Does UDL Exist in the Wild: Initial Study Based on
Observations of Videos of Instruction

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Date Defended: May 4, 2020

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Date Approved: May 13, 2020

Abstract

Due to Universal Design for Learning (UDL) being written into law in Every Student Succeeds Act (ESSA; 2015) it has been on the rise in K-12 education. Therefore, there is a need for consensus on what UDL is, and is not, in order to quash misconceptions. The rationale for a common understanding is grounded in the consistent misunderstanding that UDL practices are "just part of teaching", a phrase that individuals within the UDL community have to hear and correct on a regular basis. In this study, the researcher observed videos of instruction showing everyday educators in a variety of educational settings who were utilizing a plethora of educational practices to see, if any, the level of their UDL implementation. The purpose of the proposed study is to analyze whether UDL-aligned practices exist in videos of instruction of everyday business-as-usual (BAU) classroom environments to guide the broader education field on critical areas for future research and practice. This analysis was necessary to assist the UDL community in providing the support for the notion that UDL is not "just part of teaching," rather UDL is only being implemented when teachers are proactively and intentionally planning for barriers within the learning environment and student variability.

Keywords: Universal Design for Learning, video observation, UDL measurement

Acknowledgements

I would like to acknowledge the following people for their efforts in facilitating and assisting me through this process.

To my Dad and Desirae, you two are the reason I even pursued my Ph.D. I wanted to set an example for Desirae and more than anything I wanted to make you proud, Dad. I hope I have done both of those things and shown you that no matter where I go or what I am doing, I will always need you both in my life. You are my rocks and I would not be here without your constant love and support. Thank you for standing by me and refusing to let me give up. You are appreciated.

Jefferson you held me up and believed in me, even when I didn't believe in myself. You have always been my person, the one I lean on when times get rough, and you handle it with nothing but love, kindness, and compassion. Thank you for seeing my vision for my future and doing everything in your power to support and push me to help make my dreams a reality. I will never be able to repay you for all the sacrifices you have made on this journey, but I can promise to do everything in my power to support you in chasing your dreams. It is your turn now, and I am truly looking forward to our next chapter together.

Richard, Ling, you both have been there every time I was stuck in a rut. You talked me through some pretty rough days where I did not know if I was going to make it to the end or not, and you held me up all the way to the finish line. This process would have never even been started had it not been for the support you two provided me over the past four years. Thank you for being the people you are, I am truly blessed to have you both in my circle.

Sheida, you have one of the most amazing minds with which I have ever had the honor of engaging. In the most critical times, you have always been there when I have needed you, no

questions asked. I'm so glad I was able to grow so close with you over the last four years, and watch you blossom into the wonderful scholar that you are. You are going to change the world. Thank you for being a part of my journey, you are appreciated.

Dr. Basham you have been everything I needed and more when it comes to an advisor and a mentor. You have always encouraged me to explore new ideas, and ways of thinking, from the very beginning and that is exactly what I needed to develop the thought process necessary to be a successful scholar. You provided opportunities for me that prepared me for this next phase of my life in so many ways. You brought me into your family and treated me like I was your own, and I will forever be grateful for that. I hope you know just how truly appreciated you are. Thank you for everything!

Traci, Tabitha, and Sasha, you three have been my best friends since high school and I honestly don't know what I would do without you. Each one of you has contributed to me becoming the woman I am today in a different way, and I honestly do not have enough words in my lexicon to properly thank you. However, I need you to know that I love each one of you unconditionally, and your presence in my life has been a necessity since I was a teen and will continue to be. Thank you for being the people you are, you are appreciated.

To my other family and friends, I could go on for days thanking you all for all the love and support you all have provided over the last four years. Just know that I see you, I appreciate you, and I promise to pay it forward. Stay blessed my people, today was not promised.

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CHAPTER 1

INTRODUCTION

Does UDL Exist in the Wild?

As soon as new teachers walk into a professional development training on Universal Design for Learning (UDL) they ask a simple question, "What exactly is UDL?" Defined as a scientifically-valid framework in the Higher Education Opportunity Act of 2008, UDL addresses learner variability by removing barriers to learning through instructional design (CAST, 2018). According to Rose and Meyer (2019), a UDL framework requires proactive, intentional planning to address learner variability to access and understand information, engage with content and instruction, and express what they know. As developed by CAST (2011), the UDL instructional framework is comprised of three primary principles:

- Provide multiple means of *engagement* which support the affective networks of the brain and addresses the "why" of learning;
- Provide multiple means of *representation* which support the recognition network of the brain and addresses the "what" of learning;
- Provide multiple means of *action and expression* which support the strategic networks of the brain and addresses the "how" of learning (CAST, 2011).

Additionally, nine guidelines and 31 checkpoints support a more comprehensive framework for understanding design variables associated with these principles (CAST, 2018). These guidelines are the foundation for UDL implementation as a framework from which to build upon in designing learning environments. However, the guidelines are a *framework* for designing learning environments, and should not be confused with a checklist of tasks that are required in order for a learning environment to be considered a UDL-based environment. Implementing

UDL is not to apply all guidelines and checkpoints when designing learning environments; rather, UDL implementation should be context-based, addressing existing and emerging learning barriers and learner variability in a given learning environment.

Different from the business-as-usual model of assuming fault lies within the student when they fail to learn, UDL supports the design of student-centered environments that consider the goals of the learning experience along with barriers associated with the variability of the learners within the experience (Basham & Marino, 2013; Meyer, Rose, & Gordon, 2014). Implementing UDL with fidelity means considering the design of the learning environment and experience in relation to student outcomes. For example, if students are off-task, not engaged, or even failing a particular course if they are not turning in their assignments, a UDL framework prompts teachers to consider how the learning environment (and associated experiences) are designed to support or inhibit the desired outcomes. For instance, operating from a UDL framework would encourage teachers to not only consider engagement but motivation (e.g., lack of connection of academic success and postschool aspirations like postsecondary education and employment) as well as barriers (e.g., limited time after school to complete assignments) to students turning in their assignments and then reflect on how to proactively design the learning environment to support students in removing the identified barriers. Within a UDL-aligned environment, the design of the environment is considered well before the business-as-usual assumption that failure is due to the student's inherent faults, leading to targeting the student for intervention which is the default response of many schools. Therefore, using a UDL framework enables professionals in school systems (e.g., educators, building/district leaders) to share ownership in designing environments in collaboration learners, including students with high-incidence disabilities, to ultimately empower them to become expert learners (Basham, Israel, Graden, Poth, & Winston, 2010; Basham, Smith, & Satter, 2016; Meyer, Rose, & Gordon, 2014).

In the context of implementation, UDL allows for a flexibility in how learning goals are accomplished as it incorporates the understanding that many students experience challenges in mastering basic tools for communication and problem solving (CAST, 2018). For example, many students require support with self-scheduling their time to meet academic benchmarks and the UDL framework allows for flexibility in the support's students need to learn critical time management skills. These challenges are not limited to the physical use of a communication or problem-solving tool, but they are due to a lack of skillful incorporation into learners' communication and expression abilities. As such, UDL environments provide a solution to this problem as they enable students to utilize a variety of options to communicate what they have learned. For example, Dalton, Herbert, and Deysher (2003) provided an example of utilizing multiple tools to meet a goal by scaffolding students' responses to digital literature with embedded strategy supports. Specifically, Dalton et al. (2003) compared audio-recordings to written student response options as teachers supported students across multiple modalities to showcase their affinities and talent, rather than relying on traditional paper-based tests and written artifacts. Further, Hetzroni and Shrieber (2004) provided evidence of the positive impact of using word processors as an assistive technology support for struggling writers. Strategies utilized in Dalton et al. (2003) and Hetzroni and Shrieber (2004) can also enable teachers to enhance student engagement, reduce anxiety, and reward effort. Likewise, the application of modern technology is often considered in UDL implementation to ensure that access to knowledge is available through tools such as voice-to-text software, interactive web programs, and electronic text (Lange, McPhillips, Mulhern, & Wylie, 2006). For readers for whom the language of instruction is not their first language, who struggle in the area of reading, or experience challenges with reading comprehension, using a variety of software to access content is essential. Indeed, thoughtful and well-designed technology integration that bridges barriers to content acquisition is useful to implementing UDL in classrooms (Edyburn, 2010).

Research suggested that *all students* benefit from evidence-based instruction and proactive instructional designs (Basham et al., 2010) that are responsive to learner strengths and preferences and promote academic engagement (Greenwood, Hart, Walker, & Risley, 1994). These are key concepts of UDL, an instructional design framework that calls for teachers to design lesson that are accessible to all students thereby minimizing the need for accommodations and modifications for students with disabilities (Rose & Meyer, 2002). UDL calls for teachers to design lessons that incorporate student strengths, interests, and preferences by planning a variety of learning activities and assessment options along with supports for perception, understanding, comprehension, interest, and effort (Rose & Meyer, 2009). In addition to the flexibility and support of instructional materials and lesson plan design, UDL also calls for teachers to support students' executive functioning skills and self-regulation skills (CAST, 2011).

The understanding of what UDL is and is not is what plagues the education field today. Lowrey, Hollingshead, Howery, and Bishop (2017) found that some teachers who are implementing UDL in inclusive settings still see it as "just good teaching" (p. 235). Lowrey et al. (2017) indicated that the teachers actually thought that they have been "doing" UDL for years but now there is a name for it and guidelines to follow. Examples like these contradict the assumption that UDL is a something separate from good teaching. It also neglects a primary notion of UDL that it is necessary for educators to intentionally plan to enable all students to remove barriers in diverse learning environments (Lowery et al., 2017). Many of the teachers interviewed in Lowery et al. (2017) viewed UDL as a practice they had already been incorporating in their instruction or indicated that UDL was already built into what they do. To further investigate the claims that UDL is simply part of regular instructional practice, it was necessary to examine whether business-as-usual (BAU) instruction align to the implementation of the UDL framework. To support initial research in this area, pre-recorded BAU classroom instruction videos were observed for UDL-aligned practices.

Purpose

The purpose of this study was to observe pre-recorded videos of educators teaching in a BAU setting utilizing the Universal Design for Learning Observation Measurement Tool (UDL-OMT) to measure alignment to the implementation of UDL. The research questions addressed in this study include:

1. Are UDL-aligned practices apparent in a state instructional video database used to train district personnel?
2. Does the level of UDL-aligned practices differ across K-12 grade levels in English Language Arts?
3. Does the level of UDL-aligned practice differ across 3-12 grade levels in Mathematics?

CHAPTER 2

REVIEW OF LITERATURE

A Historical Perspective on Universal Design for Learning

Arguably, Universal Design for Learning (UDL) was founded in late 1990s by David Rose and the other founders of CAST as means to support equitable access for learners with disabilities (Basham & Blackbory, 2019). UDL is an adaptation of Universal Design (UD) to the field of education and learning (Edyburn, 2010; Gargiulo & Metcalf, 2013; Orkwis & McLane, 1998; Rose & Meyer, 2009). The emergence of UDL came about after the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA), which called for all students to have access to and make progress in the general education curriculum (Edyburn, 2005; Erlandson, 2002). Although IDEA does not define UDL in the current iteration, the amended definition provided for UD in the Assistive Technology Act of 1998 is referenced (IDEA Regulations, 34 CFR §300.44). Whether it is based on research, mystique, or simply a vision for better learning outcomes for students with disabilities or even all students, the current interpretation of UDL is much broader than its original intent. One way to approach UDL's growth across education is through a historical lens, providing understanding for its founding and growth in context of the broader educational system, research, science, and even society.

The emergence of UDL came during a time when the education system and society at-large was going through a resurgence fueled by the promise of digital technology, a distributed and interconnected information system in the World Wide Web. For the first time, the information and much of the world's knowledge was distributed across society for anyone who could afford a computer and internet connection. During this time, futurists discussed the need for a shift in education from an emphasis on fact memorization through "drill and kill" and "sage on the stage" teaching styles to a focus on higher-order thinking and future-ready skills such as critical thinking and problem solving (Rose & Meyer, 2002). Schools have raced to incorporate technology, first through stand-alone computer labs, and then through one-to-one device initiatives and massive networking upgrades. However, in many cases, the K-12 classroom itself has remained stubbornly static, with students sitting in rows of desks and a teacher delivering instruction at a whiteboard or projector screen at the front of the room (Noblitt, Vance, & Smith, 2010).

While the concept of outfitting classrooms with connected devices is certainly not new, the reality is that student devices are often not put to their highest use, precisely because they are sometimes seen as an afterthought—or and "add on"—rather than as tools that are essential to teaching and learning (Basham, Meyer, & Perry, 2010). Most school buildings predate the tablets and laptops that students are using by several decades, and although school leaders have done their best to incorporate technology into instruction, they have been aiming at a moving target. For a time, many schools relied on laptop carts, but this solution was cumbersome, with teachers unsure of when they would have access to the technology, and whether the computers would be charged and ready for use when they needed them. Some school districts have found success with bring-your-own-device policies, but others have found it nearly impossible to manage a computing environment where every student has a different device (Song, 2014). Even in districts that have invested in one-to-one programs, leaders have sometimes been disappointed by lackluster adoption and found it difficult to continue funding the programs over time or failed to make networking upgrades necessary to ensure a high level of performance for sustainable utilization (Wong & Looi, 2011).

By contrast, modern learning environments are designed with the assumption that students will have constant access to connectivity—and are supported by the back-end technology and teacher training necessary to ensure that student devices play a central role in the classroom. Similarly, audiovisual solutions in a modern learning environment directly support student learning and engagement (Lehtonen, Page, Thorsteinsson, & Hepburn, 2007). Depending on grade level and instructional goals, audiovisual solutions may include interactive whiteboards, document cameras, multitouch digital displays, projectors, and even microphone lanyards. The key is not to implement any single tool with a one-size-fits-all approach, but rather to outfit classrooms with the solutions that will best support students remove barriers (CAST, 2018) which is what Universal Design for Learning (UDL) proactively does.

