

THESIS

EFFECTS OF UNIVERSAL DESIGN FOR LEARNING INSTRUCTOR TRAINING  
AS PERCEIVED BY STUDENTS AND INSTRUCTORS

Submitted by

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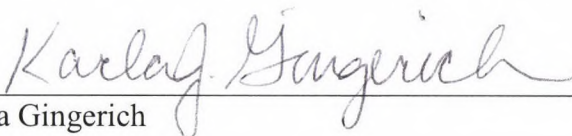
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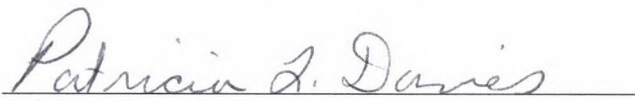
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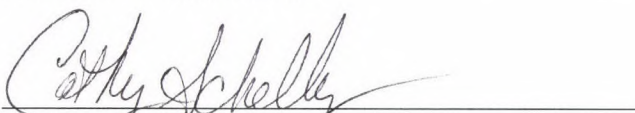
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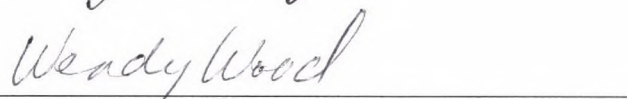
WE HEREBY RECOMMEND THAT THE THESIS PREPARED UNDER OUR SUPERVISION BY WENDY L. COLGAN ENTITLED EFFECTS OF UNIVERSAL DESIGN FOR LEARNING INSTRUCTOR TRAINING AS PERCEIVED BY STUDENTS AND INSTRUCTORS BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE.

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## ABSTRACT OF THESIS

### EFFECTS OF UNIVERSAL DESIGN FOR LEARNING INSTRUCTOR TRAINING AS PERCEIVED BY STUDENTS AND INSTRUCTORS

Objective: The number and diversity of students enrolling in higher education is increasing; however, persistence and retention rates are still an area that needs attention. Universal Design for Learning is an approach that helps provide the greatest educational access to all students. Providing education and professional development to educators in this area may prove to be beneficial to all students.

Method: This quasi-experimental and mixed method design study, examined the change in the implementation of UDL teaching techniques and strategies in college classrooms after UDL instructor training, as perceived by instructors and students. In addition, student perceptions on what promotes an effective teaching and learning environment were examined. UDL questionnaires were designed, tested, redesigned and refined in the first ACCESS project. The questionnaires were used to measure change after UDL training. In the second ACCESS project, ACCESS II staff worked closely with instructors and students of Psychology 100 courses at Colorado State University. Six instructors teaching nine sections of Psychology 100 agreed to participate in the UDL training. At the beginning and end of the semester a total of 1,164 students enrolled in those nine sections and the instructors were administered the UDL questionnaire.



Quantitative as well as qualitative data were collected and analyzed using data analysis software including SPSS 18.0 and Atlas ti 6.0.

Results: The results of the t-test demonstrated that students as well as instructors reported a significant increase in the use of UDL strategies and techniques after the UDL training. Students reported a significant increase in their instructors' use of UDL strategies and techniques after the UDL training on 6 of the 28 questions pertaining to UDL principles. All six of these questions had effect sizes representing small to medium change. Instructors also reported a significant increase in their self-perceptions regarding their use of UDL techniques and strategies after the UDL training on 2 of the 27 questions pertaining to UDL principles. Although they did not reach statistical significance, 13 of 27 questions on the instructors' questionnaire had effect sizes that represent small to larger than typical change from pre to post UDL training. In addition, valuable insight regarding student perceptions on what promotes an effective teaching and learning environment, such as what engages them, and what helps and hinders their learning were obtained.

Conclusion: The results of this research are promising and indicate that even just as few as five one-hour sessions of instructor training in the area of Universal Design for Learning (UDL) may increase the amount of UDL techniques and strategies used in the classroom and enhance the learning experiences of all students. The large effect sizes are promising and indicate meaningful change. In addition, techniques and strategies reported by students, in regards to what promotes an effective teaching and learning environment, align with the three principles of UDL: Multiple means of representation, expression and engagement. The increasingly diverse postsecondary population only



increases the urgency to leave traditional teaching strategies behind and take on a new pedagogical approach that embraces diversity.

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## **INTRODUCTION**

Just as the United States has seen a shift in its demographics over the last several decades, the characteristics of the population enrolling in higher education has also seen a shift. The number and diversity of students enrolling in colleges and universities is increasing. However, the persistence and retention rates of students in these colleges and universities are still an area that needs attention. With these present tough economic times the necessity of a post-secondary education is growing. Today, approximately six out of ten jobs, or 60%, require some sort of post-secondary education (Carnevale & Desrochers, 2003). The number of jobs requiring advanced skills will grow twice that of jobs requiring basic skills by the year 2012 (Fleetwood & Shelly, 2000; Hecker, 2004). In order for students to be successful in today's economy, the importance of successfully completing post-secondary education is rising, increasing the urgency to solve issues regarding enrollment, persistence and retention of students in higher education. To meet the needs all students and serve them effectively, the diversity of this increasing population must be embraced. The universal design approach to teaching and learning is an approach that helps provide the greatest educational access to all students. Providing education and professional development to educators in the area of Universal Design for Learning may prove to be beneficial to all students.



## **Literature Review**

### Universal Design

Universal design first emerged in the area of architecture and design and was originally developed to reduce barriers in order to make physical environments more accessible to individuals with disabilities (Zeff, 2007). The term universal design was created by Ronald Mace, the founder of the Center for Universal Design at North Carolina State University, in response to federal legislation in the 1970's and 1980's, which was greatly influenced by the Disability Rights Movement. These new laws prohibited the discrimination against individuals with disabilities and provided access to education, public places, transportation, and telecommunications. The Center for Universal Design, at North Carolina State University, defines universal design as "the design of products and environments to be used by all people, to the greatest extent possible, without the need for adaptation or specialized design" (The Center for Universal Design, 1997; Story, Mueller & Mace, 1998).

Before the universal design movement, architects seldom addressed the mobility and communication needs of individuals with disabilities, resulting in buildings that were inaccessible to many. Retrofitting is expensive, often takes away from the aesthetic value of the architectural design and is usually inadequate in many ways. Universal design provides a better approach that challenges architects to address the needs of the users at the start, in order to integrate universal accessibility and produce an aesthetically pleasing and functional product (Rose & Meyer, 2002). As the idea of Universal Design spread to civic engineering and commercial product design, an unanticipated benefit became apparent: "Addressing the divergent needs of special populations increases usability for



everyone” (Rose & Meyer, 2002, p 71). An example of this is curb cuts on sidewalks. Curb cuts were originally designed to allow access to individuals in wheelchairs; however, many users benefited from the design including people pushing strollers or pulling luggage on wheels, skateboarders, bicyclists, people with canes and even the average walker. Although originally designed for individuals with disabilities, this added feature benefited all users.

Universal Design emerged from the convergence of three societal forces: (1) the changing demographics (increasing population of individuals with disabilities as a result from war, accident, birth or aging), (2) federal response to these changing demographics (Architectural Barriers Act of 1968, Section 504 of the Rehabilitation Act of 1973, Education of Handicapped Children Act of 1975, The Americans with Disabilities Act of 1990, Fair Housing Amendments Act of 1988) and (3) the advancements in engineering and technology that led to the development of assistive technology- products enhancing accessibility to individuals with disabilities regardless of their needs (Story, Mueller & Mace, 1998, Zeff, 2007).

Just as universal design in the physical environments emerged from a compilation of forces, similar societal forces are apparent today, pushing for application, acceptance and dissemination of universal design in higher education classrooms. These forces include the increasingly diverse student population, the social and pedagogical challenges of integrating new technologies into the classroom, and the political pressures for greater accessibility and accountability (Zeff, 2007; Rose & Meyer, 2002).

## Student Diversity

As the word implies, diversity is not limited to one or two characteristics, but encompasses a multiplicity of differences including age, gender, race/ethnicity, learning styles and preferences, educational experiences, cultural backgrounds, first generation students, students with learning disabilities, English language learners and low income students. According to a descriptive summary by Berkner & Choy (2008) of the 2003-2004 academic year, 4 million students enrolled in postsecondary education for the first time. As part of the Beginning Postsecondary Students Longitudinal Study, a sample of these students, approximately 19,000 students from about 1,300 postsecondary institutions were selected to be interviewed during or just after their first year in 2004. This summary captured the diversity in backgrounds, characteristics and persistence of these students, including gender, disabilities, age, dependency and marital status, race/ethnicity, parents' education and parents' income. According to the summary, a majority of the students were female, with proportionately more students 30 years or older being female. In regards to ethnicity, overall 62% of students were white with over one-third of the students representing a variety of minorities including 15% Hispanic, 13% black, 5% Asian, 1% American Indian and 4% representing other races. Age also varied dramatically with approximately 43% of students 18 years or younger, 23% were 19 years old and 13% were 30 years or older when they first enrolled in post-secondary education. Overall 22% of students who enrolled at a 4 year institution were single parents with up to 32% at a less than 2 year institution. Of the students who enrolled exclusively part-time, 33% were married and another 15% were single parents. The parents of these students varied in their education; approximately 36% had parents who



had not gone beyond high school, 25% had at least one parent with some post secondary education and 39% had at least one parent with a bachelor's degree. A total of 65% of students who began at a less than two year institution came from families in the lowest income group (less than \$32,000).

In a Profile of Undergraduates in U.S. Postsecondary Institutions in 1999-2000 (Horn, Peter, & Rooney, 2002), it was found that 7% of the students were not U.S. citizens, with 5% permanent residents, 2% foreign students, 4% born in another country and immigrated to the U.S. and 1 in 10 were born in the U.S. but had at least one foreign parent. In addition, 13% of undergraduates spoke a language other than English in the home while growing up.

The increasing number of students with disabilities on college campuses was a force that brought universal design into higher education. Approximately 10% of all undergraduates reported having a disability (Berkner & Choy, 2008). According to statistical profiles of college freshman, the number of full time college freshman that self-reported having a learning disability more than doubled from 1988 (1.0%) to 2000 (2.4%) making it the fastest-growing category of reported disability. By 2000, two in five freshmen with a disability reported having a learning disability (40%) compared to only 16% in 1988 (Henderson, 2001).

Campuses have seen a dramatic increase of veteran students and the numbers are expected to increase as more soldiers return home (Church, 2009). The passing of the GI Bill, Americans with Disabilities Act (ADA) and other resources will increase opportunities for veterans to enroll in higher education. Due to the high survival rates of soldiers with injuries from blasts and prolonged trauma there will be a large number of



veterans with disabilities. A total of 31% of the deployed veterans have reported either TBI, PTSD, depression or a combination of these diagnoses (7.3%) (Church, 2009). In addition to students who are reporting their disabilities, many students choose not to self-disclose. According to Church (2009), a number of these students may be veteran students returning from the conflicts in Iraq and Afghanistan. Many of these veterans will have hidden or untreated medical conditions, such as mild traumatic brain injury and/or post traumatic stress disorder, and many will choose not to self-disclose. These young men and women may consider it a weakness to acknowledge a disability, and as a result may choose to remain anonymous. In addition, they may not be aware of or not utilize the traditional services and resources available on campuses for students with disabilities. Colleges and universities could establish veteran friendly campuses by working with veterans to integrate universal design on campuses and facilitate the educational goals of adult learners (Church, 2009).

#### Persistence and Retention

In a Profile of Undergraduates in U.S. Postsecondary Institutions in 1999-2000, the students were examined with respect to seven risk factors previously found to be negatively associated with persistence and degree attainment (Horn, Peter, & Rooney, 2002; Horn & Premo, 1995). These risk factors include: delayed enrollment by a year or more, attending part time, being financially dependent, having children, being a single parent, working full time while enrolled, and being a high school dropout or a GED recipient. From this perspective, the risk factors are highly related to the characteristics of a diverse undergraduate population as described in the above studies (Horn, Peter & Rooney, 2002; Horn & Premo, 1995; Berkner & Choy 2008). In 1999-2000, three

quarters , or 75%, of all undergraduates reported at least one risk factor. Overall, the average number of risk factors reported by all undergraduates was 2.2 (black students (2.7), American Indian/Alaskan Native Students (2.8), Hispanic (2.4), students with disabilities (2.6), undergrads with children or other dependents (4.3) and single parent (4.7).

