provide both physical and cognitive access to course content (Edyburn, 2010).

Increasing demand for both adult higher level learning and online content delivery poses challenges and opportunities. Providing adults with skills valued in the workplace is an opportunity. Providing online course content and delivery that meets the needs of diverse adult learners is a significant challenge. This challenge is acknowledged by public, private non-profit, and private for-profit institutions of higher education. In their description of the state of online

education, Allen and Seaman (2011) reported that fully 65.5% of chief academic officers indicated online education is critical to the long-term strategy of their institutions. Technical colleges are no different from other institutions of higher learning that provide online learning. They face the same challenges and share similar opportunities.

A leader in public education, Wisconsin was the first state to create legislation supporting adult vocational and technical education (Wisconsin Technical College System, 2009a). This action in 1911 ensured that financial resources would be provided to the system that has evolved to the present-day Wisconsin Technical College System (WTCS). Consisting of 16 independent, geographically disparate technical college districts, WTCS prepares students for occupational competence by providing hands-on experience with entry-level job skills.

Wisconsin Technical Colleges collectively provided educational services to one of every nine Wisconsin adults during the 2009-2010 academic year (Wisconsin Technical College System, 2009c). These adult learners participated in their choice of nearly 300 programs of study including associate degree programs, technical diploma programs, certificate programs, and customized courses for business (Wisconsin Technical College System, 2009c). Despite the considerable variation in location, programming, and learner demographics, the 16 Wisconsin Technical Colleges have much in common. They share a mission to provide essential technical skills to adults and skilled workers to employers.

Adhering to a state-mandated instructor certification process (Wisconsin Technical College System Office, 2011), WTCS faculty and staff who support the instructional process complete a defined course of study that prepares them to design, develop, and deliver instruction to technical college students competently. Skilled WTCS instructors know they should not facilitate an online course effectively using a one-size-fits-all approach to learning. There is

significant variability in adult learner characteristics, the type of learning in which they engage, and their motivation for seeking postsecondary education. This researcher's observations as a WTCS online instructor and instructional designer suggest that many WTCS instructors would benefit from formal UDL training. It would enable them to design, develop, and deliver online course content that provides multiple means of content representation, learner action and expression, and learner engagement.

In 2010, Dr. Therese Willkomm, an internationally-recognized advocate of UDL strategies and clinical Assistant Professor of Occupational Therapy at the University of New Hampshire (The College Of Health And Human Services, 2011), presented a series of UDL workshops coordinated by Madison Area Technical College. Wisconsin Technical College System faculty and staff were invited to participate in the face-to-face workshop sessions. One session meet for a full week at Madison Area Technical College and the remaining sessions were full day or half-day sessions held at various Wisconsin Technical College locations. Almost all workshop participants were WTCS faculty and staff. A few were members of University of Wisconsin institutions and were not considered in this investigation. Dr. Willkomm is the Director of New Hampshire's State Assistive Technology Program with the Institute on Disability at the University of New Hampshire (The College of Health And Human Services, 2011). She is an authority with more than 25 years of experience in providing universal design services and assistive technology. The intent of the workshops was to provide participants with information about UDL and suggestions for implementing UDL strategies. Wisconsin Technical College System faculty and staff who participated in the training provided by Dr. Willkomm may have acquired skills or enhanced their ability to apply UDL techniques in their online teaching practice.

Statement of the Problem

It is not known if the faculty and staff who participated in Dr. Willkomm's UDL training were influenced by their participation to apply UDL techniques to the design, development, and delivery of their online courses.

Purpose of the Study

The purpose of this study was to determine if WTCS faculty and staff who participated in Dr. Willkomm's 2010 UDL training applied UDL techniques to the design, development, and delivery of their online courses.

Research Questions

The following questions were addressed in the study.

1. Did UDL training provided by Dr. Therese Willkomm in 2010 influence WTCS faculty and staff participants in their design, development, and delivery of online courses?
2. Were UDL techniques applied by WTCS faculty and staff to online course design, development, and delivery?
3. Which UDL techniques did WTCS faculty and staff apply to their online course design, development, and delivery?

Assumptions of the Study

This study assumed that some WTCS faculty and staff who participated in the UDL training provided in 2010 had responsibility for the design, development, or delivery of online courses. It further assumed that at least some of the survey participants applied UDL principles to the design, development, and delivery of their online courses. It was assumed that those who completed the survey did so with authenticity and that data collected by the survey was recorded consistently and accurately.

Definition of Terms

Adult Learner. A financially independent learner of adult chronological age frequently characterized by the assumption of job and family responsibilities.

LMS. A Learning Management System provides web-based support of online learning delivery and management.

Online Learning. Online learning is a subset of distance learning and is characterized by the web-based delivery of learning content that is accessible to learners at any time from any place with Internet connectivity.

UDL. Universal Design for Learning is a set of guidelines for the intentional development and delivery of learning content that provides access to the widest possible audience of learners.

WTCS. The Wisconsin Technical College System is the coordinating agency of the 16 Wisconsin technical college districts.

Limitations of the Study

A possible limitation of the study is that it assumes faculty and staff who completed the survey had some familiarity with the application of UDL techniques. Another possible limitation is that the respondents were employees of WTCS college districts and their responses should not be interpreted as indicative of a different population. Other possible limitations of the research include the following.

1. The investigation examined self-reported experiences.
2. The authenticity of responses was not established.
3. The survey instrument was designed by the researcher and had no established reliability.
4. Participant bias associated with personal attitudes about adult learners.

5. Participant bias related to personal attitudes about the online learning environment.
6. Participant bias associated with personal attitudes about UDL techniques and their application.

Methodology

Data was collected for this research using a 15 question web-based survey. With the support of the University of Wisconsin-Stout's Office of Planning, Assessment, Research, and Quality staff, the survey was developed by the researcher for this study. Therefore, it has no established reliability or validity. Participants selected responses from a list of options for 15 questions to describe their application of UDL techniques, their job responsibilities, and their job environment.

The University of Wisconsin-Stout's Institutional Review Board (IRB) for the Protection of Human Subjects approved the survey on February 22, 2012. Wisconsin Technical College System faculty and staff who participated in UDL workshops presented by Dr. Therese Willkomm in 2010 were invited on March 1, 2012, via e-mail message, to complete the research survey. The UDL workshop coordinator provided the researcher with a list of 271 names and e-mail addresses for the known workshop participants.

Subsequent chapters of this document provide: a review of literature that discusses adult learners, online learning, and UDL; the presentation of research data results; conclusions formed from research data; and, recommendations for future research.

Chapter II: Literature Review

This literature review describes the history of universal design and it adaptation to the learning environment. It focuses on the application of UDL strategies in the online learning environment and presents current practices and research associated with the preparation of online instructors in higher education. The review explores the significance of adult learning and the online learning environment, and it examines the manner in which higher education instructors prepare to implement UDL strategies.

Curb cuts, power-assisted doors, and audiobooks share a common goal; they were designed to enhance the usability of a product. Initially perceived as assistive methods for individuals with disabilities to access sidewalks, buildings, and book content, these three developments demonstrate how useful and sometimes unexpected things happen when products designed for individuals with disabilities reach the mainstream. Originally curb cuts were made in sidewalks to permit access to individuals in wheelchairs. However, people riding bikes, pushing strollers, and using roller blades and skate boards began to use curb cuts as well. The sidewalks redesigned for individuals with disabilities were simply better sidewalks for everyone. The speed with which most sidewalk users adapted to the curb cuts was quickly noticed. Engineers named this phenomenon the Curb-Cut Effect (Hogan, 2003). It described the common benefit experienced by most individuals when an accommodation is provided for individuals with disabilities. The effect has become so widespread that it is considered ordinary. Modifications to the environment, like the use of automatic doors and larger restroom spaces, are appreciated by everyone regardless of the reason for the modification which was usually to accommodate individuals with disabilities (Hogan, 2003). The Curb-Cut Effect is repeated every time development occurs with accessibility in mind.

Developed using an approach known as universal design, curb cuts, as well as power-assisted doors and audio books, can be used by most individuals without regard to their level of ability. Curb cuts provide easy access to sidewalks for individuals who are walking, running, riding, and pushing. Power-assisted doors benefit those with limited ability to open doors including children, the elderly, individuals with disabilities, and adults carrying packages or young children. Audio books offer access to book content to those who are visually impaired, lack reading skills, prefer listening rather than reading, and those who cannot read a book while engaged in another activity such as driving or exercising. In these examples, the potential audience of users is expanded simply because design considered accessibility.

Universal Design

Conceived by Ronald Mace, a fellow of the American Institute of Architects, the term universal design originally described an approach that ensured products and buildings could be used by virtually everyone regardless of their level of ability or disability (The Center for an Accessible Society, n.d.). After practicing conventional architecture for several years, Mr. Mace was invited by the North Carolina Governor's Study Committee on Architectural Barriers to help create a building code for accessibility (Center for Universal Design, 2002). As advisor to the committee, Mr. Mace worked to create a model of accessibility. In 1973 the committee's model was adopted and became mandatory in North Carolina (Center for Universal Design, 2010b). It was the nation's first comprehensive design for accessibility, and the building code that was developed served as a model for other states (Center for Universal Design, 2010b). Mr. Mace's contribution to universal design is especially significant as he used a wheelchair for most of his life. Afflicted with polio at the age of nine, Mr. Mace spent many years attempting to navigate

buildings that did not accommodate persons with disabilities (Center for Universal Design, 2002).

Acutely aware of the challenges faced by individuals using wheelchairs, Mr. Mace became an ardent advocate for people with disabilities and a proponent of universal design for accessibility (Center for Universal Design, 2010b). He was recognized as an international authority and designer who spoke widely and wrote seminal articles for both architectural publications and government reports about the need for universal accessibility (Center for Universal Design, 2010b). In 1992 Mr. Mace received the Distinguished Service Award of the President of the United States (Center for Universal Design, 2010b) for promoting dignity, equality, independence, and employment of people with disabilities. The Center for Universal Design at the School of Design at North Caroline State University in Raleigh continues the work begun by Mr. Mace. It is recognized as a leading international resource for research and information on universal design for housing and building (Center for Universal Design, 2010a).

Influenced by sweeping demographic, legislative, economic, and social changes, as well as the work of Mr. Mace and his colleagues, the universal design movement gained momentum in the 1990s (Center for Universal Design, 2011). Changing demographics were reflected in the increasing number of American older adults. Statistics from the United States Department of Health and Human Services (Administration on Aging, 2011) show that adults 65 years of age and older made up 4.1% of the total population in 1900. That number reached 8.1% of the total population in 1950, and by 2000, 12.4% of total population were 65 years or older. The Administration on Aging (2011) predicts an increase in the number of older individuals as a percent of total population. Improved healthcare, the reduction of formerly fatal diseases, and the ability to manage chronic conditions have influenced lifespan during the past century.

People are living longer and older adults constitute an increasingly larger percent of the population.

Although this investigation does not focus on learners with disabilities, it is important to understand the influence that individuals with disabilities had on the development of universal design. Individuals with disabilities represent one of the largest minority groups in the United States. They represent both sexes and virtually every ethnic, racial, cultural, and age group. An estimated 12% of non-institutionalized individuals of all ages in the United States reported living with a disability according to data collected through the American Community Survey in 2008 (Erickson, Lee, & von Schrader, 2010). In the age group 65 years and older, nearly 35% of United States non-institutionalized individuals reported living with a disability (Erickson et al., 2010). As defined by the American Community Survey, a disability is a limitation that affects activities of daily living (Erickson et al., 2010). Statistics about disabilities vary depending on the criteria used to describe them. The nature of disability may be severe or less severe. It may be permanent or temporary. People who are injured may be rehabilitated, and those who are ill may recover. However, the likelihood of disability increases with age as normal abilities diminish until the lack of ability is described as a disability (Hogan, 2003). It is inevitable, therefore, that the rate of disability will increase with the growing population of older adults. Many older adults and individuals with disabilities benefit from buildings that are universally designed. They are able to remain in their homes or in a home-like environment.

As the number of older adults and adults with disabilities grew in proportion to total population, they began demanding products and services to accommodate their needs. Universal design gained momentum between 1980 and 1990 (Center for Universal Design, 2011) by responding to the needs of this expanding consumer group. Recognizing the potential of offering

products and services usable by most consumers, manufacturers and service providers began offering products and services designed for the largest possible audience. The products designed by the OXO Company are an excellent example of corporate responsiveness to a diverse consumer market.

The recipient of more than 150 international honors for their product design and packaging (OXO, n.d. b), OXO is recognized globally for its well-executed universal design principles. Their corporate mission states "OXO is dedicated to providing innovative consumer products that make everyday living easier" (OXO, n.d. a). As a pioneer in the application of universal design techniques, OXO provides extensive information about its commitment to meeting the needs of the largest possible audience. The company owes its beginning to a house wares industry entrepreneur and a gerontologist who were determined to design kitchen tools that were comfortable to use. With help from retailers, consumers, and those in the food preparation industry, OXO introduced a set of ergonomically-designed, transgenerational tools to the American public in 1990 (OXO, n.d. c). The company's global visibility and its large number of awards, in recognition of the ability to design high quality products for people of all abilities, were noticed by other providers of goods and services. OXO's business model was soon copied by corporations interested in reaching the largest possible group of consumers (Center for Universal Design, 2011).

While demographic and social changes provided incentive for economic change during the 1990s, federal legislation guided the implementation of universal design principles in American culture. Significant legislation recognizing the rights of individuals with disabilities first appeared in the late 1960s (Center for Universal Design, 2011). The Architectural Barriers Act of 1968 provided for physical access to buildings. Section 504 of the Rehabilitation Act of

1973 made it illegal to discriminate on the basis of disability. The Americans with Disabilities Act of 1990 (ADA) created public awareness of the civil rights of the disabled and provided a uniform, nationwide mandate on physical access. Thus by the early 1990s, physical access to and within buildings, with limited exception, was assured for almost everyone, those with and those without disabilities. Providing cognitive access to learning content, however, was just beginning.

