Curb Cuts in Cyberspace: Universal Instructional Design for Online Courses

Kavita Rao
Adam Tanners
University of Hawai'i Manoa

Abstract

College courses that include universal design features can minimize the need to provide accommodations for students with disabilities and make courses accessible to students from diverse backgrounds. This article examines how principles of Universal Instructional Design (UID) and Universal Design for Learning (UDL) can be incorporated into an online course to accommodate an increasingly diverse body of students in postsecondary institutions. The authors designed and implemented a graduate-level online course that incorporated UID guidelines and met UDL principles. To evaluate the universally-designed course elements, students were surveyed and interviewed during and after the course. This case study describes the universal design features that can be included in an online course and highlights the features that students valued. The authors conclude with considerations for course designers who seek to include universal design features in online courses.

Keywords: online course, universal design, UID, disability

The number of postsecondary institutions offering distance learning courses grew from 34% in 1997 (Wirt et al., 2004) to 66% in 2006-2007 (Parsad & Lewis, 2008). A report by the Sloan Consortium (Allen & Seaman, 2010) describes the steady growth in online course enrollments in the past seven years. According to the report, between 2008 and 2009, there was a 21% growth for enrollments in online courses, which far exceeds the overall growth of the number of students in higher education at less than 2%. With more students choosing distance education options, enrollments in online courses will increasingly reflect the diversity of postsecondary populations, including students with disabilities.

For students with disabilities who attend college, legislation such as Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act Amendment Act (ADAAA) of 2008 guarantee access to all classes, including online classes. The technology-rich environment of online learning provides natural opportunities to create accommodations and accessible environments for students with disabilities (Kinash, Crichton, & Kim-Rupnow, 2004). For instance, multimedia technology can support various modalities, providing options for representing and expressing information in textual, auditory and visual formats.

Instructors are wise to design courses that address the learning preferences and diverse abilities of students who are choosing distance education options. Educational models stemming from universal design (UD) principles provide frameworks for designers of online courses who seek to create accessible learning environments. The term "universal design" was coined by architect Ron Mace to describe the process of designing physical environmental features to be functionally accessible to a range of users, with and without disabilities. Educational models based on UD relate this idea of universal access to pedagogical practices, applying them to the processes of teaching and learning (Rose, Harbour, Johnston, Daley, & Abarbanell, 2006).

Three educational models adapt UD principles for purposes of curriculum and instruction — Universal Instructional Design (UID), Universal Design for Learning, (UDL) and Universal Design of Instruction (UDI). Table 1 lists the main principles of each of the

Table 1

Universal Design Educational Models

Educational Model	Main Principles or Guidelines
UID: Universal Instructional Design (Goff & Higbee, 2008)	a. Creating welcoming classrooms b. Determining essential components of a course c. Communicating clear expectations d. Providing timely and constructive feedback e. Exploring use of natural supports for learning, including technology f. Designing teaching methods that consider diverse learning styles, abilities, ways of knowing, and previous experience and background knowledge g. Creating multiple ways for students to demonstrate their knowledge h. Promoting interaction among and between faculty and students
UDL: Universal Design for Learning (National Center on Universal Design for Learning, 2010)	Principle I. Provide Multiple Means of Representation Principle II. Provide Multiple Means of Action and Expression Principle III. Provide Multiple Means of Engagement
UDI: Universal Design of Instruction (Burgstahler, 2009)	1. Class climate 2. Interaction 3. Physical environments and products 4. Delivery methods 5. Information resources and technology 6. Feedback 7. Assessment 8. Accommodation

three educational models – UID, UDL, and UDI.

These three approaches to incorporating UD can be complementary, providing a range of strategies and approaches for instructors to consider as they design courses. The principles can be applied to overall design of a course as well as specific instructional elements such as materials and instructional strategies. Burgstahler (2006) notes that incorporating UD principles may not eliminate the need for accommodations for a student with a specific disability, but it does create an environment that is accessible for a range of students and minimizes the need to create accommodations. For instance, providing audio versions of class readings can support students with learning disabilities, students with visual impairments, students for whom English is a foreign language, and students whose preference is to learn through auditory input.

Silver, Bourke, and Strehorn (1998) initiated the concept of UID as a model appropriate for postsecondary settings. In a study designed to create a working definition of UID, they stated, “with UID, students may find that many of the instructional accommodations

they would request are already part of the faculty members' overall instructional design. Furthermore, these approaches may benefit all students in the class" (p. 47). Berger and van Thanh (2004) note that UID is consistent with goals of equity and inclusion of students with disabilities and creates campus environments that respect and value diversity. Goff and Higbee (2008), in a guidebook for postsecondary faculty, list eight guidelines for the UID approach, based on Chickering and Gamson's (1987) principles for effective practices in undergraduate education. The guidebook translates UID principles into concrete course elements that instructors can consider while designing courses.

Case Study: Universal Design for an Online Course

This paper describes a case study of an online course that incorporated elements of two UD approaches, UID and UDL. The two-fold purpose of the study was to: a) examine how UID and UDL guidelines can be considered during the instructional design process and applied in an online course environment, and b) determine which elements of UD were most valued by and useful to students enrolled in the online course. In this case study, we describe the process in three phases – course design and development, implementation, and evaluation.

Formats for Online Courses

While the term "online course" implies a certain type of instructional offering, the form and structure of online courses can vary greatly. Some courses are delivered fully online while others are "hybrid" or "blended." Hybrid/blended courses use some combination of face-to-face instruction and online instruction (Allen & Seaman, 2010). With increasing access to synchronous technologies, such as web-conferencing software, "real time" meetings can also take place online in virtual classrooms, creating opportunities for interactions similar to those that take place in traditional face-to-face classes.