According to a study of persistence in post-secondary education (Berkner, Cuccaro-Alamin & McCormick, 1995), 64% of beginning students with one risk factor persisted in their program, obtained a degree or vocational certificate within 5 years, compared to 43% of students with 3 or more risk factors. Consequently, among the 1999-2000 undergraduate students with three or more risk factors, up to 50% may be expected to leave without completing a degree or certificate.

A more recent study of students that enrolled in post-secondary education for the first time in the 2003-2004 academic year examined student persistence and attainment three years later (Berkner & Choy,2008). Overall, approximately one half (51%) of all beginning students had not earned a degree but were still enrolled, and about one third (33%) had not earned a degree and were not enrolled anywhere in 2006. More specifically, of students whose initial plan was to complete a certificate, 41% had not attained a certificate or a degree and were not enrolled anywhere. Of those whose initial plan was to complete an associate's degree, 45% had not and were not enrolled anywhere in 2006. A total of 18% of those planning on earning a bachelor's degree were not enrolled anywhere and had not completed their degree in 2006 (Berkner & Choy, 2008).

These data suggest that the post-secondary education system in the U.S. offers opportunities to a diverse group of individuals. Regretfully, despite the enrollment



opportunities, gaining access to a post-secondary education does not necessarily guarantee obtaining a degree or certificate. The reality is, as the diversity of the undergraduate population broadens, it is possible that the number of students leaving without a degree will increase (Horn, Peter & Rooney, 2002).

The ability to accommodate such a diverse undergraduate population that carries such a high risk of attrition is a continuing challenge for our post-secondary education institutions (Horn, Peter & Rooney, 2002). According to Rose, Harbour, Johnston, Daley & Abarbanell (2006), there are two general types of solutions to address the “problems” of individual students. The first is to attribute the challenges to “individual” problems. This view tends to encourage solutions that emphasize the weaknesses in the individual. The other is to consider that the problems are “environmental” and are problems in the design of the learning environment. This environmental view tends to encourage solutions that address these limitations in the learning environment, while making the student less of the problem and more a natural part of the diversity of the course. The advantages of these universal solutions tend to be beneficial for many individuals and once built can be applied many times. Rose, Harbour, Johnston, Daley & Abarbanell (2006) believe that both approaches are important from a pedagogical standpoint. Solutions that embrace both concepts will be more economical, more ecological and reflect the reality that so called disabilities always reveal mismatches between the environment and the individual.”

#### Universal Design for Learning

As is true with Universal Design for the physical environmental, Universal Design for Learning (UDL) was designed to alleviate this mismatch and minimize



barriers for students with disabilities, but in the end, benefits all students. Whenever people gather, diversity is the norm, not the exception. Designing curricula to meet the needs of the students in the broad middle, at the exclusion of these students with different needs and abilities, fails to provide all individuals with fair and equal opportunities to learn (CAST, 2008). Founded in 1984, the Center of Applied Special Technology (CAST) was one of the first groups to apply the idea of universal design to education. CAST's mission "is to expand learning opportunities for all individuals, especially those with disabilities, through Universal Design for Learning" (<http://www.cast.org/about/>). Universal Design for Learning addresses the primary barrier to making expert learners of all students, the one-size-fits-all curricula. This one-size-fits-all approach raises unnecessary barriers to all learners, but most affected are students with disabilities (CAST, 2008).

In fact, research of the learning brain sheds light on learner differences and informs us that there are no "regular" students, only a continuum of strengths and weakness that make each learner unique. The premise of Universal Design for Learning is to develop a curriculum and learning environment that provides equal opportunity and access for all learners regardless of their unique learning needs (Rose & Meyer, 2002). Universal Design for Learning confronts/meets this challenge by suggesting flexible instructional materials, techniques, and strategies that empower educators to meet the needs of the greatest number of students. This helps to eliminate the need for costly and time-consuming individual adaptations and accommodations (CAST, 2008).

Universal Design for Learning is based on three guiding principles.

- **“Principle I: Provide Multiple Means of Representation** (the “what” of learning). Students differ in the ways that they perceive and comprehend

information that is presented to them. For example, those with sensory disabilities (e.g., blindness or deafness); learning disabilities (e.g., dyslexia); language or cultural differences, and so forth may all require different ways of approaching content. Others may simply grasp information better through visual or auditory means rather than printed text. In reality, there is no one means of representation that will be optimal for all students; providing options in representation is essential.

- **Principle II: Provide Multiple Means of Expression** (the “how” of learning). Students differ in the ways that they can navigate a learning environment and express what they know. For example, individuals with significant motor disabilities (e.g. cerebral palsy), those who struggle with strategic and organizational abilities (executive function disorders, ADHD), those who have language barriers, and so forth approach learning tasks very differently and will demonstrate their mastery very differently. Some may be able to express themselves well in writing text but not oral speech, and vice versa. In reality, there is no one means of expression that will be optimal for all students; providing options for expression is essential.
- **Principle III: Provide Multiple Means of Engagement** (the “why” of learning). Students differ markedly in the ways in which they can be engaged or motivated to learn. Some students are highly engaged by spontaneity and novelty while other are disengaged, even frightened, by those aspects, preferring strict routine. In reality, there is no one means of representation that will be optimal for all students; providing multiple options for engagement is essential.”

(CAST, 2008, p3)

Signed into law by the president, the Higher Education Opportunity Act of 2008 includes UDL as a scientifically valid framework for guiding educational practice that provides flexibility and reduces barriers in instruction.

(<http://www.cast.org/pd/institute/june8.html>)

In a study by Izzo, Murray & Novak (2008) the instructional climate for students with disabilities was assessed through a survey of 271 faculty members and teaching associates (TAs). In addition, focus groups were conducted with 92 additional faculty members and TAs. Three consistent themes emerged from these data: (a) a perceived uncertainty about how to meet the learning needs of an increasingly diverse population of students, (b) instructional strategies used to support student learning, and (c) the need for



training and technical assistance on promoting educational access. The study made it clear that although the instructors could not readily define UDL, they knew what multiple methods of instruction were and why they were important. UDL strategies resurfaced again and again as an important approach to the teaching and learning process. For example, “I think the course should be taught in many different ways...If you are trying to help everyone, you will help students with disabilities” and “I try to get people to be able to show their skills in many ways” (Izzo, Murray & Novak, 2008, p64). Instructors agreed that what is good for students with disabilities is often good for all students. What they struggled with was how to implement these methods in their classrooms. Not just in regard to presentation/delivery, but also maximizing student engagement and how to assess student knowledge in ways that capitalize upon student learning strengths without compromising standards for mastery. Many instructors voiced frustration about their inability to meet the instructional needs of their students and the desire for training to increase their competencies in addressing the needs of all students, including the students who choose not to self-disclose their disabilities. A total of 27% (73) respondents stated that they wanted training in UDL first and foremost (Izzo, Murray & Novak, 2008).

In a study of 72 graduate and undergraduate students enrolled in education classes (both special education and general education), it was found that even UDL training in small doses is successful in increasing the ability of instructors to include Universal Design for Learning in the development of curriculum (Spooner, Baker, Harris, Ahlgrim-DeLzell & Browder, 2007). This study was a true pre-test and post-test experimental group design with a randomly assigned control group. The participants were asked to create a lesson plan, which was scored using a rubric that assessed the use of the three

principles of UDL. The experimental group received a one hour classroom presentation on how to modify lesson plans for students with disabilities (mild and severe) using the three components of UDL. Both experimental groups (special education and general education) showed an increase in mean scores from pre-test to post-test, while the control groups' mean scores remained the same. The results of this study suggest that providing UDL training can increase instructors' knowledge and skills that are necessary to design universal curriculum that is accessible to all students (Spooner, Baker, Harris, Ahlgrim-Dezell & Browder, 2007).

The literature suggests the student population in higher education is becoming increasingly diverse, challenging instructors, and institutions in general, to leave the traditional teaching strategies behind and take on a new pedagogical approach that embraces this diversity. Although the *idea* of universal design transfers easily from the physical environment to the learning, the *principles* and *techniques* do not (Rose, Harbour, Johnston, Daley & Abarbanell, 2006). Instructors are concerned about their ability to meet the needs of this increasingly diverse population of students and desire training to increase their competencies. The literature also suggests that offering this training can provide instructors with the skills and knowledge that will allow them to deliver a fair and accessible education to all students. Despite all the recent attention to universal design in higher education research and the Association on Higher Education and Disability (AHEAD, a professional organization for disability services providers) research and application still lag behind theory (Rose, Harbour, Johnston, Daley & Abarbanell, 2006).



## Purpose Statement

The purpose of this study was to examine the change in implementation of the UDL principles and strategies in entry level psychology classes at Colorado State University after instructor UDL training, as perceived by instructors and students. Valuable qualitative data were also collected regarding students perceptions on what promotes an effective teaching and learning environment, such as what engages them and what helps and hinders their learning. These data are part of a larger project, a grant awarded to the Department of Occupational Therapy at Colorado State University titled, *ACCESS II project: Persistence in Post-secondary Education Through Universal Design for Learning and Self-Advocacy*, funded by the U.S. Department of Education (see Appendix A for a description of this funded project).

## Research Questions

### Question #1

Will instructor training regarding UDL increase the implementation of UDL principles?

### Hypothesis #1

After the UDL training for instructors there will be a significant increase in the implementation of UDL principles in the classroom as perceived by the students when compared to student perceptions before the UDL training.

### Hypothesis #2

After the UDL training, instructors' self-perceptions will demonstrate a significant increase in the implementation of UDL principles and strategies they use in the classroom when compared to perceptions before the UDL training.

## Question 2

What types of teaching strategies engage students by increasing and supporting their learning?

## Hypothesis #3

The teaching strategies that students find increase engagement and help them learn will be in alignment with UDL principles.

## **METHODS**

### **Participants**

ACCESS II staff worked closely with instructors and students of Psychology 100 (PSY 100) courses at CSU. Psychology 100 is a historically difficult ‘gateway’ course, meaning a course that high numbers of students are required to take for their majors, but from which high numbers of students drop out or fail. A total of six instructors teaching 9 psychology courses (6 sections of PSY100, PSY252, PSY260 and PSY370) participated in the study. All of these instructors attended the Teaching Fellows Seminar each week throughout the semester. Some instructors that attended the Teaching Fellows Seminar taught higher level psychology classes, in addition to the PSY 100 courses; these instructors and their students participated in this research as well. A total of 1,164 students were enrolled in the nine sections; of those 622 students (approximately 53%) filled out the first questionnaire of the semester and 421 students (approximately 36%) filled out the second questionnaire. Thus, 36% of the students completed both the first and second questionnaire. Of the students who filled out the pre-questionnaire, 614 students answered the question regarding disability identification and 57 (approximately 9.3%) reported having a disability. Only 21 (or approximately 37%) of these students had contacted the university’s student disability services office to seek accommodations for their disabilities. Of the students who completed the post-questionnaire, 390 students answered the question regarding disability identification and 40 students (approximately



10.3) reported having a disability. Sixteen students (approximately 40%) had contacted the disability services office.

## **Materials**

The development and testing of the student and instructor questionnaires took place during the first *ACCESS* project and included 2,618 students completing student questionnaires in 100 and 200 level ‘gateway’ psychology courses over 3 semesters, and 7 core instructors completing several versions of the faculty questionnaires and assisting in the refinement of the student questionnaires. In a pilot study during the fall 2007, which involved 9 sections of a 100 level ‘gateway course,’ the original 27 item questionnaire was administered at the beginning and the end of the semester after the instructors had participated in the UDL training. The results were promising, but the effects were diminished on many of the items due to a ceiling effect. Specifically, a majority of the student responses were in the top two categories of a 5 point Likert scale (e.g., agree and strongly agree) in the first questionnaire. This left almost no room to measure change. To avoid this ceiling effect, the questionnaire was redesigned so that the students could respond according to percentages, giving 11 options instead of only 5. In addition, the questionnaire was administered through the course management program, WebCT. WebCT is a software program being used across the university that provides online teaching and learning tools for delivering instruction to students over the web, including quizzes, assignments, course materials, discussion groups, and grading. This refined questionnaire was tested again in the Spring of 2008. The majority of the responses were more evenly distributed across the top 6 categories for responses, rather

than just the top 2, leaving more room to measure change. These data support that the redesigned questionnaire will be more sensitive to detect meaningful change.

The tested and refined questionnaires were used in this study.

