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**Universal Design for Learning Instruction and Lesson Planning for Secondary Preservice
General Educators**

Haidee A. Jackson¹ & James Basham²

University of Texas Permian Basin¹

University of Kansas²

Abstract

This mixed-methods study utilized qualitative analysis and cross-tabulation, to identify differences in proportions between pre- and post-lesson plans for 16 secondary preservice general educators after having received instruction on UDL. Participants' lesson plans were qualitatively and quantitatively evaluated for the presence of UDL principles using the rubric of Spooner et al. (2007). In addition, types of strategies and tools were identified in participants' changes to post-lesson plans. The results of Fisher's exact test indicated there were no significant differences between pre- and post-lesson plan scores across the UDL principles of engagement, representation, and action and expression. Results indicated that instruction on UDL was beneficial for the 16 secondary preservice general educators in this study for developing inclusive lesson plan changes in the general education setting.

Keywords: Universal Design for Learning (UDL); lesson planning; general educator preparation; inclusion, secondary educators; preservice educators

Introduction

The application of inclusive instructional design practices, pedagogies, models, and frameworks within educators' lesson planning is critical for addressing learner variability, supporting inclusion, and meeting the learning needs of all students (Basham et al., 2020). Within educator preparation, Universal Design for Learning (UDL) has been found to be an appropriate framework for general educators to design instruction supportive of ensuring pedagogy is accessible and inclusive for all learners (Fovet, 2020; Griful-Freixenet et al., 2021).

UDL has been identified in the literature as an effective instructional design framework conducive to addressing learner variability within instructional design and lesson planning, by removing potential barriers to the learning process and supporting issues of equity in education (Al-Azawei et al., 2016; Capp, 2017; Dewi & Dalimunthe, 2019; Seok et al., 2018; Rose et al., 2021). Legislative mandates in the United States (U.S.) have advanced UDL through the Higher Education Opportunity Act (HEOA) of 2008 (PL 110-315), the National Education Technology Plan (U.S. Department of Education, Office of Educational Technology, 2016), and the Every Students Succeeds Act (ESSA, 2015).

Mandates and calls for UDL persist across educator preparation programs (Smith et al., 2019), yet there have been limited studies that have investigated effective ways to integrate UDL in educator preparation, especially as it relates to secondary general educators' lesson planning. Pedagogical practices like UDL are essential for supporting all students, ensuring equitable learning is taking place in our schools, and addressing learner variability through instruction to meet the needs of students with disabilities. Educators knowledgeable in applying UDL within instruction are better equipped to design effective learning environments that are facilitative of inclusion, a critical aspect of supporting legislative mandates, and addressing learner variability in schools.

A Basic Understanding of Universal Design for Learning

Developed by the founders of the Center for Applied Special Technology (CAST) in the late 1990s, UDL began with a specific focus on ensuring all students were provided with accessible content with the use of technology. Currently, the framework is defined by three principles that are supported by nine guidelines for each and then 31 checkpoints (See CAST 2018; Figure 1 in the appendix). The principles of UDL are based on neuroscientific understandings to maximize activation of the affective, recognition, and strategic networks of the

brain, thereby ensuring access, and eliminating potential barriers to the learning process for learners (Rose et al., 2006). The principles of UDL set forth in the framework include providing multiple means of engagement, representation, and action and expression (CAST, 2018). While the principles are reflective of the neuroscientific underpinnings of the brain's networking system, the principles suggest providing multiple ways to address learner variability within the learning environment and ensure that learners' differences are considered when educators are designing instructional content, activities, and technology to support learning (Rose et al., 2006).

The guidelines highlight the provision of options for each UDL principle. Under the principle of engagement, three guidelines encapsulate designing instruction to provide options for *recruiting interest*, *sustaining effort and persistence*, and *self-regulation* (CAST, 2018). For representation, guidelines include providing options for *perception*, *language and symbols*, and *comprehension* (CAST, 2018), and in action and expression, provide options for *physical action*, *expression and communication*, and *executive functions* (CAST, 2018). Checkpoints are presented under each guideline as potential strategies for educators to consider when designing their instruction.

It is important to note that the implementation of UDL is described as a process, and not as an outcome (Rose, 2000). The implementation of UDL begins like any design process, by defining the intended goal(s). After goals are defined, educators (or designers) proactively identify common and known specific barriers in the learning environment or experience (Basham & Marino, 2013). Considering those barriers, educators (or designers) proactively design a learning experience that overcomes the barriers, while also ensuring flexibility in the design for supporting unknown (or unexpected) barriers in accomplishing the goal.