There are two major factors to consider when designing an online course – technology and pedagogy. Instructors can begin by considering the combination of technologies and methods best suited to their instructional objectives. Instructors should consider the course delivery methods they will use, determining how to combine the asynchronous and synchronous technologies that are available. Asynchronous technologies include course management systems (CMS), discussion forums, blogs, and email. Synchronous technologies include web-conferencing, chats, and videoconferencing.

Instructors should then consider the instructional materials and strategies they will use in conjunction with the technologies they select. In a synchronous environment, instructors can emulate some of the interactions that take place in a face-to-face class, using the virtual meeting space for lectures, small and large group activities, and interactions between students and instructor. Concurrently, asynchronous technologies can be used to post instructional resources, assignments, and conduct online discussions.

With the array of options for online instructional design, there is no blueprint for incorporating UD principles into an online course. Instead, as with a traditional course, instructors can apply UD principles to their online courses in a variety of ways to create environments that accommodate a range of student needs and learning preferences. Research on the use of UD principles in online and hybrid/blended courses has only recently been reported in the literature. Researchers have described ways in which higher educational environments, including distance education programs and courses, can be proactively made more accessible (Anderson & Litzkow, 2008; Burgstahler, 2008). Parker, Robinson, and Hannafin (2007) described how they utilized an online CMS within a face-to-face course to create a "blended learning environment" that integrates UDI guidelines.

The Institute for Higher Education and Policy ([IHEP], 2000) identified benchmarks for excellence in distance learning environments. Researchers have examined ways to translate these benchmarks into instructional practices (Dukes, Waring, & Koorland, 2006). Many of these instructional practices are consistent with UD guidelines. While there is overlap between established benchmarks and UD frameworks, the UD models provide guidelines that proactively address disability and diversity.

The present case study adds to this literature base by examining how UD guidelines can be applied to instructional design decisions about technology and pedagogy for an online course and evaluating the students' opinions of the UD-based course elements in order to identify the features valued by students.

Method

Phase I: Course Design

The course design team, the co-authors of this paper, consisted of the course instructor (an assistant professor) and a doctoral candidate in the Special Education Department in the College of Education. Both course designers had extensive experience in technology-enhanced instructional design and delivery, including converting traditional face-to-face courses into online formats. The course, "Collaboration in School and Community Settings," was required as part of the program sequence for teacher licensure candidates in the Special Education department.

To begin planning this course, we chose to focus on two of the UD models. We relied primarily on Goff and Higbee's (2008) UID implementation guidebook for faculty and staff in postsecondary environments. The UID framework includes eight guiding principles that can be considered during the instructional design and course implementation process (see Table 1). The Goff and Higbee guidebook contains concrete scenarios and case studies written by instructors of various courses, providing examples of ways in which the principles were applied to face-to-face courses. Based on our prior experiences converting traditional courses into online formats, we discussed which of these UID-based strategies could be effectively translated to an online course. We subsequently developed the elements of our course, practices and strategies aligned to each of the eight UID principles. As we discussed and developed our course elements, we noted that they also aligned to the three UDL Principles of Multiple Means of Representation, Action and Expression, and Engagement (http://www.udlcenter.org/aboutudl/udlguidelines). Thus, we refer to UDL as the secondary model for our course design. Table 2 provides an overview of how the selected course elements mapped to both UID and UDL principles. We organized the elements into four categories: a) course materials, b) instructional strategies, c) asynchronous technologies, and d) synchronous technologies.

We began designing this course several months prior to the start of the semester when it would be taught. As a result, we did not have any information about the disability status of the students who would eventually enroll in the course. As course designers, we saw this as an authentic environment in which to add UD elements. As instructors at a large public state university, we anticipated enrollment of a diverse population in this course. The university we work at typically serves students of diverse ethnic and socioeconomic backgrounds. Students include Pacific islanders and students who speak English as a foreign language. Teacher-training programs attract many non-traditional students returning to school for a change in vocation or certification. As special educators and instructional designers we were cognizant of the potential for diversity in learning style, preference, and disability status. One member of the design team (the second author) has experience working in postsecondary disability support services. This background helped the design team make determinations on developing materials and strategies that address the needs of students with some high incidence disabilities (e.g., print-related disabilities).

Phase II: Implementation of Course

This 16-week course was implemented in the Fall 2009 semester. This section details how the UD-based course elements and practices were incorporated by the instructor (the first author) during implementation of the course. Goff and Higbee's (2008) guidebook includes a case study section in which several instructors list the UID-based elements of their courses. Since we relied heavily on this guidebook as we made our instructional design decisions, we followed the format in the guidebook for reporting case studies. Under each of the eight UID guidelines, we provide a narrative about the course elements and instructional strategies we used.

Creating a welcoming classroom. Prior to the course start date, the instructor regularly checked the course enrollment online and sent an email message to each student as he or she registered in the course. This message was individualized and addressed each student by first name. This direct contact from the instructor was intended to establish rapport and set expectations. The message provided information to orient students to the course and to establish expectations about how to get started during the first week of instruction.

Determining essential components of a course. The course syllabus listed a set of core objectives, determined by the Special Education Department. The instructional design team considered how each objective could be addressed in an online environment, using the distance learning technologies available to the students.

