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What is This?

Improved Lesson Planning With Universal Design for Learning (UDL)

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Abstract

Efficient lesson planning with universal design for learning (UDL) enables teachers to more effectively meet students' individual needs. In this study, a comparison of lesson plans by teacher candidates in a teacher preparation program before and after UDL training is presented. After training, teachers (*n* = 45) incorporated more differentiated options and varied teacher strategies based on UDL principles into their lesson plans, so that the content was more accessible to all students. A variety of changes and options was examined, and examples of commonly occurring choices selected by the teacher candidates were provided. The improved multiplicity of options in lesson planning demonstrates a better understanding of UDL principles; however, teachers need more experience in actually implementing the UDL principles in their classrooms.

Keywords

general special education, instructional practices, teacher learning

Background/Relevance

As our education paradigm has shifted to include increased access to the general education curriculum and inclusion in the same standards-based assessments, one method that is increasingly used by both special and general education teachers is to differentiate instruction to enable all students to benefit from instruction in the general education classroom (Van Garderen, Scheuermann, Jackson, & Hampton, 2009). As our educational service delivery models change, our teacher preparation programs need to focus more on collaborative practices with an emphasis on differentiated instruction and accessible options for students served in less-restrictive settings (Brownell, Sindelar, Kiely, & Danielson, 2010). To help meet these new challenges, the Higher Education Act requires instruction in the universal design for learning (UDL) that provides flexibility in instructional presentation, student

response, and engagement (Smith, Robb, West, & Tyler, 2010). With the training focusing on differentiation, co-teaching/coplanning, and UDL, general and special education teachers can more effectively accommodate students who learn differently, engage with content from different perspectives, and speak English at varied levels of proficiency.

Many local school districts are focusing on more inclusive classroom practices and incorporating more collaborative co-teaching models. These collaborative efforts are based on the idea that each teacher has specific knowledge and expertise to address the instructional needs of the class (Van Garderen et al., 2009).

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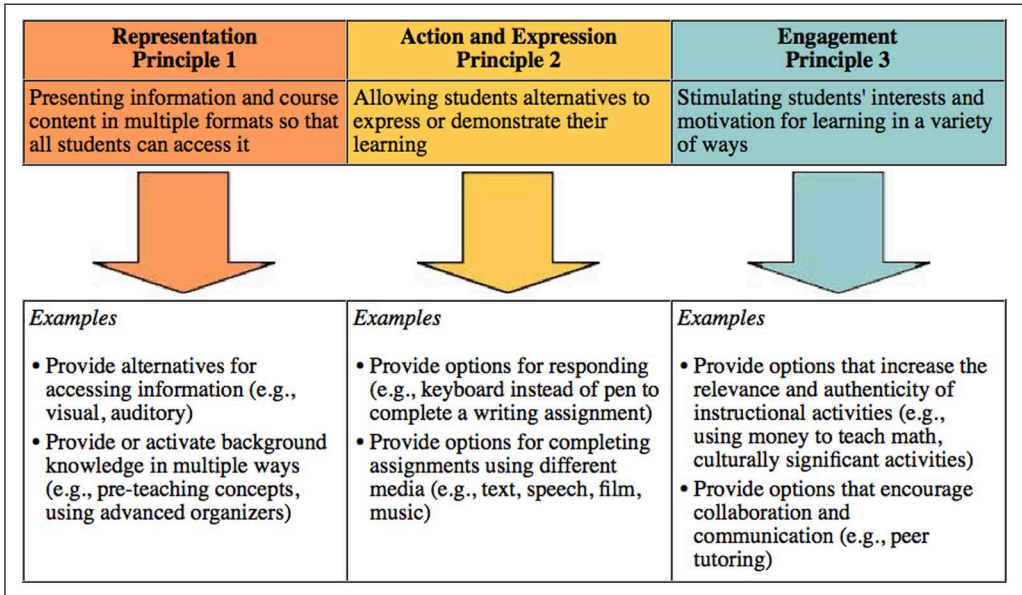E-mail: scourey@sfsu.edu

Figure 1. Universal design for learning (UDL) principles
Image from The Star Legacy Module: *UDL: Creating a Learning Environment That Challenges and Engages All Learners* (The IRIS Center for Training Enhancements, 2009). (Used with permission.)
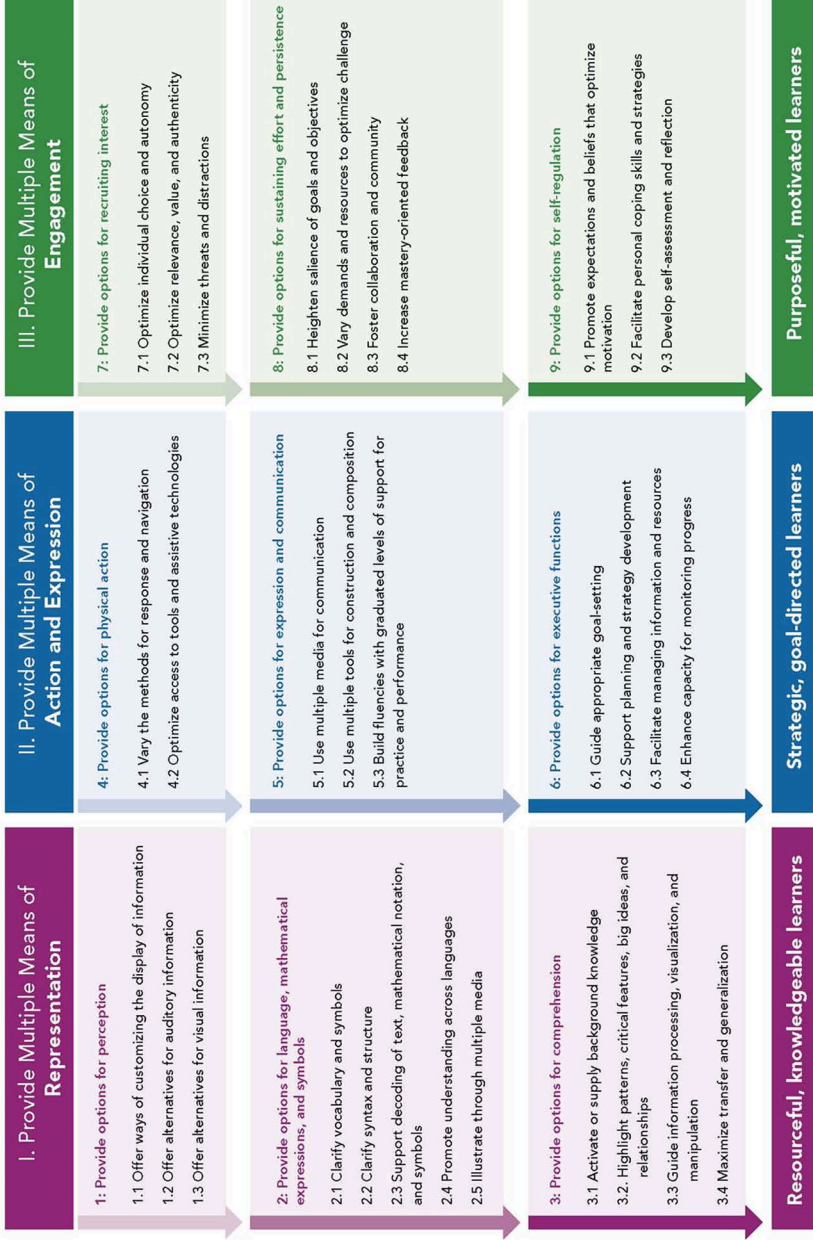
In essence, credential candidates need more preparation in bringing special education services into the general education classroom to more fully provide access to the state standards and the class curriculum. Not only are the needs of students with Individualized Educational Programs (IEPs) addressed through UDL, the needs of at-risk, but yet to be identified, students are also addressed (Kloo & Zigmond, 2008). UDL is an appropriate framework for designing lesson plans for increasingly diverse general education classrooms and supports co-teaching through the use of the three principles of UDL, advocated by the Center for Applied Special Technology (CAST), which include multiple means of representation, engagement, and action and expression (D. H. Rose & Meyer, 2006; D. H. Rose, Meyer, & Hitchcock, 2005).