Using UDL, educators can adopt a process of backward design that is goal-driven and accounts for the variability of all learners in the environment (Basham & Marino, 2013). Importantly, UDL is not a checklist of things that must be done in every learning experience but accounts for known variables in addressing the barriers and variability in the learning environment (Basham & Blackorby, 2020). Overall, the adoption of UDL requires educators to consistently think about, reflect on, and consider potential barriers for all learners through iterative design thinking. Educators (special educators and general educators) can ensure that all learners are provided with accessible content by utilizing the UDL framework to initiate an interactive design process (Basham & Marino, 2013).

Identifying UDL

While accessibility to learning through the application of technology was the initial intent of UDL (Rose & Meyer, 2002), the interpretation of UDL has evolved over time (Hollingshead et al., 2022). Scholars' center of attention on UDL's purport and application to learning and teaching in research efforts has shifted in focus when defining UDL, in large part due to UDL's flexibility (Hollingshead et al., 2022). While UDL stresses flexibility in instructional methods, strategies, and tools for addressing learner variability, this same flexibility in UDL, has created a sense of ambiguity among researchers when considering UDL adoption and its evaluation in education (Edyburn, 2010; Hollingshead et al., 2022; Kennedy et al., 2014; Lowrey et al., 2017; Ok et al., 2017; Rao et al., 2014).

Divergent understandings of UDL have been explored in the literature to include a narrative analysis of interviews among experts in UDL (Hollingshead et al., 2022); educators in practice within inclusive classrooms (Lowrey et al., 2017; Scott, 2018); administrators understanding in how UDL is associated with classroom placement, achievement, and the curriculum (Lowrey & Smith, 2018); and among program coordinators in higher education in how UDL has been presented in educator preparation programs (Scott et al., 2017). Within educator preparation, ambiguous definitions of UDL could influence educators' overall understanding of UDL in practice.

Previous Research on UDL in Lesson Planning

Developing lesson plans tends to be the most widely researched activity associated with UDL instruction in teacher preparation (Smith et al., 2019). Studies found in the literature that have been conducted with a focus on UDL instruction on lesson planning for secondary pre-service educators within the US include the work of Courey et al. (2013), Lee and Griffin (2021), Lowrey et al. (2019), McGuire-Schwartz and Arndt (2007), Owiny et al. (2019) Scott et al. (2019), and Spooner et al. (2007).

The work of Spooner et al. (2007) is notable in the literature as a seminal work because of the development of a rubric to assess preservice educators' lesson plans. The Spooner et al. (2007) rubric has been used across multiple research studies carried out in the U.S. in investigating the relationship between UDL instruction on preservice educators' lesson plans (Courey et al., 2013; Lee & Griffin, 2021; Owiny et al., 2019; Scott et al., 2019). While UDL is about proactive design and not "modifications" to learning for students with disabilities or

diverse learning needs, the Spooner et al. (2007) rubric measures modifications, or changes from an initial lesson plan to a UDL focused lesson plan. The rubric uses a three-point rating system (0 = no modifications; 1 = one or two modifications; 2 = two or more modifications) (see Spooner et al., 2007).

Studies identified in the literature that used the Spooner et al. (2007) rubric to assess preservice educators' lesson plans occurred within the duration of students' course work within their educator preparation programs and include the work of Courey et al. (2013), Owiny et al. (2019), Lee and Griffin (2021), and Scott et al., (2019). The UDL instruction received by participants in these studies was variable in content and duration. Courey et al. (2013) and Owiny et al. (2019) used the IRIS modules to provide participants with three hours of instructional content on UDL. In addition, Courey et al. (2013) provided participants with guided notes, and Owiny et al. (2019) included activities and lectures. Lee and Griffin (2021) adapted the texts by Hall, et al. (2012) and Meyer, et al. (2014) in conjunction with interactive modules in Canvas. Scott et al. (2019) provided instruction on UDL using the Modules Addressing Special Education and Teacher Education (MAST).

Purpose of Study

The purpose of this study was guided by evaluating the literature base around instruction on UDL for lesson planning within secondary preservice educator preparation programs and identifying a need across studies for further research. Further analysis and contribution of studies investigating the relationship between UDL instruction on secondary preservice educators' lesson planning could facilitate researchers in identifying potential barriers to UDL lesson planning and its evaluation among preservice educators as well as inform the field on how to develop future UDL professional development programs for secondary general educators. The following research question was posed within this study:

- (1) What differences, if any, arise within secondary preservice general educators' lesson plans after having received UDL instruction?