When carefully designed and thoughtfully applied, technology can accelerate, amplify, and expand the impact of effective teaching practices (NETP, 2016). However, to be transformative, educators need to have the knowledge and skills to take full advantage of technology-rich learning environments. While simple design features might provide for an environment that is modern, it does little to support modern learning outcomes. The reality is that a modern learning environment likely has less of a focus on the technology and more emphasis on the "learning." In fact, history has demonstrated that a focus on the technology in the learning environment has provided little more than a more automated factory model of education (Cuban, 2001).

A Visionary Time in Education

The UDL framework emerged during a time where education was undergoing a transformation for how technology could support learning. While technology as a tool has been used in teaching and learning throughout history, the last three decades has provided an insurgence of various new practices, attempts, and research on the impact of digital technology in the learning environments. For instance, in the late 1980s and early 1990s, the well-noted Apple Classrooms of Tomorrow (ACOT; Dwyer, Ringstaff, Haymore, & Sandholtz, 1994) studies provided both research and vision for how to effectively use technology in learning. Then, in the mid-1990s, the birth for the World Wide Web brought distributed information to the masses, “causing educators, from preschool to graduate school, to rethink the very nature of teaching, learning, and schooling” (Owston, 1997, p. 27).

Even after more than a decade of research exploring how to effectively and meaningfully integrate technology into the classroom, most educators were still unaware how to leverage technology in the teaching and learning process (Cuban, 2003). In his in-depth study on the use of technology in the classroom, Cuban (2003) identified the need to develop a new vision for teaching and learning as well as technology designed to meet the needs of the modern education system. Cuban (2003) discussed reframing what students and teachers do in the classroom toward a different end goal. During the same time, the U.S. Department of Education invested 100 million dollars in refurbishing the teacher education system with the Preparing Tomorrow’s Teachers Today grants (PT3). The PT3 grants placed a great deal of emphasis on supporting the development of future educators to incorporate technology effectively into their teaching. Therefore, the impetus established from the PT3 grants led to more educators and researchers investing time into learning how to incorporate technology into their teaching through modeling and new pedagogies and tools for learning (Baslanti, 2006).

Throughout the last three decades, various standards and models have emerged to support the interaction among classroom (or instructional) practice and technology use. Arguably, explicit instruction, Understanding by Design (UbD), and Technological Pedagogical Content

Knowledge (TPACK) models have had the largest lasting impact on both teacher education and practice. All of which are practices or frameworks that can be combined within the UDL framework. For instance, if the students are required to learn discrete knowledge and skills, then research has found that explicit instruction might be the most effective choice (Flores & Ganz, 2014) and a UDL environment would likely offer explicit instruction as a choice within the learning process. Additionally, using the UbD process along with TPACK educators could also consider how to design of the learning experience in a proactive manner, including the use of technology to make things accessible. In fact, designing the learning experience in a proactive manner would enable TPACK educators could benefit all learners. Given the continually reinforced importance of student choice in the learning process (e.g., Skerbetz & Kostewicz, 2013, Skerbetz & Kostewicz, 2015), these lessons might offer student choice in the process of learning and could potentially integrate multiple ways to support students' learning that align to the three principles of UDL.

Explicit Instruction. Explicit instruction has been used to describe a range of instructional models used in face-to-face learning contexts—all designed to promote on-task student behavior by the teacher's effort to monitor and control student classroom attention and persistence (Corno & Snow, 1986). The various models have emerged from primarily behavioral traditions; however, over time the models have reflected the prevailing theoretical orientation to and interpretation of teacher-directed actions in a classroom. Moreover, these models may not be named explicit instruction per se, but share key components (e.g., Tobias, 1982) that translate very well into design features of live, as well as technology-enhanced or technology-driven, instruction. According to Magliaro, Lockee, and Burton (2005) these components are:

1. Materials and curriculum are broken down into small steps and arrayed in what is assumed to be the prerequisite order.
2. Objectives must be stated clearly and in terms of learner outcomes or performance.
3. Learners are provided with opportunities to connect their new knowledge with what they already know.
4. Learners are given practice with each step or combination of steps.
5. Learners experience additional opportunities to practice that promote increasing responsibility and independence (guided and/or independent; in groups and/or alone).
6. Feedback is provided after each practice opportunity or set of practice opportunities (p. 43-44).

The underlying assumption of explicit instruction (sometimes called *explicit teaching*) is that if the student has not learned, then the teacher has not effectively taught (Adams & Carnine, 2003). This approach calls for the teacher to keep students consistently engaged in learning basic skills and knowledge through the design of effective lessons, corrective feedback, and opportunities for practice. Explicit instruction is most frequently used in the teaching of basic skills (i.e., reading, mathematical computation, writing) in the primary and elementary grades. Additionally, explicit instruction is also used in to teach remedial classes at the middle and high school levels. Research has demonstrated that explicit instruction is most useful for young learners, slow learners, and all learners when the material is new and difficult to grasp at first. Although there are several variations of explicit instruction, the following represents a synthesis of descriptions offered by Adam and Engelmann (1987), Joyce and Weil (2004), Rosenshine (1987), Rosenshine and Meister (1994) including:

1. Focusing almost all classroom activity on learning basic academic knowledge and skills. Affective and social objectives, such as improved self-esteem and learning to get along with others, are either de-emphasized or ignored.
2. Having the teacher make all instructional decisions, such as how much material will be covered at one time, whether students work individually or in groups, and whether students work on mathematics during morning and social studies during the afternoon.
3. Keeping students working productively toward learning new academic knowledge and skills (usually called being on-task) as much as possible.
4. Maintaining a positive classroom climate by emphasizing positive reinforcement and avoiding the use of aversive consequences.

The goal of explicit instruction is that all students master basic skills. Advocates for this method in the educational research community believe that students who mislearn information require substantially more time and effort to relearn concepts that would not have been the case had they learned them correctly in the first place (Adams & Carnine, 2003). From a technology perspective, explicit instruction has contributed to technology design and use most notably in models such as computer assisted instruction (CAI) that is represented in instructional modules (Johnson, Gersten, & Carnine, 1987). Current representations of this integration include online or virtual schooling (e.g., K12.com) and Khan Academy (2019) learning modules where in the students learn directly from the ongoing interaction with the technology.

Understanding by Design (UbD). Understanding by Design (UbD) is a framework for improving student achievement. Emphasizing the teacher's critical role as a designer of student learning, UbD works within the curriculum to support teachers in (a) clarifying learning goals,

(b) devising assessments that reveal strengths and areas of needed growth in students' understanding, and (c) crafting effective and engaging learning activities (McTighe & Wiggins, 1999). Developed by nationally-recognized educators Grant Wiggins and Jay McTighe, and published by the Association for Supervision and Curriculum Development (ASCD; 2005), UbD is based on the following key ideas:

- A primary goal of education should be the development and deepening of student understanding.
- Students reveal their understanding most effectively when they are provided with complex, authentic opportunities to explain, interpret, apply, shift perspective, empathize, and self-assess. When applied to complex tasks, these "six facets" provide a conceptual lens through which teachers can better assess student understanding.
- Effective curriculum development reflects a three-stage design process called "backward design" that delays the planning of classroom activities until goals have been clarified and assessments designed. This process helps to avoid the twin problems of "textbook coverage" and "activity-oriented" teaching, in which no clear priorities and purposes are apparent.
- Student and school performance gains are achieved through regular reviews of results (achievement data and student work) followed by targeted adjustments to curriculum and instruction. Teachers become most effective when they seek feedback from students and their peers and use that feedback to adjust approaches to design and teaching.

- Teachers, schools, and districts benefit by "working smarter" through the collaborative design, sharing, and peer review of units of study.

Wiggins, Wiggins, and McTighe (2005) emphasize that in practice UbD offers a plethora of advantages to educators. For instance, UbD offers a three stage “backward planning” curriculum design process anchored by a unit design template; a set of design standards with attendant rubrics; and a comprehensive training package to help teachers design, edit, critique, peer-review, share, and improve their lessons and assessments (ASCD, 2005).

Technological Pedagogical Content Knowledge (TPACK). TPACK is a framework that builds upon Lee Shulman’s (1987, 1986) construct of pedagogical content knowledge (PCK; Koehler & Mishra, 2009) to include technology knowledge. In this model (see Figure 1), there are three main components of teachers’ knowledge: (a) content, (b) pedagogy, and (c) technology. Equally important to the model are the interactions between and among these bodies of knowledge, represented as PCK, TCK (technological content knowledge), TPK (technological pedagogical knowledge), and TPACK. The following sections provide brief overview of each of the three bodies of knowledge associated with the TPACK model.

Pedagogical Content Knowledge (PCK). PCK is consistent with and similar to Shulman’s (1987, 1986) idea of knowledge of pedagogy that is applicable to the teaching of specific content. Central to Shulman’s (1987, 1986) conceptualization of PCK is the notion of the transformation of the subject matter for teaching. Specifically, according to Shulman (1986), this transformation occurs as the teacher interprets the subject matter, finds multiple ways to represent it, and adapts and tailors the instructional materials to alternative conceptions and students’ prior knowledge. PCK covers the core business of teaching, learning, curriculum, assessment and reporting, such as the conditions that promote learning and the links among curriculum, assessment, and pedagogy (Koehler & Mishra, 2009).

Technological Content Knowledge (TCK). TCK is an understanding of the manner in which technology and content influence and constrain one another. Teachers need to master more than the subject matter they teach as well as have a deep understanding of the manner in which the subject matter (or the kinds of representations that can be constructed) can be changed by the application of particular technologies. Teachers need to understand which specific technologies are best suited for addressing subject-matter learning in their domains and how the content dictates or perhaps even changes the technology—or vice versa (Koehler & Mishra, 2009, p. 1028).

Technological Pedagogical Knowledge (TPK). TPK is an understanding of how teaching and learning can change when particular technologies are used in diverse ways. This includes knowing the pedagogical affordances and constraints of a range of technological tools as they relate to disciplinarily and developmentally appropriate pedagogical designs and strategies (Koehler & Mishra, 2009, p. 1028).

Technological, Pedagogical Content Knowledge (TPACK). Underlying truly meaningful and deeply skilled teaching with technology, TPACK is different from knowledge of all three concepts individually. Namely, TPACK is the basis of effective teaching with technology, requiring an understanding of (a) the representation of concepts using technologies, (b) pedagogical techniques that use technologies in constructive ways to teach content, (c) knowledge of what makes concepts difficult or easy to learn and how technology can support remove the barriers that students face, (d) knowledge of students' prior knowledge and theories of epistemology, and (e) knowledge of how technologies can be used to build on existing knowledge to develop new epistemologies or strengthen old ones (Koehler & Mishra, 2009, p. 1029).

Koehler (2012) stated, “Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between these components of knowledge situated in unique contexts” (para. 2). Furthermore, Koehler (2012) emphasized that no single combination of content, technology, and pedagogy will apply for every teacher, every course, or every view of teaching; rather, these decisions are based on the individual teacher, grade-level, school-specific factors such as demographics, culture, and other factors that make each instructional context unique. The TPACK model is a generative framework designed to guide teacher preparation to integrate information and communication technology (ICT) in teaching and learning (Chai, Ling Koh, Tsai, & Lee Wee Tan, 2011) and has been found to be a predictor of increased self-efficacy in teachers related to the integration of technology in teaching (Abbitt, 2011). However, both general and special education teachers need to develop a strong efficacy to effectively integrate technology in teaching and learning (Benton-Borghi, 2013). Although the TPACK model has provided a theoretically sound and coherent conceptual framework to prepare general education teachers to integrate technology, the TPACK model alone will not enable general education teachers to teach the full spectrum of learners in schools (Benton-Borghi, 2013).

The Founding of UDL

Along with the aforementioned instructional influences, UDL traces its origin to the Universal Design (UD) movement of the 1990s. The term “universal design” was coined by architect and designer Ron Mace at the Center for Universal Design at North Carolina State University (Burgstahler, 2008; CAST, 2011c) and defined as “the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation of specialized design" (CAST, 2011a). In recent years, the UDL framework has found fertile ground in the field of education. Elementary school teachers and university professors alike have adopted UDL "as a conceptual and philosophical foundation on which to build a model of teaching and learning that is inclusive, equitable, and guides the creation of accessible course materials" (Shelly, Davies, & Spooner, 2011, p. 18). If the goal of UD is the removal of barriers from the physical environment, the goal of UDL is the elimination of unnecessary barriers from the learning environment.

Built upon research from the fields in mind, brain, and education, UDL provides design guidance for educators to build flexibility in learning goals, assessments, instructional practices, and materials in order to empower all learners with resources, skills, and motivation for learning (Meyer, Rose, & Gordon, 2014). The flexibility inherent in UDL environments offers all learners affordance to have different choices, learning pathways, and materials tailored to their individual needs as well as varying means to demonstrate their understanding. All these learning activities take place in dynamic ecologies that capture interactions among learners, teachers, and the designed environments (Rappolt-Schlichtmann et al., 2012).

Framing UDL Publications and Research

Much of the literature on UDL includes scholarly reviews or expert opinions about how UDL can be implemented in K-12 classrooms (Howard, 2004; Hunt & Andreasen, 2011; Lieberman, Lytle, & Clarcq, 2008; Lowrey, Hollingshead, Howery, & Bishop, 2017; McCoy & Radar, 2007; McPherson, 2009; Ok, Rao, Bryant, & McDougall, 2017; Rao, Ok, & Bryant, 2014) or in university courses (Burgstahler & Cory, 2008; Gradel & Edson, 2009; Handle, 2004; Morra & Reynolds, 2010; Ofiesh, Rojas, & Ward, 2006; Scott, McGuire, & Foley, 2003; Scott, McGuire, & Shaw, 2003), and some empirical studies exist that examine the impact of UDL on academic achievement (Coyne, Evans, & Karger, 2017; Coyne, Pish, Dalton, Zeph, & Smith, 2012).