Universal Design for Learning

Innovations that grant physical access to all individuals are the result of universal design. Eliminating barriers to cognitive access is the result of Universal Design for Learning (CAST, 2012d). UDL evolved from efforts to provide effective educational experiences to students with learning disabilities. Fundamentally UDL is a set of principles for course design, development, and delivery that provide equal opportunities to learning (CAST, 2012c). The primary principles address multiple means of representation, multiple means of action and expression, and multiple means of engagement by providing a model for creating instructional goals, methods, and assessment that work for everyone (CAST, 2012c). Like universal design, which provides physical access, UDL uses a customizable approach to provide access to learning content.

In 1984, at a time when computers were being introduced to classrooms, a group of education researchers founded the Center for Applied Special Technology (CAST, 2012a). The organization, known as CAST, soon expanded their focus to include children with physical and sensory challenges. Throughout the 1990s, CAST supported the work of assistive technology. Later their work broadened to include cognitive accessibility for non-disabled children, UDL teacher training material, and instructional design guidelines. In 2008, CAST issued UDL Guidelines 1.0. Long in development, these peer-reviewed guidelines served as an articulation

of the UDL framework (CAST, 2012d). They were developed to assist in curriculum development and to help educators identify barriers in existing curriculum materials. Developed, in part, through peer review, CAST revised the original guidelines and released UDL Guidelines 2.0 in 2011. These were a significant revision to the original guidelines, and they recognized a broader definition of student to include learners of all ages and in a variety of environments (CAST, 2012b).

Implementing universal design in the learning environment is generally considered to be more difficult than implementing universal design in the building environment (Rose, Harbour, Johnston, Daley, & Abarbanell, 2006). Application of UDL has lagged behind that of universal design because implementation principles and techniques do not readily transfer from universal design to UDL (Rose et al., 2006). Building codes specifying universal design are uniformly interpreted. Principles for providing multiple means of representation, multiple means of action and expression, and multiple means of engagement are merely guidelines rather than codified procedure. Not only is UDL more difficult than universal design to implement, it lacks scientific validation (Edyburn, 2010).

Like universal design, UDL was guided by the passage of several pieces of significant legislation. The 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA) served as a catalyst for the development of UDL principles. Edyburn (2010) described the period between the earliest mention of UDL, in section 3 of the Assistive Technology Act of 1998, to CAST's introduction of UDL Guidelines 1.0 in 2008.

> Within a period of 10 years, UDL has captured the imagination of policy makers, researchers, administrators, and teachers. The mantra that evolved from our understanding of the value of curb cuts and the like, "good design for people with

> disabilities benefits everyone." provides a powerful rationale for exploring the large-scale application of UDL in education – the lack of a credible research base notwithstanding. (p. 34)

Despite general acceptance of UDL as a valuable concept, Edyburn (2010) stated UDL lacked scientific validation and suggested that its inclusion in federal law was prompted by eager lobbyists rather than credible research. He offered 10 propositions for consideration in the second decade of UDL the last of which states that UDL is much more complex than originally thought (Edyburn, 2010). He encouraged dialog about UDL principles and practices and attention to the UDL construct.

When UDL is applied to higher education, it provides strategies that promote inclusion (Izzo, Murray, & Novak, 2008; Gradel & Edson, 2009; Wu, 2010). Many of the strategies are implemented using technology. Gradel and Edson (2009) described several institutions of higher education that successfully implemented UDL. Their success was due, in part, to the power of digital text and web-based tools in applying UDL principles. UDL in higher education requires a collaborative approach (Pliner & Johnson, 2004). Since adult students are the recipients of UDL, they should participate in its design. This approach not only enhances access to content for learners, it invites their discussion in pedagogical decisions.

Faculty in higher education, faced with the complexity of UDL implementation (Edyburn, 2010), may be confused by the relationship between accommodations and UDL. Providing accessibility for learners who disclose a need for accommodation is generally a well-documented procedure in higher education. What might not be clear to faculty is how to provide accessibility to learners who may not qualify for accommodations but who would benefit from enhanced access to content. Ketterlin-Geller and Johnstone (2006) called this the spill-over

effect. They described how struggling readers, English language learners, and those from disadvantaged socioeconomic backgrounds benefited from content designed, developed, and delivered according to UDL principles. Significant for faculty is the differentiation Ketterlin-Geller and Johnstone (2006) provided between accommodations required for an individual learner and design enhancements benefitting all learners. Hirschman, Lemke, and Smith (2010) reported that nearly 25% of college students would benefit from UD in education. This is based on data (Hirschman et al., 2010) that showed learners may identify themselves as having an impairment to learning though not a learning disability.

Adult Learning

Creating content that appeals to the greatest possible audience of learners is a goal of many higher learning educators. Achieving this goal requires knowledge of adult learning principles, UDL strategies, and effective course development. Inclusive online learning environments foster adult learning by providing multiple means of representation, action and expression, and learner engagement. A large body of research describes how and why adults learn. Recent research (Plimmer & Schmidt, 2007; Rossiter, 2007; Walter, 2009) described adults as lifelong learners. Rossiter (2007) characterized adult learners as seeking possible selves and engaging in both transformational and transitional learning in their search. Plimmer and Schmidt (2007) portrayed adult learners as largely motivated by the desire to expand career opportunities and professional roles. The desire to change careers or broaden opportunities within a chosen career is a powerful motivator to engage in study. Hoare (2009) described adult learning as a developmental process which results in a change in behavior and reassessment of existing knowledge. For adults, learning is not merely the acquisition of knowledge; it is a

developmental process that creates a change in behavior and perception of knowledge that has an effect on the adult learner's personal environment.

Taylor (2008) stated transformative learning is unique to adult learning. He characterized it as interpretive. The adult learner compares existing frames of reference and develops revised interpretations. Recent medical imaging research suggests a neurobiological component to transformative learning (Taylor, 2008). Hormones secreted during search and discover learning activities actually influence the structure of the brain (Taylor, 2008). This implies that transformative learning is intentional and motivated by curiosity and discovery. Effective teaching is enhanced by an understanding of the neurobiological component of adult learning.

According to the United Stated Department of Labor, Bureau of Labor Statistics (2010b), 60% of the occupations predicted to be among the fastest growing during the period 2008-2018 require an associate degree or higher. Adults age 25 or older make up more than 40% of all higher education enrollments (Aslanian & Giles, n.d.). These students represent 35% of undergraduate students and 80% of graduate students. Most adult learners seeking course credit leading to a certificate or degree enroll at two-year, public institutions (Adult learning in focus: National and state-by-state data, 2008). Increasing numbers of nontraditional students and others who are unable to attend traditional, face-to-face classes access college and university programs through online coursework (Rudestam & Schoenholtz-Read, 2010).

Adult learners prefer alternative course delivery – particularly online (Allen & Seaman, 2010). In their annual report on the state of online education in the United States, Allen and Seaman (2010) indicated that online enrollments in higher education have grown significantly and at a much greater rate than higher education enrollments overall. According to their report, the number of students at postsecondary, degree-granting institutions who enrolled in at least one

online class grew from 1.6 million in fall 2002 to 5.6 million in fall 2009. Looking at this from another perspective, online enrollments at these institutions grew at a compound annual rate of 19% in this period while overall higher education enrollments grew at an annual rate less than 2% (Allen & Seaman, 2010). Online learning is a clear preference among adult learners. The number of continuing education and professional education courses offered via online participation to meet the needs of working adults has also increased (Rudestam & Schoenholtz-Read, 2010). Two year associate degree institutions, the Wisconsin Technical Colleges among them, had the highest growth rates of online enrollments during a five year period from approximately 2002 through 2007 (Allen & Seaman, 2007). Given this growth, there is a specific need for WTCS online instructors to have the knowledge and skill required to teach online adult learners.

The Adult Online Learner

Adults seek formal learning experiences as they transition from one life stage to another (Aslanian & Giles, n.d.). Their learning needs are specific and frequently linked to professional goals (Rudestam & Shoenholtz-Read, 2010). Qualities that uniquely identify an individual such as age, gender, class, culture, ethnicity, personality, and life experience influence the manner in which an adult learns most effectively. These unique qualities also influence the preferred manner of learning (Johnson & Magnan, 2009). Preferred learning styles are based on individual traits that influence how individuals approach learning and acquire knowledge and skill (Morrison, Ross, Kalman, & Kemp, 2011).

Learning style research is abundant. Jung proposed that individual learning style is determined by individual preference of adapting, introversion or extraversion, to the world (Riding & Rayner, 1998). Bloom published his taxonomy of learning domains in which he

described learning style as cognitive, affective, or psychomotor (Riding & Rayner, 1998). Kolb proposed his learning style model as the combination of two pair of variables, feeling-thinking and doing-watching, that exists on a continuum and are determined by individual preference (Riding & Rayner, 1998). Honey and Mumford created a learning style theory based on a variation of Kolb's model using different but similar descriptions for learning cycle components (Riding & Rayner, 1998). Gardner published his theory of multiple intelligences which described seven strategies for acquiring information. These theories are based on a theoretical model of learner-environment interaction. Each theory presents a specific framework of learning styles choices.

Several recent studies described notable characteristics and preferences of adult online learners that differentiate them from adults who learn in the traditional classroom (Merriam, 2008; Norton & Smith, 2007; Pliner & Johnson, 2004). Adult online learners tend to be employed full-time (Alsanian & Giles, n.d.). They tend to enroll in fewer courses in a given period of time than the traditional learner. They tend to engage in active learning after 5:00 p.m. and on weekends (Alsanian & Giles, n.d.). Although this investigation does not focus on adult online learners with disabilities, online instructors, particularly those teaching at two-year community and technical colleges, should expect a wide variety of learning styles in adult learners including some who may have a disability.

In 2009, 46% of disabled young adults, who were within four years of leaving high school, reported their enrollment in a postsecondary school (Newman, Wagner, Cameto, Knokey, & Shaver, 2010). These young adults participated in a National Longitudinal Transition Study. The majority of their enrollments, 32%, occurred in two-year or community colleges with an additional 23% of enrollments at vocational, business, or technical schools (Newman et

al., 2010). Flexibility of schedule and accessible course content appeal to many students, and it is likely that at least some of these disabled students enrolled in an online class. This is significant for higher education online instructors.

Requirements for documenting disability and determining the threshold for which accommodations may be requested vary among institutions of higher learning (Gregg, 2007). Considerable literature exists that describes guidelines for learners with physical disabilities but far less information is available about those with learning disabilities (Khajavinia, 2007). Yet there is a significantly larger population of adults with learning disabilities than physical disabilities (Khajavinia, 2007). The American with Disabilities Act (ADA) requires that online courses meet the needs of students with disabilities. Institutional LMS can be modified to ensure compliance. Individual course content developed by an online instructor, however, may not be subject to institutional review. This suggests that a proactive design approach and continual review is required to ensure that all learners can access course content with few barriers (Khajavinia, 2007).

UDL and Adult Online Learning

Universal Design for Learning focuses on learning support. It emphasizes the removal of potential barriers for all or most learners during online course design. This reduces the need to provide individual learner adaptation to course content at a later time (Rose at al., 2006). Applying UDL principles to adult online courses is likely to make course delivery more effective for learners (Edyburn, 2010; King-Sears, 2009; McGuire & Scott, 2006). Representing information in multiple ways helps learners to select among display, verbal, or auditory options for perceiving information. Learner comprehension is enhanced with opportunities to activate, highlight, and guide the application of the information (CAST, 2012c). Learners who are

provided with multiple means of action and expression are able to select methods of response and navigation and construction and performance that allow them to learn effectively (CAST, 2012c). Providing multiple means of engagement allows learners to select options according to their preferences to indicate interest in learning activities, to persist, and to self-regulate (CAST, 2012c).

The three UDL principles support basic neurology of the brain (Rose et al., 2006). The principles are comparable to the general neurological functions of learning; the recognition of objects in the external environment, the generation of effective patterns of action, and the evaluation of significant possible patterns (Rose et al., 2006). Instructional strategies that facilitate multiple means of content representation, multiple means of learner action and expression, and multiple means of learner engagement appeal to the learning styles of a wide audience of learners (Edyburn, 2010; King-Sears, 2009; McGuire & Scott, 2006). Pure lecture was described by Aguinaga and O'Brien (2009) as a perfect example of digital disconnect in online learning because it focuses on instructor expertise as the sole provider of information to passive learners. It provides only one method of content representation rather than the several required by UDL. It is unlikely to appeal to the learning styles of all online learners. Flexible curriculum and assessment that integrate the principles of UDL enable all learners to achieve learning outcomes (Ofiesh, Rojas, & Ward, 2006).

Engleman and Voytecki (2010) surveyed master of education students who participated in an online course specifically designed to incorporate UDL principles and reported unexpected results. They observed that only 66% of student respondents agreed that they would like to have the same flexibility of choice in assignment activities for all their courses. Englemann and Voytecki (2010) suggested that the use of the words flexibility and activity may have been

ambiguous to students. They further suggested that students may have experienced discomfort with the freedom that flexibility of choice provided. Despite the findings in Englemann and Voytecki's (2010) small sample, there is evidence that the application of UDL principles enhances learning as reported in a larger study conducted by Rose et al. (2006). This study surveyed students who participated in a semester long university course. These online learners indicated greater appreciation of flexibility of choice in assignments (Rose et al., 2006). Similarly Pliner and Johnson (2004) determined that more flexibility enhances learning; the application of UDL strategies supports collaboration between the instructor and learner in pedagogical choices.

Sorensen and Baylen (2009) stated adult online learners expect their instructors to use technology in ways that truly enhance learning. Technology should support adult learning strategies. Teaching practices should align with andragogy with its emphasis on equal and reciprocal relationship with the instructor and its variety of methods for teaching and learning (Sorensen & Baylen, 2009). A high need for content structure and detailed information are two elements identified (Sorensen & Baylen, 2009) as critical to successful online learning. Universal Design for Learning principles support the andragogical model effectively. They provide an outline for the creation and implementation of instructional goals, methods, and assessments that support adult learning strategies. The approach is flexible and customizable to the needs of adult online learners.

