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Universities are charged with educating students from diverse backgrounds, including ELL students, nontraditional students, military students, first generation college students, and students with disabilities. In order to meet the wide variety of learning needs and abilities in the college classroom, teachers must find innovative methods for reaching this diverse population of students. One potential solution is Universal Design for Learning (UDL). Through instructional and assessment strategies that address the "why", how", and "what" of learning, the UDL approach ensures that all students can learn. The research regarding the concept of using UDL in the college classroom is minimal, but shows promise in meeting the needs of all students and the federal laws focusing on UDL. This article provides faculty with background information on UDL as well as ways to incorporate these strategies into their current courses.

Keywords: accessibility, college teaching, higher education, universal design for learning, university instruction

University faculty note there is growing diversity in their classrooms (Dell, Dell, & Blackwell, 2015; Rao, Edelen-Smith, & Wailehua, 2014; Smith, 2012). With increases in the English Language Learner (ELL) population (US Census Bureau, 2011) and the movement to include more students with disabilities (USDE, 2015), the university classroom is becoming more diverse. Universities are charged with educating students from diverse backgrounds, including ELL students, nontraditional students, military students, first generation college students, and students with disabilities. In order to meet the wide variety of learning needs and abilities in the classroom, teachers must find innovative methods for reaching this diverse population of students. One potential solution is Universal Design for

Learning (UDL). The research regarding the use of UDL in the college classroom is minimal, but the existing literature shows promise in meeting the needs of all students, as well as meeting federal laws recommending its use.

In preparing this manuscript, the authors examined the literature from the EbscoHost database, including years 2008 to 2018, and used the search terms "UDL," "Universal Design for Learning," "college teaching," and "university instruction". In addition, the following open-access journals were searched for articles on the topic of UDL in Higher Education: (a) Journal of Educators Online, (b) Journal of Interactive Online Learning, and the (c) Journal of the Scholarship of Teaching and Learning. Articles from the search were chosen based on their relevance and inclusion of specific strategies that were used in the classroom. The themes presented in this article were created by the authors. A deductive coding approach was used to organize the literature data, with initial themes chosen by the authors before beginning the review of literature and changes to the categories being made throughout the process. Some of these categories were directly noted in the literature and others were named by the authors.

Overview of UDL

Universal Design for Learning (UDL) is based on the premise that traditional curriculum is difficult for some students to access because these students have learning preferences and needs that differ from those of the traditional learner (Meyer, Rose, & Gordon, 2014). Universal Design for Learning is designed to create expert learners who take command of their own learning (Meyer et al., 2014; Novak, 2016) and "empowers people by giving them more control over their lives and choice in the things that they do or the way in which they do those things" (Salmen, 2011, pg. 15). By doing this, UDL becomes a proactive approach that faculty can use to anticipate the potential needs of students and plan instruction accordingly (Basham, Israel, Graden, Poth & Winston, 2010; Edyburn, 2010). UDL is not intended to meet the needs of every student in the classroom, but is designed to make the curriculum accessible for the majority of students (Glass, Meyer, & Rose, 2013). In a classroom that utilizes the UDL framework, teachers should guide instruction, but students are ultimately in charge of their own learning (CAST Professional Learning, 2017).

The UDL approach to instruction includes three principles: (a) multiple means of engagement, (b) multiple means of representation, and (c) multiple means of action and expression; UDL is designed to meet the unique needs of all learners through challenging instruction that is both flexible and varied (Hitchcock, Meyer, Rose, & Jackson, 2002; Rose & Strangman, 2007; Rose, Gravel, & Domings, 2010). Each UDL principle aligns with a brain network and the UDL principles are designed to specifically address the learning related with each network, as described in the following paragraphs (Rose & Strangman, 2007).

The affective network is the "what" of learning and is related to learner motivation and engagement. Learners' emotional responses to the topic and to the learning itself are controlled by the affective network (Rose & Strangman, 2007). There are a variety of ideas and strategies for increasing student engagement and motivation (Glass et al., 2013; Meyer & Rose, 2005; National Center

on Universal Design for Learning, 2014). The use of multiple means of representation and expression may also serve to increase and sustain student engagement in the course content in the college classroom (Marino et al., 2014).