Methodology

A mixed methods design, using both quantitative and qualitative data points, was employed in this study to explore the relationship between pre- and post-lesson plan scores, before and after participants had received instruction on UDL. Data points included participants' lesson plans for analysis.

Participants

Sixteen middle and secondary preservice educators participated in this study. Participants were all enrolled in a mandatory special education methods course as a part of their required coursework at a midwestern university and were majoring in social studies, English, or secondary languages (e.g., French, German, Spanish). Participants had also received introductory instruction on the UDL framework in previous courses during their educator preparation program. All participants, male ($n = 4$) and female ($n = 12$), were pursuing a middle school or secondary level certification: Spanish ($n = 1$); History and Government ($n = 5$); and English ($n = 10$). Participants were all enrolled in a 15-week semester-long course, and over the age of 18.

Procedures

Permission to evaluate participants' lesson plans was granted by participants' consent and received from the Institutional Review Board (IRB) at a university in the Midwest of the United States. Data collected from participants in this study included two separate lesson plans (pre- and post-lesson plans before and after receiving instruction on UDL in the course). Lesson plans varied by content area and were not standardized to ensure relevancy for participants' learning needs. Instruction on UDL occurred within the required special education methods class for middle school and secondary preservice educators in a blended format. Course content also included instruction on special education law, design thinking, accessibility, formative assessment, self-determination, transition planning, instructional technology, and evidence-based and high-leverage practices over nine modules that were posted on Canvas and included multimedia content (videos, podcasts, readings, and websites).

Students in the course received instruction online and in-person which included in-person Google Slides presentations and group activities. The UDL framework was covered over a 5-week timeframe in modules four through seven and included instruction on learner variability, the UDL guidelines, 31 checkpoints, and principles (multiple means of engagement, representation, and action and expression). Other topics (e.g., evidence-based practices, high-leverage practices, formative assessment, and accessibility) were threaded within the UDL instruction.

Lesson Plan Analysis

Analysis of 16 lesson plans were scored utilizing the rubric developed by Spooner et al. (2007) to assess lesson plans for the principles of UDL and follow the work of other researchers

in the field (Courey et al., 2013; Lee & Griffin, 2021; Owiny et al., 2019; Scott et al., 2019). Lesson plan scores were evaluated using the Statistics Package for the Social Sciences (SPSS), version 29.0.2.0 (20), to run descriptive statistics to assess for the difference between two proportions.

The analysis consisted of carrying out a z test in cross-tabulation (Crosstabs in SPSS) by comparing column proportions using the Bonferonni method for an adjustment to the p values ($p < .017$) to account for the small sample size ($n = 16$). The two categorical variables identified for analysis were pre- and post-UDL lesson plan scores. Three groups were assigned to each categorical variable reflective of UDL principles (i.e. multiple means of engagement, representation, action and expression). Scores in both the pre- and post-UDL lesson plans comprised the rows and columns, respectively. The dimensions of the cross-tabulation resulted in a 3x3 crosstab.

The total frequency of columns to rows in the cross-tabulation were compared for analysis. Rows of the table were inspected for columns with different subscripts. Subscripts with an a and b suggested significant difference between pre- and post-UDL lesson plan scores. Fisher's exact test was run to determine any significant associations between the categorical variables. In addition, a qualitative analysis of the 16 participants' pre- and post-lesson plans was performed to identify types of lesson plan changes (e.g., instructional strategies and tools). Changes in post-lesson plans were identified through screening of pre-lesson plans for the presence of any additional inclusive educational practices, instructional strategies, and tools, within post-lesson plans after having received instruction on UDL. Differences in scores, as well as similarities in scores between pre- and post-lesson plans, were identified to assess for lesson plan changes.

Interrater reliability was assessed by calculating percent agreement and was established through the separate scoring of the lesson plans by independent UDL researchers, who received a 1-hour training session prior to scoring. Performing an interrater percent agreement check in this study was conducive for considering how independent raters and researchers assessed for and rated the presence of UDL principles included within the participants' lesson plans. Percentage agreement has been discussed in the literature as an arbitrary measure to assess reliability, as there is no predefined level of agreement, but instead, assessing interrater agreement can be utilized by researchers to consider the implications of raters' agreement or disagreement unique

to a study (Gisev et al., 2013). In this study, assessment of interrater reliability through percent agreement was conducive to exploring any potential differences present in experts' assessment of evaluating for the presence of UDL. The number of agreements for each lesson plan score was divided by the possible number of points in the rubric (Chaturvedi & Schweta, 2015), to arrive at a percent agreement. Initial rater agreement was calculated to be at 63%, which led to a re-evaluation of the lesson plans and further discussions that led to 80% and finally 100% agreement, respectively.