Researchers have reported on learning materials and technological applications that have been designed with UDL principles in mind (Marino, 2009; Okolo, Englert, Bouck, Heutsche, & Wang, 2011; Proctor, Dalton, & Grisham, 2007), assessment materials that have been altered to incorporate UDL principles (Acrey, Johnstone, & Milligan, 2005; Johnstone, 2003; Stock, Davies, & Wehmeyer, 2004), and the training of teachers and university instructors in planning lessons that incorporate the principles of UDL (Schelly, Davies, & Spooner, 2011; Spooner, Baker, Harris, Ahlgrim-Delzell, & Browder, 2007), but only a handful of studies have examined the impact of the commonly accepted principles of UDL implemented as a total framework (Browder, Mims, Spooner, Ahlgrim-Delzell, & Lee, 2008; Dymond et al., 2006; Friesen, 2008; Kortering, McClannon, & Braziel, 2008; Morrissey, 2008). Although the research on UDL to this point has resulted in more researchers and practitioners exploring the framework, more needs to be done in order to identify UDL as a research-based practice.

What is Universal Design for Learning?

Defined as a scientifically valid framework in both the Higher Education Opportunity Act (HEOA) of 2008 and Every Student Succeeds Act (ESSA) of 2015, UDL addresses learner variability by removing barriers to learning through instructional design (HEOA, 2008; ESSA, 2015). The UDL framework requires intentional planning to address learner variability to access and understand information, engage with content and instruction, and express what they know. CAST (2011b) developed the UDL instructional framework, which includes three primary principles: (a) the *engagement* principle represents the affective networks of the brain and addresses the “why” of learning, (b) the *representation* principle represents the recognition network of the brain and addresses the “what” of learning, and (c) the *action and expression* principle represents the strategic networks of the brain and addresses the “how” of learning. More specifically, based on the identified brain networks, Rose and Meyer, and their colleagues at CAST developed the principles and guidelines to help educators apply UDL in the classroom (see CAST, 2018):

Provide multiple means of representation.

1. Provide options for perception.
2. Provide options for language, mathematical expressions, and symbols.
3. Provide options for comprehension.

Provide multiple means of action and expression.

1. Provide options for physical action.
2. Provide options for expression and communication.
3. Provide options for executive functions.

Provide multiple means of engagement.

1. Provide options for recruiting interest.
2. Provide options for sustaining effort and persistence.
3. Provide options for self-regulation (CAST, 2018).

In addition to the nine guidelines there are also 31 checkpoints to support the three UDL principles. These principles, guidelines, and checkpoints are meant to prompt teachers to design instruction so that learners can access, engage with, and demonstrate understanding of information in ways that suit individual learners, but they may leave practitioners unclear about how to actually apply the principles of UDL in practice.

In effort to make UDL more educator-friendly, Dr. James Basham and colleagues at the Universal Design for Learning – Implementation and Research Network (UDL-IRN; http://udl-irn.org/) re-worded the principles originally developed by CAST to convey the principles of UDL in simple and clear language that educators may more easily understand:

- Provide multiple means of representing or presenting information.
- Provide flexible methods for students to express understanding.
- Provide flexible ways for students to engage in the learning process (UDL-IRN, n.d.)

If educators are confused by CAST's directive to *provide multiple means of representation* and what that might entail, they may more easily understand the UDL-IRN directive to *provide multiple means of representing and presenting information*. Both CAST and the UDL-IRN seek to convey the same point: The content of the lesson should be presented to students in a variety of ways so that barriers can be overcome through design. In order to do that, educators should think about the content and come up with multiple ways to present it (e.g., lecture, digital print, demonstration).

The collaborators at the UDL-IRN also identified critical elements of UDL instruction: (a) set clear goals, (b) intentionally plan for learner variability, (c) incorporate flexible methods and materials, and (d) conduct timely progress monitoring (UDL-IRN, 2011a; Basham & Marino, 2013). There are also clear steps for the instructional process: (a) establish clear outcomes, (b) anticipate learner variability, (c) establish measurable outcomes and assessment plans, (d) determine the instructional sequence/experience, and (e) build in checkpoints for teacher reflection (UDL-IRN, 2011a; Basham & Marino, 2013). A synthesis of the principles developed by CAST and the practical wording and instructional design guidelines developed by

UDL-IRN may provide a practitioner-friendly starting point for educators to create UDL lessons, and for researchers to measure the impact of UDL.

To illustrate the contributions of CAST and UDL-IRN to understanding what effective integration of the UDL framework looks like in the classroom context, the following illustrative example is provided. A secondary biology teacher would like to conduct a lesson on cell division. According to Basham and Marino (2013). the process of UDL implementation begins by using a backwards design process, similar to that in UbD to plan the lesson. This process begins by establishing clear goals. In order to establish clear goals for the lesson, the teacher would make sure that the goals were aligned with appropriate standards and that they had a strong grasp of the goals and the desired learner outcomes. These steps would be true for traditional lessons as well, but what makes the UDL lesson different is that the goal would be separated from the means for achieving it (Rose & Meyer, 2009) in order to allow for flexibility in how students engage with the content to be learned. In the cell division example, a goal might be for students to demonstrate an understanding of the process of meiosis. Note that the goal does not include a means for achieving it such as an expectation for students to draw the phases of meiosis.

Different from UbD, UDL then asks educators to consider planning for learner variability and then design the appropriate measures of success (Basham & Marino, 2013). Planning for learner variability and incorporating flexible methods and materials are related. In order to plan to meet the needs of a diverse group of learners, the teacher would have to employ a variety of methods and make a wide array of materials available for students to use. According to UDL-IRN's (2011b) *UDL Instructional Planning Process*'s five steps, in step two, the teacher would anticipate learner needs (UDL-IRN, 2011b) by considering individual students' strengths and areas of needed improvement, and anticipate where learners may encounter obstacles (also known as barriers). It is crucial for teachers to have a clear understanding of their learners' needs within the environment prior to planning (UDL-IRN, 2011b). Step three, before planning the instructional experience, the teacher should establish measurable outcomes and assessment plans (UDL-IRN, 2011b) and decide how learning is going to be measured. During step four, the teacher would plan out the instructional experience, or the instructional sequence of events (UDL-IRN, 2011b). Considerations should be made for how to support multiple means of representation, action and expression, and engagement (UDL-IRN, 2011b). Finally, step five establishes different checkpoints for teachers to reflect and develop new understandings (UDL-IRN, 2011b). Throughout this reflection time, teachers should be thinking about whether the learners obtained the key ideas, including the instructional strategies that worked well, the tools that were utilized effectively and how could they be improved, how strategies and tools that were provided supported multiple means, what additional tools would it have helped to have access to, and how additional tools might have improved the lesson overall (UDL-IRN, 2011b).

By flushing out the roadblocks ahead of time, teachers can have a wide array of scaffolds prepared and in place in advance to meet the needs of all learners. In the cell division example provided earlier, the teacher may provide text-to-speech software so that students with reading support needs can listen as they read the textbook chapter on the topic or the teacher-provided handout. These digital versions of the textbook and handout may also contain hyperlinks to vocabulary definitions, diagrams, or short video clips that provide further scaffolding. The teacher may also provide a web-based animation or narrated tutorial of the process of meiosis with a simple web search using key words *meiosis animation*, which yields numerous results. This scaffolding may increase engagement for a student who struggles to maintain attention on the learning task at hand such as a student with an emotional behavioral disorder (EBD) or attention deficit hyperactivity disorder (ADHD). Not only would teacher plan for flexibility in how students engage with the material to be learned, but they would also plan for students to have choices in how they demonstrate their knowledge. Frequently assessing student understanding provides teachers with the necessary information to make instructional decisions. In the cell division lesson example, formative assessment or progress monitoring might reveal that a student misunderstood the sequence of the phases of meiosis. The teacher would use the information gleaned to alter the course of instruction or decide to provide additional scaffolding for that specific student.

The Chicken and Egg Issue of UDL in Practice

UDL was founded at the time wherein there was an influx of modern technology and new practices shaping the education system. While systematic changes where being integrated into the education system, UDL asked educators to “design” more inclusive learning environments that were proactively designed for a variety of learning differences. To support this effort, CAST and the UDL-IRN have both developed components to help educators as they consider the implementation of UDL. However, as UDL supports a process and framework of design, rather than a specific practice, the implementation of UDL has been challenging to define for educators supporting learners with diverse support needs (Basham & Blackorby, 2020).

As discussed in Basham and Gardner (2010) after implementing UDL, an outside evaluator questioned whether UDL in practice might just reflect really good classroom practice, especially practice that effectively integrates technology. Considering the influx of technology, theories, research, and practices that have emerged over the last two decades UDL seems to integrate many of the key components with one obvious difference, which is the proactive design for success of *all students*. Specifically, according to Basham and Marino (2013), UDL does not ascribe to one type of pedagogical practice or tool but considers what is most aligned to the associated goals. Yet, as indicated by Edyburn (2010), if UDL is implemented, it must be purposeful and recognized by the person implementing. Critically, Edyburn (2010) argues that for UDL to exist, the educators must know it exists. Furthermore, for educators to consistently implement UDL, they must understand the framework. However, it could also be argued, that if these UDL-aligned practices are implemented consistently in everyday classrooms, whether the teacher understands UDL is academic in argument rather than pragmatic. The convergence of these issues supports a need to consider how much UDL actually exists in everyday classroom practice.

Specifically, if the combination of innovative technologies, educator knowledge and skills, planning, and implementation support the same practices espoused in UDL, then the framework is simply reinforcing modern day educational practices. If these practices do not exist in everyday classrooms, then UDL is supporting a combination of practices that are new to the education system. If new, then UDL is a framework that requires educators to be prepared with a clear focus on UDL implementation rather than other knowledge and skills. This first step in considering the role of UDL in the modern education system is to identify its existence in everyday classroom environments through observations of pre-recorded videos of business-as-usual (BAU) instruction. The overall purpose of these observations was to determine whether UDL exists in BAU settings in pre-recorded videos of instruction, rather than environments designed with UDL in mind. The research questions addressed in this study were:

1. Are UDL-aligned practices apparent in a state instructional video database used to train district personnel?

2. Does the level of UDL-aligned practice differ across K-12 grade levels in English Language Arts?
3. Does the level of UDL-aligned practice differ across 3-12 grade levels in Mathematics?

Implications for this Research

Given the need to investigate whether UDL exists in the everyday classroom environment, this research has the potential to support researchers and educators in understanding what UDL implementation is as well as what it does and does not look like in pre-recorded videos of instruction. There is an opportunity here to observe a range of educational practices and see if those practices in isolation indicate some level of UDL implementation, or if paired with multiple different practices indicate varying levels of implementation. It is known that a feature of UDL implementation is to break down and/or remove barriers and support student engagement (CAST, 2018), demonstrating the importance of observing BAU classrooms in an attempt to see if there are UDL-aligned practices are apparent in BAU instructional environments. Finally, this study has the potential to influence the education community by answering the question, "Is UDL just good teaching?" and in doing so prove once and for all that UDL is more than just good teaching, rather it is the proactive intentional design of classroom environments and instruction with the framework in mind.

Conclusion

As an emerging field of research and practice, UDL as the potential to support learners with diverse learning needs in divergent systems across the country. This chapter provides a substantive analysis into the lengthy history of UDL up to its current understanding and integration in the broader education field. Basham and Blackorby (2020) stated that new policies, practices, and other improvements occur in the margins as well as other areas of education, which generates the need to consider how to design better learning environments for all learners. As interest in UDL continues to grow both in the United States education system and abroad in international education contexts, is it vital that research is conducted to seek answers to what UDL is past face value.

CHAPTER 3

METHODOLOGY

This study observed videos of instruction that showed teachers teaching in a business-as-usual (BAU) setting. This influx in the use of videos of instruction as a training tool is what has created a significant need for this research and its procedure of watching videos of instruction utilizing the Universal Design for Learning Observation Measurement Tool (UDL-OMT; Basham, Gardner, & Smith, 2020b)—to measure alignment to the implementation of Universal Design for Learning (UDL). The overall purpose of these observations was analyzing whether UDL exist in BAU settings in videos of instruction, rather than environments designed with UDL in mind. The videos cover a range of instructional practices across K-12 grade levels and the core content areas of English Language Arts (ELA) and Mathematics. The research questions addressed in this study include:

1. Are UDL-aligned practices apparent in a state instructional video database used to train district personnel?
2. Does the level of UDL-aligned practice differ across grade levels K-12 in English Language Arts?
3. Does the level of UDL-aligned practice differ across grade levels 3-12 in Math?

Method

Sample Videos

The videos ($n = 35$) used in this research were procured using an eastern state's department of education website. These videos were selected because they had been identified by a state as exemplar teaching (Massachusetts Department of Elementary and Secondary Education, 2020) and used to train state personnel to conduct in class evaluations. All of the videos are free to public access and abide by YouTube's content policy/standards. The videos were filmed in 35 different classrooms with different teachers in each video. These videos show a variety of instructional practices to support districts as they calibrate observation activities to further their understanding of instructional quality. Furthermore, the videos cover a wide range of grade levels across two core content areas. More specifically, in English Language Arts (ELA) there are four videos for K-2, eight videos for grades 3-5, five videos for grades 6-8, and four videos for grades 9-12; in Mathematics there is one video for K-2, three videos for grades 3-5, three videos for grades 6-8, and seven videos for grades 9-12.

Universal Design for Learning Observation Measurement Tool (UDL-OMT)

The Universal Design for Learning Observation Measurement Tool (UDL-OMT; Basham et al., 2020b; see Appendix A) is a 42-item assessment tool designed to measure the implementation of UDL within instructional environment of experience (Basham et al., 2020a). A Delphi process was utilized to establish content validity of the UDL-OMT with "…leadership at CAST and K-12 teachers who were working in districts known to be implementing UDL" (Basham et al., 2020a, p. 6). Reliability of the UDL-OMT consisted of Cronbach's alpha being above .80 for all three sections of the tool (Basham et al., 2020a), which according to Cortina (1993) yields an internal consistency considered "Good". The UDL-OMT considers the design of the learning environment relative to teacher implementation that includes the use of strategies and tools as well as how students respond to the environment. It can be used across various instructional environments, curricula, and teaching methodologies and is designed for observing both whole-class as well as small-group implementation.

Basham, Gardner, and Smith (2020a) discuss the design of the UDL-OMT as being, "…for observers familiar with the UDL framework and the knowledge that specific tools or strategies systematically occur in the context of supporting access, building knowledge and skills, and supporting internalization of understanding and skills across the implementation of the framework" (p. 4). Although framed and written using language familiar to educators, the items written in the UDL-OMT align directly to the UDL Guidelines 2.0 (CAST, 2018). The observer(s) adjust their rating of UDL based on their ongoing data collection throughout the video. Individual items were scored using a scale of 0 (*no evidence of UDL*) to 3 (*dynamic, interactive UDL*).