## **Procedures**

Using instructor and student UDL questionnaires that were developed, tested and refined as part of the first ACCESS project (see Appendix B); data were gathered early in the semester regarding instructors' knowledge of and skills in implementing UDL strategies and principles as they teach this 'gateway' course. The student questionnaire was delivered to all students through the quiz/survey tool on WebCT. Using the student UDL questionnaire, staff also gathered data regarding students' perceptions of how well, or whether, their courses were being taught using the principles of UDL. Through the questionnaires, students identified whether or not they have a disability. Although ACCESS members attained the students' ID numbers in order to track their progress, it is important to note that students' confidentiality and anonymity were guaranteed and protected.

Following completion of the first questionnaires by instructors and students, the instructors participated in comprehensive UDL training, using in part the UDL training and technology modules, materials and resources that were developed as a part of the first ACCESS project. These hands-on trainings occurred over the course of several weeks during the semester, and UDL strategies were then implemented in each of the participating courses during and following the trainings. At the end of each semester, the questionnaires were administered again.



## Training Procedures

Of the six instructors participating in the study, five were Ph.D.-level graduate students who had been selected for teaching fellowships based on demonstration of teaching excellence and one was an Assistant Professor who mentored the teaching fellows as a group during weekly meetings throughout the semester. It was during 5 of those meetings that the ACCESS team provided one hour sessions of UDL trainings. The training topics included principles of, and techniques in, each of the three UDL categories for both classroom instruction and the development of accessible course materials. Several supplemental readings were assigned including, *Universal Design for Learning in Postsecondary Education: Reflections on Principles and their Applications* (Rose, D. H., Harbour, W. S., Johnston, C. S., Daley, S. G., & Abarbanell, 2006). The ACCESS staff frequently referred back to these readings during the training sessions. The UDL training was slightly modified after the results of the first questionnaire, making sure to touch upon areas of interest or concern. For example, the students reported that the use of “i>clickers”, a classroom response system, helped to engage them during lecture. In response, the ACCESS staff modified the training to spend more time exploring the effective use of that technology to achieve the inclusive goals of UDL. In addition to the hands on trainings, the instructors had access to a series of tutorials developed by ACCESS team members on how to create “universally designed” Word, PowerPoint, PDF, HTML, and E-Text documents. These tutorials were designed to offer clear explanations of accessibility barriers commonly found in electronic course materials, as well as benefits of UDL techniques for a wide range of users, including those that employed assistive technologies. Additionally, step-by-step instructions were



provided to facilitate more complex operations such as conversions from one format to another, location of menu commands and selection of dialog box options.

### **Data Analysis**

Data from the beginning of each semester, before UDL training and implementation occurred, were compared with data from instructors and students at the end of the semester following UDL implementation. The information gathered included both quantitative and qualitative data. The quantitative data collected by the questionnaire were analyzed using SPSS 18.0 software (SPSS Inc., Chicago, IL). To address hypotheses 1 and 2, descriptive statistics were used to describe the sample. In addition, a paired *t*-test was used to determine any change in pre- and post-training data. The family-wise alpha was .05. For the student data, a bonferoni adjustment, dividing the family-wise alpha by the number of *t*-tests, was used, as this correction is often used when multiple *t*-tests are performed to reduce type I error. The total number of tests run was 39, resulting in a test-wise alpha of .00128. Due to the exploratory nature of the instructor questionnaire the bonferoni adjustment was not used. Thus, a test-wise alpha of .05 was used for the instructors' data. During the analysis it was found that some of the data were not normally distributed. Fortunately, the *t*-test has been found to be "robust" with regard to one or more of their assumptions, and even when the data are not normally distributed, or skewed, they can still be used under many circumstances (Morgan, Leech, Gloeckner & Barrett, 2007). To err on the side of caution, a non-parametric test, the Wilcoxon, was run in addition to the *t*-test. Given that the test results for the Wilcoxon were extremely similar to the results of the *t*-tests, only the results from the *t*-test will be reported. Hypothesis 3 was addressed using qualitative data analysis on

the answers provided by students to the open-ended questions in the questionnaire. The Atlas ti program (Version 6.1.11; Atlat.ti, GmbH, Berlin) was used. Responses were analyzed and emerging themes were be reported.

## RESULTS

### Quantitative

#### Quantitative results for hypothesis 1

Hypothesis 1 stated that after the UDL training for instructors there will be a significant increase in the amount of implementation of UDL principles in the classroom as perceived by the students when compared to their perceptions before the training. Paired samples t-tests were conducted to compare the amount of change in implementation of UDL principles in the classroom before and after training for each question on the questionnaire (see Appendix C). Students reported a significant increase in their instructors use of UDL strategies and techniques after the UDL training on 6 of the 28 questions pertaining to UDL principles, based on the adjusted test-wise alpha level of .00128 (see Table 1). According to student perceptions,

- the percentage of essential material that was presented in multiple formats increased after the UDL training ( $t(385) = -3.68, p < .0001$ );
- the percentage of time the instructor actively engages students in learning increased after the UDL training ( $t(387) = -5.24, p < .0001$ );
- the percentage of each class session, on average, the instructor relates key concepts to the larger objective of the course increased after UDL training ( $t(379) = -5.03, p < .0001$ );
- the percentage of time the instructors begin lectures with an outline of what will be covered increased after the UDL training ( $t(379) = -8.15, p < .0001$ );



- the percentage of lectures the instructor summarizes key points, either during or at the end of the lecture, increased after the UDL training ( $t(382) = -4.07, p < .0001$ );
- the percentage of time the instructor highlights key points of instructional videos to help students understand the content also increased ( $t(369) = -3.71, p < .0001$ ).

All six of these questions had effect sizes representing small to medium change, suggesting that the improvement was meaningful (Cohen, 1988; See Table 1).

Table 3.1: The differences in student responses on the pre-questionnaire and post-questionnaire (t-test) for the six questions that demonstrated statistical significance.

	<i>N</i>		Mean ( <i>SD</i> )		<i>t</i> * <i>p</i>	Effect size <i>d</i> =
	Pre	Post	Pre	Post		
Question 1	614	387	70.05 (24.638)	75.71 (23.151)	-3.675 < .0001	.20
Question 2	617	389	61.69 (28.349)	68.48 (26.739)	-5.240 < .0001	.26
Question 3	608	386	69.62 (21.192)	75.49 (20.459)	-5.026 < .0001	.28
Question 5	607	388	70.15 (36.126)	83.17 (25.171)	-8.145 < .0001	.39
Question 6	605	389	68.50 (29.373)	73.39 (27.144)	-4.068 < .0001	.21
Question 11	592	387	76.72 (26.981)	81.29 (23.565)	-3.707 < .0001	.20

\*  $\alpha = .00128$

#### Quantitative results for hypothesis 2

Hypothesis 2 stated after the UDL training there would be a significant increase in the instructors' self-perceptions in regards to the amount of implementation of UDL principles and strategies they use in the classroom when compared to perceptions before the UDL training. Paired samples t-tests were conducted to compare the amount of change in implementation of UDL principles in the classroom before and after training,

based on instructor self-perception, for each question on the questionnaire (see Appendix D). Instructors reported a significant increase in their self-perceptions regarding their use of UDL techniques and strategies after the UDL training on 2 of the 27 questions pertaining to UDL principles, based on the test-wise alpha level of .05 (see Table 3.2). According to instructor self-perceptions, the percentage of essential information provided during lectures presented in multiple formats (including text, graphics, audio, video, and/or physical movement) increased after the UDL training ( $t(5) = -2.98, p = .031$ ). According to instructor self-perceptions, the percentage of each class session, on average, they actively engaged students in learning increased after the UDL training ( $t(5) = -3.64, p = .015$ ). In addition to being statistically significant, these two questions also had larger than typical effect sizes, again suggesting the increase was meaningful (Cohen, 1988; see table 3.2). Although they did not reach statistical significance, 13 of 27 questions had effect sizes that represent small to larger than typical change from pre to post UDL training (see Table 3.3).

Table 3.2: The differences in instructor responses on the pre-questionnaire and post-questionnaire (t-test) for the two questions that demonstrated statistical significance.

	<i>N</i>		Mean ( <i>SD</i> )		<i>t</i> * <i>p</i>	Effect size <i>d</i> =
	Pre	Post	Pre	Post		
Question 1	6	6	45.00 (22.58)	80.00 (6.32)	-2.976 0.031	2.11
Question 2	6	6	26.67 (8.16)	58.33 (26.39)	-3.630 0.015	1.69

\*  $\alpha = .05$



Table 3.3: The differences in instructor responses on the pre-questionnaire and post-questionnaire (t-test) for the two questions that, although not statistically significant, demonstrated small to larger than typical effect sizes.

	<i>N</i>		Mean ( <i>SD</i> )		<i>t</i> <i>p</i>	Effect size <i>d</i> =
	Pre	Post	Pre	Post		
Question 5	6	6	40.00 (28.98)	63.33 (20.65)	-1.40 .220	.805
Question 7	6	6	48.33 (36.56)	83.33 (28.75)	-1.922 .113	.957
Question 8	6	6	61.67 (26.39)	75.00 (25.88)	-.948 .387	.505
Question 12	5	5	2.00 (4.47)	34.00 (35.07)	-1.933 .125	.71
Question 13	6	6	66.67 (32.04)	85.00 (8.36)	-1.356 .233	.57
Question 14	5	5	4.00 (8.94)	8.00 (13.04)	-.492 .648	.65
Question 15	6	6	78.33 (25.63)	95.00 (8.36)	-1.536 .185	.45
Question 19	3	3	76.67 (32.15)	83.33 (20.81)	-.256 .822	.21
Question 24	2	2	35.00 (49.50)	60.00 (56.56)	-.333 .759	.505
Question 29	5	5	58.00 (32.71)	64.00 (25.10)	-.262 .807	.18
Question 31	6	6	4.33 (.516)	4.67 (.516)	-1.581 0.175	.65
Question 33	6	6	4.33 (.516)	4.83 (.408)	-2.236 .076	.97
Question 34	6	6	4.33 (.816)	4.76 (.516)	-.791 .465	.40

\*  $\alpha = .05$

### Qualitative

Hypothesis 3 states that teaching strategies students found to increase engagement and help them learn will be in alignment with UDL principles. In addition to the paired samples t-test, open-ended responses were analyzed using Atlas ti 6.0, a qualitative data analysis software, and emerging themes were documented. Each time a theme appeared



it was recorded. This number was used to identify the main themes related to each of the open-ended questions on the questionnaire as well as analyze change (see Appendix G). The top emerging themes regarding students' perceptions of what promotes an effective teaching and learning environment will be reported; more specifically, what engages them and what increases and supports their learning. Many of the themes include terms and phrases that are re-occurring, therefore a brief description of each of the terms and phrases will be provided below. Following the descriptions, main themes related to each question will be reported with examples of student responses.

*I>clicker questions* I>clicker is an audience response system that allows students to instantly provide feedback and answer questions posed by their instructors. Each student uses a "clicker," a portable, handheld device that allows students to vote by "clicking" on the appropriate button for his/her choice. Instructors use receivers that collect votes sent by students' clickers. Instructors can then display voting results in a graph, to the audience. The results are also available for later analysis, grading, and exporting to any gradebook software or course management system.

<http://www.iclicker.com/dnn/Abouticlicker/WhatisaClicker/tabid/143/Default.aspx>

*Asks questions:* In the context of this study "ask questions" relates to the instructors' technique of not just asking questions to the class, but *expecting responses*. This encourages students to get involved and engaged in the lecture instead of sitting passively as the instructor lectures. The technique of "asking questions" also allows students to express their knowledge and share their opinions or experiences related to a subject. This type of instructional method is very different from the practice where an instructor asks an emblematic question during lecture, which in turn the instructor

answers his or her own question to make a point, never expecting or encouraging responses directly from the students.

*Videos:* Instructional videos can come from a variety of sources and serve many purposes. They can include educational videos, video clips of research studies, clips from movies or television shows, or even clips from YouTube or CNN to highlight key points or to demonstrate a concept in a novel and different way. In addition, because video includes sight and sound, video is the perfect medium for students who are auditory or visual learners.

*Partner/group discussion and activities:* Partner and group discussions and activities are another way to allow students to be actively engaged during a large lecture class. Students may be asked to discuss a topic, work through an example, complete an assignment or share an experience with a partner or with small group. Students may then be asked to bring the ideas generated with a partner or small group back to the large group.

*In-class mini writing:* In-class mini writing refers to short in-class writing assignments. These may be assigned during or at the end of class. Students may be asked to answer a question, to share their feelings or to apply content pertaining to lecture for that day.