Table 2

Mapping Course Elements to UID and UDL Principles

		A: Welcoming Classrooms	B: Essential Course Components	C: Clear Expectations	D: Timely, Constructive Feedback	E: Diverse Teaching Methods	F: Natural Supports	G: Demonstrate Knowledge	H: Interaction - Students / Faculty	I: Representation	II: Action and Expression	III: Engagement
	Course Elements	**UID**								**UDL**		
Course Materials	Syllabus: • Included disability statement • Included rubrics for all assignments • Included an overview of the weekly schedule for the whole semester	•	•	•						•		
	Textbook: • Gave students the option of purchasing a text or electronic version					•				•		
	Additional Readings: • Provided audio versions (MP3s) of articles for students					•	•			•		•
	Web-based instructional modules: • Videos and audio on this website were closed captioned • Text transcripts were available for each video or audio file.					•	•			•		•
Instructional Strategies	Assignments: • Assigned short weekly assignments for 10 out of the 16 weeks of class • Provided handouts and worksheets to guide each assignment • Had a consistent time and day of the week when assignments were posted and due			•	•		•	•		•	•	
	Final Project: • Students were given the choice of writing a traditional final paper or creating a multimedia project; detailed guidelines and rubrics were provide for each option.			•			•	•		•	•	•

Table 2 continued on next page

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	Course Elements	**UID**								**UDL**		
Synchronous	**Elluminate Live! Sessions:** • Recorded each session and made resources from the session available to students to review afterwards • Used a visual presentation during the session	•				•	•	•	•	•	•	•
Asynchronous	**Course Management System:** • Selected a few tools within the CMS and used them consistently • Listed each week's assignment in a consistent place on the CMS • Responded to each student's assignment submission with comments; posted responses within 5 days of due date	•	•	•			•		•	•		
	Voicethread: • Used Voicethread as a class "discussion" forum. Students watched multimedia presentations and responded using text, audio or video.				•	•	•	•	•	•	•	•
	Email: • Interacted with students who had individual questions and concerns via email (or phone).								•		•	

A CMS is available university-wide for asynchronous delivery of course content. In addition, the College of Education has purchased licenses for a synchronous web-conferencing system known as Elluminate *Live!* (see Appendix for overview of features). The instructional design team considered how these asynchronous and synchronous technologies could be used to meet the objectives of this course. The CMS was used for particular purposes, such as making resources available and posting assignments. The web-conferencing system was used to foster interactions by providing a means for synchronous group meetings periodically during the 16 weeks of the semester.

Communicating clear expectations. The instructor developed a simplified syllabus, formatted in way that provided quick visual access to key information that students needed to know to succeed in the course. Course requirements, grading, and expectations were clearly demarcated and separated from other areas of the syllabus. Text-heavy areas of the syllabus, such as course objectives and alignment to national and state standards, were placed on separate pages. The syllabus included a description of the grading system, the points assigned to each assignment, a weekly overview of course topics, and due dates for all major assignments. Rubrics were provided for all assignments.

To increase clarity and organization, the instructor selected and consistently used particular areas of the CMS to minimize extraneous information and use the interface in a consistent manner each week. Students were asked to visit the Announcements and Assignments area each week to find all the information and resources needed to complete the weekly assignments (see Figure 1). The title of each week's assignment had the date span for which the assignment was "active" (for example, "Week 3: September 7-13"). Students could scan the list of assignments and quickly orient themselves to the assignment they should be working on by looking for the current date (see Figure 2).

Every Monday morning the week's assignment was posted in the Assignments area, and the instructor sent an email to each student with a summary of the assignment. The email included an attachment that contained all the information that was posted in the Assignments area of the CMS. This provided a personalized note to the students each week and reminded them that a new assignment was awaiting them.

Providing timely and constructive feedback. During the course, students were assigned short weekly assignments, related to content covered during the week. The weekly submissions were consistently due on Sundays at midnight. The instructor read and responded to each student's assignment within five days after submission. Students submitted their assignments in the "Assignments" area of the CMS; the instructor typed comments into their submissions and returned these comments in the same CMS area. The instructor's comments were designed to create a personalized instructional dialogue with each student about his/her assignment.

Students often emailed the instructor with questions and comments during the week. The instructor responded to all student emails within 24 hours of receiving a question or comment.

Exploring use of natural supports for learning, including technology. Students were provided with options for receiving and responding to course content in audio, video, and text format. The course textbook was available in print and digital formats and students were told before the course started that they could choose either one. The instructor also provided audio versions (mp3 files) of all additional assigned readings. During the course, students accessed a few web-based modules to learn course content. These modules, designed by the IRIS Center at Vanderbilt University (http://iris.peabody.vanderbilt.edu/resources.html) were designed to be accessible, with closed captioning and text transcripts available for all audio and video materials.

Instead of using the text-based discussion board within the CMS, the instructor used a web-based collaborative multimedia environment called Voicethread (see Appendix A for an overview of features) as the course discussion environment. The instructor uploaded videos and narrated presentations of "guest presenters" on Voicethread and students commented on these presentations within the website. Students could choose to leave a comment using the text, audio, or video features built into the Voicethread website interface.

The varied digital formats through which students could receive and respond to course content also aligned with UDL principles. Giving students the options to receive and respond to course content in text, audio, and video formats provided multiple means of representation and expression. In addition, the multimedia presentations by guest speakers on Voicethread provided multiple means of engagement, giving students authentic contexts and real life stories connected to course content.

Figure 1. Screen shot of main page for the course in the Course Management System. Two areas, Announcements and Assignments, were consistently used throughout the course.