UDL Concepts and Definition

The principles of UDL (see Figures 1 and 2) originated from the guiding principles used by architects who design buildings, products, and environments for independent use by people with a wide range of unique physical and cognitive needs. Ron Mace conceived Universal Design to eliminate the obligation to retrofit buildings and products to meet the Americans With Disabilities Act (ADA) accessibility requirements. The Center for Universal Design at North Carolina State University and the CAST were instrumental in adapting these principles of Universal Design for the field of education to better support accessibility for all learners. CAST has developed a UDL framework (see Figure 2) to emphasize a flexible curriculum that could be presented in multiple formats so that the content would be accessible and appropriate for students with diverse backgrounds, learning styles, and abilities. The framework is based on the following three brain-based neural systems involved in learning: (a) recognition systems that identify patterns and objects, (b) strategic systems that tell us how to do things, and (c) affective systems that determine what is important and provide the motivation for learning (CAST, 2011).

Universal Design for Learning Guidelines

I. Provide Multiple Means of Representation

1: Provide options for perception
1.1 Offer ways of customizing the display of information
1.2 Offer alternatives for auditory information
1.3 Offer alternatives for visual information

2: Provide options for language, mathematical expressions, and symbols
2.1 Clarify vocabulary and symbols
2.2 Clarify syntax and structure
2.3 Support decoding of text, mathematical notation, and symbols
2.4 Promote understanding across languages
2.5 Illustrate through multiple media

3: Provide options for comprehension
3.1 Activate or supply background knowledge
3.2 Highlight patterns, critical features, big ideas, and relationships
3.3 Guide information processing, visualization, and manipulation
3.4 Maximize transfer and generalization

Resourceful, knowledgeable learners

II. Provide Multiple Means of Action and Expression

4: Provide options for physical action
4.1 Vary the methods for response and navigation
4.2 Optimize access to tools and assistive technologies

5: Provide options for expression and communication
5.1 Use multiple media for communication
5.2 Use multiple tools for construction and composition
5.3 Build fluencies with graduated levels of support for practice and performance

6: Provide options for executive functions
6.1 Guide appropriate goal-setting
6.2 Support planning and strategy development
6.3 Facilitate managing information and resources
6.4 Enhance capacity for monitoring progress

Strategic, goal-directed learners

III. Provide Multiple Means of Engagement

7: Provide options for recruiting interest
7.1 Optimize individual choice and autonomy
7.2 Optimize relevance, value, and authenticity
7.3 Minimize threats and distractions

8: Provide options for sustaining effort and persistence
8.1 Heighten salience of goals and objectives
8.2 Vary demands and resources to optimize challenge
8.3 Foster collaboration and community
8.4 Increase mastery-oriented feedback

9: Provide options for self-regulation
9.1 Promote expectations and beliefs that optimize motivation
9.2 Facilitate personal coping skills and strategies
9.3 Develop self-assessment and reflection

Purposeful, motivated learners

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Figure 2. Universal design for learning (UDL) guidelines

UDL advocates for flexible multiple media and tools targeted to these systems (The Access Center, n.d.). UDL supports effective pedagogy that may include curricular materials, technologies, and instructional strategies that provide numerous means of representation, expression, and engagement (Meyer & Rose, 2000).

Universal Design for Learning

In the context of the present study, UDL can be defined as a set of principles and techniques for use in the classroom along with the design of accessible instructional materials. These principles revolve around a variety of alternative ways for students to participate using different modes of *representation, action and expression*, and *engagement*. As we describe each mode, consider middle school students with varied levels of achievement and learning challenges who struggle to understand and work through ratio word problems. Although the teacher has worked through examples from the text and has demonstrated appropriate algorithms to solve the problems, some students cannot consistently solve the word problems. By considering the common difficulties that students with learning challenges encounter in mathematics, ratio in this case, before delivering more traditional whole class instruction, the teacher can utilize UDL principles to design a lesson that builds in strategies and scaffolds that benefit all students.