*Provide (relevant) examples:* Providing examples refers to a method the instructor uses by illustrating an idea in *multiple* ways to help students better understand key concepts that are being discussed in class. The examples can be provided in a variety of methods such as graphs, videos, stories, real life situations and past experiences. In addition to providing multiple examples, the examples were *relevant*. The instructor used real



world examples that the students could easily understand and relate to their everyday lives.

*PowerPoint: format, structure, and organization:* This refers to more than just the use of PowerPoint, but how the information is presented. Information is presented in a simple and concise manner and the content is delivered in a logical and organized way that provides students with easy access to the information.

*Checks/teaches for understanding:* Teaching strategies that the instructor uses to make sure students are grasping the important concepts and ideas fall into this category. This could include, but is not limited to, strategies such as repeating important information, providing clear, in-depth explanations for important concepts and terminology, highlighting key points, checking for student understanding before proceeding to the next topic, and asking frequently if there are any questions.

*Multiple formats:* Multiple formats refer to the use of different modalities to present information. By using different modalities (i.e. visual, auditory, etc.), the instructors are providing access to the content to a wide variety of learners with different learning styles and preferences. Instructors may present information through the use of lecture, PowerPoint, I>clickers, visual representations, videos, examples, class discussions, partner/small group discussions and activities, guest speakers and technology. This list is not comprehensive and any form of presenting information could be included in the use of multiple formats as long as instructors are using multiple methods to convey information.

*Enthusiastic/friendly:* Enthusiastic and friendly refers to the personality and overall demeanor of the instructors, during class or during any outside interactions with students.



Instructors seem to enjoy the material as well as teaching and genuinely care about teaching the class. The instructors also seem to have extensive knowledge and experience with the content. In addition, instructors are friendly, approachable, use humor and make the class fun and interesting.

### Qualitative results for hypothesis 3

The first open-ended question asked students to describe how the instructor gets students actively engaged in learning. This question elicited lists rather than answers with thick and rich descriptions. The top five emerging items or themes included 1) I>clicker questions, 2) asks questions, 3) videos, 4) partner/group discussion and activities and 5) in-class mini writings. Some examples of student responses that reflect and support these themes include:

The instructor generally will ask questions which the students are expected to answer, and/or will use the iclicker program to get the students to answer questions and actively engage in the lecture.

She shows us cool videos or begins by asking a iclicker question, usually about our opinion about the topic she is going to talk about. At least that's how she gets me engaged.

We break up into small groups and discuss situations or experiments.

In-class writings really help engage the students in reading because it allows them to express their feelings about the subject or gives them insight on what they have learned in the class thus far.

When the students were asked what the instructor could do better to actively engage them in learning, the students reported, 1) "*more iclicker questions,*" 2) *interactive activities* such as "hands on stuff," "activities that require some participation," "role playing" and "demonstrations," 3) *ask more questions,* 4) *more in-class discussion* and 5) *more partner/group discussions and activities.* A more detailed description of these themes can be found above.

In another open-ended question, students were asked, “What are the things your instructor does or things about the structure of this course, that help you learn?” This question was more general and elicited more rich and descriptive responses. The top five themes that emerged included 1) *videos*, 2) *providing (relevant) examples*, 3) *i>clicker questions*, 4) *PowerPoint: format, structure and organization* and 5) *checks/teaches for understanding*. A more detailed description of these themes can be found above. Some examples of student responses that reflect and support these themes include:

- She presents the material in an easy-to-learn way, via the slides. The iClicker quizzes force me to recall things, which is a good way I can learn, and keep the material fresh in my mind. The same goes for the mini writings - they allow me to recall the material, and explain it in the way I understood it. She is most definitely one of the better professors I have had so far when it comes to helping me learn the material.
- [Professor] is expressive with her language, excited about teaching the course, personalizes the subject matter, requires attendance, has a clear outline available online, uses relevant pictures and videos, and color codes important information not on the outline.
- She also shows videos that relate more to our age group like for example a clip from "The Office" to demonstrate Pavlov's dog.
- Love the videos they have related content to the material and in our generation we are used to learning through videos and I tend to always remember information provided to me in this way.
- She has a way of presenting the material that's really similar to the way my brain would like to absorb it.
- She repeats things so we hear it twice, explains things if things are unclear, she provides clear outlines of what we will cover next, she includes videos and pictures to make things more clear, and answers each question thoroughly.
- She presents the material in an easy-to-learn way, via the slides.



When the students were asked what the instructor of *this* course does better than instructors of other courses that help them learn, two new themes emerged. Students reported that the instructor of this course uses multiple formats and is enthusiastic and friendly. Below are some examples of student responses that reflect and support these themes.

- Uses various methods of lecture rather than just only using the PowerPoint for notes.
- Provides the same information in multiple formats other than text in power point. The text helps and is necessary, but pictures, diagrams, videos, real-life examples, and interaction really help us know the information and be interested in the information.
- She is excited to teach the course and wants to give us as much information as she can. She really cares about teaching this class; when the instructor is enthusiastic it helps me to be enthusiastic.
- She is enthusiastic about the material and seems to have extensive experience in most of what we go over. She is also very positive in her feedback and never really puts down a student for anything they say or suggest.

In addition to what helps them learn, students were also asked about things the instructor does, or about the structure of the course that *hinder* their learning. The most popular responses related to the following themes 1) advancing slides/talking too fast, 2) does not engage the students, 3) does not post notes/ slides/ppt/outline, 4) does not use multiple formats and 5) not enough detail/explanation. Some examples of student responses can be found below.

- Just lecturing and going fast with slides not giving time to write down and listen to what they are saying.
- When she goes over something really fast or vaguely touches on a subject that is needed to understand another one.



- She doesn't post said powerpoints, so if you don't get them copied down before she changes them you don't get the information.
- THE SAME SLIDE SHOW OVER AND OVER given it is different material but the same way of teaching with the notes on the slide show and the teacher talking. BORING
- [Instructor] goes straight from her notes, not reiterating with examples or very engaging.
- I don't like just straight lecture. I would like to incorporate more activities.
- Straight lecture, fast moving without much explanation.

#### Emerging Themes from Instructors' Questionnaires

Instructors were also asked some open-ended questions related to how they get students actively engaged in learning, what types of instructional technologies they use during and outside of the classroom, alternative forms of expression for students and technology they use to facilitate communication among students and between them and their students. These open-ended responses were analyzed using Atlas ti 6.0, a qualitative data analysis software, and emerging themes were documented. Each time a theme appeared it was recorded. This number was used to identify the main themes related to each of the open-ended questions on the questionnaire as well as analyze change (see Appendix H). The main themes from each of these questions will be identified below.

#### *Getting Students Actively Engaged in Learning*

When the instructors were asked how they get students actively involved, several main themes emerged. The main themes included 1) the use of I>clicker, 2) asking for verbal responses from students 3) class discussion and 4) small group/partner discussion and activities. After the UDL training, videos emerged as an additional theme. Below are some examples of instructor responses that reflect and support these themes.

- Iclickers, practicing skills or applying new information. I usually have students “find a friend” and discuss my question or work together on the exercise. Then we come back together as a group and share. Sometimes I have them work individually and write down their thoughts.
- I use I-clickers, small group discussion, and open discussion. I also bring in media and pop culture when relevant.
- I ask questions to get them thinking about the material, I present group or partner activities related to the material, I show videos and ask them discussion questions about them, I have them complete mini-writings to underscore a point made in class
- Ask students to come up with examples themselves; apply info to student's live; ask students questions or for opinions; misc. activities (Iclicker questions, quizzes, other fun interactive stuff).

### *Use of Instructional Technologies*

Instructors were also asked about their use of instructional technologies during and outside of the classroom. Again, several main themes emerged from the instructor responses regarding the use of instructional technologies during class. These responses included the use of: 1) I>clickers, 2) video, 3) PowerPoint and 4) and internet. Although all the instructors reported using I>clickers during class, they used them in different ways based on the instructors’ response on the questionnaire. Regarding instructional technologies used outside of class, a majority of the instructors reported using RamCT. Below are some examples of instructor responses.

Iclicker- to answer questions about class content and for “practice“ tests;

PowerPoint; videos- to illustrate famous effects or experiments

iclicker- recap questions @ the beginning of every class; misc questions

throughout; videos- DVDs, video clips, VHS, YouTube; internet-demonstrate

website use, etc; PowerPoint- all lectures on through PowerPoint



### *Alternative Forms of Expression*

Instructors were also asked if they allow students to express their comprehension in alternative ways besides tests and exams and to describe these alternative forms of expression. In-class mini writing and out-of-class essays were the most popular alternative forms of expression. However, there were a variety of different ways students were allowed to express their comprehension, including an applied project, research study participation and class participation through I>clicker or in-class discussion or activities. Some examples of instructor responses include:

Students were required to complete a research requirement, complete a short-answer section on the exam, received participation points for clicker use, and Students were required to write 3 pages.

They can participate in in-class activities or class discussions, or through extra credit mini-writings in class.

- 1) Test validation project (applied project where they create, explain & propose how they would validate their own test 2) Critique paper-had to critique & published test.
- Student grades were made up of various assignments, exams, writing assignments, in-class writing assignments, research credit, and extra credit for use of iclicker.

### *Technology to Facilitate Communication*

In the last of the open-ended questions, instructors were asked if they used technology to facilitate communication among students and between them and their students, and if so, to briefly describe each communication technology and how it is used. Instructors reported using technologies including 1)I>clicker, 2) email, 3) Survey Monkey and 4) RamCT. Below are some examples of how the instructors used these technologies to facilitate communication.

Mainly RamCT; both email and a discussion board  
I have enabled the discussion tool on Ram CT,...students use it to ask each other for notes.



I-clicker helps me see what % of students are “getting it

Clicker questions are used for me to gain student responses to class material;

course questions, and other feedback; email is also available

I-clicker; I will also be using Survey Monkey (an online survey tool) to collect

mid-semester feedback from students

## **DISCUSSION**

Using a mixed method design provided a clear picture of the classroom learning experience as well as the impact of UDL instructor training as perceived by instructors and students. The statistically significant t-tests comparing responses on the pre-training questionnaires to the post-training questionnaires supported the hypotheses regarding significant increase in the implementation of UDL principles and strategies used in the classroom, as perceived by students and instructors, when compared to perceptions before the UDL training. These significant results held true even when statistical tests were adjusted for multiple analyses. The students' responses revealed that the instructors' applied the knowledge and skills they acquired during the instructor training in the classroom learning environment. The areas that demonstrated a significant increase in implementation were related to techniques and strategies that could be easily and immediately integrated into the classroom; providing an outline of what will be covered at the beginning and summarizing what was covered during and/or at the end of lecture, for example. In addition, the instructors' self-perceptions of the implementation of UDL principles in their classrooms matched the student perceptions in more than one area. These similarities support the students' perceptions that these increases in implementation did occur. Thus, the quantitative data from this study contributes evidence that providing instructors with UDL training can increase the implementation of UDL principles in the classroom.

According to a previous study by Izzo, Murray & Novak (2008), many instructors voiced frustration about their inability to meet the instructional needs of an increasingly diverse population of students. The study made it clear that although instructors could not readily define UDL, they knew what multiple methods of instructions were and why they were important. They also agreed that what is good for students with disabilities is often good for all students. However, they struggled with *how* to implement these methods in their classrooms. This is similar to a concept described by Rose, Harbour, Johnston, Daley & Abarbanell, (2006); although the *idea* of universal design transfers easily from the physical environment to the learning environment, the *principles* and *techniques* do not. Instructors are concerned about their ability to meet the needs of this increasingly diverse population of students and desire the training to increase their competencies. A total of 27% (73) respondents from the aforementioned study stated that they wanted training in UDL first and foremost (Izzo, Murray & Novak, 2008).

The evidence from this study supports past literature suggesting that providing this training can impart instructors with the skills and knowledge that will allow them to provide a fair and accessible education to all students. A previous study revealed that providing instructors with even small amounts of UDL training can increase the integration of UDL principles into classroom curriculum (Spooner, Baker, Harris, Ahlgrim-Delzell & Browder, 2007). In this study, education students (both regular education and special education) participated in a one hour training session regarding the three principles of UDL. After just one hour, the students were better able to incorporate UDL into their lesson plans, based on a scoring rubric evaluating the use of the three UDL principles. Objective measures were utilized to explore the instructors' ability to



use UDL principles when *developing* lesson plans, however, did not examine the actual *implementation* of the UDL principles in the classroom. The present study adds to the evidence that providing UDL instructor training can significantly increase the amount of implementation of UDL strategies in the classroom, based on student and instructor perceptions.

