TEACHING READING TO A STUDENT WITH BLINDNESS USING UNIVERSAL DESIGN FOR LEARNING: A PRACTITIONER INQUIRY

By

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To Laura, Rachel & Jack

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As I think about my development as a teacher, I often find myself humming a song I used to sing in the BGSU Men's Chorus: *No man is an island, no man stands*

alone. I would like to thank my students and co-workers for teaching me how to be a better teacher. As I will discuss in this dissertation, learning is a social construct and my first 11 years as a teacher have been shaped by the students at TBE and CPE, as well as the exceptional teachers and staff at both schools.

My third class of students just graduated from high school. I had six of them come to speak to my class the other day to offer words of advice. As they were talking, I realized that when they were in my class I had never even heard about Universal Design for Learning. In this dissertation I will discuss how UDL has impacted my teaching practice. I would like to thank Grace Meo, David Rose, Tom Hehir, and all the folks at CAST and Harvard PPE for introducing me to the concept of Universal Design for Learning.

I thank my children, Rachel and Jack, for being the light of my life. As I write this, Rachel and Jack are at their last day of school. Rachel, who was just a baby when I started this journey, will begin kindergarten in the fall. Last night she asked if my dissertation was done and if she could call me doctor daddy. Jack, who won't have any memory of this journey, smiled, laughed, and asked for his yummy. I'm the proudest father in the universe and hope my efforts to obtain a doctoral degree will improve the lives of both of my beautiful children. Thank you, Rachel and Jack. I love being your daddy.

Finally, I would like to thank my wife, Laura for being a wonderfully supportive partner and friend. I can still remember the day I came home with the UF CTTE doctoral program brochure and we discussed the impact a journey of that nature would have on our young family. Last night, as she helped me quadruple check my final draft, I felt an

overwhelming sense of love and gratitude for this wonderful woman. Thank you for supporting me on this quest. Thank you for being a wonderful mother to our children. Thank you for being my very best friend.

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LIST OF SPECIALIZED TERMS

Accessible Instructional Materials (AIM)	According to the National Center on Accessible Instructional Materials, Accessible instructional materials, or AIM, are materials that are designed or converted in a way that makes them usable across the widest range of student variability regardless of format (print, digital, graphical, audio, video).
FIMC-VI	The Florida Instructional Materials Center for the Visually Impaired (FIMC-VI) is a statewide resource center designed to assist schools in obtaining specialized materials for students with visual impairments.
Focus 40 Braille Display	Portable Bluetooth wireless Braille display keyboard that connects to computers and/or mobile devices.
JAWS	JAWS for Windows Screen Reading Software. The program reads aloud what is on the PC screen and give the user a set of tools for navigating and accessing Web pages and all screen content.
Techbook	The Discovery Education Techbook is a digital textbook.

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By

Jonathan P. Mundorf

August 2014

Chair: Brianna Kennedy-Lewis
Cochair: Nancy Fichtman Dana
Major: Curriculum and Instruction

During this school year, like most, I was challenged by the significant learner variability present in my inclusive, standards-based, 5th grade classroom. Reading abilities were wide-ranging, as were students' learning strategies, and student engagement levels covered the spectrum. Some students came equipped with IEPs, 504 plans, ELL plans, and gifted plans; and some came without labels, but needing as much, if not more, scaffolding and accommodations than their peers in the alphabet soup of educational categories. I was tasked, like all teachers in the era of accountability, to leave none of them behind. Unique to this particular school year, however, was a new challenge for me as a 5th grade teacher: one of my students was visually impaired, completely blind since birth, and I had to teach her to read.

The purpose of my study was to tell the story of my efforts to teach reading to a student who is blind in a universally designed classroom. My previous experiences with Universal Design for Learning (UDL) were based solely in a high-incidence disability context and I was curious to find out, when presented with a student with a low-

incidence disability, if the UDL framework was truly universal. Would I be able to meet the needs of all the learners in my care within the same classroom environment?