Results

Lesson Plan Analysis

Scores of pre- and post-UDL lesson plans with counts, column percentages, and subscripts in cross-tabulations were all reported (see Table 1). Arithmetic differences between the scores in the pre- and post-UDL lesson plan scores across engagement, representation, and action and expression were noted. For engagement, 62.5% of participants ($n = 10$) received a score of two on the rubric in the pre-UDL lesson plan, whereas 93.8% of participants ($n = 15$) received a score of two on the post-UDL lesson. In representation, 43.8% of participants ($n = 7$) received either a one or a two on their pre-UDL lesson plans, whereas 81.3% of participants ($n = 13$) received a score of two on their post-UDL lesson plans. Finally, in action and expression, 43.8% of participants ($n = 7$) received either a one or two on their pre-UDL lesson plan score, whereas 75.0% of participants ($n = 12$) received a score of two on the post-UDL lesson plan.

Table 1

Pre- and Post-UDL Lesson Score Count and Percentage per Principle

Categorical Variable (UDL Principles)	Group Variable (Scores on Lesson Plans)	Pre-UDL lesson plan Count %	Group Variable (Scores on Lesson Plans)	Post-UDL lesson plan Count %
Engagement	Prescore = 0	1	Postscore = 0	0
		6.3		0.00
	Prescore = 1	5	Postscore = 0	1
		31.3		6.3
	Prescore = 2	10	Postscore = 0	15

		62.5		93.8
	Total	16	Total	16
		100.0		100.0
Representation	Prescore = 0	2	Postscore = 0	1
		12.5		6.3
	Prescore = 1	7	Postscore = 1	2
		43.8		12.5
	Prescore = 2	7	Postscore = 2	13
		43.8		81.3
	Total	16	Total	16
		100.0		100.0
Action/Expression	Prescore = 0	2	Postscore = 0	0
		12.5		100.0
	Prescore = 1	7	Postscore = 1	4
		43.8		25.0
	Prescore = 2	7	Postscore = 2	12
		43.8		75.0
	Total	16	Total	16
		100.0		100.0

Note. Pre-UDL lesson plan scores at values of zero (Prescore = 0), one (Prescore = 1), and two (Prescore = 2); Post-UDL lesson plan scores at values of zero (Postscore = 0), one (Postscore = 1), and two (Postscore = 2).

Fisher's exact test was used to determine if there was a significant difference between the pre- and post-scores on engagement, representation, and action and expression. Fisher's exact two-tailed test, using a Bonferroni adjustment of $p < .017$, indicated no significant differences in engagement between the pre and post scores. Under the principle of engagement, proportions with the column variables (postscore = 0, postscore = 2) for post-UDL lesson plans were not indicative of any significant differences after carrying out Fisher's exact test (see Table 2). At postscore = 1, 100.0% of cases were at prescore = 0. At postscore = 2, 33.3% of cases were at prescore = 1, and 66.7% cases were at prescore = 2.

Table 2*Crosstabulation for Pre- and Post-UDL Lesson Plan Scores for Engagement*

	Postscore = 1		Postscore = 2		Total	
	N	%	N	%	N	%
Prescore = 0	1 _a	100.0%	0 _b	0.0%	1	6.3%
Prescore = 1	0 _a	0.0%	5 _a	33.3%	5	31.3%
Prescore = 2	0 _a	0.0%	10 _a	66.7%	10	62.5%
Total	1	100.0%	15	100.0%	16	100%

Note. Subscript letters are ascribed to a subset of variable categories and their column proportions to identify significance. Subscript letter differences are identified at the .05 level.

Under the principle of representation, proportions with the column variables (postscore = 0, postscore = 1, postscore = 2) for post-UDL lesson plans scores were not found to have any significant differences using Fisher's exact test (see Table 3). At postscore = 0, 100.0% of cases were at prescore = 0. At postscore = 1, 50.0% of cases were at prescore = 0, and at postscore = 2, 0.0% of cases were at prescore = 0.