Without the personal interaction of a traditional classroom, online learning can be an isolating experience. The integration of UDL principles in online course development supports collaborative learning and the formation of communities that facilitate online learning (Aguinaga & O'Brien, 2009). Most online learners benefit from UDL instructional strategies that provide

choice. Integrating UDL principles in online course design is an efficient and cost-effective method of developing curriculum (Cochran, Bowman, Madsen, King, & Shrilla, 2006). It is easier and more cost effective to remediate curriculum as it is designed rather than adapt it to individual learners at the time of their participation.

Training Online Instructors to Use UDL Strategies

Effective online teaching requires specific skills and intent (Norton & Smith, 2007). In an examination of survey responses provided by 22 teacher-participants in a training course presenting online teaching skills, Norton and Smith (2007) reported that participants described the training as highly valuable. The teachers described their experience as crucial to their understanding of the intellectual and personal demands on online learners (Norton & Smith, 2007). Voytecki and Engleman (2010) investigated pedagogical and practical difficulties encountered by higher learning online instructors. They found many instructors were challenged by basic pedagogical and practical teaching matters who felt they were unprepared to develop quality online courses. Both the Norton and Smith (2007) and Voytecki and Engleman (2010) studies suggested that formal preparation consisting of basic pedagogical and practical techniques of online instruction is essential to effective online learning. Conceicao (2007) offered that as online instructors gain comfort with the online learning environment, they will use new teaching strategies, such as UDL, to design instruction with ease. Technology is essential to the effective implementation of UDL strategies (Harrison, 2006; King-Sears, 2009; Manning & Johnson, 2011; Rose et al., 2006). However, Coombs (2010) identified technology as a significant reason for the slow progress in providing online learners with accessible content. He described how institutions of higher education have focused extensively on costs and technology infrastructure creating an environment in which instructors feared they lacked the

requisite technical skills. These factors served as barriers to the strategic development of online courses integrated with UDL principles.

Preparing online instructors to incorporate UDL principles in their teaching practice is critical to meeting the diverse needs of adult online learners (Izzo, Murray, & Novak, 2008; McGuire & Scott, 2006; Rose et al., 2006). However, most college instructors have little preparation in creating inclusive classrooms (Ouellet, 2004). They should have competent knowledge of pedagogy before they can be effective online instructors. Morrison et al. (2011) identified characteristics of course design that incorporate UDL principles. These include a determination of learner readiness, alignment of instructional strategies to learner characteristics, identification of support resources, selection of effective technology resources, and alignment of assessment to learning objectives.

As online enrollments have grown, so has the need for an adequate supply of skilled online instructors. Evidence suggests that the existing supply of skilled online instructors is insufficient to meet the demand of online enrollments (Voytecki, Engleman & Jeffs, 2010). There are a number of reasons for this. Vytecki et al. (2010) indicated two reasons for the limited supply of skilled online instructors. One is the lack of research-based effective practices to share with faculty, and the other is the challenges faculty face with practical matters related to online instruction. Studies examining the application of UDL strategies in online courses found that instructors recognized as outstanding teachers intuitively integrate UDL principles into their course design (McGuire & Scott, 2006).

Acquiring skill in the application of UDL principles is a challenge for higher education faculty. Voytecki et al. (2010) described survey responses of university faculty teaching their first online course. Among the most challenging aspects, faculty identified course design issues,

lack of technology training, and lack of pedagogical training related to online teaching. These responses are not surprising given that some institutions provide instructors with training in UDL concepts and their implementation but fail to relate them adequately to the online learning environment (Izzo, Murray, & Novak, 2008; McGuire & Scott, 2006).

Palloff and Pratt (2011) described several scenarios related to online instructor development. Some instructors simply moved their existing course content to an LMS. Others participated in technology courses designed to enhance their ability to use the LMS successfully. The most effective online instructors, however, according to Palloff and Pratt (2011), were those who combined technology skills with preparation in online instructional strategies including UDL strategies. Ouellet (2004) indicated that individual instructors are likely to seek assistance in developing inclusive online classrooms when they are motivated to maintain academic integrity. Harrison (2006) indicated that to support learner-focused instruction meeting the needs of the largest possible audience, instructors should analyze what they are requiring students to do, why they are requiring it, and determine the necessity of requiring it.

Roman, Kelsey, and Lin (2010) summarized recent research indicating the most significant factors of quality online courses are instructor expertise and commitment. Online course development that integrates UDL principles is best achieved by an institutional commitment to comprehensive support of online instructor development and practice (Roman et al., 2010). Roberts (2004) reminded educators they are in a critical position to influence required changes in human perception and course design that supports UDL. It is likely that well developed and coordinated online instructor training courses result in greater faculty acceptance and sustained success (Roman et al., 2010). This supports technological and pedagogical skill development that forms the basis of effective UDL strategy implementation.

Conclusions

Conclusions drawn from the review of literature include the following.

1. Universal design and UDL share a goal, but implementing UDL strategies is more complex than implementing universal design.
2. There is general agreement about the value of UDL, but scientific research of UDL is lacking.
3. Universal Design for Learning strategies are implemented effectively using technology.
4. Adult learners in higher education are increasing in number.
5. Adult learners increasingly prefer flexible learning options including online learning.
6. Increasing numbers of learners with disabilities and at-risk learners are enrolling in post-secondary education.
7. Specific skills are required to implement UDL strategies in online instruction.
8. Instructors may lack the skills required to implement UDL strategies in online instruction.
9. Training for instructors to acquire or enhance skills needed to implement UDL strategies effectively in online courses is provided inconsistently among institutions of higher education.

Chapter III: Methodology

Introduction

The purpose of this investigation was to determine if WTCS faculty and staff applied UDL techniques to the design, development, and delivery of online courses. The goal was to determine how training presented by Dr. Therese Willkomm in 2010 may have influenced WTCS faculty and staff in their implementation of UDL strategies. The objectives for this investigation included the following.

1. Determine if the UDL training provided by Dr. Therese Willkomm in 2010 influenced WTCS faculty and staff participants in their design, development, and delivery of online courses.
2. Analyze where in their teaching practice WTCS faculty and staff applied UDL techniques (online course design, development, or delivery).
3. Identify which UDL techniques WTCS faculty and staff applied to online course design, development, and delivery.

Subject Selection and Description

Invitations to complete a survey were sent to WTCS faculty and staff who were identified as having participated in Dr. Willkomm's UDL training. Their names were provided by Jamie Schlachter, the Madison Area Technical College staff member who coordinated workshop registrations. As technical college teaching and instructional specialists, those who attended a UDL workshop would have been familiar with andragogy, learning styles, and course design principles. They were likely motivated to attend by a desire to learn more about UDL and its application to their teaching practice or course development responsibilities. They likely would have attended the UDL training voluntarily.

Instrumentation

With the support of the University of Wisconsin-Stout's Office of Planning, Assessment, Research, and Quality staff, a web-based survey (see Appendix A) was created by the researcher using the Qualtrics tool. The survey has no established reliability or validity. The University of Wisconsin-Stout's Institutional Review Board (IRB) for the Protection of Human Subjects approved the survey on February 22, 2012. Data was collected to determine if respondents applied UDL techniques following their 2010 training participation and to capture demographic information related to the respondents' professional responsibilities and their technical college employers. Participants selected responses from a list of options for 15 questions to describe their application of UDL techniques, their job responsibilities, and their job environment. The relationship between research questions and survey items is shown in Table 1.

Table 1

Relationship between Research Questions and Survey Items

Research Questions	Survey Item
Did UDL training provided by Dr. Therese Willkomm in 2010 influence WTCS faculty and staff participants in their design, development, and delivery of online courses?	1, 2, 5, 8
Were UDL techniques applied by WTCS faculty and staff to online course design, development, and delivery?	4, 7, 10
Which UDL techniques did WTCS faculty and staff apply to their online course design, development, and delivery?	3, 6, 9

Procedures

The survey was administered from March 1, 2012 through March 15, 2012. Workshop registration records contained 271 names of individuals who participated in UDL training led by Dr. Willkomm in 2010. Of the 271 registrations, 261 of them were associated with WTCS faculty and staff. They represented 15 of the 16 Wisconsin Technical Colleges. Milwaukee Area Technical College had no faculty or staff who attended a UDL training workshop.

On February 28, 2012, the researcher contacted, by e-mail message (see Appendix B), WTCS instructional design and curriculum specialist peers at 14 Wisconsin Technical Colleges. Milwaukee Area Technical College, which had no training participants, and Gateway Technical College, the technical college with which the researcher is associated, were excluded from this e-mail communication. The message informed these college representatives of the survey to be distributed and asked for their support in encouraging faculty and staff associated with their respective colleges to complete the survey.

On March 1, 2012, the researcher distributed the survey, via e-mail message (see Appendix C), to the 261 WTCS faculty and staff identified through Ms. Schlachter's training registration records. The survey distribution date was selected because it was associated with a mid-week day, Thursday, in the expectation that the number of e-mail recipients available to read and act on message content would be greater mid-week than on a Monday or Friday.

On March 4, 2012, the researcher called the instructional design and curriculum specialist peers of 14 Wisconsin Technical Colleges. These individuals had received the February 28, 2012 e-mail communication advising them of the study and survey distribution. The purpose of the call was to inform them of the low survey participation of WTCS faculty and staff and to

request their further encouragement of faculty and staff associated with their respective colleges to complete the survey.

On March 7, 2012, the researcher sent a reminder e-mail message (see Appendix D), to the same WTCS faculty and staff, who received the original March 1, 2012 survey distribution message. The purpose of the reminder e-mail message was to thank those who had completed the survey, ask those who had not yet done so to complete the survey, and encourage those with questions to contact the researcher. The reminder message distribution date was selected because it was associated with a mid-week day, Wednesday, in the expectation that the number of e-mail recipients available to read and act on message content would be greater mid-week than on a Monday or Friday. It would also provide a different mid-week opportunity for recipients to read and act on the message than the original mid-week survey distribution message of Thursday, March 1, 2012.

Data Analysis. The Qualtrics tool was used to create the research survey and collect responses. The University of Wisconsin – Stout offers the use of this tool to graduate student researchers. Qualtrics was used to calculate data related to measures of central tendency, frequencies, and percentages. The researcher used this information to identify main themes, classify responses with themes, and integrate the themes and responses into a narrative description of responses to research questions. Descriptive statistics related to respondent demographic data were analyzed to develop a profile of survey respondents. Data related to the research questions, how and where UDL techniques were applied, were analyzed for frequency of response and to examine relationships between which techniques were applied and where they were used.

Limitations

This investigation focused on WTCS faculty and staff who were identified as having attended a UDL training workshop led by Dr. Therese Willkomm in 2010. The respondents were employees of WTCS college districts. However, the experience of the survey population may not represent the experience of all WTCS faculty and staff who attended the UDL workshops and may have applied techniques to online teaching or course development but declined to complete the survey. The results reported by WTCS faculty and staff may not be able to be generalized to other populations. The response rate will influence the generalizations that can be made of the survey results. The researcher made several attempt to ensure an adequate response. The support of peer Wisconsin Technical College curriculum specialists/instructional designers, who could encourage their faculty and staff to participate in the survey, was requested by e-mail message before the implementation of the survey and by phone call shortly after the survey was implemented. The 261 WTCS faculty and staff who participated in 2010 UDL workshops received e-mail messages of invitation upon the implementation of the survey and reminder e-mail messages one week before the survey closed.

Wisconsin Technical College System faculty and staff invited to complete the survey may have participated in UDL training, other than that provided by Dr. Willkomm, before or after the 2010 UDL workshops led by Dr. Willkomm. The extent to which this training may have affected survey responses is unknown. The length of time that elapsed between invited participants' 2010 training experiences and their invitations to complete the investigation survey may have affected their responses. Furthermore, it is unknown if WTCS faculty and staff participated in the 2010 UDL training voluntarily. Participant motivation may affect the manner

in which the individual applied, or did not apply, UDL techniques to online teaching or course development following the workshop.

Summary

This investigative study attempted to determine how and where UDL techniques were applied in online course design, development, and delivery by those WTCS faculty and staff who attended UDL training in 2010 presented by Dr. Willkomm. Participants were invited to complete a survey of their experiences. Respondents described their experiences applying UDL techniques to online course design, development, and delivery.

Chapter IV: Results

Introduction

The purpose of this study was to determine how WTCS faculty and staff who participated in Dr. Therese Willkomm's 2010 UDL workshops applied UDL techniques to the design, development, and delivery of their online courses. Data was collected between March 1, 2012 and March 15, 2012 using a 15-item survey. The survey used parallel question and response formats for respondents to describe their use of techniques associated with each of the three principles of UDL. Four consistent response options were provided for respondents to describe how they applied UDL techniques. Three consistent response options were provided for respondents to identify where they applied UDL techniques. Respondents identified the UDL techniques they used by selecting from lists of standard techniques associated with specific UDL strategies (CAST, 2012c). Demographic data was collected via respondent selection from fixed response options. Survey results are reported in this chapter.

Description of Respondents

Demographic characteristics collected for the WTCS faculty and staff who attended Dr. Willkomm's UDL training in 2010 and completed the survey included: the Wisconsin Technical College employing the respondent; the job responsibilities of the respondent; the length of time the respondent has been responsible for online course development, design, or delivery; other UDL training the respondent may have completed; and whether the technical college employing the respondent offers formal UDL training.

Wisconsin Technical College Affiliation. Participation among the 16 Wisconsin Technical Colleges varied. Of the 20 survey respondents who indicated they used UDL techniques in their online course development or teaching following their training, four (20%)

respondents indicated they were affiliated with Gateway Technical College. Both Western Technical College and Moraine Park Technical College had three (15%) respondents participate. Four technical colleges, Fox Valley, Madison Area, Southwest, and Wisconsin Indianhead, were represented by two respondents (10%) each. Waukesha County and Northcentral were each represented by one (5%) respondent. Table 2 shows the distribution of respondents among Wisconsin Technical Colleges.