The qualitative data provided a clear picture of the strategies and techniques that an instructor can employ to provide a rich classroom learning experience for students in a college and university setting. The student responses supported the hypothesis that student perceptions regarding what promotes an effective teaching and learning environment, specifically what engages , increases and supports their learning, are in alignment with UDL principles. The main themes that emerged in the qualitative data fell into the three principles of UDL: Principle I: Providing Multiple Means of Representation, Principle II: Providing Multiple Means of Expression and Principle III: Providing Multiple Means of Engagement (CAST, 2008).

These main themes are also in alignment with techniques and strategies covered in an article regarding the application of UDL in postsecondary education (Rose, Harbour, Johnson, Daley & Abarbanell, 2006). In this article, the authors discuss the many ways to provide alternative means of support within lecture. According to the article, good lectures use a variety of techniques such as repetition, stating the structure of the talk early and often, and summarizing the content covered thus far. It supports the use of PowerPoint as way to provide structure to the lecture and provide an alternate representation to the content; for example the use of videos, visuals and graphics to compliment the content. However, the article states that simply reading the information

directly from the slides may actually take away from the meaning and content the speaker is trying to portray. In addition, the article supports the use of small group discussion during lecture as a technique to engage students and the importance of the use of a course website as a frame to provide instructional content such as the syllabus, notes, assignments, access to videos and web links used in class as well as discussion boards and email to facilitate communication between students and between instructors and students. Rose, Harbour, Johnson, Daley & Abarbanell (2006) also support the use of multiple means of expression such as a midterm project and presentations which can include audio, images, videos and the web in addition to the traditional text representation. The quantitative as well as qualitative data collected in the current study demonstrated the implementation of similar methods and techniques in the classroom. Although the specific terminology in this study may differ, the pervasive themes were extremely similar to past studies examining student opinions of effective teaching methods and strategies as well as the seven principles of good practice in undergraduate education (McGuire & Scott, 2006; Dewart & Rowan, 2007; Chickering & Gamson, 1987).

### **Limitations**

This research did not include a control or comparison group of students or instructors, in which the instructors would have received no training, to confirm that the changes were in fact due exclusively to the UDL instructor training and not some outside influence. It is possible that this change in implementation reported by students and instructors may have taken place without any training. The change in perception, for example, may have been influenced the students growing familiarity with the instructor,



natural improvement of instructors, instructors' response to student feedback, instructors increased knowledge and retrospective view of themselves at the end of the semester, as well as other training the instructors may have been participating in. An additional question regarding other trainings the instructors were involved in would be beneficial. Using a comparison group in future studies would help control these confounding variables. However, the changes that demonstrated significant and meaningful change were consistent with the content of the instructor training that was provided during the study, supporting the interpretation that the training did indeed influence those changes. In addition, this study measured only change in student and instructor perceptions of the amount of implementation, not the actual change. Instructors may have been implementing strategies that the students did not perceive. For example, instructors may have been providing course content using multiple formats for accessibility, such as "universally designed" Word, PowerPoint, PDF, HTML, and E-Text documents that the students may not have picked up on.

The fact that many of the areas of implementation did not demonstrate a significant increase may be attributed to several factors. First, many of the areas require a substantial change to the structure of the course. These changes (techniques and strategies) may be difficult to integrate during the semester, and may be more easily integrated during the planning and development of the course. Second, five of the six instructors are Teaching Fellows in the Psychology Department and the sixth is their advisor. As a result, all of these instructors are already exemplary, making it more difficult to demonstrate changes in the implementation of UDL in their classrooms. Third, instructors may not have been actually implementing strategies they thought they



were implementing. Finally, the instructor sample size was quite small making it difficult to reach significance even though many of the areas had small to larger than typical effect sizes, meaning there was meaningful change even if they did not reach significance.

### Suggestions for Future Research

This compilation of evidence would benefit from further research including a comparison group to further solidify the findings of this study. In addition, it may be beneficial to explore methods that would allow instructors to receive UDL training before or during the planning stages of course development. This would allow instructors to include structural changes to their courses, in addition to teaching strategies and techniques, which are in alignment with the principles of UDL. Furthermore, studies including more objective measurements, such as multiple observations of instructors in the classroom over the course of the semester before and after training, would add validity to the student and instructor perceptions and therefore increasing the implications and generalizability of these findings. Finally, student ID numbers were acquired as part of the student questionnaire in the present study. In future research, it would be beneficial to follow students throughout their postsecondary educations, examining the influence of UDL instructor training on outcomes such as grades, student persistence and retention.

### **Clinical Implications and Recommendations for Practice**

The diversity in our postsecondary education is increasing and our teaching strategies need to be able to not only accommodate, but embrace this diversity. These findings suggest that providing UDL training for instructors may increase their ability to

enhance the learning experiences for students in the classroom. Instructors were able to almost immediately integrate some of these principles into their classrooms, suggesting additional training during the planning stages of course development could lead to even more increase in the implementation of UDL principles inside and outside of the classroom. In addition, the insight acquired regarding what students feel engages them and increases and supports their learning can be used to better inform instructors on specific activities that students feel effectively engage them in learning. Increased engagement in the postsecondary classroom is likely to promote effective learning.



## **CONCLUSIONS**

This is the first large scale study to show a change in the implementation of UDL techniques and strategies in a postsecondary setting based on student perceptions following UDL instructor training. Even with just a few sessions of training structured around the principles of UDL and strategies for implementation, instructors increased the amount of UDL techniques and strategies used in the classroom; further enhancing the learning experiences of all students. The effect sizes found in the study are encouraging and indicate meaningful change. The qualitative data provided valuable insight into student perceptions regarding what promotes an effective teaching and learning environment. The findings support previous studies of student perceptions and correspond with widely-recognized best teaching practices (Chickering & Gamson, 1987; Dewart & Rowan, 2007; McGuire & Scott, (2006); Zeff, 2007). In addition, it was found that the teaching methods students felt most actively engaged them and increased their learning were in alignment with the three UDL principles: Multiple means of representation, expression and engagement (CAST, 2008). These findings provide validity to the UDL principles.

The use of both quantitative and qualitative results provided a rich portrait of effective learning experience in a postsecondary environment. The postsecondary student population is becoming increasingly diverse and has clearly indicated that teaching methods aligned with UDL increase and support their learning. This increasingly diverse postsecondary population only increases the urgency to leave

traditional teaching strategies behind and take on a new pedagogical approach that embraces this diversity.



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## APPENDICES

### Appendix A

#### ACCESS Project Summary

The Department of Education has awarded a grant to the Department of Occupational Therapy at Colorado State University (CSU) for the *ACCESS II* project: *Persistence in Post-secondary Education Through Universal Design for Learning and Self-Advocacy*.

The ACCESS II project builds on preliminary, successful implementation and dissemination of Universal Design for Learning (UDL) principles and strategies for creating inclusive classroom instruction and accessible course materials central to Universal Design for Learning (UDL). ACCESS II is working toward providing compelling evidence about UDL's effectiveness as a methodology for improving the learning experience and persistence of college students with disabilities. A student self-advocacy initiative is also being implemented to enhance UDL effectiveness.

ACCESS II goals include:

- 1) Institutionalization and expansion of UDL dissemination and implementation:

The implementation of UDL principles and strategies will take place in multiple undergraduate "gateway" courses at CSU. These are courses that have high student attritions rates, such as psychology, chemistry, microbiology, sociology and mathematics. The implementation of UDL is taking place through activities such as developing innovative, effective and efficient teaching methods and strategies, putting into practice the principles of UDL. In addition, the ACCESS II project staff



is providing professional development and training sessions for faculty and administrators at CSU and the 33 CO/WYO Consortium IHEs to provide them with the skills and supports necessary to meet the postsecondary educational needs of students with disabilities through implementation and institutionalization of UDL.

2) Comprehensive integration of student self-advocacy principles and strategies:

In addition to comprehensive training and implementation of UDL, ACCESS II will involve the development of promising new strategies for self-advocacy training and research. This is taking place through the development of a self-advocacy tutorial for students enrolled in “gateway” courses, to provide information to students that will facilitate the use of self-advocacy (SA) skills. In addition, SA strategies will be incorporated into mentor trainings; SA dissemination and skill development will be incorporated in to the Freshman Seminar curricula; SA skill development will be incorporated into the intake and support strategies at the Disability Services Offices; and the SA materials and resources will be disseminated to CO/WYO campuses and the 337 high schools in Colorado, via the Colorado Department of Education (CDE).

3) Measurement of faculty commitment and student outcomes:

Using the online WebCT questionnaire that was created during the first ACCESS project, pre and post questionnaires will be used to collect data from instructors and students in the UDL “gateway” courses at CSU. In addition to the SA tutorial, a SA questionnaire will also be developed. The effect of UDL and SA on student persistence will be determined by tracking individual student success in completing “gateway” courses that implement UDL and offer the SA tutorial. Comparisons, including student course completion, student persistence, student performance, and

students' learning experiences, will be drawn between students with and without documented disabilities who have participated in targeted courses in which UDL and SA are implemented.

In summary, the *ACCESS II* project seeks to improve post secondary outcomes for college students with and without disabilities by implementing two research-based, complimentary strategies: inclusive, universally designed teaching practices for instructors and self-advocacy skills for students. The outcomes of *ACCESS II* are expected to have far-reaching and long-lasting impacts on post-secondary education at Colorado State University.

## Appendix B

### Universal Design for Learning Student Questionnaire

Note: All information will be used for aggregate purposes only. No individual student will be identified and all results will remain anonymous.

**1. What percentage of essential information provided during lectures is presented in multiple formats, including text, graphics, audio, video, and/or physical movement?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**2. In what percentage of each class session, on an average, does the instructor actively engage students in learning?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

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**3. Describe how the instructor gets students actively engaged in learning:**

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**4. What could the instructor do better to actively engage students in learning?**

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**5. In what percentage of class sessions does your instructor relate key concepts to the larger objectives of the course?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**6. For each activity and assignment, the instructor's expectations for student performance are consistent with the learning objectives as stated on the syllabus and/or study guides.**

Strongly Agree    Agree    Neutral or Undecided    Disagree    Strongly Disagree    N/A

---



**7. In what percentage of lectures does the instructor begin with an outline of what will be covered?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**8. In what percentage of lectures does the instructor summarize key points, either during or at the end of lecture?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**9. What percentage of class time, on average, does the instructor spend facing the board or screen, or looking down at his/her notes, laptop, or overhead transparency while speaking?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**10. What are the things your instructor does, or things about the structure of this course, that help you learn?**

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**11. What are the things your instructor does, or things about the structure of this course, that hinder your learning?**

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**12. What does the instructor of this course do better than instructors of other courses to help you learn?**

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**13. What have instructors of other courses done better than this instructor to help you learn?**

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**14. The syllabus for this course clearly describes the nature and scope of content, as well as the instructor's expectations for student performance.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**15. What percentage of essential reading materials (other than the textbook) are available to students online?**

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
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☐ N/A: There were no essential reading materials besides the textbook (should this be the final option listed?)

**16. Of the materials posted online for this course, what percentage are offered in multiple file formats (for example, HTML, PDF, DOC, RTF, etc.)?**

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		N/A								

**17. For what percentage of instructional videos used in this course does the instructor highlight key points to help students understand the content?**

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

☐ N/A: There are no videos used in this course

**18. If videos are used in this course, what percentage are captioned?**

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
		N/A								

**19. Would video captions help you grasp more content from the videos?**

Yes/No (checkboxes)

**20. In what percentage of each class session are instructional technologies (clickers, videos, PowerPoint, etc.) used to enhance learning?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**21. If your instructor uses instructional technologies during class sessions, please describe the technologies used:**

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**22. For what percentage of course content delivered outside of class are instructional technologies employed? (For example, RamCT, videos, podcasts, online materials, external websites, etc.)**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%

☐ N/A: There are no instructional technologies used outside of class for this course.