Representation refers to designing instructional materials that make content accessible to the greatest number of diverse learners. For example, UDL suggests that providing multiple representations of a concept not only enables deeper engagement with that concept but also enables access for a broader range of learners (McGuire, Scott, & Shaw, 2006). In planning lessons for diverse learners, aspects of UDL may be embedded through videos, audio text, and diagrams as a framework to interpret content. This enables teachers to support student access to and engagement with content across the curriculum. In the middle school ratio example mentioned earlier, the teacher might use diverse multiple representations of ratio including images, video, and animations. In addition, questions to activate students' prior knowledge of proportional reasoning are embedded in the lesson to help students make connections with related and already-mastered concepts. The teacher could make the connections between math symbols, representations, and written text more apparent through carefully designed audio, visual, and interactive demonstrations.

Action and expression can be defined as alternative communication methods for students to communicate or demonstrate their learning. Rather than using traditional forms of assessment such as *written pencil* and *paper tests*, our middle school ratio teacher might allow students to demonstrate learning through interviews or by creating representations and novel story problems. When teachers increase the number and variety of participation options and forms of assessment for students, both teachers and students benefit (The Access Center, n.d.).

Engagement involves stimulating students' interest and motivation to learn through creative, hands-on, and meaningful instruction. A teacher provides multiple means of engagement to recruit students' interest and sustain their engagement with content. In our ratio example, the teacher may include peer-tutoring activities like revising cooking recipes for varied number of servings and creating a ratio table for each number of servings.

Universally designed lesson plans attempt to meet the needs of all learners at the onset of instruction rather than having to retrofit lesson plans that initially fail some learners (Casper & Leuichovius, 2005; CAST, 2009). UDL lesson planning makes it possible for students with wide differences in their abilities, such as seeing, hearing, speaking, moving, reading, writing, understanding English, paying attention, organizing, engaging, or remembering, to more fully participate in inclusive settings (Burgstahler & Cory, 2008; Casper & Leuichovius, 2005). The diversified lesson plans can serve as a framework to inform pedagogy and also to help teachers meet the challenges of serving a diverse student population by

incorporating flexible instructional materials, techniques, and strategies (CAST, 2009; King-Sears, 2009; Samuels, 2007).

After gaining skills in UDL lesson planning, our special education teacher candidates should be ready to take on the roles of co-teachers rather than serving in the general classroom as assistants or underutilized classroom aides. Their specific skill set can help them provide resources and services above and beyond what the general education teacher is offering. For a co-teaching model to be successful, the special education teacher brings unique skills to each classroom, focusing on core academic skills and alternative modes of instruction, and helping students gain access to the general education content (Brownell, Adams, Sindelar, Waldron, & Vanhover, 2006; Kloo & Zigmond, 2008).

UDL can be a critically important means for reaching all students through the conveyance of the curriculum in multiple sensory modalities, flexible groupings, and adjusting the instructional pace. It can increase the efficacy of instruction. Without the knowledge and ability to increase students' access to curricula, many general education teachers do not create a responsive environment designed to best meet the individual needs of their students. The UDL framework can serve as the vehicle to bring together special and general education teachers in delivering educational services to all learners in one general education classroom. Finally, as King-Sears (2009) aptly pointed out, UDL is not inextricably intertwined with technology and its use is reliant on effective pedagogy. For example, in the area of mathematics, a teacher can use UDL to mediate a poorly written math text to convey important concepts. Her instruction may incorporate technology, such as virtual manipulatives and interactive diagrams, or she might use real manipulatives or printed diagrams. Ultimately, the teacher designs effective instruction for a broad range of learners by combining sound pedagogy with UDL. Sound pedagogy is the key when teachers utilize a UDL framework for lesson planning because learning objectives must always drive the design of instruction. A

teacher must know what he/she expects students to learn before planning for instructional materials, methods, and assessments (D. Rose, Meyer, & Edyburn, 2008). Research question: After participating in a 3-hour instructional module on UDL, will candidates increase the use of UDL principles in designing lesson plans that incorporate statewide content standards and make instruction more accessible to the diversity of students in the general education classroom?

Previous Research

We designed our study based on the research conducted by Spooner, Baker, Harris, Ahlgrim-Delzell, and Browder (2007). Spooner et al. examined the effects of UDL training on the lesson plan designs of special and general education teachers in undergraduate and graduate teacher preparation classroom settings. In two classes in the special education program and two classes in the general education program, participants were randomly assigned to experimental or control conditions. Participants in the experimental condition of each class were given the UDL training intervention during the first hour of class with control participants arriving to class 1 hour later. University instructors administered a 1-hour lecture on the principles of UDL and discussed various ways to include those principles in lesson planning. The intervention culminated with each participant assisting in the creation of a group lesson plan to meet the needs of one contrived case study student with special needs in a general education classroom or a student with more severe disabilities in a special education classroom. In all four classes, experimental participants used significantly more UDL principle variations in their lesson planning after they received the 1-hour intervention and outperformed their peers in the control condition in their posttest gains. They determined that before UDL can have a profound impact on teaching and learning, teachers must learn to use it in planning instruction for all types of students including students with disabilities.

Our case study differs from that of Spooner et al. (2007) in four ways. First, because we

are preparing our special education teachers to work collaboratively with their general education colleagues, we had different objectives and outcomes for the credential candidates. Unlike Spooner et al., we wanted our candidates to design lesson plans for intact general education classes that included students with mild to moderate disabilities. Second, we recruited only teachers who are preparing to work with students with mild to moderate disabilities in an integrated general education setting. So rather than training our teachers to utilize UDL principles in their own special education classrooms or resource rooms, our focus is on bringing the principles into the general education classroom to benefit all students, not just those with disabilities. Third, instead of writing a lesson plan to address an individual student, our candidates write lesson plans that address the needs of all learners, including students with IEPs in a general education setting. Fourth, since these teachers need to be able to train general educators and advocate for the use of UDL principles, we trained the teachers with a more intensive, interactive module that they could access when preparing for their own future trainings. In this study, we examine how candidates utilize UDL principles to incorporate statewide content standards and make instruction more accessible to the diversity of students in the general education classroom.