Table 3*Crosstabulation for Pre- and Post-UDL Lesson Plan Scores for Representation*

	Postscore = 0		Postscore = 1		Postscore = 2		Total	
	N	%	N	%	N	%	N	%
Prescore = 0	1 _a	100.0%	1 _a	50.0%	0 _b	0.0%	2	12.5%
Prescore = 1	0 _a	0.0%	1 _a	50.0%	6 _a	46.2%	7	43.8%
Prescore = 2	0 _a	0.0%	0 _a	0.0%	7 _a	53.8%	7	43.8%
Total	1	100.0%	2	100.0%	13	100.0%	16	100%

Note. Subscript letters are ascribed to a subset of variable categories and their column proportions to identify significance. Subscript letter differences are identified at the .05 level.

For action and expression, proportions with the column variables (postscore=0, postscore = 1, postscore = 2) for post-UDL lesson plans scores illustrated no significant differences using Fisher's exact test (see Table 4). At postscore = 1, 50.0% of cases were at prescore = 0; at postscore = 2, 0.0% of cases were at prescore = 0. In addition, at postscore = 1, 0.0% of cases were at prescore = 2, and at postscore = 2, 58.3% of cases were at prescore = 2.

Table 4*Cross-tabulation for Pre- and Post-UDL Lesson Plan Scores for Action and Expression*

	Postscore = 1		Postscore = 2		Total	
	N	%	N	%	N	%
Prescore=0	2 _a	50.0%	0 _b	0.0%	2	12.5%
Prescore=1	2 _a	50.0%	5 _a	46.2%	7	43.8%
Postscore=2	0 _a	0.0%	7 _b	53.8%	7	43.8%
Total	4	100.0%	12	100.0%	16	100%

Note. Subscript letters are ascribed to a subset of variable categories and their column proportions to identify significance. Subscript letter differences are identified at the .05 level.

Lesson Plan Changes Identified

More than half of the participants' ($n = 9$) post-lesson plans were found to be changed after having received instruction on UDL (see Table 5). The analysis of lesson plans revealed seven participants' scores on the rubric to be consistently the same across UDL principles, illustrating no overall change to lesson plans. However, upon further investigation of these seven participants' lesson plans, it was found that while participants scored the same on the rubric, four participants had created changes to their post-lesson plans, whereas three participants had not made any changes. On further inspection of post-lesson plans, it was found that two participants who had not added any post-changes, had pre-identified learner variability, and incorporated inclusive educational practices in their pre-UDL lesson, before instruction on UDL had taken place within the course.

Table 5*Pre- and Post-Lesson Plans' Changes*

Teacher Candidate	Engagement			Representation			Action and Expression		
	Pre	Post	Change	Pre	Post	Change	Pre	Post	Change
TC1	1	2	+1	1	2	+1	0	1	+1
TC2	0	1	+1	2	2	-	2	2	-
TC3*	2	2	-	2	2	-	2	2	-
TC4	1	2	+1	1	2	+1	1	2	+1
TC5*	2	2	-	2	2	-	2	2	-
TC6	2	2	-	0	1	+1	1	1	-
TC7*	2	2	-	2	2	-	2	2	-
TC8*	2	2	-	2	2	-	2	2	-
TC9	1	2	+1	1	2	+1	1	2	+1
TC10*	2	2	-	2	2	-	2	2	-
TC11*	2	2	-	2	2	-	2	2	-
TC12*	2	2	-	1	1	-	1	1	-
TC13	2	2	-	1	2	+1	1	2	+1
TC14	1	2	+1	0	0	-	0	1	+1
TC15	1	2	+1	1	2	+1	1	2	+1
TC16	2	2	-	1	2	+1	1	2	+1
Total			+6			+7			+7
Change									

Note. *Changes in post-UDL lesson plan score did not occur

Analysis of the 16 lesson plans' changes revealed that nine participants illustrated growth on the rubric with the adoption of post- lesson plan instructional changes, while four participants did not illustrate growth on the rubric but did increase the use of instructional strategies in the post-lesson plans. In addition, two participants did not increase their score on the rubric or increase the number of instructional strategies/tools used in their post-lesson plans. One

participant did not illustrate an increase in score on the rubric or adopt any instructional changes to their post-lesson plan.