The recognition network is the "what" of learning and addresses how learners gather and categorize information. The recognition network is the experience of learning (Rose & Strangman, 2007). University faculty can meet the needs of a variety of learners via the recognition network through the utilization of multiple means of representation (Glass et al., 2013; Meyer & Rose, 2005; National Center on Universal Design for Learning, 2014).

The strategic network is the "how" of learning, which includes executive functioning and addresses the ways in which learners communicate their ideas (Rose & Strangman, 2007). University faculty can meet the needs of learners by allowing students to demonstrate their knowledge through various methods, known as multiple means of action and expression. (Glass et al., 2013; Meyer & Rose, 2005; National Center on Universal Design for Learning, 2014).

Furthermore, the UDL framework puts the responsibility for adjustment to traditional methods on the faculty member instead of the students (Meyer & Rose, 2005; Meyer, Rose, & Gordon, 2014; Rose & Strangman, 2007). The flexible nature of technology-based learning tools makes them more adaptable for meeting diverse student needs versus the fixed nature of traditional textbooks and other traditional learning materials (Edyburn, 2010; Rose, Gravel, & Doming, 2010; Rose & Strangman, 2007). It is important to note, however, that UDL is not the same as assistive technology (AT); UDL is proactive and

anticipates the potential needs of students (Basham, Israel, Graden, Poth & Winston, 2010; Edyburn, 2010), whereas AT is reactive and responds to student needs as they arise (Edyburn, 2010). In addition, teachers should be aware that, while UDL can be enhanced through the use of technology, it does not require technology (Rose, Gravel, & Domings, 2010).

UDL is rooted in the idea that a diverse classroom requires diversity in instruction (Glass et al., 2013; Hitchcock et al., 2002; Rose & Strangman, 2007). The predictability of student diversity allows faculty to make systematic adjustments to traditional instruction through the use of the three UDL principles (Glass et al., 2013; Rose & Strangman, 2007). Through instructional and assessment strategies that address the "why", how", and "what" of learning, the UDL framework ensures that all students have access to appropriate instruction and have the opportunity to learn the course content. In practical terms, UDL is creating and implementing instruction that meets multiple learning needs in order to ensure all students have equitable access to learning.

Incorporating UDL at the University-level

UDL is necessary to meet the needs of the growing number of diverse students in today's college classrooms (Dell et al., 2015; Rao, Edelen-Smith, & Wailehua, 2014; Smith, 2012). In addition to meeting the needs of a growing diversity in university classrooms, The Higher Education Opportunity Act of 2008 includes language recommending the use of UDL in the college classroom:

As defined by HEOA (2008), "UDL is a scientifically valid framework for guiding educational practice that (A) provides flexibility in the ways

information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (B) reduces barriers in instruction, provides appropriate accommodations, supports and challenges, and maintains high achievement expectations for all students including students with disabilities and students who are limited English proficient" (HEOA, P.L. 110-315, §103(a)(24)).

Additionally, both the Americans with Disabilities Act (ADA) of 1990 and Section 504 of the Rehabilitation Act of 1973 state the need for institutes of higher education to make their university accessible to *all* individuals. Neither of these laws specifically refers to UDL, but they do guarantee accessibility to individuals with disabilities. ADA (2009) notes that higher education institutions must make educational materials accessible to all students. By following the three UDL principles, higher education faculty can ensure all their students have equal access to the learning materials in the classroom. Additionally, Section 504 of the Rehabilitation Act (2016) states that individuals with disabilities receive the same education as those without disabilities. By utilizing the principles of UDL, university faculty adhere to the law and ensure equitable access to learning for all students in the classroom. While ADA and Section 504 only mandate providing access to students with disabilities, providing the same supports to all students will increase the likelihood of success for every student. Dell, Dell, and Bradshaw (2015) state "…UDL is not meant to diminish the challenges associated with scholarship in higher education, rather it focuses one equal access to information as well as learning" (p. 172).