Table 2

Wisconsin Technical College Affiliation

Age	N	Percentage
Blackhawk	0	0
Chippewa Valley	0	0
Fox Valley	2	10
Gateway	4	20
Lakeshore	0	0
Madison Area	2	10
Mid-State	0	0
Milwaukee	0	0
Moraine Park	3	15
Nicolet	0	0
Northcentral	1	5
Northeast Wisconsin	0	0
Southwest Wisconsin	2	10
Waukesha County	1	5
Western	3	15
Wisconsin Indianhead	2	10
Prefer not to answer	0	0
Total	20	100%

With the exception of Milwaukee Area Technical College, all the Wisconsin Technical Colleges had faculty or staff who attended a UDL training workshop led by Dr. Willkomm in 2010. Of the 15 colleges with faculty and staff participating in the training, nine colleges were represented by the 20 survey respondents who indicated they had applied UDL techniques to online courses they design, develop, or delivery. Forty-six individuals completed the survey, and 26 of those indicated they did not apply UDL techniques to online course design, development, or delivery. Demographic information was not collected for respondents who did not apply UDL techniques in the online learning environment. Therefore, it is possible that faculty and staff from more than the nine Wisconsin Technical Colleges, identified through the data collected, participated in the survey. However, their survey participation would have been very limited by design and their demographic data would not have been collected.

Job Responsibilities. Survey participants were asked about the nature of their job responsibilities. Four broad choices were provided for their selection. Respondents were asked to identify their job responsibilities as those associated with an instructor, an instructional technology specialist, a curriculum specialist/instructional designer, or other. Of the 20 responses, 15 (75%) indicated they were instructors. Two (10%) responded they were curriculum specialists/instructional designers, and two (10%) identified their role as other. One respondent (5%) reported a technology specialist job description. Table 3 shows the distribution of job responsibilities among respondents.

Table 3

Job Responsibility

Description	N	Percentage
Instructor	15	75
Instructional technology specialist	1	5
Curriculum specialist/instructional designer	2	10
Other	2	10
Total	20	100

There are greater numbers of teaching staff than instructional technology specialists or curriculum specialists/instructional design staff at each of the Wisconsin Technical College districts. The specialist roles support the work of instructors. Therefore, it was not unexpected that the largest group of respondents identified their job responsibility as instructor. The job responsibilities of the two respondents who identified other are unknown.

Length of Responsibility for Online Course Construction or Instruction. Respondents were asked to identify the length of time they had supported online instruction. Of the 20 responses, seven (35%) reported they had provided support for a period of four to six years. Five (25%) respondents indicated they had provided support for a period of seven to nine years. Four (20%) indicated they had provided support for a period of 10 or more years. Three (15%) respondents reported they had provided support for a period of one to three years, and one (5%) respondent indicated a support period of less than one year.

Of all respondents, 80% reported having supported online instruction for a minimum of four years. Forty-five percent reported having supported online instruction for a minimum of seven years. Table 4 shows the length of time respondents have supported online instruction.

Table 4

Length of Responsibility for Online Course Construction or Instruction

Years Supporting	N	Percentage
< 1	1	5
1-3	3	15
4-6	7	35
7-9	5	25
> 9	4	20
Total	20	100

College Provided UDL Training. Respondents were asked if their Wisconsin Technical College employer provided formal training opportunities to faculty and staff in UDL techniques. Of the 20 responses, seven (35%) responded that their colleges provided formal training opportunities. Seven (35%) indicated they were not sure if their colleges provided formal UDL technique training. Six (30%) reported that their colleges did not provide formal training opportunities.

Among those respondents with knowledge of their colleges' training opportunities, responses were nearly evenly divided among the colleges that do and the colleges that do not offer formal UDL technique training opportunities. Nearly one-third of respondents were not sure if their college provided formal training opportunities for UDL techniques. Table 5 shows respondents' awareness of UDL training provided by their respective colleges.

Table 5

Awareness of UDL Training at College

Training Provided	N	Percentage
Yes	7	35
No	6	30
Unsure	7	35
Total	20	100

Other UDL Training. Respondents were asked if they had engaged in formal training or education related to UDL other than the training provided by Dr. Willkomm in 2010. Of the 20 responses, eight (40%) indicated they had. Eleven (55%) reported they had not. One (5%) respondent was not sure whether formal UDL training or education, other than the 2010 workshop, had been completed.

The majority of respondents indicated they had not received any formal UDL training or education beyond that provided by Dr. Willkomm in 2010. Table 6 shows the responses describing participation in UDL training other than that provided by Dr. Willkomm.

Table 6

Participation in Other UDL Training

Respondent Participation	N	Percentage
Yes	8	40
No	11	55
Unsure	1	5
Total	20	100

UDL Principle I

Providing multiple means of representation is the first principle that guides UDL (CAST, 2012c). It describes options for: perception; language, mathematical expressions, and symbols; and, comprehension. Respondents were asked three questions about their application of the first UDL principle. They were asked how their participation in the 2010 UDL workshop influenced their application of UDL techniques. If their responses indicated they were influenced, to any extent, by their workshop participation, they were asked two additional questions. These questions asked respondents to identify, from among a list of representative techniques, those UDL techniques they had applied. They were also asked to describe where in their online development or teaching practice they had applied the techniques.

Workshop Attendance Influence on Ability to Apply Principle I. Of the 20 responses, 10 (50%) responded that they applied some UDL techniques presented at the workshop to the design, development, or delivery of on-line courses for which they were responsible. Seven (35%) respondents indicated they applied UDL techniques whenever possible to the design, development, or delivery of on-line courses for which they were responsible. Two (10%) respondents reported that their workshop participation had no influence on the design, development, or delivery of on-line courses for which they were responsible. One respondent (5%) reported that UDL techniques guided the redesign, redevelopment, or facilitation of all, or almost all, on-line courses for which the individual was responsible and for any new on-line courses the individual designed, developed, or delivered.

Fifty percent of respondents indicated that they applied at least some of the UDL Principle I techniques presented at a workshop they attended. Another 40% of respondents reported that as a result of their participation in a UDL workshop, they applied UDL Principle I

techniques whenever possible or that these techniques guided their online course development and delivery. Table 7 shows the extent to which respondents believed their participation in the UDL workshop influenced their application of UDL Principle I techniques.

Table 7

Reported Influence of Training to Application of UDL Principle I

Reported Workshop Influence	N	Percentage
No influence	2	10
Applied some UDL techniques	10	50
Applied UDL techniques whenever possible	7	35
Used UDL techniques to guide all on-line course work	1	5
Total	20	100

Principle I Application Techniques Applied. Eighteen (90%) respondents who were influenced by their participation in a UDL workshop presented by Dr. Willkomm reported they were influenced in their application of UDL Principle I techniques. Respondents were asked to identify all Principle I techniques they had applied to their online course development or instruction. They identified 11 of the 12 Principle I techniques (CAST, 2012c) with a frequency shown in Figure 1.

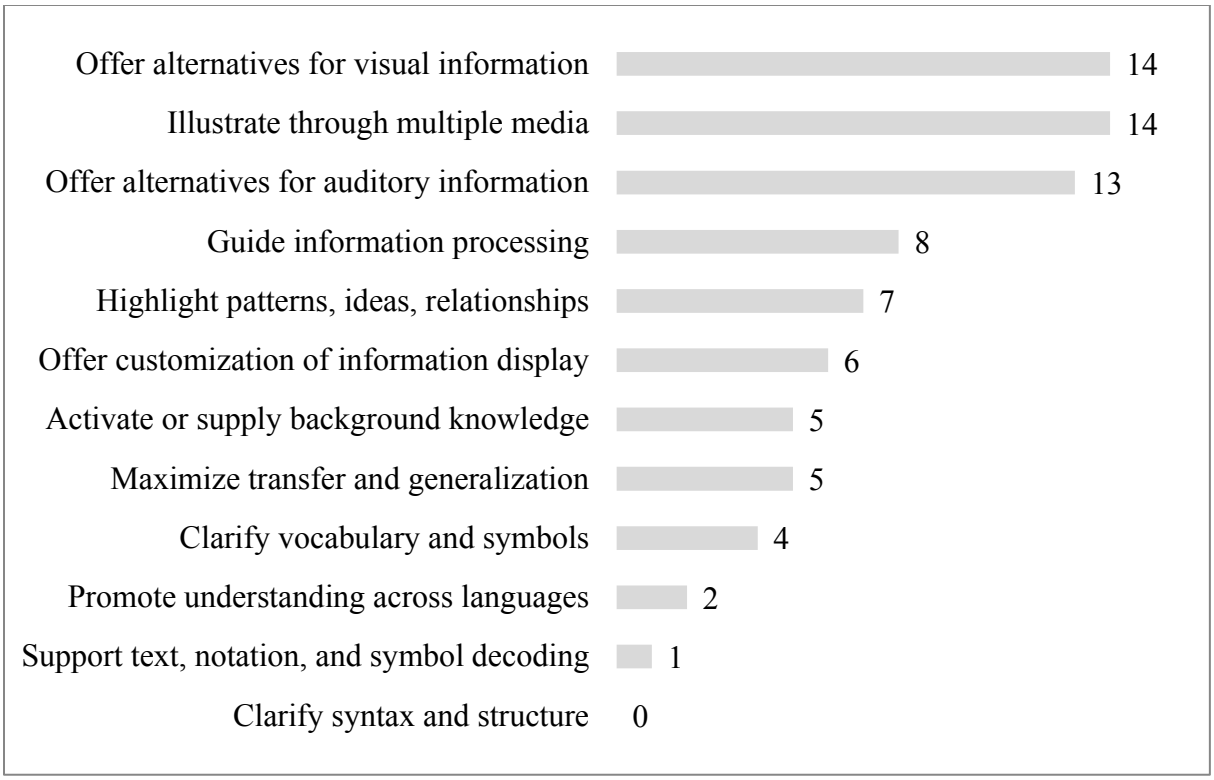

Figure 1. WTCS faculty and staff UDL principle I technique selections

Note: The values shown represent the number of times the technique was selected for use.

The UDL Principle I techniques selected most frequently were offer alternatives for visual information, illustrate through multiple media, and offer alternatives for auditory information. Techniques selected least frequently were promote understanding across languages and support text, notation, and symbol decoding. The technique, clarify syntax and structure, was not selected.

Where Principle I Application Techniques Applied. Eighteen respondents indicated their application of UDL Principle I techniques were influenced by their participation in a UDL workshop. They were asked to select all areas in their on-line development or teaching practice where they applied these techniques. Sixteen (89%) applied UDL Principle I techniques to on-line course delivery. Eleven (61%) applied Principle I techniques to on-line course design, and nine (50%) respondents applied these techniques to on-line course development. At least 50% of

respondents applied UDL Principle I techniques to all three areas of their on-line development or teaching practice. Table 8 shows where respondents applied UDL Principle I techniques.

Table 8

Where UDL Principle I Techniques Applied

Area of Application	Number of Selections	Percentage
Online Course Design	11	61
Online Course Development	9	50
Online Course Delivery	16	89

Note: Each respondent selected all areas in which UDL Principle I techniques were applied.

Implementation of UDL Principle I Techniques. Using respondent data describing which techniques were applied and where they were applied, the researcher determined how UDL Principle I techniques were implemented. Table 9 shows the distribution of the application of UDL Principle I techniques among on-line course design, development, and delivery.

Table 9

WTCS Faculty and Staff Implementation of UDL Principle 1 Techniques

UDL Principle I Application Technique	Online Course		
	Design	Development	Delivery
Offer customization of information display	4 (27%)	4 (27%)	7 (47%)
Offer alternatives for auditory information	10 (31%)	9 (28%)	13 (41%)
Offer alternatives for visual information	9 (27%)	9 (27%)	15 (45%)
Clarify vocabulary and symbols	4 (33%)	3 (25%)	5 (42%)
Clarify syntax and structure	0 (0%)	0 (0%)	0 (0%)
Support text, notation, and symbol decoding	1 (33%)	1 (33%)	1 (33%)
Promote understanding across languages	1(25%)	2 (50%)	1(25%)
Illustrate through multiple media	10 (29%)	10 (29%)	14 (41%)
Activate or supply background knowledge	6 (35%)	6 (35%)	5 (29%)
Highlight patterns, ideas, relationships	7 (33%)	7 (33%)	7 (33%)
Guide information processing	6 (29%)	6 (29%)	9 (43%)
Maximize transfer and generalization	5 (38%)	4 (31%)	4 (31%)

UDL Principle II

Providing multiple means of action and expression is the second principle that guides UDL (CAST, 2012c). It describes options for physical action, for expression and communication, and for executive functions. Respondents were asked how their participation in the 2010 UDL workshop influenced their application of UDL techniques. If their responses indicated they were influenced, to any extent, by their workshop participation, they were asked

two additional questions about their application of UDL Principle II techniques. They were asked to identify, from among a list of representative techniques, those UDL techniques they had applied, and they were asked to describe where in their online development or teaching practice they had applied the techniques.

Workshop Attendance Influence on Ability to Apply Principle II. Fifteen (75%) respondents who were influenced by their participation in a UDL workshop presented by Dr. Willkomm reported they were influenced in their application of UDL Principle II techniques. Of the 20 responses, eight (40%) respondents reported they applied some UDL techniques presented at the workshop to the design, development, or delivery of on-line courses for which they were responsible. Seven (35%) respondents indicated they applied UDL techniques presented at the workshop whenever possible to the design, development, or delivery of on-line courses for which they were responsible. Five (25%) respondents reported that their workshop participation had no influence on the design, development, or delivery of on-line courses for which they were responsible. No (0%) respondents reported that UDL techniques guided the redesign, redevelopment, or facilitation of all, or almost all, on-line courses for which the individual was responsible and for any new on-line courses the individual designed, developed, or delivered.

Seventy-five percent of respondents indicated they applied UDL Principle II techniques as a result of their participation in a UDL workshop. More than one-third of respondents reported they applied UDL Principle II techniques presented at the workshop whenever possible. Fewer than 50% of respondents indicated they applied at least some of the UDL Principle II techniques presented at a workshop they attended. Table 10 shows the extent to which respondents believed their participation in the UDL workshop influenced their application of UDL Principle II techniques.

Table 10

Reported Influence of Training to Application of UDL Principle II

Reported Workshop Influence	N	Percentage
No influence	5	25
Applied some UDL techniques	8	40
Applied UDL techniques whenever possible	7	35
Used UDL techniques to guide all on-line course work	0	0
Total	20	100

Principle II Application Techniques Applied. Fifteen respondents indicated their application of UDL Principle II techniques were influenced by their participation in a UDL workshop. They were asked to identify all Principle II techniques they had applied to their online course development or instruction. They identified nine of the nine Principle II techniques (CAST, 2012c) with a frequency shown in Figure 2.