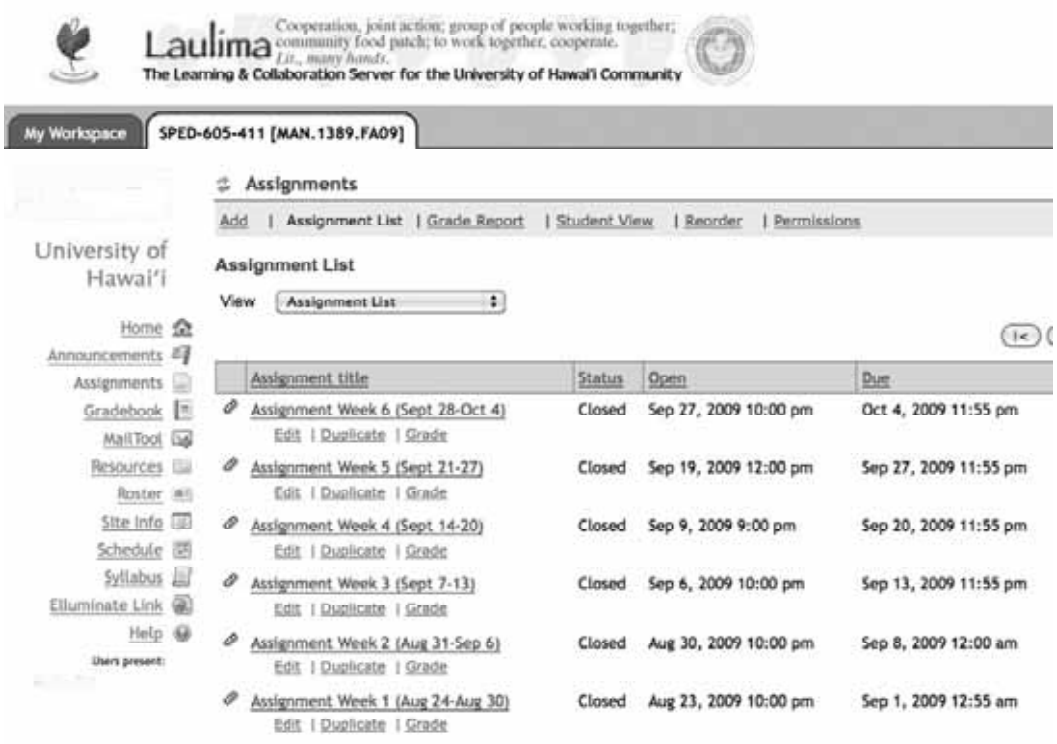

Figure 2. Screen shot of the listing of weekly assignments. The date span that each assignment was "open" was listed in the title of the assignment, making it clear for students to determine which assignment they should be working on each week.

Designing teaching methods that consider diverse learning styles, abilities, ways of knowing, and previous experience and background knowledge. Assignments were designed to help students connect course content to their experiences and opinions. The students in this class had diverse backgrounds and experiences. They ranged greatly in age, experience, and cultural background. All assignment prompts gave students the opportunity to bring in their own personal experience and relate it to content. For instance, while most students were teaching in some capacity and chose to answer questions based on their current school or classroom experiences, some students chose to discuss issues from their perspective as parents of children with disabilities.

The use of multiple technologies and the combination of systems (such as the CMS, Elluminate *Live!* and Voicethread) created an environment that addressed diverse learning styles. The CMS provided a consistent place to access information. Elluminate *Live!* helped to create an environment for interaction with peers and the instructor, and also provided a way in which students could absorb and interact with course content in varied ways, through the instructor's live presentation, group discussions with other students, and visual and audio supports. Voicethread provided students the choice to respond to content using text, audio, or video while simultaneously creating a forum in which other students could read or listen to their opinions. Students had multiple ways to connect with the content, interact with peers and the instructor, and demonstrate their knowledge throughout the course.

Creating multiple ways for students to demonstrate their knowledge. During the course, students were given options for demonstrating knowledge and completing assessments. Rather than having just a few "high value" tests or assignments, students were assigned several smaller weekly assignments. The purpose of the weekly assignments was to provide students with multiple opportunities to convey their knowledge as an alternative to using "high stakes" exams to assess student mastery of content. Most weekly assignment prompts were accompanied by a worksheet with guided questions. These questions helped students focus on key areas of course content as they reflected on its meaning.

Rather than continuing the practice of requiring a final paper as the culminating course assignment, students were given the option of submitting a paper or a multimedia project. The assignment listed all criteria for a paper or a project and provided grading rubrics for both types of submissions. The multimedia project option included criteria that required an equivalent demonstration of course content mastery and rigor as the final paper.

Promoting interaction among and between faculty and students. The course incorporated four synchronous "meetings" over Elluminate *Live!* web-conferencing software, spaced approximately three weeks apart. The main objective of these synchronous sessions was to bring the class together online periodically in order to promote interactions between peers and the instructor. Another objective was to use an online environment that provided visual, auditory, and interactive supports for learning in collaboration with others. These objectives aligned with other UID principles, such as creating a welcoming classroom environment and incorporating teaching methods that considered diverse learning preferences.

The instructor purposefully used strategies to ensure that these sessions were an effective use of students' time and provided added value that could not be achieved asynchronously. The sessions lasted between 1 and 1.5 hours. For each synchronous session, the instructor began with an overview of the session's topics, led a short discussion of the week's content and then gave students an activity to do within small groups in the "breakout room" feature of Elluminate Live! Groups of three or four students discussed a topic and completed an activity designed by the instructor. Each session ended with a large group discussion of the concepts that students had talked about in their breakout rooms. The instructor incorporated interactive features of Elluminate Live! such as online polling and the whiteboard on which students shared comments and thoughts. Universal design features used in the Elluminate Live! sessions included visual PowerPoint slides, preparatory handouts for the breakout room sessions posted in the CMS prior to the Elluminate Live! meeting, and an archived recording of each session for students to review later if desired.

Phase III: Evaluation

Participants and setting. The 25 students enrolled in the course were part of a cohort in their third semester of a Master's degree program. The students were located on several islands in the state of Hawai'i, including O'ahu, the big island of Hawai'i, Maui,

Kaua‘i and Moloka‘i. Twenty-four of the 25 students were enrolled in the program to get a Master's degree in special education and obtain licensure to teach in the Hawai‘i Department of Education. One student had her teaching license from another state and was taking the course to obtain a Master's degree. Twenty-three of the 25 students were working in educational settings, as teachers (on "emergency hire" contracts) or paraprofessionals in the schools, while enrolled in the course.