In order to study my experiences teaching a student with blindness to read, I chose to engage in practitioner research. This research methodology best suited my study because I was asking questions about my own instruction and I wanted to study my own classroom, reflecting on my own teaching practice.

As I reviewed, analyzed and reflected upon my experiences teaching reading to a student with blindness, four major implications were present across the data:

- In order for classrooms to meet the needs of all learners, students and teachers need options within the curriculum.
- Students and teachers need clarity about goals and options for meeting those goals.
- Optimal UDL implementation requires the collaboration of students and teachers.
- A positive classroom community supports UDL.

CHAPTER 1
INTRODUCTION AND BACKGROUND

Reading strategy posters were up. Bulletin Boards were colorful. Graphic organizers were posted. Motivational quotes filled the room. The reading corner was stocked. Learning centers were set up. It was going to be a great school year! Yet, I was struck by an epiphany about my aesthetically pleasing learning environment: she would not be able to see any of it. During the school year, like most, I would be challenged by the significant learner variability present in my inclusive, standards-based, English Language Arts 5th grade classroom. Reading abilities would be wide-ranging, as would students' learning strategies, and student engagement levels would cover the spectrum. Some students would come equipped with IEPs, 504 plans, ELL plans, and gifted plans; and some would come without labels, but needing as much, if not more, scaffolding and accommodations than their peers in the alphabet soup of educational categories. I would be tasked, like all teachers in the era of accountability, to leave none of them behind. Unique to this particular school year, however, would be a new challenge for me as a 5th grade reading teacher: one of my students would be visually impaired, completely blind since birth, and I would have to teach her to read.

Inclusion as a strategy for achieving education for all is a complex issue without a coherent approach (Bines & Lei, 2011). Simply placing students with myriad needs into general education settings does not guarantee participation, positive outcomes or full acceptance (Jimenez, Graf, & Rose, 2007). Teachers are tasked on a daily basis to meet various challenges of teaching all students in inclusive classrooms. Schools have never been as inclusive of students with disabilities (Heihr, 2002; Lee, Wehmeyer, Soukup, & Palmer, 2010; Rose & Meyer, 2002; Rose, Meyer, & Hitchcock, 2005) and as

culturally diverse (Cochran, 2008; Darling-Hammond, 2009; Wahl & Duffield, 2005). Furthermore, educational demands are on the rise and higher curriculum standards are shifting from acquiring knowledge to integrating knowledge. All students are accountable to the same high standards, and teachers and students are increasingly accountable for students' educational achievement. Federal mandates such as the Individuals with Disabilities in Education Act (IDEA) and the No Child Left Behind Act (NCLB) require that all students be provided with access, participation, and progress in the general education curriculum (Rose et al., 2005). These legislative requirements demand that educators ensure every student has access to and demonstrates mastery of the general curriculum (Wahl & Duffield, 2005; Jimenez et al., 2007).

Beyond these challenges, recent research in neuroscience confirms that each brain processes information differently and the way we learn is as individual as DNA or fingerprints (Rose & Meyer, 2002). Teachers are faced with the reality of an elaborate spectrum of learner variability in their classrooms (Rose & Meyer, 2002; Rose et al., 2005). This research exposes myriad differences within the category of what used to be considered typical, including: ability to recognize information, processing and strategic thinking, and learner motivation and engagement (Rose et al., 2005).

In a classroom of diverse learners there is no single method of instruction that can meet the needs of all students (Rose & Meyer, 2002). Given the diversity present in schools and the promise of inclusion as a strategy for achieving education for all, teachers need a framework and strategy for addressing the challenges of learner diversity in schools.

Originally from Ohio, I attended Bowling Green State University and studied elementary education with the aspiration of being a tremendous teacher. During my coursework I took a total of one special education course and my memories of the learning experience are minimal. I moved to Florida in July of 2003 to be a teacher. I envisioned teaching on an island as a vacation job. I truly thought I would be field-tripping to the beach regularly, and teaching at the local elementary school would mirror the paradise that surrounded the school grounds. The stark contrast between my vision and the reality of teaching was significant.