---

**23. For instructional technologies used outside of class, please describe the technologies used:**

---

---

---

**24. What percentage of materials for this course (other than the textbook) are accessible, clearly organized, and easy to use?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%

☐ N/A: There are no course materials other than the textbook

---

**25. As a student in this course, I am given opportunities to express my comprehension of material in ways other than traditional tests and exams (for example, through written essays, projects, portfolios, presentations, etc.).**

Strongly Agree    Agree    Neutral or Undecided    Disagree    Strongly Disagree    N/A

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**26. If you are allowed to express your comprehension in alternative ways besides tests and exams, briefly describe these alternative forms of expression:**

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**27. This course employs technology to facilitate communication among students and between students and the instructor.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**28. If your instructor uses technology to facilitate communication among students and between students and the instructor, briefly describe each communication technology and how it is used:**

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**29. What percentage of assignments for this course can be submitted electronically?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%

☐ N/A: None of the assignments for this class can be submitted electronically

---

**30. In what percentage of each class session, on an average, do you feel engaged and motivated to learn?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**31. For what percentage of topics taught in this course does the instructor explain the real-world importance?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**32. This course challenges you with meaningful assignments.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
-------------------	-------	-------------------------	----------	----------------------	-----

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**33. For what percentage of the topics covered in class does the instructor express his or her personal enthusiasm?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**34. What percentage of the feedback your instructor provides on assignments is helpful and instructive (as opposed to feedback that is merely “correct/incorrect” or “complete/incomplete”)?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**35. The average length of time I wait to receive feedback on assignments is:**

- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 1 week
- ☐ 1.5 weeks
- ☐ 2 weeks
- ☐ 3 weeks
- ☐ 4 weeks

(or maybe we can do a text field and a drop-down menu)

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**36. The instructor for this course is highly approachable and available to students.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**37. The instructor creates a class climate in which student diversity is respected.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**38. The instructor offers contact with students outside of class time in flexible formats (for example, face-to-face, email, online chat, telephone, etc.)**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
-------------------	-------	-------------------------	----------	----------------------	-----

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**39. What percentage of class sessions have you attended this semester?**

0%   10%   20%   30%   40%   50%   60%   70%   80%   90%  
100%

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**40. The syllabus for this course includes a statement about the instructor's appreciation for diversity and his or her willingness to make "appropriate accommodations" for students with disabilities.**

Strongly Agree   Agree   Neutral or Undecided   Disagree   Strongly Disagree   N/A

---

**41. I am familiar with the services provided by the following offices on campus for students and faculty (check all that apply):**

- ☐ Academic Advancement Center (AAC)
  - ☐ Ask Pat website
  - ☐ Assistive Technology Resource Center (ATRC)
  - ☐ Career Center
  - ☐ Center for Advising and Student Achievement (CASA)
  - ☐ Center for Community Partnerships (CCP)
  - ☐ College of Natural Science Tutorial Hall
  - ☐ Division of Student Affairs advocacy offices
  - ☐ The Institute for Learning and Teaching (TILT)
  - ☐ Learning Assistance Program (LAP)
  - ☐ Morgan Library Assistive Technology
  - ☐ Psychological Services Center (PSC)
  - ☐ Resources for Adult Learners
  - ☐ Resources for Disabled Students (RDS)
  - ☐ The Writing Center
  - ☐ University Counseling Center
  - ☐ The Wellness Zone
- 

**42. What grade do you think you will receive in this course?**

Drop-down list (A, B, C, D, F, W?)

---

**43. What grade do you think the average person will receive in this course?**

Drop-down list (A, B, C, D, F)

---

**44. Are you a student with a disability (for example, a learning disability, ADHD, a physical disability, etc.)?**

Yes/No (checkboxes)



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**45. If you are a student with a disability, have you contacted the Resources for Disabled Students office (RDS) to request accommodation services?**

Yes/No/ N/A (checkboxes)

---

**46. Please identify your student status, mark all that apply (checkboxes):**

- ☐ 1st semester of college
  - ☐ 2nd semester of college
  - ☐ Newly transferred from another college/university
  - ☐ Non-traditional student (a student who does not follow a direct path from high school to college)
  - ☐ Part-time student
  - ☐ Other
- 

**47. If you identified your student status as “Other,” please describe:**

---

**8. How many hours per week are you employed in a non-University job? (drop down menu. Increments?)**

0 hours  
1-4 hours  
5-9 hours  
20-29 hours  
30 – 39 hours  
40 or more hours per week

---

**49. How many hours per week are you employed in a University job? (drop down menu. Increments?)**

0 hours  
1-4 hours  
5-9 hours  
20-29 hours  
30 – 39 hours  
40 or more hours per week

---

**50. How long did it take you to complete this survey? (field/menu combo, in 10 min. increments)**

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**51. The monetary incentives (i.e., the chance to win up to \$100 in gift certificates) motivated me to complete this survey:**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**52. Which of the following incentives would MOST motivate you to fill out this questionnaire?**

- ☒ a. Name entered for a drawing for a \$25 gift certificate for CSU Food Court
- ☐ b. Name entered for a drawing for \$25 cash
- ☐ c. Name entered for a drawing for \$25 gift certificate for the CSU Library
- ☐ d. Name entered for a drawing for \$25 gift certificate for Amazon.com
- ☐ e. Name entered for a drawing for \$25 gift certificate for Starbucks
- ☐ f. No incentive needed; I would fill out the questionnaire without incentives.

Universal Design for Learning  
Pre-Instructor Survey  
Fall Semester 2008

**1. What percentage of essential information provided during lectures is presented in multiple formats, including text, graphics, audio, video, and/or physical movement?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**2. In what percentage of each class session, on an average, do you actively engage students in learning?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**3. Describe how you get students actively engaged in learning:**

---



**4. What percentage of each class session, on average, do you spend doing the following activities? (For each activity, enter an estimated percentage, from 0% to 100% in 10 point increments. Each column total should not exceed 100%.)**

You	Your students
Lecturing _____	Presenting _____
Listening _____	Listening _____
Discussing/ Moderating discussion _____	Discussing/ Moderating discussion _____
Writing/Note taking _____	Writing/Note taking _____
Drawing/Diagramming _____	Drawing/Diagramming _____
Demonstrating a skill _____	Demonstrating a skill _____
Hands-on experimenting/ Practicing _____	Hands-on experimenting/ Practicing _____
Watching a demonstration or video _____	Watching a demonstration or video _____
Asking questions _____	Asking questions _____
Answering questions _____	Answering questions _____
Reading _____	Reading _____
Problem solving _____	Problem solving _____
Working with students in small groups _____	Working with one another in small groups _____

**5. In what percentage of class sessions do you relate key concepts to the larger objectives of the course?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

**6. For each activity and assignment, my expectations for student performance are consistent with the learning objectives as stated on the syllabus and/or study guides.**

Strongly Agree    Agree    Neutral or Undecided    Disagree    Strongly Disagree    N/A

**7. In what percentage of lectures do you begin with an outline of what will be covered?**

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%  
100% N/A

---

**8. In what percentage of lectures do you summarize key points, either during or at the end of lecture?**

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%  
100% N/A

---

**9. The learning objectives stated on the syllabus for this course are “SMART” — i.e., Specific, Measurable, Achievable, Relevant, and Timely.**

Strongly Agree Agree Neutral or Undecided Disagree Strongly Disagree N/A

---

**10. The syllabus for this course clearly describes the nature and scope of content, as well as my expectations for student performance.**

Strongly Agree Agree Neutral or Undecided Disagree Strongly Disagree N/A

---

**11. What percentage of essential reading materials (other than the textbook) are available to students online?**

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%  
100%

☐ N/A: There were no essential reading materials besides the textbook

---

**12. Of the materials you post online for this course, what percentage are offered in multiple file formats (for example, HTML, PDF, DOC, RTF, etc.)?**

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%  
100% N/A

---

**13. For what percentage of instructional videos used in this course do you highlight key points to help students understand the content?**

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%  
100%

☐ N/A: There were no videos used in this course.

---

**14. If videos are used in this course, what percentage are captioned?**

0% 10% 20% 30% 40% 50% 60% 70% 80% 90%  
100% N/A

---



**15. In what percentage of each class session are instructional technologies (clickers, videos, PowerPoint, etc.) used to enhance learning?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**16. If you use instructional technologies during class sessions, please describe the technologies you use:**

---



---



---

**17. For what percentage of course content delivered outside of class are instructional technologies employed? (For example, RamCT, videos, podcasts, online materials, external websites, etc.)**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%

☐ N/A: There were no instructional technologies used outside of class for this course.

---

**18. For instructional technologies used outside of class, please describe the technologies used:**

---



---



---

**19. What percentage of materials for this course (other than the textbook) are accessible, clearly organized, and easy for students to use?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%

☐ N/A: There were no course materials other than the textbook.

---

**20. Students in this course are given opportunities to express their comprehension of material in ways other than traditional tests and exams (for example, through written essays, projects, portfolios, presentations, etc.).**

Strongly    Agree    Neutral    Disagree    Strongly    N/A  
Agree    or Undecided    Disagree

---

**21. If you allow students to express their comprehension in alternative ways besides tests and exams, briefly describe these alternative forms of expression:**

---



---



---

**22. This course employs technology to facilitate communication among students and between students and the instructor.**

Strongly    Agree    Neutral    Disagree    Strongly    N/A  
Agree    or Undecided    Disagree



---

**23. If you use technology to facilitate communication among students and between you and your students, briefly describe each communication technology and how it is used:**

---

---

---

**24. What percentage of assignments for this course can be submitted electronically?**  
0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%

☐ *N/A: None of the assignments for this course could be submitted electronically.*

---

**25. In what percentage of each class session, on an average, do you feel that students are engaged and motivated to learn?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**26. For what percentage of topics taught in this course do you explain the real-world importance?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**27. This course challenges students with meaningful assignments.**

Strongly    Agree    Neutral    Disagree    Strongly    N/A  
Agree    or Undecided    Disagree

---

**28. For what percentage of the topics covered in class do you express your personal enthusiasm?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**29. What percentage of the feedback you provide on assignments is designed to be helpful and instructive (as opposed to feedback that is merely “correct/incorrect” or “complete/incomplete”)?**

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%  
100%    N/A

---

**30. The average length of time students wait to receive feedback on their assignments is (check one):**

- ☐ 1 day
- ☐ 2 days
- ☐ 3 days
- ☐ 4 days
- ☐ 5 days
- ☐ 1 week
- ☐ 1.5 weeks
- ☐ 2 weeks
- ☐ 3 weeks
- ☐ 4 weeks

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**31. As an instructor, I believe I am highly approachable and available to students.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**32. I create a class climate in which student diversity is respected.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
-------------------	-------	-------------------------	----------	----------------------	-----

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**33. I offer contact with students outside of class time in flexible formats (for example, face-to-face, email, online chat, telephone, etc.)**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
-------------------	-------	-------------------------	----------	----------------------	-----

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**34. The syllabus for this course includes a statement about my appreciation for diversity and my willingness to make “appropriate accommodations” for students with disabilities.**

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
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**35. I am familiar with the services provided by the following offices on campus for students and faculty (check all that apply):**

- ☐ Academic Advancement Center (AAC)
- ☐ Ask Pat website
- ☐ Assistive Technology Resource Center (ATRC)
- ☐ Career Center
- ☐ Center for Advising and Student Achievement (CASA)
- ☐ Center for Community Partnerships (CCP)
- ☐ College of Natural Science Tutorial Hall
- ☐ Division of Student Affairs advocacy offices
- ☐ The Institute for Learning and Teaching (TILT)
- ☐ Learning Assistance Program (LAP)
- ☐ Morgan Library Assistive Technology
- ☐ Psychological Services Center (PSC)
- ☐ Resources for Adult Learners
- ☐ Resources for Disabled Students (RDS)
- ☐ The Writing Center
- ☐ University Counseling Center
- ☐ The Wellness Zone

**36. In your estimation, how many students in this course have a disability, either apparent (physical disability) or non-apparent (learning disability, ADHD, etc.)?**

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**37. How many students have contacted you to tell you about their disability or request an accommodation?**

---

**38. How long did it take you to complete this survey (in minutes)?**

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Name:

Universal Design for Learning Post Instructor Questionnaire  
Revised for Spring Semester 2009

**1. What percentage of essential information provided during lectures is presented in multiple formats, including text, graphics, audio, video, and/or physical movement?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**2. In what percentage of each class session, on an average, do you actively engage students in learning?**

*Before your participation in the UDL project:*

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

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**3. Describe how you get students actively engaged in learning:**

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*We deleted questions 4 and 5 - please proceed to question number 6.*

**6. In what percentage of class sessions do you relate key concepts to the larger objectives of the course?**

*Before your participation in the UDL project:*

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

**7. For each activity and assignment, my expectations for student performance are consistent with the learning objectives as stated on the syllabus and/or study guides.**

Before your participation in the UDL project:

Strongly Agree                  Agree                  Neutral or Undecided                  Disagree                  Strongly Disagree    N/A

Since your participation in the UDL project:

Strongly Agree                  Agree                  Neutral or Undecided                  Disagree                  Strongly Disagree    N/A

**8. In what percentage of lectures do you begin with an outline of what will be covered?**

*Before your participation in the UDL project:*

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

**9. In what percentage of lectures do you summarize key points, either during or at the end of lecture?**

*Before your participation in the UDL project:*

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

**10. The learning objectives stated on the syllabus for this course are “SMART” — i.e., Specific, Measurable, Achievable, Relevant, and Timely.**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

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**11. The syllabus for this course clearly describes the nature and scope of content, as well as my expectations for student performance.**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

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**12. What percentage of essential reading materials (other than the textbook) are available to students online?**

Before your participation in the UDL project:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
<input type="checkbox"/> N/A: There were no essential reading materials besides the textbook										

Since your participation in the UDL project:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
<input type="checkbox"/> N/A: There are no essential reading materials besides the textbook										

---

**13. Of the materials you post online for this course, what percentage are offered in multiple file formats (for example, HTML, PDF, DOC, RTF, etc.)?**

Before your participation in the UDL project:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
N/A										

Since your participation in the UDL project:

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
N/A										

---



**14. For what percentage of instructional videos used in this course do you highlight key points to help students understand the content?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: There were no videos used in this course.