According to Basham et al. (2020a) the UDL-OMT uses four sections to consider alignment to UDL, which are the following: (a) introducing and framing new material, (b) content representation and delivery, (c) expression of understanding, and (d) activity and student engagement. Observers are free to decide what sections of the tool to use based on what portions of instruction were observed. For example, the introduction of a lesson may not be observed due to the observation taking place on the third day of instruction. Thus, the introducing and framing new material section of the UDL-OMT would not be utilized by the observer. The exact protocol for knowing when to skip sections is explicitly stated in the section of the UDL-OMT titled *Observing Partial Sessions*. In this section it is discussed that if observers are not able to observe an entire instructional session, then they must be aware of components included in the measure that may be missed due to timing of the observation (Basham et al., 2020b). The protocol calls for the observer to draw a line through the item(s) that were missed at the end of the session and explains that they should not be scored in the overall observation. Specifically, all scoring should only be representative of the time spent in the environment (Basham et al., 2020b).

Procedure

Observation Procedure. The process for observing instruction was consistent across all videos. At the beginning of each observation, the video played the first five minutes then was paused and replayed to give the observer(s) an opportunity to observe the overall climate of the classroom, with no focus on scoring items on the instrument. After the first five minutes of the video was replayed for a second time the observer initiated the observation using the UDL-OMT measure. The observer began rating the occurrence of UDL, shifting among Sections B through D of the instrument as needed. As classroom activities in the video progressed, the observer would start and stop the video as needed to ensure an accurate observation of the whole environment was being conducted through the video analysis.

The observer focused on identifying the occurrence of UDL (as represented by the UDL-OMT items) through observation of student and teacher behaviors, use of instructional strategies, and classroom tools that were suggestive or explicit of UDL. For instance, if the video recording contained lectures or conversations between a teacher and student(s) where the teacher provided multiple examples to illustrate or clarify a concept or procedure. The observer also took note of the nature and degree of interaction and dialogue among students working in small groups, as suggested by Basham et al. (2020b). In addition, the observer simultaneously compiled an anecdotal record (narrative observations) to document specific and/or unique examples of UDL or situations where UDL should likely be present but is not.

Scoring the UDL-OMT. Throughout observations, the observer(s) accessed a digital version (Qualtrics) of the instrument and were required to transcribe any paper-based data into the online form immediately following the observation and prior to talking with the other observer. During an observation, when an observer experienced activities/behavior that supported UDL alignment (or nonalignment), they tentatively marked the item. If they observed what they characterized as more substantiated UDL (e.g., they made a previous judgment that there was preemergent UDL, rating an item as "1") but observed a more active use of UDL within the same context at a subsequent point, they selected the more aligned item on the scale. Fundamentally, the UDL-OMT was designed to be a dynamic observation tool. At any given time within a lesson/activity, it is possible that a UDL guideline/checkpoint may be actively applied (or situationally present within the environment but not applied; see instrument scale Table 1). Basham et al. (2020a) stated that, "The tool was not designed to be an instrument where the observer watched a classroom for an extended period of time and relied on memory to make a large number of judgments only at the conclusion of an observation" (p. 7). Mean scores for each section ([a] through [d]) were also calculated as well as the overall mean for the completed sections. The overall means covert to the ranges that can be found in Table 1. This scale changes within the instrument are based on the demarcations utilized in the observations conducted on the UDL-OMT study done by Basham et al. (2020a).

Inter-rater Reliability

To ensure inter-rater reliability (IRR) five videos (15%; Cohen, 1960; McHugh, 2012) were selected at random and were coded by a separate researcher. Both observers were previously trained on the UDL-OMT. We took the total number of agreements and divided by the total number of possible responses (n = 160), then multiplied by 100. This gave us an IRR score of .97 which is considered almost perfect (Cohen, 1960; McHugh, 2012).

Data Analysis

After 35 observations occurred, all data were independently coded and downloaded for analysis. To address the first research question, descriptive statistics were calculated to analyze whether UDL practices were apparent in pre-recorded videos of instruction. For instance, scores across the two core subjects and grade levels were averaged to see if the videos met the scoring criteria and at which level. Additionally, descriptive statistics were utilized to analyze individual items across observations. To the second research question, implementation level data were combined by grade level for ELA grades K-2, 3-5, 6-8, and 9-12 and then mean scores of the implementation level data were calculated to conduct an independent *t* test to see whether there were significant differences among the four groups. Finally, to answer the third research question, implementation level data were combined by grade level for Mathematics grade levels 3-5, 6-8, and 9-12 and then mean scores of the implementation level data were calculated to conduct an independent *t* test in efforts to see whether there were significant differences among the three groups. Mathematics grade level K-2 were intentionally omitted from the data analysis for Research Question 3 due to that subsection only having one video, thus nothing to combine for comparison.

CHAPTER 4

RESULTS

Research Questions

This study was designed to answer the following research questions:

1. Are Universal Design for Learning (UDL) aligned practices apparent in a state instructional video database used to train district personnel on observing quality instructional practices?
2. Does the level of UDL-aligned practice differ across K-12 grade levels in English Language Arts?
3. Does the level of UDL-aligned practice differ across 3-12 grade levels in Mathematics ?

Characteristics of Classrooms Observed

While using the UDL-OMT observers are asked to take an anecdotal record of what is occurring in the classroom context. Although this is study did not involve a n extensive analysis of these qualitative data, a description of what was observed overall across classrooms was provided to support a baseline understanding. For instance, students worked in predetermined partners in a few of the videos. These partners/groups shown on the videos of instruction appeared to demonstrate that students were sitting closest to one another. Furthermore, all students in each group were asked to do the same activity. Additionally, a large quantity of formative assessment was conducted, but only conducted in one way. There were limited options provided across all 35 videos of instruction.

Descriptive Statistics

All descriptive data provided are based on scores from the Universal Design for Learning

Observation Measurement Tool (UDL-OMT). The subsection means, standard deviations, and overall mean of the videos of instruction are presented in Table 2. As shown the overall mean score for all videos observed showed a *No Evidence of UDL* level of Universal Design for Learning (UDL) implementation (*M*= .23, *SD*= .06), indicating that UDL was not observed during these videos of instruction.

Differences in UDL Implementation Across Grade Levels

To answer Research Questions 2 and 3, a series of independent samples *t* tests were conducted in order to compare the differences between grade levels for English Language Arts (ELA) and Mathematics. The *t* test for ELA compared the following grade level groups: K-2 and 3-5, K-2 and 6-8, K-2 and 9-12, 3-5 and 6-8, 3-5 and 9-12, and 6-8 and 9-12. Next, the *t* test for Mathematics compared the following grade level groups: 3-5 and 6-8, 3-5 and 9-12, and 6-8 and 9-12. It should be stated again that grade levels K-2 Mathematics only had one video in the database, thus there was not a large enough sample size within that group to include in the tests. Below the results for those independent samples *t* tests are discussed.

English Language Arts. An independent samples *t* test was conducted to evaluate if there was a difference between grade levels K-2 and 3-5 in their ELA UDL implementation. There was no significant difference $t(11) = .18$, $p = .86$. Both grade levels K-2 (*M* = .39, *SD* = .36) and 3-5 (*M* = .34, *SD* = .37) scored in the *no evidence of UDL* level of implementation. The 95% confidence interval for the difference in means was quite slim, ranging from -.50 to .58.

Next, an independent samples *t* test was conducted to evaluate if there was a difference between grade levels K-2 and 6-8 in their ELA UDL implementation. Once again, there was no significant difference $t(6) = 1.10$, $p = .31$. Grade levels K-2 (*M* = .39, *SD* = .36) and 6-8 (*M* =.20, *SD* = .16) scored in the *no evidence of UDL* level of implementation. The 95% confidence interval for the difference in means was small, ranging from -.23 to .63.

The third independent samples *t* test was conducted to evaluate if there was a difference between grade levels K-2 and 9-12 in their ELA UDL implementation. These results indicated that there was no significant difference $t(5) = .85$, $p = .44$. Both grade levels scored in the *no evidence of UDL* range of implementation with 9-12 ($M = .21$, $SD = .18$). The 95% confidence interval for the difference in means was small, ranging from -.34 to .69.

The fourth independent samples *t* test was conducted to evaluate if there was a difference between grade levels 3-5 and 6-8 in their ELA UDL implementation. These results indicated no significant difference $t(13) = .84$, $p = .41$. As stated above, both of these grade levels indicated *no evidence of UDL* level of implementation. The 95% confidence interval for the difference in means ranged from -.23 to .54.

The fifth independent samples *t* test was conducted to evaluate if there was a difference between grade levels 3-5 and 9-12 in their ELA UDL implementation. This test indicated no significant difference between the two groups $t(12) = .63$, $p = .54$. The 95% confidence interval for the difference in means ranged from -.31 to .57.

The final independent samples *t* test conducted for ELA was to evaluate if there was a difference between grade levels 6-8 and 9-12 in their UDL implementation. This final test was also showed no significant difference $t(7) = -.21$, $p = .84$. The 95% confidence interval for the difference in means was small, ranging from -.28 to .24.

Mathematics. Three independent samples *t* test were conducted for the content area of Mathematics. The first independent-samples *t* test for Mathematics was conducted to evaluate if there was a difference between grade levels 3-5 and 6-8 in their UDL implementation. There was not a significant difference $t(4) = -.46$, $p = .67$. Grade levels 3-5 ($M = .31$, $SD = .21$) and 6-

8 (*M* = .42, *SD* = .35) both scored in the *no evidence of UDL* level of implementation. The 95% confidence interval for the difference in means was minimal, ranging from -.77 to .54.

Secondly, an independent samples *t* test was conducted to evaluate if there was a difference between grade levels 3-5 and 9-12 in their Mathematics UDL implementation. There was not a significant difference $t(11) = .32$, $p = .75$. Both grade levels scored at the *no evidence of UDL* level of implementation, 9-12 (*M* = .25, *SD* = .28). The 95% confidence interval for the difference in means was slim, ranging from -.33 to .45.

Finally, there was an independent samples *t* test conducted to evaluate if there was a difference between grade levels 6-8 and 9-12 in their Mathematics UDL implementation. The test indicated there was not a significant difference $t(11) = .86$, $p = .41$. As stated above both grade level score at the *no evidence of UDL* level of implementation. The 95% confidence interval for the difference in means was thin, ranging from -.26 to .59.

Individual Items Across the Observations

Introducing and Framing New Material. Findings from this study for *Introducing and Framing New Material indicated very low means for each item by item analysis* (see Table 3). A total of 17 videos included and were scored in this subsection of the UDL-OMT. This demonstrates that in almost all of the videos there was no introduction section where the goals were laid out explicitly for students, or the videographer did not record that part of instruction. The first item of the UDL-OMT measure provided observers with an opportunity to add information on the teachers' introduction to the lesson and the extent to which they established student understanding of learning or activity goals. For this item, the maximum score was a 2 (*Emergent)*, which means that the 5 times introduction did occur it occurred at the *Emergent* level of implementation, but the other 12 times this item was measured the score was either -1

(*Not Applicable*) or 0 (*No Evidence of UDL)*. This results demonstrates that 29% of the time the goal of the lesson or activity was observed being presented to students using more than a single strategy or tool.

Content Representation and Delivery. The subsection labeled *Content Representation and Delivery* has findings that indicate low means as well when doing an item by item analysis (see Table 4). For instance, the item "Does instruction support multiple levels of content understanding (e.g., novice, intermediate, expert)?" scored a .03 with a maximum score of 1 across all 33 videos. This means that when it came to representing information in ways that could be accessed by students of varying levels (e.g., novice, intermediate, expert), not a single instructional video attempted to explicitly meet those needs of the learners in the environment.

Expression of Understanding. Findings from the subsection *Expression of Understanding* demonstrated more promise than the other three sections of the UDL-OMT (see Table 5). Analyzing the scores item by item allows for the observation that there are multiple items (6) that 1 to 4 of the 35 videos scored a 2 indicating that UDL is occurring at the *Emergent* level of implementation within the environment. The items that had between 1 and 4 videos scored at this level are as follows: allows options for learners to express understanding in a variety of ways (ELA: n = 1; Mathematics: n = 2); provides access to a variety of options to allow students to express their understanding (ELA: n = 1; Mathematics: n = 3); builds competencies in use of multiple options for expressing their understanding (ELA: n = 1; Mathematics: n = 1); provides options that guide planning, strategy development, and/or goal-setting that promote expression of understanding (ELA: n = 1; Mathematics: n = 2); the environment facilitates management of information and resources to achieve the desired learning outcomes (ELA: n = 1; Mathematics: n = 0); and intentionally provides supports for students' problem solving and critical thinking abilities ((ELA: n = 0; Mathematics: n = 2). Although, these sections all had at least one video score a 2 in them, it is important to note that not one item had an overall mean above a .34, which still indicates that overall the videos of instruction showed a level of implementation at *No Evidence of UDL*.

Activity and Student Engagement. Findings from the subsection *Activity and Student Engagement* provided low means as well (see Table 6), showing that the item, "promotes learner choice and self-determination in engaging with the content" only had one instructional video (ELA) scored a 3 or *Dynamic, Interactive Implementation.* There were also some other areas where at least one video scored a 2 or *Emergent* implementation of UDL. Those items were the following: provides a variety of activities relevant to all learners (ELA: n = 1; Mathematics: n = 0); encourages learners' use of strategic planning to complete instructional tasks (ELA: n = 1; Mathematics: n = 2); encourages collaboration and communication among learners (ELA: n = 1; Mathematics: n = 8); provides formative progress monitoring and content checks (ELA: n = 0; Mathematics: n = 1); and provides closure that reiterates big ideas and instructional purposes (ELA: n = 1; Mathematics: n = 0). It is also important to note that one item had a maximum of 0 or *No Evidence of UDL* implementation, the item in this case was "promotes sustained effort and focus."