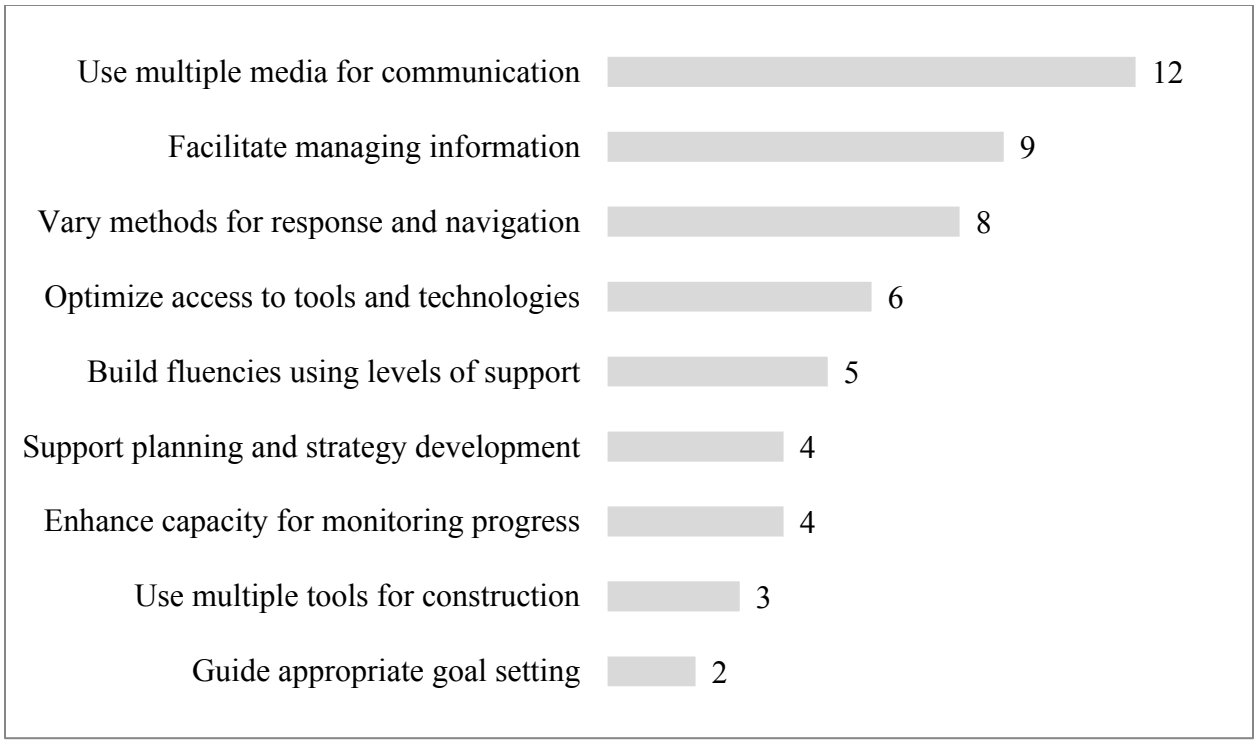

Figure 2. WTCS faculty and staff UDL principle 1I technique selections

Note: The values shown represent the number of times the technique was selected for use.

The UDL Principle II techniques selected most frequently were use multiple media for communication, facilitate managing information, and vary methods for response and navigation. UDL Principle II techniques selected least frequently were use multiple tools for construction and guide appropriate goal setting. Responses indicated that WTCS faculty and staff applied techniques to use multiple media for communication six times more often than they applied techniques to guide appropriate goal setting and four times more often than they applied techniques to use multiple tools for construction.

Where Principle II Application Techniques Applied. Fifteen respondents indicated their applications of UDL Principle II techniques were influenced by their participation in a UDL workshop. They were asked to select all areas in their on-line development or teaching practice where they applied these techniques. Fourteen (93%) applied UDL Principle II techniques to on-

line course delivery. Nine (60%) applied Principle II techniques to on-line course design, and eight (53%) respondents applied these techniques to on-line course development. More than 50% of respondents applied UDL Principle II techniques to all three areas of their on-line development or teaching practice. However, application of techniques to on-line course delivery was significantly greater than the application of techniques to on-line course design or development. Table 11 shows where respondents applied UDL Principle II techniques.

Table 11

Where UDL Principle II Techniques Applied

Area of Application	Number of Selections	Percentage
Online Course Design	9	60
Online Course Development	8	53
Online Course Delivery	14	93

Note: Each respondent selected all areas in which UDL Principle II techniques were applied.

Implementation of UDL Principle II Techniques. Using respondent data describing which techniques were applied and where they were applied, the researcher determined how the UDL Principle II techniques were implemented. Table 12 shows the distribution of the application of UDL Principle II techniques among on-line course design, development, and delivery.

Table 12

WTCS Faculty and Staff Implementation of UDL Principle I1 Techniques

UDL Principle II Application Technique	Online Course		
	Design	Development	Delivery
Vary methods for response and navigation	6 (35%)	4 (24%)	7 (41%)
Optimize access to tools and technologies	5 (36%)	4 (29%)	5 (36%)
Use multiple media for communication	9 (33%)	7 (26%)	11 (41%)
Use multiple tools for construction	3 (50%)	1 (17%)	2 (33%)
Build fluencies using levels of support	4 (31%)	4 (31%	5 (38%)
Guide appropriate goal setting	2 (33%	2 (33%)	2 (33%)
Support planning and strategy development	4 (33%)	4 (33%)	4 (33%)
Facilitate managing information	6 (27%)	7 (32%)	9 (41%)
Enhance capacity for monitoring progress	3 (33%)	2 (22%)	4 (44%)

Application was more frequent in on-line course delivery than in on-line course design or development for five of the nine UDL Principle II techniques. For two techniques, guide appropriate goal setting and support planning and strategy development, application was evenly applied to all three areas of online course.

UDL Principle III

Providing multiple means of engagement is the third principle that guides UDL (CAST, 2012c). It describes options for recruiting interest, sustaining effort and persistence, and for self-regulation. Respondents were asked how their participation in a 2010 UDL workshop influenced their application of UDL Principle III techniques. If their responses indicated they were influenced, to any extent, by their workshop participation, they were asked two additional

questions about their application of UDL Principle III techniques. They were asked to identify, from among a list of representative techniques, those UDL techniques they had applied, and they were asked to describe where in their online development or teaching practice they had applied the techniques.

Workshop Attendance Influence on Ability to Apply Principle III. Of the 20 responses, 10 (50%) respondents reported they applied some UDL techniques presented at the workshop to the design, development, or delivery of on-line courses for which they were responsible. Seven (35%) respondents indicated they applied UDL techniques presented at the workshop whenever possible to the design, development, or delivery of on-line courses for which they were responsible. Two (10%) respondents reported that their workshop participation had no influence on the design, development, or delivery of on-line courses for which they were responsible. One (5%) respondent reported that UDL techniques guided the redesign, redevelopment, or facilitation of all, or almost all, on-line courses for which the individual was responsible and for any new on-line courses the individual designed, developed, or delivered.

Ninety percent of respondents indicated they applied UDL Principle III techniques as a result of their participation in a UDL workshop. Forty percent of respondents applied UDL Principle III techniques whenever possible or used them as a guide for all on-line course design, development, or delivery. Table 13 shows the extent to which respondents believed their participation in the UDL workshop influenced their application of UDL Principle III techniques.

Table 13

Reported Influence of Training to Application of UDL Principle III

Reported Workshop Influence	N	Percentage
No influence	2	10
Applied some UDL techniques	10	50
Applied UDL techniques whenever possible	7	35
Used UDL techniques to guide all on-line course work	1	5
Total	20	100

Principle III Application Techniques Applied. Eighteen (90%) respondents who were influenced by their participation in a UDL workshop presented by Dr. Willkomm reported they were influenced in their application of UDL Principle III techniques. Respondents were asked to identify all Principle III techniques they had applied to their online course development or instruction. They identified 10 of the 10 Principle III techniques (CAST, 2012c) with a frequency shown in Figure 3.

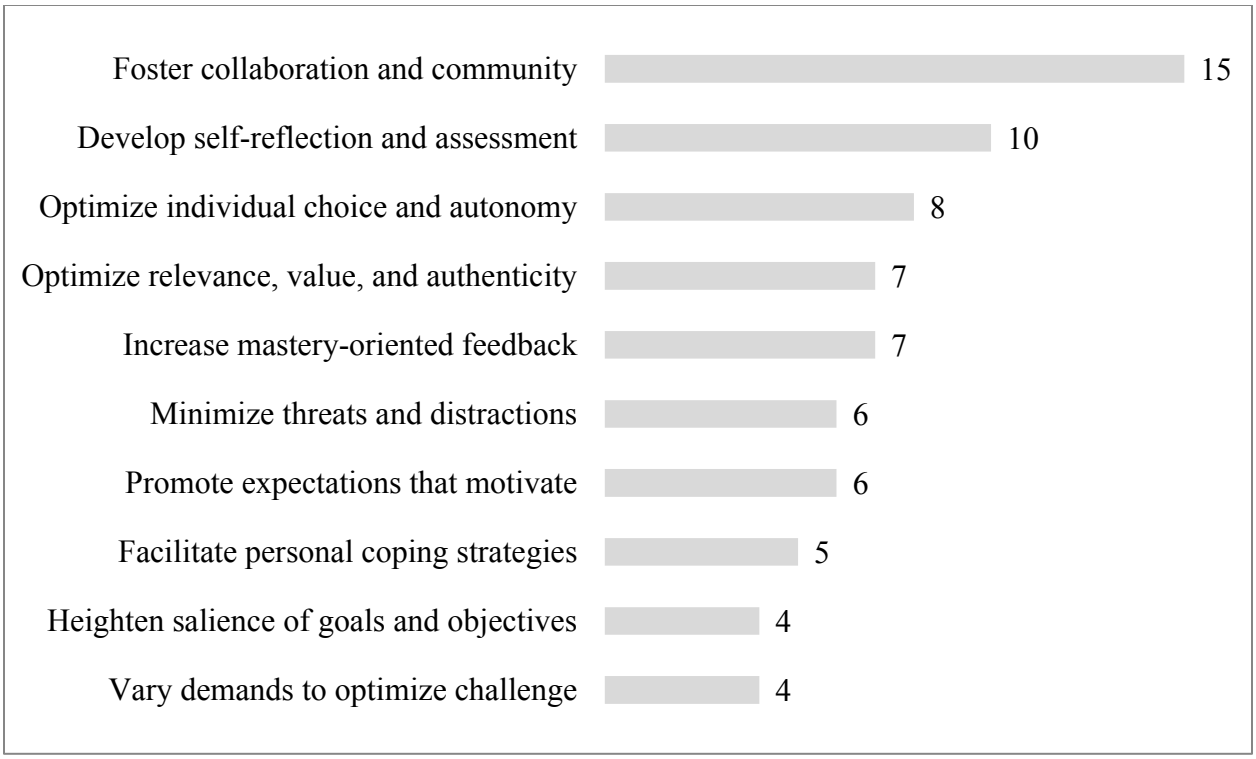

Figure 3. WTCS faculty and staff UDL principle III technique selections

Note: The values shown represent the number of times the technique was selected for use.

The UDL Principle III techniques selected most frequently were foster collaboration and community and develop self-reflection and assessment. Foster collaboration and community was selected significantly more frequently than any of the other nine Principle III techniques. Selected least frequently were heighten salience of goals and objectives and vary demands to optimize challenge.

Where Principle III Application Techniques Applied. Eighteen respondents indicated their application of UDL Principle III techniques was influenced by their participation in a UDL workshop. They were asked to select all areas in their on-line development or teaching practice where they applied these techniques. Seventeen (94%) applied UDL Principle III techniques to on-line course delivery. Nine (50%) applied Principle III techniques to on-line course design, and seven (39%) respondents applied these techniques to on-line course development. More

than twice as many UDL techniques were applied to on-line course delivery than on-line course development. Table 14 shows where respondents applied UDL Principle III techniques.

Table 14

Where UDL Principle III Techniques Applied

Area of Application	Number of Selections	Percentage
Online Course Design	9	50
Online Course Development	7	39
Online Course Delivery	17	94

Note: Each respondent selected all areas in which UDL Principle III techniques were applied.

Implementation of UDL Principle III Techniques. Using respondent data describing which techniques were applied and where they were applied, the researcher determined how the UDL Principle III techniques were implemented. Table 15 shows the distribution of the application of UDL Principle III techniques among on-line course design, development, and delivery.

Table 15

WTCS Faculty and Staff Implementation of UDL Principle III Techniques

UDL Principle III Application Technique	Online Course		
	Design	Development	Delivery
Optimize individual choice and autonomy	3 (21%)	3 (21%)	8 (57%)
Optimize relevance, value, and authenticity	4 (25%)	5 (31%)	7 (44%)
Minimize threats and distractions	2 (20%)	2 (20%)	6 (60%)
Heighten salience of goals and objectives	2 (25%)	2 (25%)	4 (50%)
Vary demands to optimize challenge	1 (20%)	0 (0%)	4 (80%)
Foster collaboration and community	9 (30%)	7 (23%)	14 (47%)
Increase mastery-oriented feedback	5 (31%)	4 (25%)	7 (44%)
Promote expectations that motivate	5 (31%)	5 (31%)	6 (38%)
Facilitate personal coping strategies	3 (25%)	4 (33%)	5 (42%)
Develop self-reflection and assessment	7 (32%)	6 (27%)	9 (41%)

Application was more frequent in on-line course delivery than in on-line course design or development for all 10 UDL Principle III techniques. For the technique, promote expectations that motivate, application was nearly evenly applied to all three areas of the online course construction and instruction environment.

Summary

This research used an on-line survey to collect data from WTCS faculty and staff. The data was analyzed and qualitative and quantitative findings were presented. The findings will be discussed further in Chapter Five.