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: There are no videos used in this course.

---

**15. If videos are used in this course, what percentage are captioned?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

N/A

---

**16. In what percentage of each class session are instructional technologies (clickers, videos, PowerPoint, etc.) used to enhance learning?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

N/A

---

**17. If you use instructional technologies during class sessions, please describe the technologies you use:**

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**18. For what percentage of course content delivered outside of class are instructional technologies employed? (For example, RamCT, videos, podcasts, online materials, external websites, etc.)**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: There were no instructional technologies used outside of class for this course.

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: There are no instructional technologies used outside of class for this course.

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**19. For instructional technologies used outside of class, please describe the technologies used:**

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**20. What percentage of materials for this course (other than the textbook) are accessible, clearly organized, and easy for students to use?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: There were no course materials other than the textbook.

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: There are no course materials other than the textbook.

---

**21. Students in this course are given opportunities to express their comprehension of material in ways other than traditional tests and exams (for example, through written essays, projects, portfolios, presentations, etc.).**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

**22. If you allow students to express their comprehension in alternative ways besides tests and exams, briefly describe these alternative forms of expression:**

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**23. This course employs technology to facilitate communication among students and between students and the instructor.**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

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**24. If you use technology to facilitate communication among students and between you and your students, briefly describe each communication technology and how it is used:**

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**25. What percentage of assignments for this course can be submitted electronically?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: None of the assignments for this course could be submitted electronically.

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%

☐ N/A: None of the assignments for this course can be submitted electronically.

---



**26. In what percentage of each class session, on an average, do you feel that students are engaged and motivated to learn?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**27. For what percentage of topics taught in this course do you explain the real-world importance?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**28. This course challenges students with meaningful assignments.**

Before your participation in the UDL project:

Strongly Agree                  Agree                  Neutral or Undecided                  Disagree                  Strongly Disagree    N/A

Since your participation in the UDL project:

Strongly Agree                  Agree                  Neutral or Undecided                  Disagree                  Strongly Disagree    N/A

---

**29. For what percentage of the topics covered in class do you express your personal enthusiasm?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

---

**30. What percentage of the feedback you provide on assignments is designed to be helpful and instructive (as opposed to feedback that is merely “correct/incorrect” or “complete/incomplete”)?**

Before your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

Since your participation in the UDL project:

0%    10%    20%    30%    40%    50%    60%    70%    80%    90%    100%  
N/A

**31. The average length of time students wait to receive feedback on their assignments is (check one):**

- |                                 |                                    |
|---------------------------------|------------------------------------|
| <input type="checkbox"/> 1 day  | <input type="checkbox"/> 1 week    |
| <input type="checkbox"/> 2 days | <input type="checkbox"/> 1.5 weeks |
| <input type="checkbox"/> 3 days | <input type="checkbox"/> 2 weeks   |
| <input type="checkbox"/> 4 days | <input type="checkbox"/> 3 weeks   |
| <input type="checkbox"/> 5 days | <input type="checkbox"/> 4 weeks   |

**32. As an instructor, I believe I am highly approachable and available to students.**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

**33. I create a class climate in which student diversity is respected.**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	N/A
----------------	-------	----------------------	----------	-------------------	-----

**34. I offer contact with students outside of class time in flexible formats (for example, face-to-face, email, online chat, telephone, etc.)**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	_____ N/A
----------------	-------	----------------------	----------	-------------------	-----------

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	_____ N/A
----------------	-------	----------------------	----------	-------------------	-----------

**35. The syllabus for this course includes a statement about my appreciation for diversity and my willingness to make “appropriate accommodations” for students with disabilities.**

Before your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	_____ N/A
----------------	-------	----------------------	----------	-------------------	-----------

Since your participation in the UDL project:

Strongly Agree	Agree	Neutral or Undecided	Disagree	Strongly Disagree	_____ N/A
----------------	-------	----------------------	----------	-------------------	-----------

**36. I am familiar with the services provided by the following offices on campus for students and faculty (check all that apply):**

- ☐ Academic Advancement Center (AAC)
- ☐ Ask Pat website
- ☐ Assistive Technology Resource Center (ATRC)
- ☐ Career Center
- ☐ Center for Advising and Student Achievement (CASA)
- ☐ Center for Community Partnerships (CCP)
- ☐ College of Natural Science Tutorial Hall
- ☐ Division of Student Affairs advocacy offices
- ☐ The Institute for Learning and Teaching (TILT)
- ☐ Learning Assistance Program (LAP)
- ☐ Morgan Library Assistive Technology
- ☐ Psychological Services Center (PSC)
- ☐ Resources for Adult Learners
- ☐ Resources for Disabled Students (RDS)
- ☐ The Writing Center
- ☐ University Counseling Center
- ☐ The Wellness Zone

**37. In your estimation, how many students in this course have a disability, either apparent (physical disability) or non-apparent (learning disability, ADHD, etc.)? \_\_\_\_\_.**



**38. How many students have contacted you to tell you about their disability or request an accommodation?**

---

**39. How long did it take you to complete this survey (in minutes)?**

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## Appendix C

Table of Comprehensive Quantitative Results- Students

The differences in student responses on the pre-questionnaire and post-questionnaire ( <i>t</i> -tests) for the 39 questions related to UDL strategies.									
Question	Pre-training questionnaire		Post-training questionnaire		<i>t</i>	$\alpha=.00128$ <i>p</i>	95% CI		Cohen's <i>d</i>
	M	SD	M	SD			LL	UL	
Q1	70.83	24.62	75.80	23.11	-3.66	<.00128	-7.64	-2.31	0.20
Q2	61.21	28.42	68.48	26.77	-5.24	<.00128	-9.96	-4.54	0.26
Q5	69.95	20.75	75.66	20.25	-3.48	<.00128	-7.95	-3.48	0.28
Q6	4.25	0.75	4.28	.89	-0.46	.648	-.123	0.08	0.03
Q7	68.97	37.00	83.29	25.15	-8.15	<.00128	-17.86	-10.9	0.42
Q8	67.44	30.58	73.73	27.28	-0.41	<.00128	-9.33	-3.25	0.21
Q9	15.85	17.18	17.19	18.00	-1.30	.194	-3.37	0.69	0.08
Q14	4.43	0.69	4.39	0.81	0.74	.459	-.05	0.12	-0.05
Q15	43.30	34.03	44.16	35.35	-0.31	.756	-6.32	4.60	-0.03
Q16	48.49	38.11	50.47	38.51	-0.63	.527	-8.14	4.18	0.05
Q17	76.54	27.17	82.00	23.27	-3.70	<.00128	-8.36	-2.56	0.20
Q18	15.70	28.57	19.79	29.70	-2.60	.100	-7.19	-0.99	0.14
Q19	1.74	0.44	1.75	0.44	-0.30	.766	-0.59	0.04	0.02
Q20	84.69	25.49	88.51	21.36	-2.76	.006	-6.54	-1.09	0.15
Q22	55.11	32.09	61.33	32.58	-2.73	.007	-10.69	-1.75	0.19
Q24	71.92	28.82	76.64	26.77	-2.29	.023	-8.78	-.661	0.16
Q25	3.98	0.88	3.91	1.04	1.51	.131	0.02	0.17	-0.08
Q27	4.09	0.77	4.04	0.78	1.15	.251	-0.36	0.14	-0.07
Q29	47.36	38.29	49.42	40.88	-1.17	.243	-5.54	1.49	0.05
Q30	72.91	23.80	72.63	22.53	0.29	.770	-1.62	2.19	-0.01
Q31	81.95	20.59	80.73	20.10	1.29	.198	-0.64	3.08	-0.06
Q32	3.77	0.86	3.74	0.97	0.67	.505	-0.07	0.14	-0.04
Q33	76.44	24.09	78.14	23.03	-1.50	.134	-3.93	0.52	0.07
Q34	64.24	30.32	65.08	29.83	-0.39	.697	-5.09	3.40	0.03
Q35	6.29	4.07	7.88	5.15	-4.80	<.00128	-2.24	-0.94	0.39
Q36	4.33	0.79	4.33	0.83	0.13	.895	-0.07	0.09	0.00
Q37	4.47	0.59	4.46	0.70	0.21	.836	-0.07	0.08	-0.02
Q38	4.31	0.67	4.24	0.75	1.71	.088	-0.01	0.15	-0.10
Q39	94.76	9.86	88.07	13.44	11.85	<.00128	5.58	7.80	-0.68
Q40	4.23	0.72	4.26	0.79	-0.67	.501	-0.12	0.06	0.04
Q42	1.51	0.56	1.72	0.74	-6.35	<.00128	-0.27	-0.14	0.37
Q43	2.42	0.59	2.43	0.55	-0.35	.726	-0.07	0.05	0.02
Q44	1.9	0.30	1.90	0.30	0.53	.594	-0.14	0.02	0.00
Q45	1.61	0.50	1.61	0.50	0.00	1.00	-0.11	0.11	0.00
Q48	1.54	1.19	1.60	1.30	-2.05	.041	-0.12	-.002	0.05
Q49	2.02	1.57	2.07	1.58	-1.11	.266	-0.16	-1.11	0.38



Q50	1.88	0.77	1.91	1.53	-41.38	.747	-17.03	-15.49	0.08
Q51	3.95	0.94	4.17	0.97	-5.16	<.00128	-0.30	-0.14	0.24
Q52	2.74	1.58	2.72	1.52	0.30	.768	-0.13	0.18	-0.01

Note: CI = confidence interval of the Difference; LL = lower limit; UL = upper limit.

Key to Student Quantitative Questionnaire Questions:

#### Key to Instructor Questionnaire Questions

- Q1 = Instructor presents information in multiple formats.
- Q2 = Instructor actively engages students in learning.
- Q5 = Instructor relates key concepts to the larger objective of the course.
- Q6 = Instructor's expectations are consistent with syllabus learning objectives.
- Q7 = Instructor begins each lecture with an outline of what will be covered.
- Q8 = Instructor summarizes key points either during or after the lecture.
- Q9 = Instructor often speaks while facing the board/screen or looking at notes.
- Q14 = Course syllabus clearly describes the content and expectations of this course.
- Q15 = Essential reading materials (other than textbook) are available online.
- Q16 = Materials posted online are offered in multiple formats.
- Q17 = Instructor highlights key points of videos to increase student understanding.
- Q18 = The videos used in this course are captioned.
- Q19 = Video captions would help you grasp more content from instructional videos.
- Q20 = Instructor uses instructional technologies (e.g., clickers) to enhance learning.
- Q22 = Instructional technologies are employed for content delivered outside of class.
- Q24 = Course materials are accessible, clearly organized, and easy to use.
- Q25 = Students are allowed to express their comprehension in multiple ways.
- Q27 = Technology is used to facilitate communication between students and instructor.
- Q29 = Assignments for this course can be submitted electronically.
- Q30 = In this course I feel engaged and motivated to learn.
- Q31 = The instructor explains real-world importance of the topics taught in the course.
- Q32 = I feel challenged with meaningful assignments.
- Q33 = The instructor expresses enthusiasm for the topics covered in class.
- Q34 = Instructor provides helpful and instructive feedback on all assignments.
- Q35 = I receive prompt feedback on all assignments.
- Q36 = The instructor is highly approachable and available to students.
- Q37 = The instructor creates a class climate in which student diversity is respected.
- Q38 = Instructor offers contact with students outside of class time in flexible formats.
- Q39 = Percentage of class sessions attended this semester.
- Q40 = Syllabus includes statement regarding instructor's appreciation for diversity.
- Q42 = Grade you think you will receive in this course.
- Q43 = Grade you think the average person will receive in this course.
- Q44 = Disability identification.
- Q45 = I have contacted the Resources for Disabled Students office.
- Q48 = Hours per week you are employed in a non-University Job.
- Q49 = Hours per week you are employed in a University Job.
- Q50 = Length of time it took to complete this questionnaire.
- Q51 = Monetary incentives motivated me to complete this questionnaire.
- Q52 = The following incentives motivated me to complete this questionnaire.