CHAPTER 5

DISCUSSION

This study sought to observe whether practices associated with Universal Design for Learning (UDL) existed in videos of business-as-usual (BAU) instruction in K-12 English Language Arts (ELA) and Mathematics classrooms. These videos were part of a statewide database to train personnel. The Universal Design for Learning Observation Measurement Tool (UDL-OMT; Basham et al., 2020b) was used to measure if and how instructional practices aligned to the UDL framework. Generally, it was found that UDL-aligned practices were not apparent in the videos of BAU classrooms. This finding held true across grade levels in both ELA and Mathematics instruction. Overall, the findings presented in this study begin to show the complexity of UDL implementation, and how it is far from "just part of teaching" as it was not naturally occurring in any of the 35 videos of instruction.

UDL presents a framework of instructional design that considers the variability of learners in a classroom when designing classroom environments, lessons, and materials (Rao, 2019). This framework seeks to target traditional ideas of instructional design geared toward the "average" student, claiming that teaching designed for homogenous groups contains implicit barriers to learning in both academic and social-emotional spheres (CAST, 2011). Instead of referring students who do not fit the mold to a separate classroom, UDL, at its core, values inclusion and proposes that instruction designed for the variety of learners in the classroom is a strength for all learners. The Individuals with Disabilities Education Act's (IDEA) requirement that students be educated in the least restrictive environment (LRE) means educators are obligated to continue pursuing effective instructional tools that allow access to the broadest range of learners as possible. UDL has gained national attention as both a paradigm and a set of guidelines to lower barriers to learning for the diversity of learners in our classrooms today.

Broadly, UDL embodies guide points for good teaching supported by an underlying philosophy that values diversity of learners and inclusion classrooms. Research demonstrates that UDL needs to be operationally defined (Smith et al., 2019) and its guidelines flushed out for educators and researchers to successfully implement the framework and determine benefits and areas to improve. Documents such as the UDL Guidelines by CAST (2018) offer concrete tools for implementation that can help teachers and researchers articulate specific methods to apply in implementing UDL. As educators in the field become practiced at defining and utilizing UDL, and the research base continues to grow and more concrete conclusions about the effectiveness of these practices on learning will be generated.

Characteristics of Classrooms Observed

Although these videos of instruction did not fall into the category of being UDL-based classrooms, it is important to discuss their characteristics to understand the different aspects of *No Evidence of UDL* classroom implementation. As stated earlier, a few of the videos showed students engaging in predetermined group or partnered work. With the exception of two videos, these partners seemed to be those located closest to each other (e.g., a pod of desks). Most of the time students were not allowed to choose their partner. This could have been done for classroom management purposes. Moreover, within groups all students were tasked with the same activity. There was no planning for variability in how these students were being assessed and videos across the sample consistently demonstrated that not all students were ready to engage with the content at the required level at the time of the recording as evidenced by students' stated confusion related to the task at hand.

Additionally, there were a large quantity of formative assessments occurring during these recordings. Formative assessment is an important part of UDL implementation and should be done in a variety of ways. However, because the formative assessments used were not varied, typically done in a verbal question/answer format, they still scored a zero in that area. A fundamental takeaway from all these videos of instruction is that options need to be provided before these classrooms can be considered UDL-aligned environments.

The Need for Digital Technology in the Classroom

The two highest rated classrooms, while still low scoring, both utilized modern digital technology. In the two classrooms that utilized modern technological devices (e.g., computers, iPads, laptops), the teachers provided options for how students could express their understanding and engage with the content. Teachers provided at least two avenues for their students to achieve the overall target of the day and allowed students to collaborate in predetermined groups. While the relation and practice is not known, Edyburn (2010) argued technology supports the implementation of UDL because it supports the accessibility and flexibility in these environments.

Implications for Future Research and Teaching

Although the results from this study do not include settings that were designed around UDL, future research should utilize the UDL-OMT in classrooms that are UDL-based. This line of research would provide the opportunity to maximize all the tool has to offer in way of measuring the level of UDL implementation. Additionally, infusing knowledge of UDL and developing pre- and in-service teachers' skills in preparation programs and within in-school professional development trainings, then implementation of UDL has the potential to be purposeful and recognized by the person implementing and evaluating (Edyburn, 2010).

Furthermore, this preparation and professional development could enhance teachers' understanding of their critical role as the designer of student learning, consistent with the Understanding by Design (UbD) framework due to its backward design nature (ASCD, 2005; McTighe & Wiggins, 1999). With this knowledge teachers would be enabled to ensure their instruction is deepening student understanding while providing them with complex and authentic opportunities to explain, interpret, apply, shift perspective, empathize, and self-assess (ASCD, 2005). The results of this study also contribute to the foundational understanding of UDL developed in the late 1990s and provides some evidence of the alignment of UDL and instructional practices and differences across grade levels and subject areas (i.e., English Language Arts, Mathematics). However, given these preliminary findings, it is important to recognize the dearth of research to fully understand UDL implementation in real context and plan for exploring UDL implementation in full partnership with stakeholders (e.g., general educators, special educators, administrators, students).

Intentionally planning for learner variability is considered one of the key components of UDL (Smith et al., 2019). Because the videos did not set out with the intention to plan for the variability of the learners in the environment, they cannot be considered UDL. There is a challenge in observing whether teachers intentionally plan for variability, unless the teacher is interviewed prior to or after the lesson there is no way of knowing. There is more research needed to find a way to include teachers' input to inform observers of their intentions when planning, as a part of the UDL-OMT evaluation process.

The UDL-OMT is a tool that was created as a means to support ongoing observation in environments supporting UDL implementation; however, as utilized in this study, the tool could be used to analyze classrooms that are not supporting UDL implementation for further analysis of what UDL-aligned practices do and do not look like in the classroom. This is especially critical for researchers attempting to train new teachers or pre-service teachers in UDL implementation. The new or pre-service teachers could be evaluated using the UDL-OMT to create individual baseline levels of implementation, undergo a plethora of trainings in UDL implementation, and use the instrument again to measure growth and/or improvement in the use of UDL-aligned practices or strategies. This would reinforce the idea that the UDL-OMT may be better used to measure changes over time rather than a single summative evaluation (Basham et al., 2020a). Furthermore, the primary researcher supports the notion that if the instrument is being utilized to measure UDL implementation, multiple observations should be performed over the entirety of a lesson. To continue, this should cover different days, times, and varied activities, enabling the instrument's ability to truly gauge UDL's implementation by one teacher (Basham et al., 2020a). Hence, future research using videos of instruction should try to find multiple videos of a single teacher across multiple days and during multiple different components of the entire lesson. This would allow the individual evaluating to have a better picture of all the practices being implemented in that teacher's classroom and whether or not those practices align to the UDL framework.

The UDL-OMT looks at implementation from a holistic approach. This can create issues when analyzing fidelity of implementation because the instrument does not look at discrete evidence that supports the validity of the specific guidelines and/or checkpoints within the framework (Basham et at., 2020a). Future research should aim to break down the UDL-OMT into its individual subsections and attempt to provide explicit examples of what each item should look like to improve the instrument and design characteristics for a plethora of learning environments that are UDL-aligned (Basham et al., 2020a; Cook & Rao, 2018). Thus, engaging in these research activities would provide a more accurate picture of what UDL looks like in action and a shared understanding.

In Basham et al. (2020a), observers were free to move about the classroom; however, these observations were focused on the view from the perspective of the camera lens and tied to what was on screen. Future research should also take into consideration the observer's ability to move freely and question students/teachers before, during, and after the observation. These questions could lead to an explanation of specific behaviors by students and teachers and provide a more in-depth analysis of the teacher's UDL implementation. There may be weight to having follow up procedures that will enable observers to clarify or refine their initial assessment and reflect on their interpretation of the observed UDL implementation (Basham et al., 2020a; Smith et al., 2019) and possibly change the teacher's overall rating.

Limitations

As this was an initial pilot study to a much larger study, there are numerous limitations to consider. First, a limited number of videos of instruction were observed. None of the classrooms were consider UDL-based classrooms, and if this study were to be replicated, videos of instruction of UDL-based classrooms should be utilized and observers should be supported by a more in-depth training on what each component of the tool looks like in the classroom. This could assist in further analyzing the reliability of the instrument. Second, although face-to-face observations would have been preferred, due to COVID-19, all observations were done through watching videos of instruction to maintain the safety of the researchers and school participants (e.g., students, teachers). Therefore, there were restrictions in the extent to which an in-depth analysis of the overall environment could be included s the primary and secondary researchers could only score what the camera showed them, which inhibited the primary researcher and the secondary scorer to have a full understanding of what strategies were represented in the environment but were not explicitly pointed out by the teacher. This directly led to the third limitation of our ability to use a score of 1 or *Pre-emergent* in cases where if we were located in live classrooms conducting observations, as done in the Basham at al. (2020a) study, we could have had a better understanding of the environment. Only being able to see what the camera showed also limited our ability to accurately measure engagement levels. Fourth, these videos were posted between the years 2015 and 2016, thus making them four to five years old which does not give an accurate representation of today's current classroom environments. Additionally, not all of the videos lasted the same amount of time as video length ranged from 11 to 61 minutes long. Due to the videos being of varying lengths of time, not all videos captured all components of instruction (e.g., introduction and framing of new materials, representation and delivery of content). Fifth, there were some limitations associated with the UDL-OMT tool. For instance, section B1 had an item posed the question, "Does the environment or instruction supported multiple levels of content understanding (e.g., novice, intermediate, expert)?" This statement is quite similar to section D1's question, "Does the environment or instruction support multiple levels of challenge?" The inclusion of questions that seemed similar appeared to be unnecessary, however, if you scored one statement a 2, then you automatically had to score the other section's statement a 2 as well because the statements are essentially asking the same thing. Finally, a relevant limitation due to these being pre-recorded videos of instruction was that the researchers were unable to collect demographic data on the teachers. Had this information been provided (as it would have been if the observations were face-to-face), then we could have analyzed if certain characteristics of teachers predicted the style in which they were going to design their instruction/environment and/or their level of UDL implementation.

Conclusion

As reported in this study, UDL does not naturally occur consistently enough in classrooms to be considered UDL-aligned, based on the UDL-OMT scores obtained on instructional video observations. However, Basham and colleagues (2020a) believe that in its current form the UDL-OMT should be used as a formative assessment, where multiple individuals use the instrument to discuss and develop a better understanding of UDL-aligned instructional practices. As stated earlier, the instrument could be utilized by non-implementers to measure their baseline of implementation, complete professional development or take the online professional development provided by CAST (2018) and continue to use the tool to measure their improvement/growth toward having a classroom that is UDL-based. To advance further understanding in UDL implementation, it is necessary for educators and researchers to recognize practices aligned with the framework. Additionally, it is critical to develop a better understanding whether UDL is simply part of BAU teaching practices or something separate, as identified in this initial study. If UDL is something novel and valued in education, then educators must be supported in both understanding and implementing the framework in real contexts.

References

Abell, M. M., Jung, E., & Taylor, M. (2011). Students' perceptions of classroom instructional environments in the context of 'Universal Design for Learning.' *Learning Environments Research, 14*(2), 171. https://doi.org/10.1007/s10984-011-9090-2

Acrey, C., Johnstone, C., & Milligan, C. (2005). Using universal design to unlock the potential for academic achievement of at-risk learners. *Teaching Exceptional Children, 38*(2), 22-31.

Adams, G., & Carnine, D. (2003). Direct instruction. *Handbook of learning disabilities*, 403-416.

Al-Azawei, A., Serenelli, F., & Lundqvist, K. (2016). Universal design for learning (UDL): A content analysis of peer reviewed journals from 2012 to 2015. *Journal of the Scholarship of Teaching and Learning, 16*(3), 39–56. https://doi.org/10.14434/josotl.v16i3.19295

Basham, J. D., Blackorby, J. (2020). UDL next: The future of the framework. *Critical Issues in Universal Design for Learning.* Oviedo, FL: Knowledge by Design.

Basham, J. D., Gardner, J. E., Smith, S. (2020a). Measuring the implementation of UDL in classrooms and schools: Initial field test results. *Remedial and Special Education, 00*(0), 1-13. https://doi.org/10.1177/0741932520908015

Basham, J. D., Gardner, J. E., Smith, S. (2020b). Universal design for learning observation measurement tool (UDL-OMT; Version 1.0).

Basham, J. D., Israel, M., Graden, J., Poth, R., & Winston, M. (2010). A comprehensive approach to RTI: Embedding universal design for learning and technology. *Learning Disability Quarterly*, *33*(4), 243–255. https://doi.org/10.1177/073194871003300403

Basham, J. D., & Marino, M. T. (2013). Understanding STEM education and supporting students through universal design for learning. *Teaching Exceptional Children*, *45*(4), 8–15.

Basham, J. D., Smith, S. J., & Satter, A. L. (2016). Universal design for learning: Scanning for alignment in K-12 blended and fully online learning materials. Journal of Special Education Technology, 31(3), 147-155. https://doi.org/10.1177/0162643416660836

Baslanti, U. (2006). Challenges in preparing tomorrow's teachers to use technology: Lessons to be learned from research. *Online Submission*, *5*(1).

Benton-Borghi, B. H. (2013). A universally designed for learning (UDL) infused technological pedagogical content knowledge (TPACK) practitioners' model essential for teacher preparation in the 21st century. *Journal of Educational Computing Research*, *48*(2), 245–265. https://doi.org/10.2190/EC.48.2.g

Browder, D., Mims, P., Spooner, F., Ahlgrim-Delzell, L., & Lee, A. (2008). Teaching elementary students with multiple disabilities to participate in shared stories. *Research & Practice for Persons with Severe Disabilities, 33*(1-2), 3-12.

Burgstahler, S. E. (2008). Universal design in higher education. In S. E. Burgstahler & R. C. Cory (Eds.), *Universal design in higher education: From principles to practice* (pp. 3-20). Cambridge, MA: Harvard Education Press.

Burgstahler, S., & Cory, R. (2008). *Universal design in higher education: From principles to practice.* Cambridge, MA: Harvard Education Press.