Method

Participants

The participants were 45 graduate students in the Mild to Moderate Graduate Level I Credential Program at an urban university in northern California. This convenience sample was working toward special education certification and was enrolled in one of the two sections of an introductory special education teacher preparation class taught by two of the authors (Gall, Gall, & Borg, 2007). Participants ranged in age from 23 to 53 with a mean age of 32.9 and were 72% female. The ethnicities of these participants were as follows: 5%

African American, 20% Asian American, 63% Caucasian, 9% Hispanic, and 2% other. The participants' highest levels of education were as follows: 39% completed a bachelor's degree, 27% had some graduate work, 32% completed a master's degree or professional degree, and 2% had some advanced graduate work or a PhD. Teaching experience averaged 1.3 years, but most participants had no teaching experience. The participants were all comfortable using computers, with 25% somewhat comfortable and 75% very comfortable. All but one participant used the Internet once or more per day.

Setting

All participants gave their informed consent and agreed to allow the researchers to use their data (three lesson plans) and demographic survey for inclusion in this research project. Because the data collected were part of the normal requirements of this class, refusal to participate indicated disallowing individual lesson plans to be included in the aggregate data analysis. All candidates enrolled in both sections agreed to participate for 100% participation. The participants came from two sections of a course titled *Introduction to Mild/ Moderate Disability*, each taught by one of the authors. This class was chosen because one of the objectives was to teach credential candidates how to differentiate instruction to meet a wide range of learners. We included UDL and collaboration in the content because many of the candidates enrolled will be, or are currently, teachers of record in a classroom and they needed this content to enhance their practice and assure achievement for all students.

Procedure

Participants in both sections were required to write a lesson plan at the beginning of the semester before the UDL training, directly after the training, and at the end of the semester. For the first two lesson plans, participants were given case study scenarios that described a general education classroom setting that

included students with learning disabilities. Each of the lesson plan scenarios included IEP goals for the students with learning disabilities in the class and a content standard that must be addressed in the lesson plan template (see Appendix A). For the final lesson plan, participants were asked to create their own scenario in a general education setting. Credential candidates had received instruction on how to use our lesson plan template (see Appendix B), but there was no instruction in UDL at this point. The first lesson plan served as a pretest to determine what the credential candidates knew about differentiating instruction and incorporating principles of UDL without formal UDL instruction. The lesson plan template that the participants used prompted them to use multiple options for access in each of the three areas discussed earlier: representation, action and expression, and engagement. After the first lesson plans were turned in, we scheduled the 3-hour UDL training for each section. One of the researchers delivered the 3-hour training to each section at the scheduled time.

The UDL training was composed of a web-based training module, *Universal Design for Learning: Creating a Learning Environment That Challenges and Engages All Students* (The IRIS Center for Training Enhancements, 2009), and guided notes created by the researchers (see Appendix C). The IRIS training module not only presented the principles of UDL but also modeled the UDL principles in the delivery with embedded videos, closed captioning, and audio. Examples of how to overcome typical barriers in the traditional general education classroom content areas were also included in the training. As the researcher presented the content, she also modeled UDL by utilizing guided notes to accompany the IRIS module. Upon completion of the module, candidates were given the same lesson plan template to complete a second lesson plan based on a hypothetical middle school mathematics classroom scenario (see Appendix A). In addition to the lesson plan template, participants were also given a list of resources for utilizing UDL modifications (see Appendix D).

For the third lesson plan, we allowed our candidates to design their own case study scenario with hypothetical special education students and authentic California content standards to address. In this way, they were able to use their own experiences from real classrooms to make the lesson plan more authentic.

Instrumentation

Candidates enrolled in this course typically write at least two lesson plans over the course of a semester. For this study, we required three lesson plans, one before training, one directly after training, and the third one due at the end of the semester. In this way, we examined acquisition of UDL principles and maintenance of those principles at the end of the semester. The lesson plan template created for this class was designed to help credential candidates think through all of the important steps in designing a lesson plan for students with a variety of special needs (see Appendix B). In addition to the three aspects of UDL, the template requires candidates to state a learning objective, connect the objective to a state content standard, and describe at least one student with a disability. The teacher candidates were also prompted to address the specific classroom needs of any individuals with a disability as determined by the IEPs. For the first two lesson plan assignments, we provided a state content standard and IEP goals for special education students included in the class. The template also prompted students to explain their approach to each of the following areas: Introduction (attending cue and anticipatory set), Body (procedures, input, modeling, guided practice, and independent practice), Closure, and Evaluation (rubric criteria for approaching, meeting, and exceeding expectations). The lesson plans were scored using the rubric designed by Spooner et al. (2007). The rubric consisted of a 3-point scale and evaluated the participants' use of UDL principles in the design of the lesson plan. Points were distributed as follows: 0 for no clear description of instructional modifications, 1 point if one or two modifications were discussed, and 2 points

Table 1. Performance Data

UDL principles	Lesson Plan 1		Lesson Plan 2		Lesson Plan 3	
	Class 1 (*n* = 21)	Class 2 (*n* = 24)	Class 1 (*n* = 21)	Class 2 (*n* = 24)	Class 1 (*n* = 21)	Class 2 (*n* = 24)
	X (*SD*)	*X* (*SD*)	*X* (*SD*)	*X* (*SD*)	*X* (*SD*)	*X* (*SD*)
Representation	0.81 (0.60)	0.92 (0.78)	1.67 (0.48)	1.67 (0.48)	1.81 (0.40)	1.79 (0.42)
Expression	0.81 (0.51)	0.67 (0.57)	1.29 (0.46)	1.62 (0.58)	1.62 (0.50)	1.75 (0.44)
Engagement	0.76 (0.63)	0.62 (0.65)	1.76 (0.44)	1.75 (0.44)	1.67 (0.48)	2.00 (0.00)
Total	2.38 (1.43)	2.21 (1.47)	4.71 (1.06)	5.04 (1.12)	5.10 (0.94)	5.54 (0.66)
Grand *M*	2.29		4.89		5.33	

Note: UDL = universal design for learning.

if three or more modifications were discussed (see Table 1). The components of *representation, action and expression*, and *engagement* were scored separately and then summed up to yield a final score between 0 and 6. After scoring was complete, we examined the lesson plans to extract rich details that demonstrate how credential candidates utilize materials, instructional methods, and assessments within the UDL framework to address the learning objective.