Immediately, I recognized my naiveté. My first class of students needed a lot of help. I had students who did not speak English, students with learning disabilities, students with behavior disorders, and students without labels who had their own challenges. Luckily, or at least I thought at the time, in my classroom I had many materials to use in order to solve the problems faced by my students. My principal and mentor teachers encouraged me to use the school district's curriculum guides and textbooks…and I did. I read the scripts in the reading teacher's guide; I used the practice problems in the math teacher's guide; and I followed the steps laid out in the science teacher's guide. I was frustrated by how much I struggled as a first-year teacher. I taught the lessons just as I was told, but only a small number of kids really "got it" when I would teach. So I would have to remediate the kids that did not "get it" and spend time going over it again and again. My kids liked school, the parents were happy, but it was not working. By the end of the first year I was exhausted, overwhelmed, and really frustrated about my ineffectiveness. My colleagues assured

me these were typical first year teacher feelings and after a summer break I would be rejuvenated and ready to start another year.

My second class of students was loaded with even more challenges than the first. Learning disabilities, giftedness, behavior problems, and teaching students who spoke seven native languages consumed my attention and time. I felt like I was always playing catch up. I stuck to the curriculum guides and broadcasted my lessons to the class as they were written in the teacher's guides, but was still unable to meet the needs of all of my students. Kids stayed busy and they were engaged, but learning was not happening. Reflecting back, though, I feel like I thought they were learning. I think I believed I was effective, but not as effective as I wanted to be. Year Three followed the same script as the first two years and by the end of 2006 I considered quitting. I was tired of being tired. I did not like the feeling of ineffectiveness. I was running in place. Rather than leaving the profession, I decided to be proactive and start my Master's degree. I figured I could learn additional tips and tricks to be a better teacher. My graduate program required a final capstone project and I had heard about Harvard's summer programs for teachers. I found an institute about meeting the needs of all learners.

I credit the week I spent at Harvard with saving my career. I learned about Universal Design for Learning from David Rose, Tom Hehir, and Grace Meo, among others, and I have not been the same since. Rather than being surprised by learner diversity, they explained that we should expect it. Learner variability is the norm, not the exception. Effective teachers anticipate the variability and plan for the students in the margins. When we design learning experiences for these students, all students will

benefit. The power and flexibility of technology allows the teacher countless opportunities to transform the curriculum from the ineffective one-size-fits-all model to a one-size-fits-one model. This was such a contrast to the way I had been teaching. In my frustration and as a result of my inexperience, I reverted back to the ways I had been taught. I was a sage on the stage, completely ignoring the variability in my classroom and focusing on the disability in the students. I was a master at creating a busy classroom and I incorrectly assumed that busy students were learning students. Upon returning from Harvard, I reinvented myself as a teacher. Instead of focusing and complaining about the disability I saw in my students I chose to target the disability in our curriculum. By examining the goals, methods, materials and assessments for barriers, I was able to design learning experiences for all of my students. The barriers within the curriculum were minimized because I had developed a student-centered stance for exploring the curriculum with my students.

The Center for Applied Special Technology (CAST) defines Universal Design for Learning (UDL) as an educational approach to teaching, learning, and assessment, by drawing on new brain research and new media technologies to respond to individual learner differences. The framework is based on the Universal Design movement in architecture and product development. Ron Mace, the architect who developed the Universal Design approach, advised other architects to consider the needs of the broadest possible range of users from the beginning. Universal Design is not a one size fits all solution; rather it emphasizes alternatives embedded into the design. Accommodations and modifications are designed from the beginning, not added on later, which increases accessibility opportunities for everyone. The movement emerged

as a result of the access needs of people with disabilities. The usefulness of these alternatives for the non-disabled population and the complications caused by retrofitting buildings contributed to the Universal Design movement in architecture, and later product development (Rose, Sethuraman, & Meo, 2000).