Data collection and analysis. To evaluate the students' opinions and perceptions of the UD elements of the course, we used qualitative inquiry methods. Students signed a consent form, approved by the University Institutional Review Board, at the start of the course, agreeing to participate in the study. The instructor explained that participation in the study was voluntary and had no bearing on their class standing or grade in the course.

Instruments. Data was collected through a questionnaire developed by the course design team to gather information on specific UD elements of the course. This 25-question survey was administered through an online survey system, Survey Monkey (www.surveymonkey.com), prior to the end of the course. Students were able to access the questionnaire through a URL posted in the CMS by the instructor and complete the survey anonymously. The questionnaire for this study was administered prior to the end of the course in order to keep it separate from the University's standard end-of-semester course evaluation survey.

Additional data were collected through interviews with specific students. These interviews were conducted after final course grades were submitted. Six students were selected as a purposive sample of the students in the course. The selected students met particular criteria that made them likely to provide information to deepen our understanding of the UD features valued by students. The criteria for this sample included a) students who had informed the instructor of their affinity for the UID features, b) students who were located in particularly rural settings where online courses are the only option to pursue teacher licensure, and/or c) one student who had voluntarily self-disclosed a disability during the course. These students received an interview questionnaire with four open-ended questions related to their experiences with the UD features of the course. The interview questions differed from the survey by providing students the opportunity to elaborate in an unstructured format on their personal experiences with the UD features of the course. Students were given the option of responding to the questionnaire in written format or responding by speaking with an interviewer over the phone. Four of the six students chose to respond to the questions; three via email and one in a phone interview.

Analysis of data. The online survey system (Survey Monkey) provided results for each question, reporting percentages of responses for all close-ended questions and a compilation of responses for open-ended questions.

We reviewed the open-ended responses and sorted them to find patterns and recurring preferences, categorizing ideas by frequency. In the Results section, we report the data from close-ended questions and provide examples of frequently mentioned preferences in the open-ended responses in order to illustrate which UD course elements were most valued by students.

Results

All 25 students responded to a questionnaire specifically designed to collect information on their perceptions of the UD features of the course. The results of the survey are reported under the following categories: a) Course Expectations and Materials, b) Instructional Strategies, and c) Asynchronous and Synchronous Technologies.

Course Expectations and Materials

On a five-point scale (Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree), all students were in agreement about the clarity of the syllabus and the rubrics. They felt that these materials provided clear expectations and information about the class. Table 3 provides additional details about the students' preferences and comments on the course expectations and materials.

For the course textbook, three-fourths of students chose the traditional hard copy instead of the digital "e-text" version of the textbook. Some of the students who chose the printed textbook commented that a physical copy of the book was both familiar and most comfortable to use. They noted that they liked highlighting the hard copy and being able to flip through it for reference. Those who chose the digital format noted that they appreciated the convenience of being able to access their book anywhere online and they enjoyed features such as the ability to highlight the electronic text. They could access it at home or at their workplace without having to carry the physical textbook back and forth.

Table 3

Online Survey Questions Related to Course Expectations and Materials

Survey Question	Responses	Key Comments (direct quotes from students)
SYLLABUS: I feel that overall course expectations were clearly laid out in the syllabus.	Strongly Agree: 88% (n=22) Agree: 12% (n=3)	• Very detailed instructions on expectations. • Clear expectations helped me organize myself.
RUBRICS The rubrics for weekly assignments and final project that were in the syllabus and the final course assignment document are useful to me.	Strongly Agree: 76% (n=19) Agree: 24% (n=6)	• I really appreciate the use of rubrics to set the criteria. • Rubric had high expectations, which is good. Give the student a higher goal to attain. • Great guidance on what to expect.
TEXTBOOK: I purchased the a) print or b) digital version of the textbook	Print 76% (n=19) Digital: 24% (n=6)	• I prefer holding a book in my hands, underlining the important parts for later reference. • I prefer reading textbooks in the print format; however, I prefer reading short articles or journals electronically. • I found the highlighter tool [in the electronic version] to be quite helpful.
READINGS: For assigned articles, you could choose to read PDF versions and/ or listen to MP3 versions. Which format(s) did you choose?	Read only text version: 52% (n=13) Read AND listened to the articles concurrently 32% (n=8) Read some and listen to some 16% (n=4)	• I tried listening to the MP3s but I really was turned off from it because of the electronic voice. If it had been a human voice I would have been more apt to listen. • I enjoyed having the MP3 play while I read along with the text. I am easily distracted when it comes to reading things on the computer, so this helped me stay focus. • Listening to the MP3 while reading the articles really helped me to comprehend the readings with ease (that actually surprised me. I did it at first as an experiment but ended up noticing a difference in my comprehension and retention level). I wish all college courses offered this way of learning.
WEB-BASED MODULE In the Web-based IRIS module, the video and audio files had transcripts available. Which formats did you use?	Watched and listened to the video and audio files 48% (n=12) Read the transcripts AND watched/listened concurrently 44% (n=11) Read only the transcripts 8% (n=2)	• I enjoyed the personal touch of actually hearing human voices. This assignment had more impact and meaning because of the content and the need to hear/feel the parents and their perspective when speaking of their children. • I watched and listened to the IRIS module, however when trying to find answers, I would frequently go back to read transcripts. • Actually I alternated--in the beginning I listened and read, but towards the end, I think I relied on reading more, as it seemed to take less time.

For articles that were available in text and audio format, students ranged in their preferences, with more students trying out the non-traditional "digital" option of listening to audio files. When given text and audio options for course readings, 52% of the students chose to read the text, 32% listened AND read concurrently, and 16% chose solely to listen to the audio version of the articles. While no one chose the audio format exclusively, students reported that being able to read and listen at the same time enhanced their comprehension and engagement. Students also commented on the ability to listen while doing other tasks (such as training for a marathon). One student identified a preference for the printed version of the textbook but digital and audio versions of the briefer articles.