Design and Data Analysis

While we had two sections of the same course, both sections received the UDL training before the second lesson plan was completed. A two-factor analysis of variance (ANOVA) with repeated measures comparing lesson plan mean score differences between the two sections of the class and mean score differences within groups over three points in time was completed for the dependent variable (scores for each component of UDL in lesson plans). T-tests were completed to further tease out differences between scores of Lesson Plans One and Two, and Lesson Plans Two and Three. Effect sizes were calculated using Cohen's *d* for differences between Lesson Plans One and Two, and Lesson Plans Two and Three. The first two authors scored the lesson plans together; 20% of the lesson plans were scored a second time by a doctoral student to check for interrater reliability.

We compared the number of agreements and divided them by the number of total possible points. Interrater agreement was 94% across all three sets of lesson plans. Finally, after scoring the lesson plans, researchers examined them to elucidate how participants applied the three principles of UDL (*representation, action and expression,* and *engagement*) to address learning goals and plan for instructional materials, instructional methods, and assessment. We looked for areas of strengths and weaknesses in applying UDL principals to address learning objectives to inform future training sessions.

Results

In this study, the question of whether credential candidates in a special education teacher-training program could increase their understanding of UDL and apply these principles to their lesson plan writing is addressed. Specifically, credential candidates were trained with a 3-hour UDL training module to see whether they could incorporate flexible materials, techniques, and strategies for delivering instruction, and could plan activities for students to demonstrate their knowledge in a variety of ways. Table 2 provides means and standard deviations by a group for pretest, posttest, and maintenance conditions (Lesson Plans One, Two, and Three). A two-factor ANOVA with repeated measures comparing class sections with scores across time revealed no

Table 2. Scoring Rubric on the Three Components of Universal Design for Learning

Objective	Score		
	0 Point	1 Point	2 Points
Representation	No clear description of modifying materials to provide equal access to all students	Discusses one or two modifications of materials to provide equal access, but needs to be explained more in depth	Discusses three or more modifications of materials to provide equal access to all students, gives clear and precise explanations
Expression	No clear description of providing alternative communication methods	Discusses at least one alternative communication method, but needs to be explained more in depth	Discusses two or more alternative communication methods, gives clear and precise explanations
Engagement	No clear description of strategies to involve or engage students with disabilities	Discusses one or two strategies to involve students with disabilities, but needs to be explained more in depth	Discusses three or more strategies to involve students with disabilities, gives clear and precise explanations

Note: Scoring Rubric developed by Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007.

significant differences between the two class sections' performance on the three lesson plans, $F(1, 43) = .75$, $p = .392$. There was a significant difference, however, in scores of lesson plans across time, $F(1, 43) = 205.73$, $p < .001$. The interaction between class section and lesson plan score changes across time was not significant, $F(1, 43) = 2.16$, $p = .15$. Paired sample t-tests revealed significant differences on lesson plan scores between the first ($M = 2.29$, $SD = 1.44$) and second ($M = 4.89$, SD = 1.09), $t(44) = 10.44$, $p < .001$, $ES = 2.06$, and between the second ($M = 4.89$, $SD = 1.09$) and third lesson plans ($M = 5.33$, SD = 0.83), $t(44) = 2.35$, $p < .05$, $ES = .46$.

Post-UDL Training Analyses

Results indicate that there were no significant differences between mean scores of the two sections at any of the three points in time. We did not expect to find differences because the same researcher provided training to both sections of the class using identical materials. Improvement in credential candidates mean scores of the number of UDL principles used in the design of their second lesson plans demonstrates significant improvement in their ability to include UDL principles in lesson

plans. The large effect size suggests that the 3-hour UDL training was effective at teaching about UDL principles and encouraging teacher candidates to incorporate them in their lesson plans.

Maintenance Condition Analyses

The results indicate that candidates' mean scores on incorporation of UDL principles in their lesson plans significantly improved in the maintenance condition from both the pretest (first lesson plan) and the posttest conditions (second lesson plan). The medium effect size suggests that the 3-hour training administered several weeks prior to the third lesson plan continued to influence participants to utilize UDL principals in lesson planning and even showed some improvement as the students were becoming more comfortable with practicing use of the concepts.

Discussion

In this study, we examined the effectiveness of a 3-hour UDL training session to help special education credential candidates incorporate the principles of UDL in lesson plans. The 3-hour training was effective in teaching the

Table 3. Participants' UDL Modifications

Representation	Action and Expression	Engagement
Books on Tape http://www.booksontape. com/search. cfm?reader=56984&media_ type=&trans_type=P&short=2	PowerPoint http://actden.com/pp/	Guided Notes
Bookshare http://www.iriscenter.com/bs/ chalcycle.htm	Problem Solving: Draw a Picture http://www. teachervision.fen. com/math/problem-solving/48931.html	Peer Assisted Learning Strategies (PALS) http://www.iriscenter.com/pals26/chalcycle. htm
Powerpoint Slideshow http://actden.com/pp/	Animated Skits and Lessons/Movie Making www.xtranormal.com	Computer Brainstorm and Concept Mapping http://www.inspiration.com/
Websites CIA: The World Factbook https://www.cia.gov/library/ publications/the-world-factbook/	Nutrition Games and Graphic Organizers http://teamnutrition. usda.gov/educators. html	Story Maps https://www.google .com/search? q=Story+Maps &hl=en&client=firefox-a&hs=4er&rls=org.mozilla:en-US: official&prmd=imvns&tbm=isch& tbo=u&source=univ&sa=X&ei=pY_WTu3RF-feiAKK5uyIDA&ved=0CCkQsAQ& biw=679&bih=519#hl= en&client=firefox-a& hs=r0W&rls= org.mozilla:en-US:official &tbm=isch &q=story +map +graphic+ organizer&revid=1733428156&sa= X&ei=6Y_WTvWxIMqSiQLr_uC3DA &ved=0CD4Q1QIoAA&bav=on.2,or.r_gc.r_ pw.,cf.osb &fp=566466b6b1a684f2&biw=679 &bih=519
National Geographic www.nationalgeographic.com	Math Doesn't Suck Activities www.mathdoesntsuck. com	
Math Computer Simulation http://nlvm.usu.edu/en/nav/ vlibrary.html		
http://mathsnacks.com/snacks. php		