CAST. (2011a). *CAST Timeline: One mission, many innovations, 1984-2010.* (Web Page). Wakefield, MA: CAST. Retrieved from http://www.cast.org/about/timeline/

CAST. (2011b). UDL guidelines - educator checklist version 2. Retrieved from https://wvde.state.wv.us/osp/UDL/7.%20UDL%20Guidelines%20Checklist.pdf

CAST. (2011c). *UDL questions and answers* (Web Page). Wakefield, MA: CAST. Retrieved from http://www.cast.org/udl/faq/index.html

CAST. (2015). UDL in the ESSA. Retrieved from http://www.cast.org/whats-new/news/2016/udl-in-the-essa.html#essa

CAST. (2018). Universal design for learning guidelines version 2.2. Retrieved from http://udlguidelines.cast.org

Cohen J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, 20(1), 37–46.

Cook, S. C., Rao, K. (2018) Systematically applying UDL to effective practices for students with learning disabilities. *Learning Disability Quarterly, 41*(3), 179-191. https://doi.org/10.1177/0731948717749936

Council for Exceptional Children. (2011). New guidelines for universal design for learning provide a roadmap for educators and educational publishers (Web Page). Retrieved October 13, 2011 from http://www.cec.sped.org/AM/Template.cfm?Section=Home&CAT=none&CONTENTID=10573&TEMPLATE=/CM/ContentDisplay.cfm

Corno, L., & Snow, R. E. (1986). Adapting teaching to individual differences among learners. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed.) (pp. 605–629). New York: Macmillan.

Cortina, J. M. (1993). What is coefficient alpha? An examination of theory and applications. *Journal of Applied Psychology*, *78*(1), 98–104.

Coyne, P., Evans, M., & Karger, J. (2017). Use of a UDL literacy environment by middle school students with intellectual and developmental disabilities. *Intellectual and Developmental Disabilities*, *55*(1), 4–14. https://doi.org/10.1352/1934-9556-55.1.4

Coyne, P., Pisha, B., Dalton, B., Zeph, L. A., & Smith, N. C. (2012). Literacy by design: A universal design for learning approach for students with significant intellectual disabilities. *Remedial and Special Education*, *33*(3), 162–172. https://doi.org/10.1177/0741932510381651

Crane, A., Aust, R., Lee, Y., Rury, J., Branham, R., & Eckersley, M. (2018). Exploring best practices for implementing design thinking processes in K12 education (Unpublished doctoral dissertation). University of Kansas: Lawrence, KS.

Cuban, L. (2003). *How to ensure ed/tech is not oversold and underused*. Scarecrow Press.

Cuban, L. (2009). *Oversold and underused*. Harvard university press.

Dalton, B. D., Herbert, M., & Deysher, S. (2003, December). Scaffolding students' response to digital literature with embedded strategy supports: The role of audio-recording vs. writing student response options. Paper presented at the 53rd Annual Meeting of the National Reading Conference, Scottsdale, AZ.

Davis, N., Kirkman, C., Tearle, P., Taylor, C., & Wright, B., (1996). Developing teachers and their institutions for IT in education: An integrated approach. *Journal of Technology and Teacher Education (4)*1 3-18.

Dolan, B. (2000). Universal design for learning. *Journal of Special Education Technology; Norman*, *15*(4), 47.

Dolan, R., Hall, T. E., Banerjee, M., Chun, E., & Strangman, N. (2005). Applying principles of universal design to test delivery: The effect of computer-based read-aloud on test performance of high school students with learning disabilities. *The Journal of Technology, Learning and Assessment*, *3*(7). Retrieved from https://ejournals.bc.edu/index.php/jtla/article/view/1660

Dwyer, D. C., Ringstaff, C., Haymore, J., & Sandholtz, P. D. (1994). Apple classrooms of tomorrow. *Educational leadership*, *51*(7), 4-10.

Dymond, S., Renzaglia, A., Rosenstein, A., Eul, J. C., Banks, R., Niswander, V., & Gilson, C. (2006). Using a participatory action research approach to create a universally designed inclusive high school science course: a case study. *Research & Practice for Persons with Severe Disabilities, 31*(4), 293-308.

EdTech Staff. (2018, February 12). What is a modern learning environment? In *EdTech: Focus on K-12*. Retrieved from https://edtechmagazine.com/k12/article/2018/02/what-modern-learning-environment

Edyburn, D. (2005). Universal design for learning. *Special Education Technology Practice, 7*(5), 16-22.

Edyburn, D. L. (2008). A new paradigm for instructional materials. *Journal of Special Education Technology*, *23*(4), 62–65.

Edyburn, D. L. (2013). Critical issues in advancing the special education technology evidence base. *Exceptional Children*, *80*(1), 7–24.

Edyburn, D.L. (2010). Would you recognize universal design for learning if you saw it? Ten propositions for new directions for the second decade of UDL. *Learning Disability Quarterly*, *33*(1), 33–41. doi:10.1177/073194871003300103

Erlandson, R. (2002). Universal design for learning: Curriculum, technology, and accessibility. Norfolk, VA: Associaltion for the Advancement of Computing in Education (AACE).

Flores, M. M., & Ganz, J. B. (2014). Comparison of direct instruction and discrete trial teaching on the curriculum-based assessment of language performance of students with autism. *Exceptionality*, *22*(4), 191-204.

Friesen, S. (2008). Raising the floor and lifting the ceiling: Math for all. *Education Canada, 48*(5), 50-54.

Gargiulo, R., & Metcalf, D. (2013). *Teaching in today's inclusive classrooms: A universal design for learning approach* (2nd ed.)Belmont, CA: Wadsworth Publishing.

Gradel, K., & Edson, A. (2009). Putting universal design for learning on the higher ed agenda. *Journal of Educational Technology Systems, 38*(2), 111-121. doi: 10.2190/ET.38.2.d

Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content knowledge (TPACK). *Computers & Education*, *57*(3), 1953–1960. https://doi.org/10.1016/j.compedu.2011.04.010

Greenwood, C., Hart, B., Walker, D., & Risley, T. (1994). The opportunity to respond and academic performance revisited: A behavioral theory of developmental retardation and its prevention. In R. Gardner III, D. Sainato, J. Cooper, T. Heron, W. Heward, J. Eshleman & T. Grossi (Eds.), *Behavior Analysis in Education: Focus on Measurably Superior Instruction* (pp. 213-223). Pacific Grove, CA: Brooks/Cole.

Hallgren K. A. (2012). Computing inter-rater reliability for observational data: An overview and tutorial. *Tutorials in quantitative methods for psychology*, *8*(1), 23–34. https://doi.org/10.20982/tqmp.08.1.p023

Handle, V. (2004). Universal instructional design and world languages. *Equity & Excellence in Education, 37*, 161-166. doi: 10.1080/10665680490454039

Hehir, T. (2009). Policy foundations of universal design for learning. In D.T. Gordon, J.W. Gravel & L.A. Schifter (Eds.). *A Policy Reader in Universal Design for Learning*, 34-45. Retrieved from http://www.udlcenter.org/resource_library/articles/policy_foundations_of_udl

Hetzroni, O. E., & Shrieber, B. (2004). Word processing as an assistive technology tool for enhancing academic outcomes of students with writing disabilities in the general classroom. *Journal of Learning Disabilities, 37*(2), 143-154.

Hitchcock, C., & Stahl, S. (2003). Assistive technology, universal design, universal design for learning: Improved learning opportunities. *Journal of Special Education Technology*, *18*(4), 45–52. https://doi.org/10.1177/016264340301800404

Howard, K. (2004). Universal design for learning: Meeting the needs of all students. *Learning & Leading with Technology, 31*(5), 26-29.

Hunt, J., & Andreasen, J. (2011). Making the most of universal design for learning. *Mathematics Teaching in the Middle School, 17*(3), 166-172.

Johnson, G., Gersten, R., & Carnine, D. (1987). Effects of instructional design variables on vocabulary acquisition of LD students: A study of computer-assisted instruction. *Journal of Learning Disabilities*, *20*(4), 206-213

Johnstone, C. (2003). Improving validity of large-scale tests: Universal design and student performance (Technical Report 37). Minneapolis, MN: University of Minnesota, National Center of Educational Outcomes.

King-Sears, M. (2009). Universal design for learning: Technology and pedagogy. *Learning Disability Quarterly*, *32*(4), 199–201. https://doi.org/10.2307/27740372

Koehler, M. (2012, September 24). TPACK explained. In *TPACK ORG*. Retrieved from http://tpack.org/

Kortering, L., McClannon, T., & Braziel, P. (2008). Universal design for learning: A look at what algebra and biology students with and without high incidence conditions are saying. *Remedial and Special Education, 29*(6), 352-363. doi: 10.1177/0741932507314020

Lange, A. A., McPhillips, M., Mulhern, G., & Wylie, J. (2006). Assistive software tools for secondary-level students with literacy difficulties. *Journal of Special Education Technology, 21*(3), 13-22.

Lehtonen, M., Page, T., Thorsteinsson, G., & Hepburn, M. (2007). An application of a virtual learning environment in support of teaching and learning for design and technology education. *International Journal of Learning Technology, 3*(2), 133-151.

Lieberman, L., Lytle, R., & Clarcq, J. (2008). Getting it right from the start: Employing the universal design for learning approach to your curriculum. *Journal of Physical Education, Recreation, & Dance, 79*(2), 32-39.

Lowrey, K. A., Hollingshead, A., Howery, K., & Bishop, J. B. (2017). More than one way: Stories of UDL and inclusive classrooms. *Research and Practice for Persons with Severe Disabilities*, *42*(4), 225–242. https://doi.org/10.1177/1540796917711668

Marino, M. (2009). Understanding how adolescents with reading difficulties utilize technology-based tools. *Exceptionality, 17*, 88-102. doi: 10.1080/09362830902805848

McCoy, K., & Radar, M. (2007). Differentiated instruction in the classroom and technology lab: Back to the one-room schoolhouse. *Journal of Applied Research for Business Instruction, 5*(1), 1-6.

McGuire, J. M., Scott, S. S., & Shaw, S. F. (2006). Universal design and its applications in educational environments. *Remedial and Special Education*, *27*(3), 166–175. https://doi.org/10.1177/07419325060270030501

McGuire-Schwartz, M. E., & Arndt, J. S. (2007). Transforming universal design for learning in early childhood teacher education from college classroom to early childhood classroom. *Journal of Early Childhood Teacher Education*, *28*(2), 127–139. https://doi.org/10.1080/10901020701366707

McHugh, M. (2012). Interrater reliability: The kappa statistic. *Biochemia Medica, 22*(3), 276-282.

McPherson, S. (2009). A dance with the butterflies: A metamorphosis of teaching and learning through technology. *Early Childhood Education Journal, 37*, 220-236. doi: 10.1007/s10643-009-0338-8

Meo, G. (2008). Curriculum planning for all learners: Applying universal design for learning (UDL) to a high school reading comprehension program. *Preventing School Failure: Alternative Education for Children and Youth*, *52*(2), 21–30. https://doi.org/10.3200/PSFL.52.2.21-30

Meyer, A., Rose, D. H., & Gordon, D. T. (2014). *Universal design for learning: Theory and practice*. CAST Professional Publishing.

Mishra, P. & Koehler, M.J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054. Retrieved August 16, 2019 from https://www.learntechlib.org/p/99246/.

Koehler, M. J., & Mishra, P. (2009). What is technological pedagogical content knowledge? *Contemporary Issues in Technology and Teacher Education*, *9*(1), 60-70.

Mace, R. L., Hardie, G. J., & Place, J. P. (1991). Accessible environment: Toward universal design.[On-line].

Magliaro, S. G., Lockee, B. B., & Burton, J. K. (2005). Direct instruction revisited: A key model for instructional technology. *Educational technology research and development*, *53*(4), 41-55.

McTighe, J., & Wiggins, G. (1999). *The understanding by design handbook*. ASCD.

Morra, T., & Reynolds, J. (2010). Universal design for learning: Application for technology enhanced learning. *Inquiry, 15*(1), 43-51.

Morrissey, K. (2008). *The effects of universal design for learning as a secondary support on student behaviors and academic achievement in an urban high school implementing primary level positive behavior support.* (Doctor of Philosophy), Loyola University Chicago. (3332361)

Niess, M., Van Zee, E., & Gillow-Wiles, H. (2011). Knowledge growth in teaching mathematics/science with spreadsheets: Moving PCK to TPACK through online professional development. *Journal of Digital Learning in Teacher Education, 27*(2), 42-52.

Noblitt, L., Vance, D. E., Smith, M. (2010). A comparison of case study and traditional teaching methods for improvements of oral communication and critical-thinking skills. *Journal of College Science Teaching, 39*(5), 26-32.

O'Donnell, A. M. (2006). The role of peers and group learning. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (pp. 781-802). Mahwah, NJ, US: Lawrence Erlbaum Associates Publishers.

Ofiesh, N., Rojas, C., & Ward, R. (2006). Universal design and the assessment of student learning in higher education: Promoting thoughtful assessment. *Journal of Postsecondary Education and Disability, 19*(2), 173-181.

Ok, M. W., Rao, K., Bryant, B. R., & McDougall, D. (2017). Universal design for learning in pre-K to grade 12 classrooms: A systematic review of research. *Exceptionality*, *25*(2), 116–138. https://doi.org/10.1080/09362835.2016.1196450

Okolo, C., Englert, C., Bouck, E., Heutsche, A., & Wang, H. (2011). The virtual history museum: Learning U.S. history in diverse eighth grade classrooms. *Remedial and Special Education, 32*(5), 417-428. doi: 10.1177/0741932510362241

Orkwis, R., & McLane, K. (1998). A curriculum every student can use: Design principles for student access *ERIC-OSEP Topical Brief*. Reston, VA: ERIC-OSEP Special Project, Council for Exceptional Children.

Owston, R. D. (1997). Research news and comment: The world wide web: A technology to enhance teaching and learning? *Educational researcher*, *26*(2), 27-33.

Papert, S. (1993). *The children's machine: Rethinking school in the age of the computer*. New York, NY: Basic Books.

Pisha, B., & Coyne, P. (2001). Smart from the start: The promise of universal design for learning. *Remedial and Special Education*, *22*(4), 197–203. https://doi.org/10.1177/074193250102200402

Proctor, P., Dalton, B., & Grisham, D. (2007). Scaffolding english language learners and struggling readers in a universal literacy environment with embedded strategy instruction and vocabulary support. *Journal of Literacy Research 39*(1), 71-93.