For the Web-based IRIS module, while almost half the class just watched the videos or listened to the audio files, 44% chose to read the text transcripts in addition to watching/listening. Students commented that the text transcripts were useful as they looked for information to complete a weekly assignment related to the IRIS module.

Overall, students appreciated being able to select text formats that met their preferences. Their comments also illustrated that the combination of textual, auditory, and visual information was of benefit to some students in comprehending and recalling information. Students commented that having options throughout the course was both useful and motivating.

Instructional Strategies

Ninety-two percent of the students agreed that short weekly assignments were useful and practical. All students liked having guided worksheets to accompany assignments. Ninety-six percent of the students reported that the consistent weekly instructor feedback supported their learning. Table 4 includes key comments from students on these facets of the course.

Several students commented on the effectiveness of having small, lower-value assignments each week. As working professionals, students reported that this approach to organizing assignments helped them keep up with class and master course content incrementally. The fact that the weekly assignments were always posted on a Monday and due the following Sunday provided students with a consistent structure. Some students mentioned that they were able to build in the time needed to study for this course because the expectations were consistent.

All students agreed that the guided worksheets that accompanied the weekly assignments were useful to them and helped them complete the assignments with more comfort and ease. Students noted that these short, weekly assignments allowed them to demonstrate knowledge in various ways instead of in a single written assignment at the end of the course. The weekly assignments were low pressure and helped bring down the stress associated with having just one or two large assignments in the class.

The instructor also used weekly assignments as a way to interact with students. This was also an effective and well-liked component of the course for students. They relayed their appreciation about getting personalized and timely feedback on assignments. This consistent connection with the instructor was an important link for students, keeping them motivated and on track with course assignments. Some students mentioned that the weekly assignments helped build confidence because they received periodic and consistent feedback on whether they were mastering course content as expected.

Asynchronous and Synchronous Technologies

All students agreed that the materials were clearly laid out in the CMS. Students commented on the effectiveness of weekly reminders about CMS features to notice as well as the ease with which they could locate course information on the CMS. The majority of students found the synchronous sessions conducted with Elluminate Live! to be effective, engaging, and useful. Ninety-six percent of the students agreed that the presentations on Voicethread were useful and 92% agreed that they liked having the options to post comments by text, audio, or video in Voicethread. Table 5 provides additional details and student comments about their opinions on the asynchronous and synchronous technologies used.

Voicethread. The use of the Voicethread website was highly valued by students as an alternative way to learn content and demonstrate knowledge. Voicethread was especially powerful as a way to provide options for expression; students appreciated being able to use text, audio, or video when posting comments. Some students took the opportunity to personalize their posts; for instance, one student strummed his guitar to enhance an audio comment that he posted. Students also enjoyed the "real stories" from the guest speakers' multimedia presentations; students noted that they felt great empathy with the speakers and learned more about what it was like to be in their shoes.

Table 4

Online Survey Related to Instructional Strategies

Survey Question	Responses	Key Comments (direct quotes from students)
SHORT ASSIGNMENTS I like having short weekly assignments with a relatively low point value (5 points a week) instead of fewer assignments that are worth more.	Strongly Agree: 64% (n=16) Agree: 28% (n=7) Neutral: 8% (n=2)	• The workload is spread out and for the working person, this is really practical. • I could go either way; however the weekly assignments keep me connected to the course and materials weekly. Turning assignments or reflections in weekly help me with my learning process and again help me stay accountable for the course. • These mini assignments are a great way to help keep us focused on the class throughout the semester, as opposed to cramming when nearing large due dates. These assignments also provide various ways for us to show our understanding and knowledge, beyond just a major paper or test, thus giving more chances for multiple-skill sets.
GUIDED WORKSHEETS For most weekly assignment submissions, there have been handouts/worksheets to guide you as you respond. I like having such worksheets/ handouts to guide my assignment responses.	Strongly Agree: 88% (n=22) Agree: 12% (n=3)	• These handouts/worksheets really help me to focus my thinking. Open-ended assignments with no guidance can be a nightmare, requiring you to put in a lot of work without knowing where to go with it. • Handouts are helpful because they help you narrow the focus of your study. • I gain a clearer understanding of what is expected. Again, works really well especially for an online course.
INSTRUCTOR FEEDBACK I feel that the instructor feedback in this class is adequate and helps support my learn	Strongly Agree: 92% (n=23) Agree: 4% (n=1) Neutral: 4% (n=1)	• The weekly feedback on our submissions was so helpful and validated the effort put into completing the assignments. • This was the most valuable aspect of the class for me. Knowing where I stand in my classes is essential to keeping my stress/ overwhelmed levels low. • I so appreciate the feedback! The feedback was always given on a timely manner and was very useful. The feedback given assisted me in my thinking process, helped me reflect on the materials and my own assignments.

Elluminate *Live!* Over half of the students reported that the synchronous sessions were useful and engaging and achieved the goal of fostering greater interaction and connection with peers. Students commented on the benefits of the social aspects of learning from and with each other and of connecting with the instructor periodically.

Post-Course Interview Results

Four students answered the post-course interview questions. The data from the interviews confirmed the results of the surveys, with all respondents noting an affinity for the multiple options to receive information and demonstrate knowledge throughout the course. Students reiterated the value of using Voicethread as a class forum, stating how much they liked having the text, audio, and video options available both to post information and to read/hear/watch the comments of classmates.