Much of the research regarding UDL in higher education focuses on its effectiveness and includes action research in particular content areas and student perceptions on UDL principles in their courses (Dell, et al; Robinson & Wizer, 2016; Smith, 2012; Tobin, 2014). The existing literature outlines a variety of strategies for implementing the three UDL principles in university instruction. Several strategies meet the requirements for more than one principle; when appropriate, these strategies are listed under more than one principle.

Multiple Means of Engagement

Multiple means of engagement and the affective network focus on actions taken by both students and faculty to increase active participation in learning course material. University faculty design instruction for a wide variety of student needs and can make adjustments to instruction to allow for multiple means of engagements. Table 1 provides themes chosen by the authors and identified in the literature that highlight multiple means of engagement.

Table 1
Multiple Means of Engagement Themes

Theme	Supported Research
Allow time to work and apply concepts taught in class	Gradel & Edson, 2010
Assignments are aligned with course or program objectives	Davies, Schelly, & Spooner, 2013; Schelly, Davies, & Spooner, 2011

Enhance learning with technology, making sure it is accessible	Davies, Schelly, & Spooner, 2013; Gradel & Edson, 2010; Schelly, Davies, & Spooner, 2011
Foster collaboration /Use cooperative learning strategies	Gradel & Edson, 2010; Lurhs & McAnally-Salas, 2016; Rao, Edelen-Smith, & Wailehua, 2014; Scott, Temple, & Marshall, 2015; Smith, 2012
Instructor is easily accessible to students	Davies, Schelly, & Spooner, 2013; Rao, Edelen-Smith, & Wailehua, 2014
Offer real-world experiences	Schelly, Davies, & Spooner, 2011
Provide alternative sources of content	Rao, Edelen-Smith, & Wailehua, 2014; Scott & Temple, 2017; Scott, Temple, & Marshall, 2015; Smith, 2012
Provide guides or examples for assignments to include rubrics	Gradel & Edson, 2010; Rao, Edelen-Smith, & Wailehua, 2014; Robinson & Wizer, 2016
Provide notes and summaries of class content	Davies, Schelly, & Spooner, 2013; Gradel & Edson, 2010; Schelly, Davies, & Spooner, 2011
Provide varied activity formats	Gradel & Edson, 2010; Rao, Edelen-Smith, & Wailehua, 2014; Scott, Temple, & Marshall, 2015
Respect student diversity	Davies, Schelly, & Spooner, 2013; Schelly, Davies, & Spooner, 2011
Scaffold	Gradel & Edson, 2010; Tobin, 2014
Use frequent assessments	Gradel & Edson, 2010

Foster collaboration. Collaboration, especially with discussion prompts is one theme identified in the literature. Scott et al. (2015) mention the importance of fostering collaboration through the use of group investigations. Additionally, the use of discussions focusing on interactions between the whole class or smaller groups has proven to be effective. Furthermore, when faculty design discussion board prompts and activities, Lurhs & McAnally-Salas (2016) note the need for faculty interaction to guide student responses. Scott & Temple (2017) state that one way to increase engagement and learning outcomes in online discussions is by providing students with a discussion guide. Gradel and Edson (2010) report the importance of promoting student interdependence and independence by utilizing cooperative learning strategies. One way to accomplish this is what they call the "Ask 3" method. This method has students ask three classmates their question before asking the professor.

Alternative accessible content sources. A second theme identified in the literature is to offer accessible alternative content sources. These may include voiceover PowerPoints, videos, and more. To provide alternative sources for content, Rao et al. (2014) suggest the following: (a) replace the book with various other sources of information, (b) provide audio versions of articles' create narrated presentations, (c) use web-based instructional modules, (d) provide text transcripts for audio and video files, and (e) closed captioning for videos. Faculty can increase access to learning by using digital course materials, such as a magnifier on a computer screen to improve viewing, changing presentation background color to improve viewing, and using a text-

to-speech application to listen to course material (Smith, 2012). Tobin (2014) makes note of the importance of using tools that are accessible on more than one device or medium to both faculty and students; these tools should be simple for both to learn and use. One example includes the creation of voice-over PowerPoint presentations and then uploading the PowerPoint onto YouTube. This allows students to access course content anywhere and from any device. Tobin (2014) also suggests that faculty script out what they want to say and demonstrate, or emphasize the concept before creating their audio version lecture in order to reduce off-topic content in the PowerPoint narration.