participants about UDL principles and incorporating them into lesson planning. By incorporating principles, we mean they included at least one novel manner to deliver content, engage students, and assess student learning in ways that may overcome barriers inherent in more traditional forms of teaching (see Table 3 for examples of participants' lesson plan modifications). Our training stressed the importance of the learning objective being at the center of materials, methods, and assessments chosen to accomplish that objective. We scored each lesson plan by how well participants described how they would implement materials, instruction, and assessments to address the learning objective. As men-

tioned, a high score of 2 in any of the three principle areas meant that participants discussed implementation of three or more modifications to overcome traditional barriers to effective instruction and assessment. An interesting observation was that in the "Materials" section of the lesson plan template, where participants list all the materials that they will be using in each area, many different modifications were listed. Later in the plan, however, when participants were required to explain how the materials would be used in each UDL area, some of the materials listed were not actually implemented or described.

Modifications

Only modifications fully described for implementation were scored because it demonstrates that the participant has considered how they would use that modification to address the learning objective. The middle school ratio lesson plans provided many examples of a variety of materials listed but fewer actually implemented in the body of the lesson plan. For example, a participant might list power point, graphic organizers, audio equipment, three-dimensional (3-D) models, and manipulatives under representation materials but only describe using power point, graphic organizer, and 3-D models in the actual plan. In the area of engagement materials, a participant listed guided notes, games, 3-D models, peer tutoring, and various websites that could be consulted. In the actual plan, the participant only fully describes the use of 3-D models, guided notes, and peer tutoring as ways to engage students in the ratio lesson. In the area of action and expression materials, our participants were especially likely to list more modifications than they actually described as using in the plan. One participant listed manipulative materials, web-based test, web-based games, and created word problems. In the actual plan, however, the participant describes the teacher modeling the use of manipulatives and demonstrating web-based games, but the students in the class end up solving paper and pencil class-made worksheets. This was a common occurrence across all three

sets of lesson plans. Participants list a variety of modifications in the materials section of each principle but fully describe fewer in the body of the plan. In addition, many of the participants had difficulty in modifying traditional forms of assessments and continued to rely on written tests and paper and pencil worksheets. Possibly because teacher-centered instruction is emphasized in more than 80% of textbooks used in schools (Van de Walle, 2007), our participants observed traditional teaching and assessment techniques during their own education, and they need more time and experience with UDL to change behaviors. The performance data (see Table 2) depict lower mean scores in the area of action and expression, suggesting that participants had more difficulty in designing modifications for this principle. As we continue to develop our UDL training, we will focus more time in the area of action and expression, especially in the design of novel forms of assessments to check for student learning.

Implementation

While our credential candidates improved in their ability to incorporate UDL principles in lesson planning (Courey, LePage, Siker, & Blackorby, 2012), we don't know if they can actually implement these plans in real classrooms. In another study, we observed that credential candidates create lesson plans to address difficulties that students with learning challenges bring to the mathematics classroom. They struggled to implement activities that fully addressed the learning objective in a real middle school mathematics classroom. For example, the credential candidates used colorful manipulatives and candies to convey the meaning of a ratio, but they struggled to engage the students in connecting the meaning of a ratio to solving ratio word problems. In addition, little thought was given to novel forms of assessment and most candidates used dry erase boards and pencil and paper worksheets. There seems to be converging evidence that credential candidates need more practice in designing lesson plans with the UDL framework. More important, they need

more supervised practical experiences while implementing these lesson plans in real classrooms.

Our teacher education programs need to be more attentive to the changes in reform policy and to address the changing landscape of our classrooms. As more instruction occurs in a general education classroom, more of our services will occur in an embedded manner. We need to educate future teachers, and special and general education teachers to function effectively in more inclusive environments. UDL is an appropriate framework for designing lesson plans for a diverse general education classroom and supporting co-teaching because UDL considers the needs of diverse learners by providing multiple means of *representation, action and engagement,* and *expression* (D. H. Rose et al., 2005; D. H. Rose & Meyer, 2006).

Limitations

The results of this study suggest that credential candidates can improve in their abilities to incorporate UDL principles in creating lesson plans. The lesson plans created for the assignments were written with contrived settings in mind. Thus, we cannot be sure that these results would generalize to the teachers' lesson plans for their actual students. First, the sample size was small and limited to special education teacher candidates who learn about differentiated instruction in other classes. While the introductory class sections used in this study is usually the first credential class our candidates enroll in, some candidates may have taken a different class before, where they were exposed to differentiated instruction. Because there are common strategies used when differentiating instruction and using a UDL framework, some candidates may have come to our introductory class with prior instruction for modifying instruction and materials. Second, we also taught collaborative skills in a separate class session; however, the lesson plans

that candidates generated gave no indication of their ability to combine these two skill sets for the benefit of real students in inclusive settings. Finally, there was also no control group of teachers with whom to compare the teachers who received UDL training. The teacher candidates could have improved between the pretest and posttest due to a confounding factor and not based on the UDL training. In addition, the teacher candidates were exclusively from the department of special education.

Practical Implications and Conclusions

We serve a variety of students in our current classrooms. The teachers in these classrooms need to be prepared in the best methods for reaching all of these students. The results of this study have several implications for teacher preparation programs. First, credential candidates can benefit from instruction in lesson planning that promotes the use of specific UDL techniques and principles to make the general curriculum more accessible to all students. Second, the effect size findings suggest that the UDL training maintained over time from the second to third lesson plans and students' use of principles increased as demonstrated by the increase in scores. When implemented in a general education setting, the lesson plans can be written so as to provide increased curriculum access for struggling students and their more advanced peers. In this manner, all students in the class may benefit from the variety of instructional and assessment options used by the teachers. The richness of a lesson plan with multiple options for representation, action and expression, and engagement will probably appeal to students with less proficiency in English, students with cultural differences, or gifted students who can engage with more challenging material. Learning styles and preferences are present in all learners, not just in those with special needs; the multiplicity of

methods and the variety of materials offered through UDL can provide universal academic access to all.