Three students noted that they had started using universally designed strategies in their classrooms as a result of learning about and seeing UD modeled in the course. One student had started to use Voicethread with her own high school students. Another student commented that, by experiencing the range of options that are part of UD from the perspective of a student, she had started to give her own high school students more options in their assignments. Another student was providing her elementary school students with audio options to accompany their weekly readings after being exposed to this strategy in this online course.

Discussion

While UID and UDL have gained popularity as frameworks, there is limited literature describing how the principles within these models can be applied to the instructional design of an online course. This case study attempted to determine how UD principles could be applied within an online course and to examine which of the universally designed features students in the course found most useful.

Effective Practices

The results of this small-scale study show that students appreciated several features of the course that were designed to meet UID and UDL principles. This section groups students' reported experiences with the online course's UD features into three broad categories: a) providing options and choices, b) instructional strategies, and c) interactions. A deeper consideration of these categories gives rise to several instructional implications for infusing online learning environments with UD features.

Providing options and choices. Students appreciated the choices and options provided by several course elements. These included the multiple formats for materials (such as the provision of text and MP3 versions of articles) and the use of Voicethread to present and discuss information. Both of these course elements align with the fifth UID guideline (Explore the use of natural supports for learning, including technological supports). As expected, students selected formats to use based on their personal preferences and habits.

There was resounding agreement that the use of the Voicethread website appealed to students. Voicethread provided a collaborative space in which course information could be represented and expressed in multimodal formats, aligning closely to the seventh UID principle (Creating multiple ways for students to demonstrate their knowledge) and to UDL Principle II (Multiple means of expression). Students liked being able to express themselves in text, audio, and video formats and to choose whether to read or listen to the comments of others. When designing the course, we chose Voicethread because it provided a public forum of sorts. In this web-based space, we could post multimedia and video presentations and give students multiple ways to respond to these learning activities. Instructors can provide similar multimodal choices with a range of technology-based tools or websites. For example, rather than relying on a text-based discussion board on the CMS, instructors can give students the opportunity to respond by recording themselves in audio or video formats and posting these files in the CMS.

For instructors designing an online course, it is useful to consider which course elements lend themselves to multiple formats. These can include course resources provided in multiple formats as well as course assignments that allow students to respond in a variety of formats. Instructors can also present course content in various formats, using narrated presentations and videos to enhance text-based content that students are expected to read.

Instructional strategies. For the non-traditional learners in our course, many of whom were returning to college for a degree after a gap of many years and had full-time jobs and families, the instructional strategies provided scaffolding and support to make the course

manageable along with other life commitments. This was consistent with the sixth UID guideline (Design teaching methods that consider diverse learning styles, abilities, ways of knowing and previous experience and background knowledge). According to student comments, the brief, weekly assignments were less stressful than high stakes assessments. Students appreciated the clarity of the assignments and the consistent instructor feedback. As intended by the course designers, these elements made the course more manageable to students. Several expressed how they were able to "keep up" with this course more effectively than prior online courses they had taken.

An outcome that was unexpected but worthy of note is that three students informally disclosed learning disabilities to the instructor as the course was underway. None of the students had chosen to disclose a disability to the instructor through the Disability Support Services office at the University. The students who did disclose learning disabilities did so by telling the instructor via email once the course was in progress. They noted that the clear and consistent layout of sections in the CMS, the multiple formats of resources provided, and the short assignments made this course much more accommodating and non-threatening for them. One student noted that this course was one of the most manageable online courses she had taken. They were thankful to the instructor for providing the UD supports and communicated these feelings in personal emails during and after the course. This information provided insights into the fact that students with learning disabilities may be taking online courses without disclosing to instructors or requesting accommodations from DSS offices. This illustrated that UD features can be of real benefit to those who may need additional support in a course, inherently taking into account their backgrounds and diverse needs.

Another unintended but interesting outcome was that some students reported using some of the UD strategies in their own teaching practice. As special educators, they saw the merit of applying UD strategies in their K-12 settings, especially to give their students options for representation and expression. The instructional strategies from this course became a model that our students found relevant and useful in their own classrooms.

Interaction. This course incorporated many forms of interaction in accordance with the eighth UID principle (Promoting interaction among and between faculty and students). Students appreciated regular online interactions with the instructor, noting that her timely feedback on each assignment increased their engagement and enthusiasm for completing the assignments. Some students commented that they wished they heard more from instructors in other online courses, noting that they stayed more engaged with this course because they knew they would receive personal comments on each assignment from the instructor.

Students had the opportunity to share ideas and opinions through asynchronous (Voicethread) and synchronous (Elluminate *Live!* sessions) forums. Course activities requiring students to use these technology tools were scheduled throughout the semester. This helped foster a sense of community throughout the course. Students did not learn in isolation, interacting only with the instructor, but had opportunities to hear from each other through the postings on Voicethread and to work with each other periodically during the Elluminate *Live!* sessions.

For instructors who would like to include synchronous components into online courses, it is useful to determine how to balance the number and duration of sessions with student needs. For our course, four Elluminate *Live!* sessions were adequate, especially since students interacted asynchronously through Voicethread and through short weekly assignments with the instructor. It is also important to select a time for the synchronous session with consideration of the students' schedules. For example, since most of our students were working full time, the synchronous sessions took place in the early evenings on a day and time students agreed to at the start of the semester.

Recommendations for Instructors

Integrating UD components into online courses can be a time-consuming process. For an instructor converting a face-to-face course into an online format, consider aligning UD guidelines with course resources, instructional strategies, asynchronous interactions, and synchronous interactions. Rather than trying to incorporate every UID feature possible, instructors can start by adding a few UD components into each course and building on these components as they teach the course repeatedly.

For example, providing resources in multiple formats requires extra preparation time. While software automatically converts the text to MP3 files, it takes time to prepare a text file for conversion. Instructors

can use an incremental approach, converting new and additional resources each semester, thereby creating a bank of more accessible course materials over time. As new technologies become available, instructors can revisit course elements periodically to add or change elements and remain responsive to student needs.