Ralabate, P., Hehir, T., Dodd, E., Grindal, T., Vue, G., Eidelman, H., Karger, J., Smith, F., & Carlisle, A. (2012). *Universal design for learning: Initiatives on the move: Understanding the impact of the Race to the Top and ARRA funding on the promotion of universal design for learning*. Wakefield, MA: National Center on Universal Design for Learning.

Rands, M. L., Gansemer-Topf, A. M. (2017). The room itself is active: How classroom design impacts student engagement. *Journal of Learning Spaces, 6*, 26-33.

Rao, K. (2019). Instructional design with UDL: Addressing learner variability in college courses. In S. Bracken & K. Novak (Eds.), *Transforming higher education through Universal Design for Learning: An international perspective*.

Rao, K., Ok, M. W., & Bryant, B. R. (2014). A review of research on universal design educational models. *Remedial and Special Education*, *35*(3), 153–166. https://doi.org/10.1177/0741932513518980

Rappolt-Schlichtmann, G., Daley, S. G., Lim, S., Lapinski, S., Robinson, K. H., & Johnson, M. (2013). Universal design for learning and elementary school science: Exploring the efficacy, use, and perceptions of a web-based science notebook. *Journal of Educational Psychology*, *105*(4), 1210–1225. http://dx.doi.org.www2.lib.ku.edu/10.1037/a0033217

Rose, D. (2001). Universal design for learning. *Journal of Special Education Technology*, *16*(3), 57–58. https://doi.org/10.1177/016264340101600308

Rose, D.H., and Meyer, A. (2002). *Teaching every student in the digital age: Universal Design for Learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Rose, D., & Meyer, A. (2009). *A practical reader in universal design for learning* Cambridge, MA: Harvard Education Press.

Rose, D. H., & Strangman, N. (2007). Universal design for learning: Meeting the challenge of individual learning differences through a neurocognitive perspective. *Universal Access in the Information Society; Heidelberg*, *5*(4), 381–391. http://dx.doi.org.www2.lib.ku.edu/10.1007/s10209-006-0062-8

Schelly, C., Davies, P., & Spooner, C. (2011). Student perceptions of faculty implementation of universal design for learning. *Journal of Postsecondary Education and Disability, 24*(1), 17-30.

Scott, S., McGuire, J., & Foley, T. (2003). Universal design for instruction: A framework for anticipating and responding to disability and other diverse learning needs in the college classroom. *Equity & Excellence in Education, 36*(1), 40-49. doi: 10.1080/10665680390210148

Scott, S., McGuire, J., & Shaw, S. (2003). Universal design for instruction: A new paradigm for adult instruction in postsecondary education. *Remedial and Special Education, 24*(6), 369-379.

Shulman, L. (1986). Those who understand: Knowledge growth in teaching. *Educational Researcher, 15*(2), 4-14.

Shulman, L. S. (1987). Knowledge and teaching: Foundations of the new reform. *Harvard Educational Review, 57*(1), 1-22.

Skerbetz, M. D., & Kostewicz, D. E. (2013). Academic choice for included students with emotional and behavioral disorders. *Preventing School Failure: Alternative Education for Children and Youth, 57*(4), 212–222. https://doi.org/10.1080/1045988X.2012.701252

Skerbetz, M. D., & Kostewicz, D. E. (2015). Consequence choice and students with emotional and behavioral disabilities: Effects on academic engagement. *Exceptionality, 23*(1), 14–33. https://doi.org/10.1080/09362835.2014.986603

Song, Y. (2014). "Bring your own device (BYOD)" for seamless science inquiry in a primary school. *Computers & Education, 74*, 50-60. https://doi.org/10.1016/j.compedu.2014.01.005

Sousa, D. A. (Ed.). (2010). *Mind, brain, & education: Neuroscience implications for the classroom*. Solution Tree Press.

Spooner, F., Baker, J., Harris, A., Ahlgrim-Delzell, L., & Browder, D. (2007). Effects of training in universal design for learning on lesson plan development. *Remedial and Special Education, 28*(2), 108-116.

Sporns, O. (2010). *Networks of the Brain*. MIT press.

Stock, S., Davies, D., & Wehmeyer, M. (2004). Internet-based multimedia tests and surveys for individuals with intellectual disabilities. *Journal of Special Education Technology, 19*(4), 43-47.

Story, M. F., Mueller, J. L., & Mace, R. L. (1998). The universal design file: Designing for people of all ages and abilities.

Thompson, A. D., & Mishra, P. (2007). Breaking news: TPCK becomes TPACK! *Journal of Computing in Teacher Education*, *24*(2), 38-64.

Tobias, S. (1982). When do instructional methods make a difference? *Educational Researcher*, 11, 4–10.

Tokuhama-Espinosa, T. (2010). *Mind, brain, and education science: A comprehensive guide to the new brain-based teaching*. WW Norton & Company: New York, NY.

UDL-IRN. (2011a). Critical elements of UDL in instruction (Version 1.2), from http://udl-irn.org

UDL-IRN. (2011b). UDL in the instructional process (Version 1.0), from http://udl-irn.org

Walker, A., Recker, M., Robertshaw, M., Osen, J., Leary, H., Ye, L., & Sellers, L. (2011). Integrating technology and problem-based learning: A mixed methods study of two teacher professional development designs. *Interdisciplinary Journal of Problem-based Learning, 5*(2), 70-94.

Wiggins, G., Wiggins, G. P., & McTighe, J. (2005). *Understanding by design*. ASCD.

Wong, L. H., Looi, C. K. (2011). What seams do we remove in mobile-assisted seamless learning? A critical review of the literature. *Computers & Education, 57,* 2364-2381.

Table 1

UDL-OMT Overall Mean Score Ranges and Definitions

Label	Score Range	Definition
No or Low Occurrence	0-.5	UDL is not occurring in this environment.
Pre-Emergent	.6-1.5	UDL was not directly observed, however, the environment is primed for UDL.
Emergent	1.6-2.3	UDL was observed, but it was not necessarily applied consistently during the observation. This implementation is likely not sustainable over long periods of time.
Ideal Implementation	2.4-3.0	UDL was obvious and being consistently implemented through sustainable practices

Note. UDL-OMT= Universal Design for Learning Observation Measurement Tool

Table 2

UDL-OMT Means and Standard Deviations for Subsection, and Overall Mean

Section	*M*	*SD*
Introduction and Framing New Material	.35	.09
Content Representation and Delivery	.29	.08
Expression of Understanding	.15	.07
Activity and Student Engagement	.16	.05
Overall Mean	.23	.06

Note. UDL-OMT= Universal Design for Learning Observation Measurement Tool

Table 3

Individual Items Across the Observations for Introducing and Framing New Material

Item Number	Item	Number of Responses	*M*	*SD*
1	Establishes student understanding of learning or activity goals	17	.65	.93
2	Establishes student understanding for how to be successful in the learning or activity.	20	.85	.93
3	Activates or supplies background knowledge.	19	.26	.45
4	Highlights what is important for students to learn and/or do.	16	.38	.50
5	Supports understanding of big ideas and critical concepts.	21	.33	.48
6	Uses questions that support understanding of inquiry.	25	.28	.46
7	Identifies potential misunderstandings/misconceptions.	15	.20	.41

Note. Number of Responses is out of 40 possible responses.

Table 4

Individual Items Across the Observations for Content Representation and Delivery

Item Number	Item	Number of Responses	*M*	*SD*
8	Supports multiple levels of content understanding (e.g., novice, intermediate, experts).	37	.03	.16
9	Presentation of information allows for customization/flexibility.	37	.24	.64
10	Instruction allows alternatives for visual display of information.	38	.39	.68
11	Instruction allows alternatives for auditory information.	38	.66	.85
12	Supports options for multiple languages.	3	.00	.00
13	Supports understanding of relationships across disciplines, settings, or concepts.	26	.23	.51
14	Clarifies content-specific vocabulary, symbols, and jargon.	32	.47	.57
15	Clarifies content-specific based syntax and structure.	23	.22	.51
16	Highlights options for self-directed clarification of vocabulary and symbols.	20	.30	.73

Note. Number of Responses is out of 40 possible responses.

Table 5

Individual Items Across Observations for Expression of Understanding

Item Number	Item	Number of Responses	*M*	*SD*
17	Allows options for learners to express their understanding.	39	.26	.64
18	Provides access to a variety of options to allow students to express their understanding.	39	.26	.64
19	Builds competencies in use of multiple options for expressing their understanding.	38	.16	.50
20	Provides options that guide options to plan, develop strategy, and/or goal-setting that promotes expression of understanding.	36	.22	.60
21	The environment facilitates management of information and resources to achieve the desired learning outcomes.	37	.11	.39
22	Intentionally provides supports for students' problem-solving and critical thinking abilities.	36	.33	.63
23	Facilitates students self-monitoring of progress.	38	.21	.41

Note. Number of Responses is out of 40 possible responses.

Table 6

Individual Items Across Observations for Activity and Student Engagement

Item Number	Item	Number of Responses	*M*	*SD*
24	Promotes learner choice and self-determination in engaging with the content.	40	.38	.81
25	Provides a variety of activities relevant to all learners.	40	.05	.32
26	Promotes sustained effort and focus.	38	.00	.00
27	Encourages learners' use of strategic planning to complete instructional tasks.	39	.26	.60
28	Encourages collaboration and communication among learners.	38	.68	.90
29	Supports multiple levels of challenge.	40	.00	.00
30	Provides for self-reflection and assessment.	39	.03	.16
31	Provides formative progress monitoring and content checks.	40	.30	.51
32	Provides closure that reiterates big ideas and instructional purposes.	38	.11	.39

Note. Number of Responses is out of 40 possible responses.

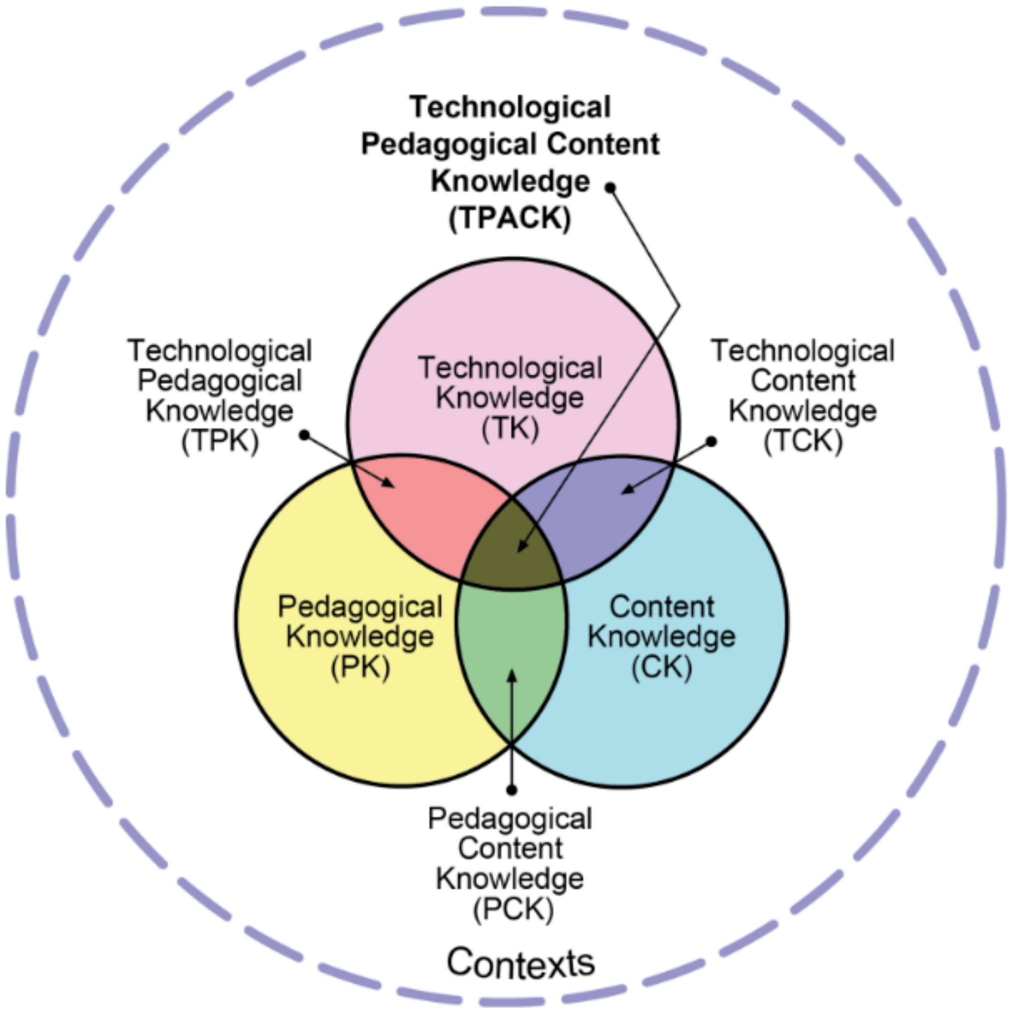

Figure 1. TPACK (Source: http://tpack.org)

APPENDIX A
Universal Design for Learning
Observation Measurement Tool (UDL-OMT)
Version 1.0 (3/09/2020)

Description: This instrument has been designed to measure the implementation of Universal Design for Learning (UDL) within instructional sessions. The directions provide general use guidelines. Those with questions are encouraged to contact the instruments developers. Observers should be familiar with UDL and the UDL framework as well as the rating scale used on this tool. For information on UDL see http://www.udlcenter.org/ as well as the UDL Critical Elements (see https://udl-irn.org/home/udl-resources/). The UDL Instructional Observation Instrument (UDL-IOI) considers the design of the learning environment relative to teacher implementation that includes the use of strategies and tools as well as how students respond to the environment. It may be used across various instructional environments, across various curricula and teaching methodologies. The instrument is designed for observing both whole-class well as small-group implementation.

Observation Procedure

This instrument was designed based on the general flow of a lesson; however, this flow should not limit an observer from shifting among the various sections and variables. Ideally, observers should be present for the entire instructional session.