Future research includes a follow-up study to team special education teacher candidates with candidates from either the elementary or secondary credential programs to see if they could use the specific skills and principles in a collaborative manner to create and implement lesson plans for real classrooms. In addition, beyond extending this research to include special education teachers teamed with general education teachers, we will include a control group of similar teams that will receive UDL training after data collection.

Appendix A

Case Study for Lesson Plan 1

Allmon is a teacher in a third-grade classroom at a public school. His class consists of 24 students, including one student with a learning disability (Rhonda, see below). This class is currently working on a language arts unit about animal and plant life. Students have previously read several books about different animals and have investigated life cycles using the National Geographic website.

Rhonda is 9 years old and currently in Allmon's third-grade general education classroom. Although a very young child, Rhonda suffered from recurring ear infections and now has hearing loss in her right ear. Rhonda has been labeled with a learning disability after the testing revealed a discrepancy between her IQ and achievement in reading. She is working on fluency and comprehension. Although she is verbal, Rhonda sometimes uses augmentative and alternative communication due to her slight hearing loss. It appears that she loves her teacher and friends, but she often complains about having to sit still all day at school. Rhonda's teachers say that she is very cooperative and motivated. Rhonda enjoys singing and painting.

Science competency goal 1. The learner will build an understanding of plant growth and adaptations.

1.02.Observe and describe how environmental conditions determine how well plants survive and grow in a particular environment.

Appendix B

New Lesson Plan Template

Lesson Title/Topic:
(Identify specific content area and lesson topic. Say how the lesson fits into the larger unit of study.)

Developed By:

Date:

Target Students:

Student name(s)	Background	Concerns

I. IEP Goals
IEP annual goal for students with disabilities

_____

Student name(s)   IEP goals

_____

II. Lesson Objective(s)
Lesson objective (for individual students/group/class):

_____

Student name(s)   Objectives

_____

III. Content Standards Addressed During This Lesson
California content standards

_____

Standard   Benchmark   Performance Indicators

_____

IV. Materials *(List all materials you will be using in each area)*

_____

Representation	Action and expression	Engagement
Presenting information and course content in multiple formats so that all students can access it	Allowing students alternatives to express or demonstrate their learning	Stimulating students' interests and motivation for learning in a variety of ways
Examples:	Examples:	Examples:
Provide alternatives for accessing information (e.g., visual and auditory)	Provide or activate background knowledge in multiple ways (e.g., preteaching concepts, using advanced organizers)	Provide options that increase the relevance and authenticity of instructional activities (e.g., using money to teach math and culturally significant activities)
Provide or activate background knowledge in multiple ways (e.g., preteaching concepts and using advanced organizers)	Provide options for completing assignments using different media (e.g., text, speech, film, and music)	Provide options that encourage collaboration and communication (e.g., peer tutoring)

_____

V. Article References
Look for existing teaching strategies as evidence

Article name(s)	Link	Citation

VI. Procedures/Lesson Plan Outline
(Describe the presentation of the overall lesson. If students with severe disabilities are included in the group, embed individualized objectives into the general procedures and describe individualized prompting, correction, and reinforcement procedures)

1. Lesson Format
(How will students take part in the lesson? What's the setting in your classroom?)
   Consider: demonstrations, group investigation, games, multimedia, presentation, and so on.

2. Introduction
(How will you grab the student's attention?)

Procedures	Teacher will. . .	Student will. . .
Attending Cue: (How will transition from prior activity be made? What will you initially say/do to gain students attention)		
Anticipatory Set: (How will you create interest in this lesson? Is preassessment necessary? Is this review or new info?)		

3. Body
(This is the core of the lesson.)

Procedures	Teacher will. . .	Student will. . .
Input: (How will you convey to students the info they need to learn—methods/techniques? How does this lesson link to previous learning?)		
Modeling: (How will you model—verbally explain with visual example/demo? How will you support students to activate their own thinking?)		
Guided Practice: (How will students practice skill and how will you prompt/provide guidance? What prompts will you use? What corrective feedback will you provide?)		
Independent Practice: (How will students demonstrate ability to perform skill independently?)		

4. **Closure**
This is done at the end of the lesson. The purpose of the closure is to help students organize their learning; major point is to clarify any confusion. Also, it is the summary of the class. Assign homework, answer questions, introduce next class ideas, and so on.

VII. Evaluation *(How will you know whether lesson objectives have been accomplished? Are you addressing the IEP goal? Who will collect the data?* *Attach data sheet(s) and instructions to this plan.)*
   General Lesson Objective Evaluation Functional Behaviors

Students	Exceeds expectations	Meets expectations	Approaching expectations
Students will (demonstrate the following academic behaviors to approach, meet or exceed expectations)			

VIII. Modifications/Adaptations: *(Descr ibe in detail what modifications/adaptations you will provide to support learning? Types of* *Adaptations: input, output, size, time, difficulty, level of support, degree of participation, modified goals, and substitute curriculum.)*

Student(s)	Modifications/adaptations

Appendix C

UDL Guided Notes

Universal Design for Learning
The following guided notes are based on the Iris Learning Module.
UDL is a research-based framework for designing curricula—that is, educational goals, methods, materials, and assessments—that enable all individuals to gain knowledge, skills, and enthusiasm for learning. This is accomplished by simultaneously providing rich supports for learning and reducing barriers to the curriculum, while maintaining high achievement standards for all students.

UDL supports teachers' efforts to meet the challenge of diversity by providing flexible instructional materials, techniques, and strategies that help teachers differentiate instruction to meet these varied needs. It does this by providing options for

- presenting information and content in different ways (the "what" of learning).

- differentiating the ways that students can express what they know (the "how" of learning).
- stimulating interest and motivation for learning (the "why" of learning).

A universally designed curriculum is designed from the outset to meet the needs of the greatest number of users, making costly, time-consuming, No Child Left Behind (NCLB), and after-the-fact changes to curriculum unnecessary.

Both Individuals with Disabilities Education Act (IDEA), and NCLB recognize the right of all learners to a high-quality standards-based education. The laws preclude the development of separate educational agendas for students with disabilities and others with special needs. They also hold teachers, schools, districts, and states responsible for ensuring that these students demonstrate progress according to the same standards.