Participants' changes to lesson plans included variable means to support inclusion through instructional supports/tools/activities to address learner variability and support the needs of students with disabilities in their classrooms. Instructional strategies employed represented great variability in application to lesson planning across content areas among the pre-service educators (see Table 6). Changes identified in lesson plans included the use of technological applications (text-to-speech, online video response, interactive video tools, websites, and video captioning) in addition to providing students with alternative means to interact and access, categorize, and engage with content (pre-filled outlines, read-aloud prompts, concept maps, verbal and written instructions/explanations, and graphic organizers). Participants also utilized instructional supports to address social and emotional support (personal coping skills, productive reinforcement, providing choice, individual feedback, peer grouping, and collaborative work). Findings from inspecting lesson plan changes indicated that instruction on UDL was beneficial for secondary pre-service educators' abilities to design inclusive instructional lesson plans to address learner variability through a variety of tools and instructional strategies.

Table 6

Post-UDL Lesson Plan Changes

Teacher Candidate	Changes
TC1	Productive reinforcements, written instructions via handouts, read aloud prompts
TC2	Objectives and goals of lesson provided to students
TC3**	Changes not submitted
TC4	Describing goals for students, modeling instruction, and outlining content/material to facilitate cognitive processing and access
TC5*	Organization-concept maps
TC6	Read aloud, providing multiple means of action and expression for students to submit work, multiple means of representing content via verbal and written explanations, positive feedback to students, and providing students with more time

TC7*	Pre-filled notes, organization tools (graphic organizers and maps), written instructions provided for English Language Learners (ELL)
TC8*	Constructive feedback given to students, multi-modal responses using online video response, and game competition for engagement
TC9	Options and choice provided in submitting assignments and creating presentations, access to chrome books and textbooks, soliciting students' feedback/reflections, modeling for students, stress put on creating a safe learning environment
TC10**	Changes not submitted
TC11*	Providing individual feedback to students, follow-up questions for students, modeling for students' discussion practices
TC12**	Changes not submitted
TC13	PEARDECK, images, accessible subtitles, use of websites and interactive video tools to support student engagement
TC14	Variable timing for students, collaborative peer-assisted groups to support learning
TC15	Translation of content for ELL learners, text-to-speech, providing students with support for developing personal coping skills, and organizing and managing time
TC16	Modeling for students, providing multiple options for students to submit their work (i.e. podcast, video, paper), variable timing for students to complete work, explicit instruction on vocabulary provide

Note. *No difference found in post-lesson plan score; **No difference found in post-UDL lesson score and changes not submitted

Discussion

Results of the lesson plan analysis were found using arithmetic differences between pre- and post-UDL lesson plans. No significant differences were found between participants' pre- and post-UDL lesson plan scores across the principles of engagement, representation, and action and expression in this arithmetical analysis. However, results found from evaluating participants' lesson plans modifications are suggestive of the benefit of instruction on UDL for the pre-service educators' ability to design lesson plans with additional instructional strategies and tools that can

support inclusion. The results from this study suggest a further need to carry out studies that investigate the association between instruction on UDL and lesson planning for pre-service educators

Implications for Educator Preparation

The changes made in post-UDL lesson plans illustrated a great variety of selected supports and tools from the participants. The variety of tools that were presented in the post-UDL lesson plans was demonstrative of considerations of greater accessibility in the presentation of content with and without the use of technology. Participants' inclusion of additional tools were variable across content areas within the design of their own individual lesson plans. While participants' choice of changes to post-UDL lesson plans can be evaluated using the rubric of Spooner et al. (2007) as having the potential to increase accessibility to the general education curriculum, assessment of implementation is still needed.

The post-UDL lesson plans demonstrated the participants ability to plan for greater access, after having received UDL instruction, but may not translate in implementation without appropriate support. As UDL is an iterative design process that entails active reflection in the assessment of instruction in real-world learning environments to eliminate potential barriers that may arise in carrying out the learning process, further efforts in educator preparation should focus around UDL instruction on lesson planning and its implementation.

Each learning environment will be unique, and student's individual needs will differ within the learning process. Preservice educators must continue to be mindful of identifying potential barriers within instruction to secure individual student's access and learning as they transition to being in-service educators. UDL coaching models in educator preparation within the practicum experience could be very beneficial for pre-service educators in consideration of instructional needs within implementation. As pre-service educators become teachers of record, they may still need individual support in facilitating implementation of UDL within the iterative design process. To this end, greater collaborative efforts between researchers, educators, coaches, technologists, content specialists, and instructional designers may help to facilitate the individual needs of pre-service educators as they enter the teaching profession and begin to implement UDL.