Pre-observation: The Critical Elements of UDL Instruction clearly specify that instructional goals must be clearly defined and understood by teachers/instructors and students. If possible, ask for an advance copy of the goals associated with the instructional event you are observing. If this is not possible, collect posthoc information (e.g., print version or via discussion with the teachers/instructor) that includes the goals.

General Directions: To begin, the observer should take five minutes to simply observe the overall classroom. Then, the observer should begin rating the practice of UDL, moving among sections A through D as needed, to indicate the observed level of UDL taking place. In addition, it is strongly recommended that the observer simultaneously compile an anecdotal record (actual recordings and narrative observations) to document specific and/or unique examples of UDL or situations where UDL should likely have been present but was not.

At the conclusion of the observation, the effectiveness rating scales for sections A-D should be completed. Section E serves to characterize the overall observation of the instructional environment, and students' engagement, interests, and focus levels. Provide any other relevant information not covered in sections A-E, in Other Observer Notes.

Observation Steps: During observation use underline "__" for the initial rating on each item; at the end of the observation, circle "**O**" the final rating for each item. For items you were unable to observe, draw a line through the item(s) at the end of the session.

Observing Partial Sessions: For observers unable to attend an entire instructional session, including multiple day instructional units, please be cognizant of components included in the measure that you may have missed due to the timing of your observation. For items you were unable to observe, draw a line through the item(s) at the end of the session. These items should not be scored in the overall observation. Scoring and associated reports should only be representative of the time spent in the environment.

Observing Complex Instructional Environments/Sessions: A complex instructional environment is defined as an environment where the numbers of observers are unable to readily observe all aspects of the entire instructional environment. Examples of these environments may include: an environment using a center-based instructional model (e.g., students moving to/form numerous centers), an environment using blended online instruction where the instruction is being delivered between online and brick-and-mortar modalities (including Flipped classroom models), or an environment where 60 students are working in numerous small groups during a project-based learning experience. Importantly. Observers should recognize that complexity within the environment might be associated with the implementation of UDL. To greatest extent possible this complexity should be noted and measured within the observation.

Single Observer in a Complex Environment: If a single observer is conducting the observation, they should gather extensive anecdotal records including recordings and narrative observations of the instructional environment. After establishing a solid understanding of the environment, the observer should move throughout the environment and complete the instrument while at the same time continually taking notes. Whenever possible, aspects of the environment should be noted next to single items of the protocol. For instance, "*students given options for expressing understanding through multiple means only during station two; all other stations students were made to write with a pencil specific answers" (in Section C)* should be noted and calculated into overall observation and/or report. Observers are strongly encouraged to take time immediately following the observation to finalize the observation notes and scoring.

Multiple Observers in a Complex Environment: Different from multiple observers in a normal environment, if multiple observers are present in a complex environment, observers should plan to both gather factual recording and narrative observations (see single observer situation) and then each target specific aspects of the environment to gather a complete picture of the environment. After the observation is over, the multiple observations should be combined into a single "complete" observation. Combining observations can be done two ways (1) through the process of negotiation with the other observers or (2) through the process of generating a combined mean score (see Section on Scoring).

Interacting with Teachers & Post Interview: A single, one-time observation, may not yield sufficient opportunity to observe and document the scope of UDL attributed to a broader context (e.g., how UDL is being implemented by a teacher, versus how UDL was implemented during a 50-minute period). For example, you might observe a session where the teacher is moving throughout a classroom working with students on individual and small group assignments based on a lesson that was actually started two days ago. Based on this observation, it's unclear whether UDL was used within the unit two days ago. Thus, if you suspect that the session is more complex than what you observed, you should conduct a brief, post-observation interview with the teacher.

Inform the teacher that you suspect the observation was limited due to the narrow window of the observation and/or the timing of the observation (e.g., it was the 2nd day in a 4-day project-based learning experience). Ask the teacher to share any additional insight regarding how s/he approached the following elements in class during the days leading up to the observation: Introducing and Framing New Material; Content Representation and Delivery; Expression of Understanding; and Activities and Student Engagement. If the teacher identifies elements of UDL that would inform the final score on instrument, please adjust the score, and then cite these additions in the note section.

Scoring

This tool may be used to provide specific points of reflection on the UDL implementation of a specific teacher or to identify overall areas for program improvement. Based on specific needs, a reflective process of review may be desired. If a formalized scoring process is desired, the following process is suggested. Note: A single observation should not serve as a characterization of UDL implementation. It is recommended that multiple observations be conducted prior to characterizing the level of implementation within an environment. Specifically, it is suggested that at least three observations be conducted, with at least two unannounced.

Suggested Scoring Process: Calculate the mean score for each section (A-D) and then calculate overall mean for the complete observation. Calculate mean scores by adding the number of items scored in a single section and dividing by the total possible points for a given section (or multiple sections). Remember, items not scored (items with lines drawn through them) do not count for or against the section or overall mean. Thus, these items are not calculated in the mean. Items not scored may be discussed in the observation notes or a narrative summary.

Suggested ways to characterize scores:

No or low Occurrence: UDL is not occurring in this environment (Range 0-.5)

Pre-Emergent: UDL was not directly observed, however the environment is primed for UDL (Range .6-1.5)

Emergent: UDL was observed, but it was not necessarily applied consistently during the observation. This implementation is likely not sustainable over long periods of time (Range 1.6-2.3)

Ideal Implementation: UDL was obvious and being consistently implemented through sustainable practices (Range 2.4-3.0)

Online/Digital Version: Please contact James Basham, jbasham@ku.edu for access to an online version.

APPENDIX A

Universal Design for Learning
Observation Measurement Tool (UDL-OMT)

Version 1.0 (3/09/2020)

Background Information

Observer: ______________________________

Date: ________________ Content Area: ______________________________

Classroom/Teacher: ____________________________

Time Period Observed	Start Time: ______________	End Time: ______________

Observer Notes:

APPENDIX A

UDL Rating Scale

Use the following scale to rate the individual items.

Rating	Description and Examples
0 = No Evidence of UDL:	No multiple means - Learners were not provided options for engagement, expression, or learning. Learners experienced or used a single strategy or tool; they did not experience or engage in any other option to access the information, demonstrated understanding, took action, or engaged in the activity.
1 = Incomplete Evidence of UDL in Environment: (Pre-Emergent)	Learners experienced or used a single strategy or tool; however others strategies or tools were clearly available in the environment but not explicitly used by students or referenced by the teacher.
2 = UDL is occurring (Emergent**)**	Learners experienced or used at least two or more strategies and/or tools for how they accessed the information, demonstrated understanding, took action, or engaged in the activity however the options were generally static and/or traditional in nature; relying heavily on teacher dependence to support the interpreted range of learner variability.
3 = Dynamic, Interactive UDL (Ideal Implementation)	Learners experienced or used at least two or more strategies and/or tools for how they accessed the information, demonstrated understanding, took action, or engaged in the activity; plus learners relying far less on teacher dependence, have more choice on their use of tools or strategies that is customizable, interactive, dynamic, and efficiently supports the interpreted range of learner variability.

Note: If "don't know", simply write ***Don't Know*** in the note area next to the item.

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A1. Introducing and Framing New Material							**Notes**	
1.	Establishes student understanding of learning or activity goals.	0	1	2	3			
2.	**Establishes student understanding for how to be successful in the learning or activity.**	0	1	2	3			
3.	Activates or supplies background knowledge.	0	1	2	3			
4.	Highlights what is important for students to learn and/or do.	0	1	2	3			
5.	Supports understanding of big ideas and critical concepts.	0	1	2	3			
6.	Uses questions that support understanding or inquiry.	0	1	2	3			
7.	Identifies potential misunderstandings/ misconceptions.	0	1	2	3			
	Column Totals							*←Total for Introducing and Framing New Material*

From your perspective and the understanding of the learner variability in the environment…

The goal(s) were presented so the learners in the environment could perceive them.
☐ Yes ☐ No ☐ I Don't Know *Notes:*

The learning experience provided an opportunity for learners to demonstrate understanding of the goal(s).
☐ Yes ☐ No ☐ I Don't Know *Notes:*

The goals were separate from the means; meaning there were multiple options to accomplish the goal(s).
☐ Yes ☐ No ☐ I Don't Know *Notes:*

B1. Content Representation and Delivery						Notes	
1.	Supports multiple levels of content understanding (e.g., novice, intermediate, expert).	0	1	2	3		
2.	Presentation of information allows for customization/flexibility.	0	1	2	3		
3.	Instruction allows alternatives for visual display of information.	0	1	2	3		
4.	Instruction allows alternatives for auditory information.	0	1	2	3		
5.	Supports options for multiple languages.	0	1	2	3		
6.	Supports understanding of relationships across disciplines, settings, or concepts.	0	1	2	3		
7.	Clarifies content-specific vocabulary, symbols, and jargon.	0	1	2	3		
8.	Clarifies content-based syntax and structure.	0	1	2	3		
9.	Highlights options for self-directed clarification of vocabulary and symbols.	0	1	2	3		
	Column Totals						*←Total for Content Representation and Delivery*

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B2. Content Representation and Delivery Supporting Learner Ability						
Content representation and delivery supported the learners' ability to…		Strongly Disagree	Disagree	Agree	Strongl y Agree	
B1.	Access options to perceive and accomplish the goals.	0	1	2	3	*Total for Content Representation and Delivery Supporting Learner Ability ↓*
B2.	Build options to understand language and symbols needed to accomplish the goals.	0	1	2	3	
B3.	Internalize comprehension associated with accomplishing the goals.	0	1	2	3	
	Column Totals					

C1. Expression of Understanding						Notes
1.	Allows options for learners to express understandings in a variety of ways.	0	1	2	3	
2.	Provides access to a variety of tools and/or technologies that allow students to express their understanding.	0	1	2	3	
3.	Builds competencies in use of multiple options for expressing their understanding.	0	1	2	3	
4.	Provides options that guide students to plan, develop strategies, and/or goal-setting that promotes expression of understanding.	0	1	2	3	
5.	The environment facilitates management of information and resources to achieve desired learning outcomes.	0	1	2	3	
6.	Intentionally provides supports for students' problem-solving and critical-thinking abilities.	0	1	2	3	
7.	Facilitates student self-monitoring of progress.	0	1	2	3	
						← *Total for Expression* … *rstanding*

C2. Expression of Understanding Supporting Learners' Action and Expression						
The learners' ability to take action and express themselves in order to …		Strongly Disagree	Disagree	Agree	Strongl y Agree	
C1.	Access physical options to accomplish the goals.	0	1	2	3	*Total for Action and Expression of Understanding Supporting Learner Ability* ↓
C2.	Build options for expression and communication to accomplish the goals	0	1	2	3	
C3.	Internalize options for supporting executive functions for accomplishing the goals	0	1	2	3	
	Column Totals					

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D1. Activity and Student Engagement						Notes	
1.	Promotes learner choice and self-determination while engaging with the content.	0	1	2	3		
2.	Provides a variety of activities relevant to all learners.	0	1	2	3		
3.	Promotes sustained effort and focus.	0	1	2	3		
4.	Encourages learners' use of strategic planning to complete instructional tasks.	0	1	2	3		
5.	Encourages or gives choice for collaboration and communication among learners.	0	1	2	3		
6.	Supports multiple levels of challenge.	0	1	2	3		
7.	Provides for self-reflection and self-assessment.	0	1	2	3		
8.	Provides formative progress monitoring and content checks.	0	1	2	3		
9.	Provides closure that reiterates big ideas and instructional purposes.	0	1	2	3		
	Column Totals						*← Total for Activity and Student Engagement*

D2. The Learning Experience Supporting Student Engagement						
The learning experience supported student engagement by …		Strongly Disagree	Disagree	Agree	Strongly Agree	
D1.	Providing access to options to recruit interest to accomplish the goals.	0	1	2	3	*Total for The Learning Experience Supporting Student Engagement ↓*
D2.	Building options for sustaining effort and persistence to accomplish the goals.	0	1	2	3	
D3.	Internalize options for supporting self-regulation for accomplishing the goals	0	1	2	3	
	Column Totals					

Instructional Components and Summation

Description
Please write a brief description of the activity/lesson:

Lesson Type (select one):	Teacher Centered	Student Centered	Other:	
Observation Conducted On (select one):	Entire Lesson	Partial Lesson	Other:	

E. Support for Expert Learning						
The learning experience supported expert learning by developing students who are …		Strongly Disagree	Disagree	Agree	Strongly Agree	
F1.	Purposeful about learning.	0	1	2	3	*Total for Support for Expert Learning* ↓
F2.	Motivated about learning.	0	1	2	3	
F3.	Resourceful in learning.	0	1	2	3	
F4	Knowledgeable in learning.	0	1	2	3	
F5	Strategic about learning.	0	1	2	3	
F6	Goal-directed about learning.	0	1	2	3	
	Column Totals					
Notes on Support for Expert Learning						

APPENDIX A

F. Formative Assessment					
		Strongly Disagree	Disagree	Agree	Strongl y Agree
1.	Formative assessment was used to monitor student progress and understanding throughout the learning experience.	0	1	2	3
Notes on Formative Assessment:					

What would you estimate was **the <u>overall</u>** <u>**percentage of learners**</u> <u>**who were engaged**</u> during this observation?

Low Engagement					**High Engagement**
0%	**20%**	**40%**	**60%**	**80%**	**100%**

Estimated overall engagement: ____________

Notes on student engagement:

G. What might be some areas for improved implementation of UDL within the learning environment?

Notes on Improved Implementation of UDL:

Scoring Summaries

If desired, this page provides a scoring summary sheet.

Summary of UDL Scores (Sections A-D)		Mean	Notes
A1.	Introducing and Framing New Material		
B1.	Content Representation and Delivery		
C1.	Expression of Understanding		
D1.	Activity and Student Engagement		
	Total Score		
	Grand Mean		

Summary of Impression of Learner Support (B2-D2)		Mean	Notes
B2	Content Representation and Delivery Supporting Learner Ability		
C2.	Expression of Understanding Support for Learners'		
D2	The Learning Experience Supporting Student Engagement		
	Total Score		
	Grand Mean		