## Appendix D

Table of Comprehensive Quantitative Results- Instructors

The results of Paired Samples t-tests for instructor responses from the pre-questionnaire and post-questionnaire.

Question	Pre-training questionnaire		Post-training questionnaire		<i>t</i>	$\alpha=.05$ <i>p</i>	95% CI		Cohen's <i>d</i>
	M	SD	M	SD			LL	UL	
Q1	45.00	22.58	80.00	6.32	-2.98	.031	-65.23	-4.77	2.42
Q2	26.67	8.17	58.33	26.39	-3.63	.015	-54.09	-9.24	1.83
Q3	40.00	28.98	63.33	20.66	-1.40	.220	-66.18	19.51	0.94
Q4	4.33	0.52	4.33	0.52	0.00	1.00	-0.94	0.94	0.00
Q5	48.33	36.56	83.33	28.75	0.00	1.00	-0.94	0.94	1.07
Q6	61.67	26.39	75.00	25.86	-1.92	.113	-81.82	11.82	0.51
Q7	3.83	0.75	3.83	0.75	-0.95	.387	-49.48	22.82	0.31
Q8	4.17	0.41	4.17	0.41	0.00	1.00	-0.94	0.94	0.00
*Q9									
Q10	2.00	4.47	34.00	35.07	-1.93	.125	-77.96	13.96	1.61
Q11	66.67	32.04	84.00	8.37	-1.36	.233	-53.09	16.42	0.91
Q12	4.00	8.94	8.00	13.04	-0.50	.648	-26.56	18.56	0.36
Q13	78.33	25.63	95.00	8.37	-1.54	.185	-44.56	11.23	0.98
Q14	56.25	50.89	55.00	33.17	0.04	.975	-113.6	116.06	-0.03
Q15	76.67	32.15	83.33	20.82	-0.26	.822	118.7	105.35	0.25
Q16	4.67	0.52	4.67	0.52	0.00	1.00	-0.94	0.94	0.00
Q17	4.20	0.45	3.60	0.89	1.00	.374	-1.07	2.27	-1.34
Q18	35.00	49.50	60.00	56.57	-0.33	.795	-978.0	928.0	0.47
Q19	68.00	13.04	60.00	7.07	0.93	.405	-15.88	31.88	-0.61
Q20	85.00	10.49	85.00	5.48	0.00	1.00	-13.27	13.27	0.00
Q21	4.33	0.52	4.33	0.52	0.00	1.00	-0.94	0.94	0.00
Q22	85.00	10.49	85.00	8.37	0.00	1.00	-17.56	17.56	0.00
Q23	58.00	32.71	64.00	25.10	-0.26	.807	-69.68	57.68	0.21
Q24	4.33	0.52	4.67	0.52	-1.58	.175	-0.88	0.21	0.65
Q25	4.50	0.55	4.50	0.55	0.00	1.00	-0.94	0.94	0.00
Q26	4.33	0.52	4.83	0.41	-2.24	.076	-1.08	0.08	1.09
Q27	4.33	0.82	4.67	0.52	-0.79	.456	0.75	0.75	0.50

\* No paired sample to compare.

Note: CI = confidence interval of the Difference; LL = lower limit; UL = upper limit.

## Key to Instructor Questionnaire Questions

- Q1 = You present essential information in multiple formats.
- Q2 = You actively engage students in learning.
- Q5 = You relate key concepts to the larger objectives of the course.
- Q6 = Student expectations are consistent with learning objectives in the syllabus.
- Q7 = You begin lectures with an outline of what will be covered.
- Q8 = You summarize key points either during or after the lecture.
- Q9 = The learning objectives stated on the syllabus for this course are “SMART”.
- Q10 = Course syllabus clearly describes the content and expectations of this course.
- Q11 = Essential reading materials (other than textbook) are available online.
- Q12 = Materials posted online are offered in multiple formats.
- Q13 = You highlight key points of instructional videos to increase student understanding.
- Q14 = The videos used in this course are captioned.
- Q15 = You use instructional technologies (e.g., clickers, RamCT) to enhance learning.
- Q17 = Instructional technologies are employed for course content delivered outside of class.
- Q19 = Course materials (except textbook) are accessible, clearly organized, and easy to use.
- Q20 = Students are allowed to express their comprehension of material in multiple ways.
- Q22 = Technology is used to facilitate communication between students and the instructor.
- Q24 = Assignments for this course can be submitted electronically.
- Q25 = Students are engaged and motivated to learn.
- Q26 = You explain the real-world importance of the topics taught in this course.
- Q27 = You challenge students with meaningful assignments.
- Q28 = You express your enthusiasm for the topics covered in class.
- Q29 = You provide helpful and instructive feedback on all assignments.
- Q31 = You are highly approachable and available to students.
- Q32 = You create a class climate in which student diversity is respected.
- Q33 = You offer contact with students outside of class time in flexible formats.
- Q34 = Syllabus includes statement regarding your appreciation for diversity.

## Appendix E

Table of Qualitative Results- Students

Top 5 emerging themes for student qualitative questions				
Question	Theme	Number of Responses		
		Pre (%)	Post (%)	Total (%)
		n = 622	n = 421	n = 1043
Q3	I>clicker Questions	340 (55)	262 (62)	602 (58)
	Asks Questions	321 (53)	181 (43)	504 (48)
	Videos	78 (13)	51 (12)	129 (12.4)
	Partner/Group discussion and activities	74 (11.9)	54 (12.8)	128 (12.3)
	In-class mini writing	50 (8)	66 (15)	116 (11.1)
Q4	More i>clicker questions	68 (11)	50 (12)	118 (11.3)
	Interactive Activities	49 (8)	23 (5)	72 (7)
	Ask more questions	37 (6)	25 (6)	62 (6)
	In-class discussion	29 (4.7)	11 (3)	40 (3.8)
	Partner/group discussion and activities	22 (3.5)	15 (12)	37 (3.5)
Q10	Videos	146 (23)	98 (23)	244 (23.4)
	Provides (relevant) examples	154 (25)	75 (17.8)	220 (21)
	I>clicker questions	97 (16)	82 (19)	179 (17)
	Powerpoints: format, structure, and organization	90 (14)	63 (15)	153 (14.7)
	Checks/teaches for understanding	62 (10)	48 (11.4)	110 (10.5)



<i>Question</i>	<i>Theme</i>	<i>Number of Responses</i>		
		<i>Pre (%)</i>	<i>Post (%)</i>	<i>Total (%)</i>
Q11	Advancing slides/talking too fast	58 (9)	30 (7)	88 (8.4)
	Does not engage students	26 (4.2)	15 (3.5)	41 (3.9)
	Does not post notes/slides/ppt/outline	19 (3)	19 (4.5)	38 (3.6)
	Does not use multiple formats	22 (3.5)	5 (1)	27 (2.6)
	Not enough detail/explanation	17 (3)	8 (2)	2 (.2)
Q12	Multiple Formats	105 (17)	78 (18)	183 (17.5)
	Provides (relevant) examples	85 (13.6)	49 (11.6)	134 (12.8)
	i>clicker Questions	74 (11.9)	46 (10.9)	120 (11.5)
	Enthusiastic/Friendly	45 (7)	40 (9)	85 (8.1)
	Engages Students	44 (7)	15 (3.5)	59 (5.6)
Q13	Posts notes/slides/ppt/outlines	43 (6.9)	37 (8.7)	80 (7.7)
	Partner/Group discussion and activities	21 (3.4)	15 (3.6)	36 (3.4)
	Engages/involves students	19 (3)	17 (4)	36 (3.4)
	Reviews/Relates to previous material	15 (2.4)	19 (4.5)	34 (3.2)
	In-class activities	21 (3.4)	6 (1.4)	27 (2.6)

Emerging themes related to UDL that demonstrated at least 1% of change.				
Question	Theme	Percent		
		pre	post	change
Q3	I>clicker questions	55	62	7
	In-class mini writing	8	15	7
	In-class activities	5	7	2
	Guest Speakers	.3	1.6	1.3
	Humor	1.6	2.6	1
	Videos	13	12	-1
	Enthusiastic/Friendly	4	1.4	-2.6
	Asks for student examples/opinions	7	2	-5
	Asks Questions	52	43	-9
Q4	Videos	3	4	1
	More clicker questions	11	12	1
	Ask for students opinion	1.9	.9	-1
	In-class discussion	4.7	3	-1.7
	Provide (relevant) examples	3.6	1.3	-2.3
	Interactive Activities	8	5	-3
Q10	I>clicker questions	16	19	3
	In-class mini writing	1	3.5	2.5
	Multiple formats	1.4	2.6	1.2
	Sample/practice exams	.08	1.6	1.52
	Checks/teaches for understanding	10	11.4	1.4
	Powerpoints: format, structure, and organization	14	15	1
	Answers student questions	3.7	2.1	-1.6
	Uses Visuals: pictures/diagrams/visual concepts	7.5	4	-3.5
	Provide (relevant) examples	25	17.8	-7.2
Q11	Does not post notes/slides/ppt/outline	3	4.5	1.5
	Just reads off slides	2	<1	-1
	Not enough detail/explanation	3	2	-1
	Advancing slides/talking too quickly	9	7	-2
	Does not use multiple formats	3.5	1	-2.5
Q12	Guest speakers	.3	3.8	3.5
	Enthusiastic/Friendly	7	9	2
	Interactive with students	2	4	2
	Multiple Formats	17	18	1
	Pacing	3	4	1
	I>clicker questions	11.9	10.9	-1

	Provide (relevant) examples	13.6	11.6	-2
	Engages Students	7	3.5	-3.5
Question	Theme	Percent	Question	Theme
		pre	post	change
Q13	Study guides	.09	3	2.91
	Reviews/Relates to previous material	2.4	4.5	2.1
	Post notes slides/ppt/outline	6.9	8.7	1.8
	Multiple Formats	1.8	2.9	1.1
	Engages/Involves students	3	4	1
	Relevant Examples/Questions	2.7	1.7	-1
	In-class activities	3.4	1.4	-2

#### Key to Student Qualitative Questionnaire Questions

Q3 = Describe how the instructor gets students actively engaged in learning.

Q4 = What could the instructor do better to actively engage students in learning?

Q10 = Things your instructor does, or about the structure of this course, that helps you learn?

Q11 = Things your instructor does, or about the structure of the course, that hinder learning.

Q12 = What does the instructor of this course do better than other instructors to help you learn?

Q13 = What have instructors of other courses done better than this instructor to help you learn?



## Appendix F

Table of Qualitative Results- Instructors

Main themes emerging from instructor qualitative questions.				
Question	Theme	# of responses		
		Pre	Post	Difference
Q1	I>clicker	6	5	-1
	Ask for verbal response	4	5	1
	Small group/partner discussion activities	3	5	2
	Class Discussion	4	2	-2
	Videos	0	2	2
	Mini writing	0	1	1
	Making material relevant	0	2	2
	Miscellaneous interactive activities	0	1	1
Q2	i>clickers	6	5	-1
	Videos	5	6	1
	PowerPoint	5	5	0
	Internet	2	0	-2
	Document Camera	0	1	1
Q3	RamCT	6	3	-3
	Additional websites/links	1	2	1
Q4	Out-of-class essays	6	5	-1
	In-class writing	5	4	-1
	I>clicker	1	2	1
	Applied project	1	1	0
	Research Study Participation	1	2	1
	Class participation	1	1	0
	Short answer on exams	1	1	0
Q5	I>clicker	4	1	-3
	Survey Monkey	1	0	-1

## Key to Instructor Qualitative Questionnaire Questions

- Q1 = Describe how you get students actively engaged in learning.  
Q2 = If you use instructional technologies during class sessions, describe them.  
Q3 = Describe instructional technologies used outside of class.  
Q4 = Describe alternative ways you allow students to express their comprehension.  
Q5 = Describe technology used to facilitated communication.