Implications for Addressing Students with Disabilities

Universal design does not eliminate the need for formal accommodations, but provides a proactive approach to addressing many of the needs of diverse learners including students with disabilities. The format of the course provided ways to support students with high incidence disabilities such as LD that could also be helpful for a student with a low incidence disability, such as a visual impairment. For example, we provided accessible PDFs for all reading materials and accompanying MP3 files, which could accommodate students with learning disabilities and/or low vision. The College of Education chose the Elluminate *Live!* web-conferencing software due to its accessibility features such as closed captioning and support for screen readers. We did not use the closed captioning feature during our virtual classes but had the capacity to accommodate a request for closed captioning if needed.

While the Voicethread website included some accessibility features, at the time that we used it for this course its Flash-based interface did not provide support for all assistive technologies, such as screen readers and alternative navigation tools. We were aware of this limitation and would have created alternate assignments for students with disabilities who needed additional assistive technology accommodations. Despite the limitations of the Voicethread website, the option to post information in a variety of formats – text, audio, or video – was useful for including accommodations designed for students with high incidence learning disabilities. Recently, Voicethread has enhanced its accessibility features and added a "Voicethread Universal" option, which allows for the use of screen readers and other assistive technologies (http://voicethread.com/about/features/accessibility). Voicethread's commitment to adding and updating its accessibility features holds promise for including Voicethread as a viable system in future courses that include UD elements.

Recommendations for Future Studies

This case study describes the design and implementation of a course during one semester and the results are limited to the 25 students enrolled in the course; It represents an initial phase of research, part of an iterative and ongoing process of design, development, evaluation, and reflection intended to inform the design of future UD-based courses. To derive more information on how a universally-designed online course enhances engagement and learning outcomes for all students, including those with disabilities, it is necessary to collect data from future iterations of courses that use similar UD strategies and to collect data from more students in order to have a larger sample size. To gain insights on how a course like this supports students with disabilities, it would be useful to examine which course elements are most useful to students who are willing to provide demographic information including disability status.

Noting that none of the students in this course disclosed a disability through the University DSS office, we wondered whether online learners were as aware of DSS services as the traditional campus-based students. Many of the online students at our University reside on neighbor islands and are a plane ride away from campus. Though it is a standard practice in our Special Education department to include a statement in course syllabi about the services offered by the DSS office, the fact that the online students do not physically come to campus may affect their knowledge of and ability to access DSS services. We surmised that some students with disabilities can benefit from supports in an online class, but by the very nature of being a "distance learner" may not access these services. A study that focuses on the use of DSS service by online learners may help students, instructors, and DSS staff understand how accommodations could further address the needs of such students. A related question is whether the provision of UD supports within online courses eliminates the need for students with certain types of disabilities to disclose to their institutions.

Conclusions

Incorporating principles of UD into an online course takes forethought, planning, and time. When designing a course, the instructor should consider the objectives of the course and decide how to meet these objectives with appropriate strategies and technologi-

cal tools. With the pace of development in technology, many tools are becoming less specialized and more commonly available to the end user. Instructors can increasingly create universally-designed digital materials without having to rely on technology experts. As a technologically-savvy generation of students enrolls in online courses at the postsecondary level, universally designed courses will provide valued learning options while proactively accommodating many of the needs of an increasingly diverse student body.

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About the Authors

Kavita Rao received her B.A. from the University of North Carolina at Chapel Hill and her M.A. and Ph.D from the University of Hawai'i. Her experience includes working as a K-12 technology coordinator and an educational technology specialist for a regional educational laboratory. She is currently an Assistant Professor in the Department of Special Education at the Ph.D from the University of Hawai'i at Mānoa. Her research interests include using technology to modify instruction for diverse learners, online learning for teacher professional development in rural and remote areas, and universal design for learning. She can be reached by email at: kavitar@hawaii.edu.

Adam Tanners received his B.A. from the State University of New York (SUNY) at Albany, M.A. from The University of Iowa, and Ph.D. from the University of Hawaii. His experience includes working as a counselor at the Student Disability Services office at The University of Iowa and an assistive technology specialist University of California at Berkeley. He is currently an Assistant Specialist in the Department of Special Education at the University of Hawai'i at Mānoa. His research interests include universal design in education, use of everyday technologies as accommodations to students with disabilities. He can be reached by email at: tanners@hawaii.edu.

Appendix

A summary of the features of Elluminate *Live!* and Voicethread are provided below. The respective websites provide additional and updated information about these resources.

Elluminate *Live!*

Website: www.elluminate.com
Cost: Individual or site licenses must be purchased.
Description: Elluminate Live! is a virtual meeting environment which allows users to connect synchronously.

Features include:

- Two-way Audio – participants can talk and listen to each other
- Direct Messaging – participants can type messages to each other
- Interactive whiteboard – presentations can be uploaded and viewed by everyone in the conference; participants can also write/draw/type on the whiteboard
- Multimedia – show videos, play audio files,
- Desktop Sharing – show specific documents on your computer
- Video – moderator and participants can see each other via webcam
- Breakout Rooms – Moderator can put participants in small groups within the web-conferencing environment
- Closed captioning

Voicethread

Website: www.voicethread.com
Cost: Free (limited features); Pro account can be purchased for additional features.
Description: Voicethread is a web-based collaborative environment in which users can watch multimedia presentations (document, slides, or video) and comment using voice, text, audio file, or video.

Features include:

- Multimedia – upload videos, presentations, documents
- Commenting – comment using text, voice/audio (call in via telephone or use a microphone) or video (using a webcam)
- Privacy settings – a Voicethread multimedia file can be set to private so only those with the link and invitation can view it.