Scott, Temple, and Marshall (2015) suggest providing course information in accessible ways, such as textbooks, PDF files, or websites, and providing transcripts of any audio and/or video presentation. Tobin (2014) suggests using podcasts, screencasts, or video demonstrations in order to provide multiple formats of your lecture. When creating alternatives for content and materials, Tobin (2014) suggests creating video demonstrations and text-only versions.

Additionally, providing alternative content sources can include posting websites on the topic to gain more information, allowing students to choose their own topic to complete an assignments, and allowing students to select their own materials to complete assignments (Smith, 2012). When offering those choices, Smith (2012) suggests allowing students to learn the content by working alone or with partners when discussing a topic or completing an assignment.

Scaffold. Additionally, the use of scaffolding has been mentioned as a way to meet the engagement principle. Tobin (2014) suggests that instructors teach in smaller segments as students can better access the chunked work on mobile devices. He also states it makes it easier for faculty when they want to change only a portion of the lesson; they can just change a small segment, rather than the whole lesson. Tobin (2014) states that five minutes segments or shorter is preferable. Gradel and Edson (2010) suggest a model (say it), use (show it), and ask (write it) strategy to engage learners in the classroom.

Be easily accessible. Finally, university faculty can meet the principle of multiple means of engagement through being accessible to students. Students prefer faculty members who are accessible via email, as well as through regular, scheduled office hours (Marks, Haug, & Huckabee, 2016). Rao et al. (2014) suggest instructors set consistent office hours at least two days a week, and respond to student assignments with comments and within five days.

Multiple Means of Representation

The recognition network aligns with UDL's principle of multiple means of representation. Multiple means of representation is the ways in which students *acquire* information and knowledge. Faculty can meet the multiple means of representation principle by making changes to their course materials and adjusting their instructional strategies. Table 2 provides examples, found in the literature, of ways instructors provide multiple means of representation in their courses.

Table 2

Multiple Means of Representation Themes

Theme	Supported Research
Create course outcomes that address varying learning preferences	Gradel & Edson, 2010
Highlight critical or key information	Davies, Schelly, & Spooner, 2013; Schelly, Davies, & Spooner, 2011; Robinson & Wizer, 2016; Scott, Temple, & Marshall, 2015; Smith, 2012
Include transcripts of visual/audio and slide presentations	Robinson & Wizer, 2016; Scott, Temple, & Marshall, 2015
Offer real-world experiences	Schelly, Davies, & Spooner, 2011
Provide choices about product format	Gradel & Edson, 2010; Scott, Temple, & Marshall, 2015
Prompt feedback on assignments	Dias & Trumpy, 2014; Robinson & Wizer, 2016; Schelly, Davies, & Spooner, 2011
Provide guides or examples for assignments to include rubrics	Rao, Edelen-Smith, & Wailehua, 2014; Robinson & Wizer, 2016
Provide lectures or content in multiple formats	Davies, Schelly, & Spooner, 2013; Gradel & Edson, 2010; Rao, Edelen-Smith, & Wailehua, 2014; Schelly, Davies, & Spooner, 2011; Simonds & Brock, 2014; Smith, 2012; Tobin, 2014
Provide syllabus and course overview	Dell, Dell, & Bradshaw, 2015; Rao, Edelen-Smith, & Wailehua, 2014
Simple Navigation/Consistent use of Learning Management Tools (LMS)	Gradel & Edson, 2010; Rao, Edelen-Smith, & Wailehua, 2014; Scott & Temple, 2017
Use accessible technology	Gradel & Edson, 2010; Tobin, 2014
Use conceptual mapping tools	Gradel & Edson, 2010
Utilize social media	Friedman & Friedman, 2013

Multiple formats. One theme that emerged in the literature regarding multiple means of representation is the use of multiple formats when providing course content to students. Faculty can utilize video-based lectures and tutorials to support the content presented through text-based readings and other mediums. Smith (2012) suggests faculty provide class lecture in multiple formats, such as providing an in-class lecture, recording the lecture, and/or providing other types of audio recording related to the class topic. Simonds & Brock (2014) found that older students prefer video lectures, while younger students show a preference for interactive activities in an online course; they recommend faculty utilize multiple means of representation and provide both options. Tobin (2014) mentions how closed captioning is beneficial for students with disabilities, English language learners, and students working in quiet spaces, such as libraries. For both online and in-seat courses, student learning can be enhanced through the use of social media (Friedman & Friedman, 2013). Friedman & Friedman (2013) argue that including social media activities in a course increases

communication, collaboration, creativity, and sense of community for students.