Implications for Future Research

Although exploring researchers' differences in identifying UDL was not a part of the research questions posed in this study, the results of this study imply a definitive need for further discussion and exploration of this subject. The practicality of evaluating the relationship between UDL instruction on lesson planning, and solidifying its measurement, to understand the potential benefits and limitations of UDL instruction on preservice educators are not without question. While 100% agreement was reached among the experts evaluating the lesson plans, the initial percent agreement between scorers evaluating lesson plans was established at 69%. Lesson plans were reevaluated to achieve 80%, and 100% agreement, respectively. Differences in interpretations between scorers were identified through the discussions.

Scorers' differences in initial scores when evaluating lesson plan changes stemmed from a difference in opinion on how to evaluate instructional strategies or additions of tools to lesson plans in using the UDL principles. An example of this can be seen in evaluating the presence of an online video tool as a change to a lesson plan. Scorers evaluated the online video tool differently. One scorer categorized the addition of the online video tool under the principle of engagement in UDL, whereas another scorer categorized the same tool as belonging to the principle of representation. Ambivalence occurred in assessing how a lesson plan change was to be categorized under the UDL principles. Naturally, questions arose, such as whether an instructional change could be equally applied to more than one principle, and still illustrate growth on the rubric and on the total score of each participant's lesson plan.

The discussions intimated the complexity of defining and evaluating UDL, as presented in the opinions of the raters in this study. Variability in interpretation by the raters reflected the accounts present in the literature surrounding ambiguity in UDL's definition and its evaluation. Future research efforts will need to address the ambiguity present within the field and among researchers in understanding, applying, identifying, and measuring the UDL principles within lesson plans.

Furthermore, while the results of this study found no significant differences in the proportions between participants' pre- and post-lesson plans scores across the UDL principles, caution in generalizing the results of this study is warranted. First, while the arithmetical analysis did not suggest statistical differences present in pre- and post-UDL lesson plan scores, the UDL instruction received in this study may have still facilitated participants' ability to change their

lesson plans to be more accessible and address learner variability. Second, generalizing the results of UDL instruction across studies within the literature is problematic. UDL instruction is not standardized. There is no UDL curriculum from which to draw comparisons as to the significant association of its application as an intervention across populations. Future research efforts may need to address the design parameters of a UDL curriculum to measure its impact on preservice educators. To do so, ambiguity in developing and operationalizing instruction on UDL for educators will need to be addressed.

In addition, as the scoring rubric of Spooner et al. (2007) assessed for changes in lesson plans on a set scale where the presence of one and two changes received the same score, the rubric was insufficient for teasing out the differences in instructional strategies/tools presented within lesson plans. Growth in participants' use of instructional strategies and tools was found to occur within lesson plans on further inspection, but not accounted for in the design of the rubric. Lesson plans were found to have increased instructional strategies/tools from one to two or from three to four or more, but this did not translate to a change in score on the rubric. The use of one or two instructional strategies/tools was scored at a one and three or more instructional strategies/tools were maximized at a score of two on the rubric. Future research efforts need to be undertaken to expand upon the rubric developed by Spooner et al. (2007) when investigating differences in participants' use of instructional strategies/tools in lesson plans. Moreover, revisiting the evaluation of UDL instruction in lesson planning using rubrics is warranted.

Study Limitations

There were 42 pre-service educators that received instruction on UDL within the course, from which this study took place. A small sample size of 16 participants were included in this study. This small sample size represents less than half of the total number of pre-service educators that received instruction on UDL within the course. The findings from this study are not representative of the entire class population that received instruction in UDL.

Also, participants in this study were enrolled in their last semester before completing their student teaching and were previously exposed to the concept of UDL during their educator preparation program. In addition, participants submitted variable lesson plans that were unformatted or standardized, but instead, were individualized to meet the learning needs of participants' and were in alignment with their area of interest and content area of study. Variability was not pre-identified with case files, and participants were given autonomous

direction in developing their lesson plans to address learner variability by considering inclusion and supporting the learning needs of students with disabilities within their lesson plans.

Conclusion

This study investigated how secondary preservice general educators' lesson planning changed after exposure to UDL instruction. It is critical that researchers and educators engage in exploration of how instruction on UDL for preservice educators' may correspond to their ability to address learner variability in their classrooms and support students with disabilities within education classrooms. Results indicated that the instruction on UDL was beneficial for the participants' ability to address inclusion through changing their lesson plans to be facilitative of UDL principles. However, no significant differences in participants' lesson plan scores was found between pre- and post-lesson plans across the UDL principles. Future research efforts investigating the relationship between UDL instruction and lesson planning on preservice educator preparation are critical to the field to support the needs of pre-service educators in implementing UDL, and in transitioning to becoming teachers of record.