Neither law adequately addresses the greatest impediment to their implementation: the curriculum itself. In most classrooms, the curriculum is disabled. It is disabled because its main components—the goals, materials, methods, and assessments—are too rigid and inflexible to meet the needs of diverse learners, especially those with disabilities. Most of the present ways to remediate the curriculum's disabilities—teacher-made workarounds and modifications, alternative placements, and so on—are expensive, inefficient, and often ineffective for learning.

Technology tools, if designed, according to the Web Accessibility Initiative and UDL guidelines, can be created to support the individualization necessary to engage all learners, as illustrated by the following examples.

Objectives

After reviewing in the IRIS Learning Module used for training, the "Perspectives and Reso urces" section and completing the accompanying activities, you should

- understand the principles of UDL.
- be able to apply the UDL principles to the components of a curriculum.

UDL Guided Notes Worksheet
Directions: Fill in the blanks as we go through the module. Ask questions

UDL addresses the educational needs of *all* students: average learners, English learners, students who have received poor instruction in the past, students with learning disabilities, students with sensory and motor challenges, and gifted and talented students, among others. UDL benefits all students by

- meeting the needs of the widest range of students by reducing the number of _____to learning
- providing challenging, salient, and age-appropriate materials to students with a range of _____
- allowing students to learn in accordance with their dominant _____ _____
- creating alternative ways for students to both receive and deliver information

Representation Principal 1   Action and expression Principal 2   Engagement Principal 3

By using these three principles when they design their lesson plans, teachers can reduce or eliminate barriers that may interfere with students' learning or with their ability to demonstrate their learning.

Teachers need to apply the UDL principles to the four main curricular components (define):

Learning goals	Instructional materials	Instructional methods	Assessments

Goals (see Activity on Page 4)

Though a goal should be clearly stated, observable, and measurable, it should also adhere to the three UDL principles. Discuss barriers that may prevent all students in the class from achieving a traditional goal.

Traditional Goal

Apply UDL principles to write your goal in a way that does not confound the means that students use to access information or to demonstrate their knowledge.

UDL Goal
Instructional Materials (see Activity on Page 5)

Traditional materials	Potential barriers	UDL materials	Rationale for use

Instructional Methods (see Activity on Page 6)

Representation	Action and expression	Engagement
☐ Provide multiple examples ☐ Highlight important information ☐ Present content utilizing multiple media and formats ☐ Build or activate background knowledge	Model skills in a variety of ways ☐ Provide opportunities to practice with scaffolds and supports ☐ Provide corrective feedback ☐ Allow alternatives for students to express or demonstrate their learning	Offer choices of content and tools ☐ Provide adjustable levels of challenge ☐ Allow students to choose from a variety of reinforcers ☐ Allow options for the learning environment or context ☐ Utilize flexible grouping

Assessment

Traditional assessments	Barriers	UDL assessment	Rationale

UDL in Practice

Pam, a student with learning disabilities for whom English is also a second language, uses CAST's eReader software to help her complete a reading assignment. eReader's spoken voice and synchronized highlighting features help her track words on a page, pace her reading, and associate the way a word looks with the way it sounds. After reading the story several times with the spoken voice option turned on and the highlighting speed set to slow, she turns the read aloud feature off, increases the highlighting speed slightly, and reads the story again. In this manner, she works gradually to increase her reading comprehension and speed.

Seth, a student with low vision whose word comprehension skills are excellent, uses eReader to adjust the font, style, size, and color of digital text, background, and highlighting, to achieve maximum contrast and readability.

Jeremy, a poor speller who does not enjoy writing, uses the auditory feedback offered by Don Johnston's Write:OutLoud software to engage in the task of writing an English composition. As he types his composition and it is displayed on the computer screen, the program reads it aloud by word, sentence, paragraph, or letter-by-letter, helping him to identify sentence construction problems and spelling mistakes. When he misspells a word, it flashes on the screen, indicating his error. Using the program's talking spell checker, he calls up a list of suggested words to replace the misspelled word, and, in the case of homonyms, short definitions to distinguish one word from another. Jeremy selects a word when its pronunciation (or definition) indicates it is the correct word, and completes the composition without spelling errors.

Daniel, whose physical disabilities prevent him from using a mouse or a computer keyboard, uses Ke:nx software with Write:OutLoud to gain single switch access to program controls and an onscreen keyboard. In this manner, he too can access the writing supports of the program to help him complete his written work.

Ellen, an eighth-grade student with learning disabilities, finds it challenging to use the rich resources of the Internet because there is so much information to look at and so many visual distracters. Finding and organizing information from the web is getting easier for her, however, since her school installed CAST's eTrekker software on its library computers. She signs on, opens eTrekker, and types in a research question such as *What did Harriet Tubman do in the Civil War as a nurse?* eTrekker checks Ellen's spelling and identifies the keywords in her question, such as *Harriet Tubman, Civil War*, and *nurse*. Ellen presses the search button and eTrekker lists ten websites that match her search criteria. eTrekker's interface presents a search engine environment free of distracting advertisements and extraneous information. Ellen selects a few sites to visit, goes to those sites, and, uses the reading supports of eReader, which she has also opened on her computer, and selects the read feature to have information read aloud to her. eTrekker keeps her research question and keywords on the screen, helping her to maintain focus on the nursing aspect of Tubman's life, rather than her role in the Underground Railroad. Ellen highlights and pastes information into the onscreen notepad and generates some of her own notes on the topic. When she finishes her Internet search, eTrekker stores her research question and keywords, and the websites she has visited.

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http://iris.peabody.vanderbilt.edu/udl/chalcycle.htm

Appendix D

UDL Resources
IRIS at Peabody Module
http://iris.peabody.vanderbilt.edu/udl/chalcycle.htm
CAST Curriculum Self-Check and Resources
http://udlselfcheck.cast.org/
CAST Book Builder

http://bookbuilder.cast.org/

The ACCESS Center on UDL

http://www.k8accesscenter.org/training_resources/reaching_UDL_approach.asp

Declaration of Conflicting Interests

Funding

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