Highlight critical information. A second theme to emerge from the literature is the need to highlight critical or key information being taught. Smith (2012) suggests providing summary lecture notes, color-coding notes or highlighting key points, and providing graphic organizers to summarize the topic as ways to reinforce the key concepts being taught. Gradel and Edson (2010) state one way to accomplish highlighting key course information is to have students create summaries or extensions of the lecture and post them digitally on the learning management system (LMS) to share with one another. Additionally, students can highlight key elements by using text, graphics, and diagrams while also providing a checklist of core concepts (Scott et al., 2015).

Course syllabus. What to include on your syllabus is also important when faculty want to meet the principle of multiple means of representation. Including a disability statement on the syllabus is identified as one way to meet this principle. Dell et al. (2015) and Rao et al. (2014) note the importance of including a policy on accommodations and disabilities in the syllabus. In addition, Rao et al. (2014) suggest including rubrics for all assignments, defining key components of the course, and including an overview of the weekly schedule for the entire semester in the syllabus. The course syllabus should clearly describe the course expectations, as well as the content to be taught (Schelly et al., 2011).

Simple navigation. The use of a learning management system, along with simple navigation of course content, is important when meeting the needs of students and addresses the principle of multiple means of representation. Rao et al. (2014) suggest faculty select a few tools within the Learning Management System (LMS) and use them consistently instead of having students use all or most of the tools available. Making sure all course materials are accessible, easy to use, and clearly organized is imperative to the representation principle (Schelly et al., 2011).

Provide feedback. Furthermore, it is critical for university faculty to provide feedback on student work in a timely manner (Robinson & Wizer, 2016; Schelly et al., 2011). This can be accomplished through the use of multiple means of representation, including the use of audio files with recordings of oral feedback from the professor (Dias & Trumpy, 2014). Students prefer prompt and explicit feedback that includes suggestions for improving future assignment submissions (Marks et al., 2016).

Multiple Means of Action & Expression

Multiple means of action and expression aligns with the strategic network and is related to how students *demonstrate* their understanding of the content. University faculty adjust course assignments to include multiple means of action and expression. Table 3 provides ways in which the university faculty can modify instructional strategies to meet this second principle.

Table 3
Multiple Means of Expression Themes

Theme	Supported Research
Accessible technology	Gradel & Edson, 2010; Scott, Temple, & Marshall, 2015
Clarify assignment expectations	Rao, Edelen-Smith, & Wailehua, 2014; Scott, Temple, & Marshall, 2015; Smith, 2012
Discussion boards	Rao, Edelen-Smith, & Wailehua, 2014; Scott, Temple, & Marshall, 2015
Offer flexible opportunities for demonstrating skills	Smith, 2012
Provide choices when responding	Gradel & Edson, 2010; Schelly, Davies, & Spooner, 2011; Scott, Temple, & Marshall, 2015; Tobin, 2014; Vu & Fadde, 2013
Provide feedback	Smith, 2012
Provide opportunities to practice with supports	Smith, 2012
Summative Assessments	Gradel & Edson, 2010
Use conceptual mapping tools	Gradel & Edson, 2010

Clarify assignments. One theme identified in the literature was the need to provide detailed information regarding assignments. Clarifying assignment expectations can be done by providing models or exemplars of past assignments or grading rubrics (Smith, 2012). When giving assignments to students, Rao et al. (2014) state it is important to include handouts and worksheets to guide each assignment; they also suggest that faculty be consistent with the day and time that assignments are posted and due.

Smith (2012) suggests faculty provide constructive feedback on all assignments and have students receive feedback from their peers on assignments. Additionally, Gradel and Edson (2010) recommend allowing time in class for students to complete their work and allowing peer correction before handing in the assignment. Both students and faculty should frequently rate products,
participation, and efforts as a way to provide feedback (Gradel & Edson, 2010).