Chapter V: Discussion

Introduction

In 2010 Dr. Therese Willkomm conducted a series of UDL workshops for WTCS faculty and staff. This investigation was conducted to determine if the training provided at the UDL workshops influenced WTCS workshop participants in their application of UDL techniques in the online learning environment. Data was collected from 20 WTCS faculty and staff who were responsible for designing, developing, or delivering online learning content. They completed a survey about their application of UDL techniques in the online learning environment.

Investigation results are discussed and summarized. Study limitations are addressed. Researcher conclusions are explained with a discussion of recommendations for WTCS faculty and staff online course development and teaching preparation. The chapter concludes with recommendations for further research.

Discussion

Each research question is presented and the associated survey results are discussed. A detailed analysis of the research questions is provided in the previous chapter. The first objective of the investigation was to determine if the UDL training provided by Dr. Therese Willkomm in 2010 influenced WTCS faculty and staff participants in their design, development, and delivery of online courses. Survey questions one, two, five, and eight addressed this objective.

Collected data indicate that the UDL workshops in which WTCS faculty and staff participated influenced their application of UDL techniques in the online learning environment. Ninety percent of respondents indicated their participation influenced their application of techniques associated with UDL Principle I, multiple means of representation, and UDL Principle III, multiple means of engagement. Seventy-five percent of respondents indicated their

participation influenced their application of techniques associated with UDL Principle II, multiple means of action and expression. However, the extent of influence, as determined by how UDL techniques were applied, varied considerably.

Of those who reported they applied UDL Principle I techniques, 50% indicated they applied some techniques. Thirty-five percent reported they applied these techniques whenever possible. Only 5% indicated they used UDL Principle I techniques as the context for which they designed, developed, or delivered online instruction. Of those who reported they applied UDL Principle II techniques, 40% reported they applied some techniques. Thirty-five percent indicated they applied these techniques whenever possible, and no respondents indicated they used UDL Principle II techniques as the context for which they designed, developed, or delivered online instruction. Reported application of UDL Principle III techniques was the same as those for UDL Principle I techniques. Fifty percent reported they applied some techniques. Thirty-five percent indicated they applied Principle III techniques whenever possible, and 5% indicated they used these principles as the context for which they designed, developed, or delivered online instruction.

The data indicate that the UDL workshops in which WTCS faculty and staff participated in 2010 influenced their application of UDL techniques. However, few respondents reported using UDL techniques as the context for designing, developing, or delivering online instruction. Most respondents applied some techniques or applied them whenever possible. It may be that WTCS faculty and staff with some expertise in UDL strategies did not attend the workshops. Therefore, a more complete application of UDL techniques was not reflected in the survey data. The workshop content may have appealed to faculty and staff with limited knowledge of UDL techniques. Following their participation in a workshop, those without previous application

experience may have applied techniques in a limited manner at their colleges Similarly it may be that those with some knowledge of UDL techniques but limited application experience may have applied the techniques in a manner whenever possible at their colleges following their workshop participation. It may be that WTCS faculty and staff lacked the knowledge and experience to apply UDL techniques in a comprehensive manner within their online course development and delivery.

The second objective of the investigation was to analyze where, in the online construction and instruction process for which they are responsible, WTCS faculty and staff applied UDL techniques. Survey questions four, seven, and 10 addressed this objective. Respondents were asked to identify all areas of their online course development or teaching practice in which they applied UDL techniques.

Application of techniques to on-line course delivery was greater than the application of techniques to on-line course design or development. Nearly 90% of respondents applied UDL Principle I techniques in course delivery. Principle II techniques were applied in on-line course delivery by 93% of respondents, and Principle III techniques were applied by 94% of respondents in on-line course delivery. This may reflect the experience of the majority of survey participants who were instructors. Facilitating the delivery of course content is a primary responsibility of WTCS instructors. It may also reflect instructors' relative unfamiliarity with the application of UDL Principle techniques to on-line course design or development.

Application of techniques to on-line course design occurred less frequently than to on-line course delivery. Slightly more than 60% of respondents applied UDL Principle I techniques in course design. Fifty percent of respondents reported they applied UDL Principle II and UDL Principle III techniques to on-line course design. The smaller number of participants reporting

application of techniques in course design may be the result of the large number of WTCS instructors who completed the survey. On-line course design may not be an instructor responsibility. Wisconsin Technical Colleges independently determine the roles and responsibilities associated with course design. Therefore, if an instructor did not design on-line courses, the instructor would not be expected to report the application of UDL techniques to that phase of on-line course creation.

Universal Design for Learning techniques were reported to be applied least frequently by faculty and staff in on-line course development. Fifty percent of respondents applied UDL Principle I techniques in course development. Fifty-three percent of respondents reported they applied UDL Principle II techniques, and nearly 40% of respondents indicated they applied UDL Principle III techniques to on-line course development. The number of participants reporting application of techniques in course development may be the result of the large number of WTCS instructors who completed the survey. Wisconsin Technical Colleges independently determine the roles and responsibilities associated with on-line course development. It is possible that course development may not be an instructor responsibility. Therefore, if an instructor did not develop on-line courses, the instructor would not be expected to report the application of UDL techniques to that phase of on-line course creation. The manner in which respondents interpreted the tasks associated with on-line course development may have influenced their responses. If a respondent assumed specific on-line course creation tasks were associated with design rather than development, the respondent would not be expected to report the application of UDL techniques to on-line course development.

The third objective of the investigation was to identify which UDL techniques WTCS faculty and staff applied to online course design, development, and delivery. Survey questions

three, six, and nine addressed this objective. Respondents were asked to identify all techniques they applied in their online course development or teaching practice.

Of the 12 techniques associated with UDL Principle I, multiple means of representation, three were selected most frequently. These include: offer alternatives for visual information, illustrate through multiple media, and offer alternatives for auditory information. Teaching expertise requires the ability to adapt content, communication, and delivery in ways that are meaningful to learners (Hardré, 2005). Survey respondents may have integrated these techniques into their online course development or teaching practice before they attended a UDL workshop. Their responses may reflect the professional ease with which they apply these techniques.

Universal Design for Learning Principle I techniques selected least frequently were promote understanding across languages and support text, notation, and symbol decoding. Their infrequent selection may be related to respondent unfamiliarity. The technique, clarify syntax and structure, was not selected by any respondents. Respondents may not have known what this technique describes or how to implement it.

Nine techniques are associated with UDL Principle II, multiple means of action and expression. The most frequently selected technique, use multiple media for communication, is likely a technique with which most survey respondents have some experience. Instructional technology specialists, curriculum specialists, and instructors who are responsible for content in the online learning environment routinely develop and implement opportunities for communicating with learners.

Least frequently selected UDL Principle II techniques include use multiple tools for construction and composition and guide appropriate goal setting. Their infrequent selection may be related to respondent unfamiliarity. Respondents may not know how or when to implement

these techniques. It is possible that course developers and instructors perceive guiding learners in appropriate goal setting as a less critical UDL technique than those techniques associated directly with course content or delivery.

Of the 10 techniques associated with UDL Principle III, one, foster collaboration and community, was selected by more than 80% of survey respondents. Application of this technique is fairly standard practice among online course developers and instructors. It is considered vital to successful online learning and the vehicle through which online learning occurs (Palloff & Pratt, 2007). Three techniques were selected least frequently. These include: facilitate personal coping skills and strategies, heighten salience of goals and objectives, and vary demands and resources to optimize challenge. Applying these techniques may require highly developed professional skills. Dawley (2007) described the successful online teacher as one who empowers students through the promotion of the achievement of learning objectives. If survey respondents believed they lacked the skill and experience to apply these techniques, they would not have applied them to their online course development or teaching practice, and they would not have selected the techniques in the survey.

Limitations

There were limitations of this investigation. The sample of WTCS faculty and staff that completed the survey was small. It would be difficult to generalize their responses to all WTCS faculty and staff or another population. There was limited participation among Wisconsin Technical Colleges. Of the 16 Wisconsin Technical Colleges, seven colleges had no faculty or staff who participated in the survey. Faculty and staff at these colleges either declined to participate in the survey or self-identified as not meeting the stated criteria for full participation in the survey. The Wisconsin Technical College System Factbook 2012 (2012) indicates

Milwaukee Area Technical College (MATC) offers the greatest number of programs within the Wisconsin Technical College System and has one of the largest enrollments. However, no faculty or staff from MATC attended a 2010 UDL workshop. Therefore no MATC faculty or staffs was invited to participate in the investigation's survey.

The job responsibilities of the two respondents who selected other as a response are unknown. It is possible their responsibilities were a hybrid teaching-specialist role. It may be that these individuals interpreted the response options differently than others who made a selection among the three job descriptions. It is possible that these two responses were provided by individuals with administrative responsibilities.

It is not known if WTCS faculty and staff attended the UDL workshops voluntarily or if their attendance was required. Those WTCS faculty and staff who attended voluntarily may have been more willing to apply UDL techniques, complete the investigation survey, and report their application of UDL techniques than those who were required to attend. The list of WTCS faculty and staff invited to complete the survey and the sample of those who did so may have attended other UDL training before or after the 2010 UDL workshops. It is not known how other UDL training in which WTCS faculty and staff may have participated may have influenced their willingness to complete the survey and report their application of UDL techniques.

In the survey invitation electronic message sent to WTCS faculty and staff, web-based resources were provided to clarify and provide further information about UDL and its principles. It is not known if survey respondents accessed the resources, and it is not known if their awareness of UDL and its associated principles was sufficient to respond to survey questions as the researcher intended. It is possible that respondents' awareness of UDL concepts and principles influenced their survey responses.

Online course construction and instruction phases were briefly described within the survey. They were referenced as online course design, development, and delivery. The manner in which survey respondents interpreted these phases and their responsibilities associated with each phase may have influenced their survey responses for questions related to the application of UDL principles.

Conclusions

Based on the findings of the investigation, these conclusions were identified.

1. WTCS faculty and staff who attended UDL workshop training presented by Dr. Therese Willkomm in 2010 were influenced by their participation to apply UDL techniques to their online course development or teaching practice.
2. UDL techniques were applied most frequently in the delivery of online instruction, less frequently in the design of online instruction, and least frequently in the development of online instruction.
3. Wisconsin Technical College System faculty and staff were most likely to apply UDL techniques in a limited manner as indicated by the frequency of their responses that they applied some UDL techniques presented at the workshops they attended.
4. The UDL technique applied most frequently by WTCS faculty and staff, foster collaboration and community, is associated with Principle III, multiple means of engagement. Nearly as frequently applied are three UDL techniques that are associated with Principle I, multiple means of representation. They are: illustrate through multiple media, offer alternatives for visual information, and offer alternatives for auditory information.

Recommendations

The following recommendations are proposed based on the findings and conclusions of this investigation.

1. Given the limited application of UDL techniques described in the survey, comprehensive training specifically related to UDL strategy, techniques, and principles in the online learning environment should be made available to WTCS faculty and staff. The training could be integrated into existing WTCS faculty certification training, or it could be developed as a stand-alone course. The training should be required for all WTCS faculty and staff. Individual college districts could extend this training with localized training and staff support.
2. A repository of UDL technique application models should be developed and maintained at the state, regional, or local level for WTCS faculty and staff use. It appears that the application of UDL techniques among WTCS faculty and staff is an emerging practice. A shared repository of resources could encourage greater use of UDL techniques in more areas of course construction and instruction.
3. The development, design, and delivery of online courses within the Wisconsin Technical College System should be guided by UDL and its principles. Online courses that are subject to district review should be assessed, among other criteria, in terms of their application of UDL techniques.
4. Further study should be conducted to compare and contrast how each of the 16 Wisconsin Technical Colleges applies UDL techniques. The research should consider all learning environments, all methods of instructional delivery, and all programs. This could be a state-wide initiative or an informal effort in which colleges collect and share data.

5. Further research should be conducted to determine how UDL techniques are applied in the online learning environments of two-year post-secondary institutions. This information could serve as a basis of comparison.
6. The results of this investigation should be shared with all WTCS curriculum specialists and instructional designers. This could encourage dialog and further research with a goal to identify and apply best practices for UDL in the online learning environment.

References

Administration on Aging. (2011, September 1). Aging statistics. In *Older population as a percentage of the total population: 1900 to 2050* (projected future growth of the older population) [Spreadsheet]. Retrieved from US Department of Health & Human Services website: http://www.aoa.gov/AoARoot/Aging_Statistics/future_growth/future_growth.aspx.

Adult learning in focus: National and state-by-state data (Monograph). (2008). Retrieved from Council for Adult and Experiential Learning website: http://www.cael.org/pdf/State_Indicators_Monograph.pdf.

Aguinaga, N., & O'Brien, C. (2009). Universal design for learning and technology integration in higher education: Can we meet the needs of students with disabilities in university classrooms? In I. Gibson et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2009* (pp. 2419-2421). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/30993.

Allen, I. E., & Seaman, J. (2007). *Online nation: Five years of growth in online learning,* Babson Survey Research Group. Retrieved from http://sloanconsortium.org/publications/survey/online_nation.

Allen, I. E., & Seaman, J. (2011). *Going the distance: Online education in the United States 2011*, Babson Survey Research Group. Retrieved from http://www.onlinelearningsurvey.com/reports/goingthedistance.pdf.

Aslanian, C., & Giles, N. G. (n.d.). *Hindsight, insight, foresight: Understanding adult learning trends to predict future opportunities*. Retrieved from EducationDynamics website: http://www.educationdynamics.com/CMSPages/GetFile.aspx?guid=119845f5-ed25-4597-a32e-9761e930d300.

Aud, S., Hussar, W., Kena, G., Bianco, K., Frohlich, L., Kemp, J., & Tahan, K. (2011). *The condition of education 2011* (NCES 2011-033). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

CAST. (2012a). CAST timeline: One mission, many innovations, 1984-2010. In *About CAST* (history). Retrieved from http://www.cast.org/about/timeline/index.html.

CAST. (2012b). Changes in guidelines 2.0. In *About UDL*. Retrieved from http://www.udlcenter.org/aboutudl/udlguidelines/changes.