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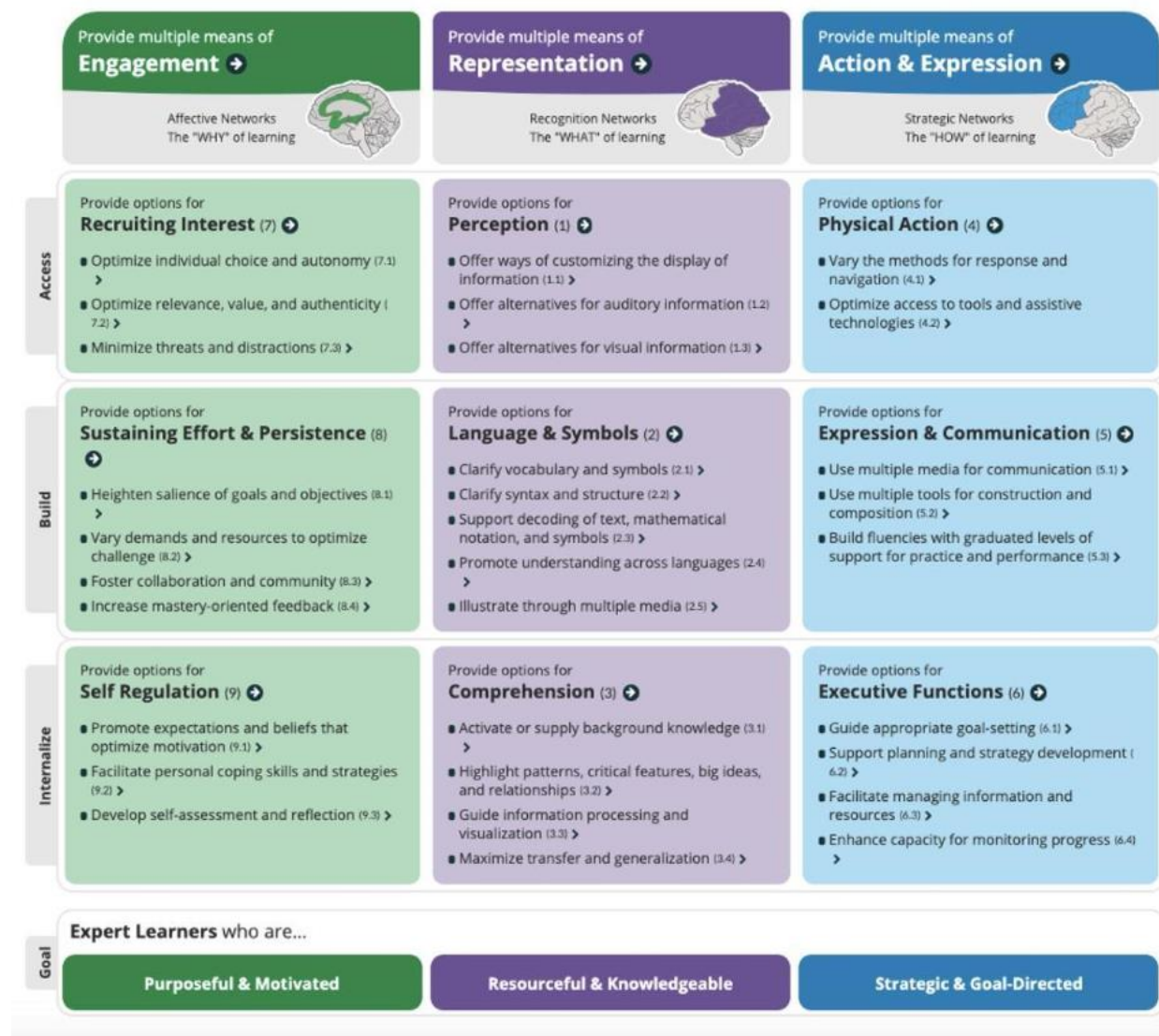
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Appendix

Figure 1

UDL Framework

Universal Design for Learning Guidelines



CAST (2018). Universal Design for Learning Guidelines version 2.2. Retrieved from <http://udlguidelines.cast.org>. Reprinted with permission.