Flexible opportunities. Secondly, faculty can meet the principle of multiple means of action and expression by offering flexible opportunities to demonstrate skills and content knowledge. Smith (2012) provides several examples: (a) assignments that include images or videos, (b) allowing spell check word processor or other digital writing tools, (c) allowing or suggesting the use of graphic organizers to plan assignments, (d) creating a web-based or digital product, including internet hyperlinks, maintaining a digital collection of products created for the course, and (e) speech-to-text applications. Tobin (2014) identifies the importance of faculty setting the objectives and allowing their students to choose the medium in which to respond. The examples of products students can create to show faculty they understand the material include essays, podcasts, and videos.

Discussion boards. A third theme to emerge from the literature was the use of discussion boards. Faculty can improve student learning in online discussions by using discussion guides (Scott & Temple, 2017; Smith Davis, 2013). These guides can be used to both guide the discussion and as a method for students to organize their notes from the discussion (Smith Davis, 2013). In order to ensure access to text-based discussions, faculty must teach students to avoid the use of unnecessary discussion threads as those can be confusing when read by a screen-reader (Dell et al., 2015).

Scott et al. (2015) also note the importance of allowing students to choose presentation format for demonstrating content mastery and then sharing their product to the discussion board. Examples they provide include PowerPoint, Voki, and oral reports. They also suggest providing additional discussion boards for in-class groups to engage in discussion regarding assignments, and then another separate discussion board for interactions with the instructor. Student learning through course discussions is also enhanced when faculty explicitly teach students the skills required for a successful discussion (Brank & Wylie, 2013).

Provide choices. University professors can provide choice for student assignments in two ways: (a) assignment format or (b) choice within a particular format. For a live discussion, either in-person of online, students prefer having the option to participate either verbally or in a written format, such as a chat function (Vu & Fadde, 2013). Scott & Temple (2017) describe an assignment where students are required to write a paper on a court case, but may choose the specific case and the related special education concept.

Summative assessments. The use of summative assessments also emerged from the literature to meet the action and expression principle. The use of summative assessments allow instructors to know what needs to be retaught. Gradel and Edson (2010) suggest utilizing a "muddiest card" in which your students write what they are unclear of at the end of the course. For online courses or in-seat courses, they also suggest the use of wikis or blogs where, at the end of class, students go and write what they are unclear of from that day's lesson. Gradel & Edson (2010) also state the importance of using a question strategy to check for understanding.

The literature indicates the need for instructional assessment to occur through the use of multiple means of action and expression and choice when possible (Novak, 2016). In addition, instruction can be enhanced through assignments that reflect real-world activities students may complete in their careers post-graduation.

Conclusion

The authors utilize a UDL framework in their face-to-face and online courses and believe this practice benefits their students. When choosing to implement UDL, the authors recommend following the advice of Novak (2016). She recommends that teachers should start small and choose one UDL practice; implement it until you are comfortable with it. Then, try adding another and continue doing this until you are fully implementing the UDL framework. Specifically, we recommend beginning by (a) using PowerPoint presentations, (b) providing both traditional and online versions of the textbook, (c) utilizing online course modules, (d) including different activities into discussions and/or assignments, such as graphic organizers,

and word clouds, (e) providing individualized feedback on all course assignments, (f) contacting students by phone before the course begins, and (g) hosting weekly online virtual meetings via Zoom or Twitter.

When choosing strategies to implement, we recommend thinking about what excites you in teaching, as well as what activities that you or your students find discouraging. Begin by replacing activities that discourage you with something that excites you. For example, the authors grew weary of reading weekly research papers and students complained that these papers left them unprepared for teaching, so they began to think of other ways their students can demonstrate learning. The authors have replaced papers with voice-over PowerPoint presentations aimed at training their colleagues on a topic, designing websites, writing newsletters or blog posts for parents, and making grids on Padlet. By starting small and continuing to add more ideas over time, the implementation of a UDL framework is not overwhelming and should keep both faculty and students excited about learning.

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