CAST. (2012c). UDL guidelines - version 2.0. In *About UDL*. Retrieved from http://www.udlcenter.org/aboutudl/udlguidelines.

CAST. (2012d). UDL questions and answers. In *About UDL* (question 5). Retrieved from http://www.cast.org/udl/faq/index.html#q5.

Center for Universal Design. (2002). Ron Mace. In E. Ostroff, M. Limont, & D. G. Hunter, *Building a world fit for people: Designers with disabilities at work* (sec. 1). Retrieved from http://www.humancentereddesign.org/adp/profiles/index.php.

Center for Universal Design. (2010a, February 7). *History of the center*. Retrieved from NC State University, College of Design website: http://www.ncsu.edu/project/design-projects/udi/center-for-universal-design/history/.

Center for Universal Design. (2010b, September 7). *Ronald L. Mace*. Retrieved from NC State University, College of Design website: http://www.ncsu.edu/project/design-projects/udi/center-for-universal-design/ron-mace/.

Center for Universal Design. (2011, July 9). *History of universal design*. Retrieved from NC State University, College of Design website: http://www.ncsu.edu/project/design-projects/udi/center-for-universal-design/history-of-universal-design/.

Cochran, D., Bowman, C., Madsen, C., King, J., & Shrilla, A. (2006). Universal design for learning (UDL): The hook to catch and hold diverse learners – lessons from designing graduate education instruction. In C. Crawford et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2006* (pp. 4187-4191). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/22762.

Conceicao, S. O. (2007). Setting directions for the future of online and adult education. *New directions for adult and continuing education*, (113), 87-91.

Conlan, J., Grabowski, S., & Smith, K. (2003). Adult Learning. In M. Orey (Ed.), *Emerging perspectives on learning, teaching, and technology.* Retrieved from http://projects.coe.uga.edu/epltt/.

Coombs, N. (2010). *Making online teaching accessible*. San Francisco, CA: Jossey-Bass.

Dawley, L. (2007). *The tools for successful online teaching*. Hershey, PA: Information Science.

Eduventures. (2008). *The adult learner: An eduventures perspective who they are, what they want, and how to reach them*. Retrieved from http://learn.eduventures.com/rs/eduventures/images/Eduventures_WP_AdultLearners.pdf.

Edyburn, D. L. (2010). Would you recognize universal design for learning if you saw it? Ten propositions for new directions for the second decade of UDL. *Learning Disability Quarterly*, *33*(1), 33-41.

Engleman, M., & Jeffs, T. (2008). Increasing student engagement with universal design for learning. In C. Bonk et al. (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2008* (pp. 52-57). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/29578.

Engleman, M., & Schmidt, M. (2007). Testing an experimental universally designed learning unit in a graduate level online teacher education course. *Journal of Online Learning and Teaching, 3*(2), 112-132. Retrieved from http://jolt.merlot.org/vol3no2/engleman.htm.

Engleman, M., & Voytecki, K. (2010). Universal design for learning in online university courses: A 5-year study of learning styles, personality types and instructional preferences. In D. Gibson & B. Dodge (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2010* (pp. 449-454). Chesapeake, VA: AACE.

Erickson, W., Lee, C., & von Schrader, S. (2010, March 17). *Disability statistics from the 2008 American community survey (ACS).* Ithaca, NY: Cornell University Rehabilitation Research and Training Center on Disability Demographics and Statistics (StatsRRTC). Retrieved from www.disabilitystatistics.org.

Fact book 2012. (2012). Retrieved from Wisconsin Technical College System Office website: http://www.wtcsystem.edu/reports/data/factbook/.

Frey, T. (2008). Determining the impact of online practicum facilitation for in-service teachers. *Journal of Technology & Teacher Education*, *16*(2), 181-210.

Gradel, K., & Edson, A. J. (2009-2010). Putting universal design for learning on the higher ed agenda. *Journal of Educational Technology Systems, 38*(2), 111-121. doi:10.2190/ET.38.2.d.

Gregg, N. (2007). Underserved and unprepared: Postsecondary learning disabilities. *Learning Disabilities Research & Practice (Blackwell Publishing Limited)*, *22*(4), 219-228. doi:10.1111/j.1540-5826.2007.00250.x

Hardré, P. (2005). Instructional design as a professional development tool-of-choice for graduate teaching assistants. *Innovative Higher Education*, *30*(3), 163-175. doi:10.1007/s10755-005-6301-8.

Harrison, E. G. (2006). Working with faculty toward universally designed instruction: The process of dynamic course design. *Journal of Postsecondary Education & Disability*, *19*(2), 152-162.

Hirschman, A. M., Lemke, M. R., & Smith, R. O. (2010, November 18). *Real numbers and implications for interventions: The prevalence of disability on campus*. Concurrent Workshop presented at the annual Accessing Higher Ground Conference, Assistive Technology in Higher Education Network, Westminster, CO.

Hoare, C. (2009). Models of adult development in Bronfenbrenner's bioecological theory and Erickson's biopsychosocial life stage theory: Moving to a more complex three-model view. In M. C. Smith & N. DeFrates-Densch (Eds.), *Handbook of research on adult learning and development* (pp. 68-102). New York, NY: Routledge.

Hogan, G. (2003). *The inclusive corporation*. Athens, OH: Swallow Press.

Holmes, G., & Abington-Cooper, M. (2000, Summer/Fall). Pedagogy vs. andragogy: A false dichotomy? *The Journal of Technology Studies, 26*(2). Retrieved from http://scholar.lib.vt.edu/ejournals/JOTS/Summer-Fall-2000/holmes.html.

Horton, S. (2005). *Access by design*. Retrieved from http://www.universalusability.com//l-2000/holmes.html C. Smith.

Horton, W. (2011). *E-Learning by design* (2nd ed.). San Francisco, CA: Pfeiffer. (Original work published 2006).

Izzo, M., Murray, A., & Novak, J. (2008). The faculty perspective on universal design for learning. *Journal of Postsecondary Education & Disability*, *21*(2), 60-72.

Jarvis, P. (2004). *Adult education and lifelong learning* (3rd ed.). New York, NY: RoutledgeFalmer. (Original work published 1983).

Johnson, G. R., & Magnan, R. (2009). *Beyond subject matter expertise*. Madison, WI: Atwood.

Keeler, C. G., & Horney, M. (2007). Online course designs: Are special needs being met? *American Journal of Distance Education*, *21*(2), 61-75. doi:10.1080/08923640701298985.

Kenner, C., & Weinerman, J. (2011). Adult learning theory: Applications to non-traditional college students. *Journal of College Reading & Learning*, *41*(2), 87-96.

Ketterlin-Geller, L. R., & Johnstone, C. (2006). Accommodations and universal design: Supporting access to assessments in higher education. *Journal of Postsecondary Education & Disability*, *19*(2), 163-172.

Khajavinia, R. (2007). Online course designs: Anything to change? In T. Bastiaens & S. Carliner (Eds.), *Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education 2007* (pp. 7159-7197). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/26919.

King-Sears, M. (2009). Universal design for learning: Technology and pedagogy. *Learning Disability Quarterly*, *32*(4), 199-201.

Manning, S., & Johnson, K. E. (2011). *The technology toolbelt for teaching*. San Francisco, CA: Jossey-Bass.

McGuire, J. M., & Scott, S. S. (2006). Universal design for instruction: Extending the universal design paradigm to college instruction. *Journal of Postsecondary Education & Disability*, *19*(2), 124-134.

Merriam, S. B. (2008). Adult learning theory for the twenty-first century. *New Directions for Adult & Continuing Education*, (119), 93-98. doi:10.1002/ace.309.

Morrison, G. M., Ross, S. M., Kalman, H. K., & Kemp, J. E. (2011). *Designing effective instruction* (6th ed.). Hoboken, NJ: John Wiley & Sons. (Original work published 2001).

Newman, L., Wagner, M., Cameto, R., Knokey, A. M., & Shaver, D. (2010). *Comparisons across time of the outcomes of youth with disabilities up to 4 years after high school. A report of findings from the national longitudinal transition study-2 (NLTS2).* Menlo Park, CA: SRI International. Retrieved from http://www.nlts2.org/reports/2010_09/nlts2_report_2010_09_complete.pdf.

Norton, P., & Smith, R. D. (2007). Preparing virtual teachers: Who is on the other end? In R. Carlsen et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2007* (pp. 456-463). Chesapeake, VA: AACE. Retrieved from http://www.editlib.org/p/24580.

Ofiesh, N. S., Rojas, C. M., & Ward, R. A. (2006). Universal design and the assessment of student learning in higher education: Promoting thoughtful assessment. *Journal of Postsecondary Education & Disability*, *19*(2), 173-181.

Online learning: By the numbers. (2010, November 5). *The Chronicle of Higher Education*, pp. B28-B29. Retrieved from http://chronicle.texterity.com/onlinelearning/20101105b/?sub_id=SAVWg2H6W1FC.

Ouellet, M. L. (2004). Faculty development and universal instructional design. *Equity & Excellence in Education*, *37*(2), 135-144.

OXO. (n.d. a). *About OXO*. Retrieved from http://www.oxo.com/aboutOXO.aspx.

OXO. (n.d. b). *Our awards*. Retrieved from http://www.oxo.com/OurAwards.aspx.

OXO. (n.d. c). *Our roots*. Retrieved from http://www.oxo.com/OurRoots.aspx.

Palloff, R. M., & Pratt, K. (2007). *Building online learning communities* (2nd ed.). San Francisco, CA: Jossey-Bass. (Original work published 1999).

Palloff, R. M., & Pratt, K. (2011). *The excellent online instructor*. San Francisco, CA: Jossey-Bass.

Parry, M. (2010, November 5). Tomorrow's college. *The Chronicle of Higher Education*, pp. B4-B6. Retrieved from http://chronicle.texterity.com/onlinelearning/20101105b/?sub_id=SAVWg2H6W1FC.

Parsad, B.,& Lewis, L. (2008). *Distance education at degree-granting postsecondary institutions: 2006–07* (NCES 2009–044). National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education. Washington, DC.

Plimmer, G., & Schmidt, A. (2007). Possible selves and career transition: It's who you want to be, not what you want to do. *New Directions for Adult and Continuing Education*, (114), 61-74.

Pliner, S. M., & Johnson, J. R. (2004). Historical, theoretical, and foundational principles of universal instructional design in higher education. *Equity & Excellence in Education*, *37*(2), 105-113.

Raphael, A. (2006, Summer). A needs assessment: A study of perceived need for student services by distance learners. *Online Journal of Distance Learning Administration, 9*(2). Retrieved from http://www.westga.edu/~distance/ojdla/summer92/raphel92.pdf.

Riding, R., & Rayner, S. (1998). *Cognitive styles and learning preferences*. Oxford, UK: David Fulton.

Roberts, K. (2004). The need for universal design in online learning environments. *AACE Journal, 12*(2), 188-197.

Roman, T., Kelsey, K., & Lin, H. (2010, Winter). Enhancing online education through instructor skill. *Online Journal of Distance Learning Administration, 8*(4). Retrieved from http://www.westga.edu/~distance/ojdla/winter134/roman_kelsey134.html.

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

Rossiter, M. (2007). Possible selves in adult education. *New Directions for Adult and Continuing Education*, (114), 87-94.

Rudestam, K. E., & Shoenholtz-Read, J. (2010). The flourishing of adult online education: An overview. In K. E. Rudestam & J. Shoenholtz-Read (Eds.), *Handbook of online learning* (2nd ed., pp. 1-29). Thousand Oaks, CA: Sage.

Sorensen, C. K., & Baylen, D. M. (2009). Learning online. In A. Orellana, T. L. Hudgins, & M. Simonson (Eds.), *The perfect online course* (pp. 69-86). Charlotte, NC: Information Age.

State Educational Technology Directors Association. (2010, November 9). *The digital transformation in education: U.S. Secretary of Education Arne Duncan's remarks at the State Educational Technology Directors Association education forum* [Video file]. Retrieved from http://www.youtube.com/ watch?v=sSx125ZXc8A.

Taylor, E. W. (2008). Transformative learning theory. *New Directions for Adult & Continuing Education*, (119), 5-15. doi:10.1002/ace.301.

The Center for an Accessible Society. (n.d.). *Universal design*. Retrieved from http://www.accessiblesociety.org/topics/universaldesign/.

The college of health and human services. (2011). Therese Willkomm. In *Occupational therapy faculty.* Retrieved from University of New Hampshire website: http://chhs.unh.edu/ot/facultyot.html.

U.S. Department of Education, National Center for Education Statistics. (2007). *The condition of education 2007* (NCES 2007-064). Washington, DC: U.S. Government Printing Office.

United States Department of Labor, Bureau of Labor Statistics. (2010, September). College students and graduates. In *Back to college* (par. 3). Retrieved from http://www.bls.gov/spotlight/2010/college/.

United States Department of Labor, Bureau of Labor Statistics. (2010, December 3). Overview of the 2008-18 projections. In *Occupational outlook handbook, 2010-11 edition* (employment change by detailed occupation). Retrieved from http://www.bls.gov/oco/oco2003.htm#education.

Voytecki, K., Engleman, M., & Jeffs, T. (2010). A preliminary investigation into pedagogical and practical difficulties encountered by university faculty in online teaching. In D. Gibson & B. Dodge (Eds.), *Proceedings of society for information technology & teacher education international conference 2010* (pp. 956-961). Chesapeake, VA: AACE.

Voytecki, K., Zambone, A., Engleman, M., & Anderson, P. (2008). Alignment of instructor and student learning styles and preferences in distance education courses. In K. McFerrin et al. (Eds.), *Proceedings of society for information technology & teacher education international conference 2008* (pp. 1556-1561). Chesapeake, VA: AACE.

Walter, P. (2009). Philosophies of adult environmental education. *Adult Education Quarterly*, *60*(1), 3-25.

Wisconsin Technical College System. (2009a). *History*. Retrieved from http://www.wtcsystem.edu/history.htm.

Wisconsin Technical College System. (2009b). *Responsibilities*. Retrieved from http://www.wtcsystem.edu/responsibilities.htm.

Wisconsin Technical College System. (2009c). *Who we serve*. Retrieved from http://www.wtcsystem.edu/serve.htm.

Wisconsin Technical College System Office. (2011). *How to become certified*. Retrieved from http://systemattic.wtcsystem.edu/certification/Cert/Become/become.htm.

Wu, X. (2010, December 1). Universal design for learning: A collaborative framework for designing inclusive curriculum. *i.e.: inquiry in education, 1*(2), article 6. Retrieved from http://digitalcommons.nl.edu/ie/vol1/iss2/6/.

Appendix A: Survey Instrument

This research has been reviewed by the UW-Stout IRB as required by the Code of Federal Regulations Title 45 Part 46.

Your knowledge and experience make you highly qualified to participate in this research. As you complete this survey, think about your participation in one or more Universal Design for Learning (UDL) workshops conducted by Dr. Therese Willkomm. She presented a series of workshops to Wisconsin Technical College faculty and staff in 2010. For this survey, reflect on how you may have applied UDL techniques to the design, development, and delivery of on-line courses following your participation in one of Dr. Willkomm's workshops. Specifically consider how you may have applied techniques in support of one or more of the three UDL principles shown below.

- Principle 1: Provide Multiple Means of Representation.
- Principle 2: Provide Multiple Means of Action and Expression.
- Principle 3: Provide Multiple Means of Engagement.

This survey should require no more than ten minutes to complete. You are encouraged to complete it at the time you open and begin the survey. However, it is possible to begin the survey and save your responses and complete them later - as long as you complete them before the end of the survey's availability. Your identity cannot be determined from your responses. All responses will be kept confidential. Only the researcher can access the information which will be reported in a descriptive summary. You may decline to participate in this study at any time even if you have previously indicated you would participate. You do not need to tell the researcher you have decided not to participate. As this is an on-line survey, your responses will be completely anonymous. You have the right not to participate in this survey; however, if you decide to participate, your responses will be recorded, and the data will not be able to be withdrawn since it will not be linked to your name. Questions are presented one at a time. You must answer the question presented to move forward. You may move backward to review your responses. Your responses will not be recorded until you reach the end of the survey and have responded to all required questions. Once your responses are recorded, you cannot complete the survey again. Read each question or statement completely and carefully and select a response based on your personal experiences applying UDL techniques in on-line course design, development, or delivery. Thank you for your participation in this study. Click the red arrow button at the bottom of this page to begin the survey.

1. During 2010, Dr. Therese Willkomm presented a series of UDL workshops in a full-week, full-day, and half-day formats. Your name was provided by the coordinator of the 2010 UDL training workshops. You were identified as having participated in a workshop provided by Dr. Therese Willkomm. Please select from among the choices below to continue or exit the survey.

    a. I attended a UDL workshop, and I am responsible for designing, developing, or delivering on-line classes.
    b. I attended a UDL workshop, but I am not responsible for designing, developing, or delivering on-line classes.
    c. I did not attend a UDL workshop.

2. To what extent did the workshop you attended influence your ability to apply Principle 1 (below) in the design, development, or delivery of on-line courses?

    Principle 1: Provide multiple means of representation.

    a. No influence on the design, development, or delivery of on-line courses for which I am responsible.
    b. I applied some UDL techniques presented at the workshop to the design, development, or delivery of on-line courses for which I am responsible.
    c. I applied UDL techniques presented at the workshop whenever possible to the design, development, or delivery of on-line courses for which I am responsible.
    d. UDL techniques guided the redesign, redevelopment, or facilitation of all, or almost all, on-line courses for which I am responsible and for any new on-line courses I designed, developed, or delivered.

3. You have indicated that your participation in a UDL workshop influenced your application of techniques that provide multiple means of representation. Select all techniques that you have applied.

    a. Offer ways of customizing the display of information.
    b. Offer alternatives for auditory information.
    c. Offer alternatives for visual information.
    d. Clarify vocabulary and symbols.
    e. Clarify syntax and structure.
    f. Support decoding of text, mathematical notation, and symbols.
    g. Promote understanding across languages.
    h. Illustrate through multiple media.
    i. Activate or supply background knowledge.
    j. Highlight patterns, critical features, big ideas, and relationships.
    k. Guide information processing, visualization, and manipulation.
    l. Maximize transfer and generalization.

4. Where did you apply UDL techniques that provide multiple means of representation? Select all that apply.

    a. On-line Course Design (This describes activities associated with the design of course content including learner to course interaction.)
    b. On-line Course Development (This describes activities associated with the creation of course content including learner to course interaction based on the course design.)
    c. On-line Course Delivery (This describes activities associated with the distribution of content to learners and facilitation of their interaction with course content.

5. To what extent did the workshop you attended influence your ability to apply Principle 2 (below) in the design, development, or delivery of on-line courses?

    Principle 2: Provide multiple means of action and expression.

    a. No influence on the design, development, or delivery of on-line courses for which I am responsible.
    b. I applied some UDL techniques presented at the workshop to the design, development, or delivery of on-line courses for which I am responsible.
    c. I applied UDL techniques presented at the workshop whenever possible to the design, development, or delivery of on-line courses for which I am responsible.
    d. UDL techniques guided the redesign, redevelopment, or facilitation of all, or almost all, on-line courses for which I am responsible and for any new on-line courses I designed, developed, or delivered.

6. You have indicated that your participation in a UDL workshop influenced your application of techniques that provide multiple means of action and expression. Select all techniques that you have applied.

    a. Vary the methods for response and navigation.
    b. Optimize access to tools and assistive technologies.
    c. Use multiple media for communication.
    d. Use multiple tools for construction and composition.
    e. Build fluencies with graduated levels of support for practice and performance.
    f. Guide appropriate goal setting.
    g. Support planning and strategy development.
    h. Facilitate managing information and resources.
    i. Enhance capacity for monitoring progress.

7. Where did you apply UDL techniques that provide multiple means of action and expression? Select all that apply.

    a. On-line Course Design (This describes activities associated with the design of course content including learner to course interaction.)
    b. On-line Course Development (This describes activities associated with the creation of course content including learner to course interaction based on the course design.)
    c. On-line Course Delivery (This describes activities associated with the distribution of content to learners and facilitation of their interaction with course content.)

8. To what extent did the workshop you attended influence your ability to apply Principle 3 (below) in the design, development, or delivery of on-line courses?

   Principle 3: Provide multiple means of engagement.

   a. No influence on the design, development, or delivery of on-line courses for which I am responsible.
   b. I applied some UDL techniques presented at the workshop to the design, development, or delivery of on-line courses for which I am responsible.
   c. I applied UDL techniques presented at the workshop whenever possible to the design, development, or delivery of on-line courses for which I am responsible.
   d. UDL techniques guided the redesign, redevelopment, or facilitation of all, or almost all, on-line courses for which I am responsible and for any new on-line courses I designed, developed, or delivered.

9. You have indicated that your participation in a UDL workshop influenced your application of techniques that provide multiple means of engagement. Select all techniques that you have applied.

   a. Optimize individual choice and autonomy.
   b. Optimize relevance, value, and authenticity.
   c. Minimize threats and distractions.
   d. Heighten salience of goals and objectives.
   e. Vary demands and resources to optimize challenge.
   f. Foster collaboration and community.
   g. Increase mastery-oriented feedback.
   h. Promote expectations and beliefs that optimize motivation.
   i. Facilitate personal coping skills and strategies.
   j. Develop self-reflection and assessment.

10. Where did you apply UDL techniques that provide multiple means of engagement? Select all that apply.

    a. On-line Course Design (This describes activities associated with the design of course content including learner to course interaction.)
    b. On-line Course Development (This describes activities associated with the creation of course content including learner to course interaction based on the course design.)
    c. On-line Course Delivery (This describes activities associated with the distribution of content to learners and facilitation of their interaction with course content.)

11. Have you engaged in formal training or education related to UDL other than the training provided by Dr. Willkomm?

    a. Yes
    b. No
    c. Not Sure

12. Does your college provide formal training opportunities to faculty and staff in UDL techniques?

    a. Yes
    b. No
    c. Not Sure

13. Select the job that most closely describes the activities for which you are responsible.

    a. Instructor
    b. Instructional Technology Specialist
    c. Curriculum Specialist / Instructional Designer
    d. Other

14. Identify your college district.

    a. Blackhawk
    b. Chippewa Valley
    c. Fox Valley
    d. Gateway
    e. Lakeshore
    f. Madison Area
    g. Mid-State
    h. Milwaukee Area
    i. Moraine Park
    j. Nicolet Area
    k. Northcentral
    l. Northeast Wisconsin
    m. Southwest Wisconsin
    n. Waukesha County
    o. Western
    p. Wisconsin Indianhead
    q. Prefer Not to Answer

15. Number of years you have been responsible for designing, developing, or delivering on-line courses as an employee of a Wisconsin Technical College.

    a. Less than 1
    b. 1 to 3
    c. 4 to 6
    d. 7 to 9
    e. 10 or more

Appendix B: E-Mail Request to WTCS Curriculum Colleagues

from: Chapko, Nancy <chapkon@gtc.edu>
to: Chapko, Nancy chapkon@gtc.edu
bcc: [WTCS Instructional Designers and Curriculum Specialists]
date: Tue, Feb 28, 2012 at 2:17 PM
subject: Need Your Help to Spread the (Survey) Message

Hello Colleagues,

I am asking for your help.

On Thursday, March 1, I will be sending an e-mail invitation to the more than 200 WTCS faculty and staff (which may include you) who participated in at least one Universal Design for Learning (UDL) workshop that Dr. Therese Willkomm presented in 2010. You may recall her lively workshops in which she described UDL techniques and demonstrated their application.

As part of my EdS research at the University of Wisconsin –Stout, I am conducting a survey to determine what influence Dr. Willkomm's workshops had on those who attended. In short, I'm attempting to determine if WTCS faculty and staff incorporated any of the techniques demonstrated into their own online teaching practice or course development processes. Your college was represented at the workshops, and that is why I'm asking for your help.

From the list of workshop attendees – graciously provided by MATC-Madison - certainly some faculty and staff are no longer performing the jobs they were in 2010. Others may not be terribly interested in completing a survey. Hoping to achieve the best response possible, I am, therefore, asking if you would spread the word at your college that the survey participation of all who attended a UDL workshop would be very much appreciated.

The survey is short and results are confidential. Full instructions will be provided in thee-mail invitation. Those who participate in the survey will help create a description of the manner in which WTCS faculty and staff implemented UDL techniques in online courses following Dr. Willkomm's training. The data collected will help faculty and staff understand how UDL techniques may be integrated effectively in online course design, development, and delivery.

Your personal endorsement of the survey will help me achieve my research goals. Feel free to redirect this message to a colleague if appropriate. I look forward to sharing the results when they are available. Please let me know if you have questions.

Best Regards,

Nancy Chapko
Instructional Designer
Gateway Technical College
262-767-5334

Appendix C: E-Mail Invitation to Participants to Complete Survey

from: Chapko, Nancy chapkon@gtc.edu
to: Nancy Chapko <chapkon@gtc.edu>
bcc: [WTCS Faculty and Staff]
date: Thu, Mar 1, 2012 at 12:04 AM
subject: Tell Us How You Applied UDL Techniques

Hello WTCS Faculty or Staff Member,

You are invited to participate in a study of Wisconsin Technical College faculty and staff regarding the manner in which you applied Universal Design for Learning (UDL) techniques following Dr. Therese Willkomm's training in 2010. You were identified by the MATC-Madison coordinator of the UDL training workshops as having participated in a full week, full day, or half-day workshop presented by Dr.Willkomm.

Your participation in this study will help create a description of the manner in which Wisconsin Technical College System faculty and staff implemented UDL techniques in online courses following Dr. Willkomm's training. The data collected will help faculty and staff understand how UDL techniques may be integrated effectively in online course design, development, and delivery.

If you would like a brief review of UDL principles, view this four-minute video, UDL at a Glance. A document describing UDL guidelines is attached. More information is available at the Center for Applied Special Technology (CAST) at www.cast.org.

The study in which you are invited to participate requires your completion of a short, confidential, web-based survey. It should take no more than ten minutes to complete and will be available through March 15, 2012. A consent to participate in research document is attached for your information. Do not sign the document or return it. There is no need for you to acknowledge your receipt of the document. Your consent to participate is implied when you access the survey.

Your participation in the study is voluntary. You may decline to participate at any time even if you've previously indicated you would participate. You do not need to tell me you have decided not to participate. As this is an online survey, your responses will be completely anonymous. You have the right not to participate in this survey; however, if you decide to participate, your responses will be recorded, and the data will not be able to be withdrawn since it will not be linked to your name.

I welcome your participation in this study. This message and its contents are intended specifically for you. Please do not forward its contents or the survey link to others. You may contact me directly at chapkon@gtc.edu or 262-767-5334 with any questions.

Access the Survey Here

I would appreciate your response by March 15.

Best Regards,

Nancy Chapko
Instructional Designer
Gateway Technical College
496 McCanna Parkway
Burlington, WI 53105

Appendix D: E-Mail Reminder to Invited Survey Participants

from: Chapko, Nancy chapkon@gtc.edu
to: Nancy Chapko <chapkon@gtc.edu>
bcc: [WTCS Faculty and Staff]
date: Wed, Mar 7, 2012 at 11:03 AM
subject: Only You Can Tell Us How UDL Has Been Applied

Hello WTCS Faculty and Staff,

Last week you received an e-mail message asking you to tell us how you applied UDL techniques to your teaching, or course development, practice by completing a confidential web-based survey. If you have completed the survey, thank you!

If you have not had a chance to take the survey yet, I would appreciate if you would review the forwarded message and complete the survey at your earliest convenience (the survey link is located at the bottom of the forwarded message). Only you can tell us how UDL techniques have been applied by WTCS faculty and staff.

This message has been sent to all WTCS faculty and staff who participated in Universal Design for Learning workshops provided by Dr. Therese Willkomm in 2010. Since no personal data is retained with the surveys for reasons of confidentiality, we are unable to identify whether or not you have already completed the survey.

Best Regards,

Nancy Chapko
Instructional Designer
Gateway Technical College
496 McCanna Parkway
Burlington, WI 53105
262-767-5334

Appendix E: UDL Application Principles