CAST began developing the UDL model in the mid-1980s in response to the needs of students with physical disabilities. In the early 1990's educators at CAST began to realize that learning materials such as books created barriers in the same way stairs do in buildings. The organization believed that planning for students "in the margins" could lead the way to educational reform because these students help educators see the barriers that prevent teaching and learning for all (Cochrane, 2008; Rose et al., 2005). UDL is based on two decades of research in the areas of learner differences, technology, effective pedagogy, and fair and accurate assessments (Rose & Meyer, 2002; Rose et al., 2005).

The framework is not a panacea for teaching diverse learners, but rather a set of guidelines and principles for planning for all learners. It is not a single process but a framework that encompasses several existing methods for enhancing the learning process for diverse learners. UDL supports existing practices by asking educators to anticipate potential barriers to the curriculum and utilize multiple means of presentation, expression, and engagement to successfully navigate the student around the barrier (Cochran, 2008; Jimenez et al., 2007).

The UDL framework supports teachers' efforts to meet the challenge of teaching diverse learners in inclusive, standards-based classrooms. It is based upon three principles, providing multiple means of: representation, expression, and engagement.

These principles give learners various ways of acquiring information and knowledge, provide learners alternatives for demonstrating what they know, and tap into learners' interests, offer appropriate challenges, and increase motivation (Rose & Meyer, 2002, Rose et al., 2005).

UDL promotes flexibility in presenting content and demonstrating content mastery (Lee et al., 2010). UDL embeds accessible features into curriculum design by frontloading flexibility, instead of relying only on after-the-fact accommodations. By providing learning opportunities in multiple and flexible formats and applying the framework across the entire curriculum – goals, methods, materials and assessments – all students are provided with the opportunity to access information. Using a curriculum that is rooted in the three UDL principles, students have options for how they learn, choices that will engage their interest, and choices for how they demonstrate their learning. Teachers use flexibility in presenting lesson content, providing options for student engagement, and facilitating student expression and learning assessments (CAST, 2008).

Prior to this study, my experiences with, and stories about, the application of the UDL framework were limited in that they had only included students with high-incidence disabilities, i.e. communication disorders, specific learning disabilities, attention deficit hyperactivity disorder, mild/moderate cognitive disabilities, and emotional or behavioral disorders. Blindness is considered a low-incidence disability because of its infrequency in public education classrooms, typically less than 1% of the student population. Jackson (2005) explains:

> The relative rarity of students with these disabilities in public schools often poses significant challenges for local schools struggling to meet their

> needs. Since they encounter these students so infrequently, most local schools have little if any knowledge of how to best educate these students, of what technologies are available to assist them, and of how to obtain needed and appropriate support services from outside agencies. All students with low incidence disabilities thus experience a commonality: they are difficult to serve in current local public school programs. (p. 10-11)

The challenge of teaching a student with a visual impairment, in an inclusive reading classroom, was both exciting and nerve-wracking, challenging and expanding the limits of my previous uses of UDL.

Purpose of the Study

The purpose of my study was to tell the story of my efforts to teach reading to a student who is blind in a universally designed general education classroom, to find out if this framework would hold up under the intense pressures of teaching students with a variety of learning disabilities, both low and high-incidence. My previous experiences with UDL were based solely in a high-incidence disability context and I was curious to find out, when presented with a student with a low-incidence disability, if the UDL framework was truly universal. Would I be able to meet the needs of all the learners in my care within the same classroom environment?

Additionally, I hoped to contribute to the literature on UDL. UDL is based on decades of research, to be explored at length in chapter 2, which has been conducted in three phases by educators and researchers at CAST and around the world (CAST, 2010). The first phase created the general framework of UDL by studying modern research in the learning sciences: cognitive science, cognitive neuroscience, neuropsychology, and neuroscience. The three basic learning networks (recognition, expression, engagement) and principles of UDL (multiple means of representation, expression, and engagement) emerged from that review. The second phase of research

establishing UDL elaborated upon the three basic principles of UDL by honing in on what would be needed in an adequate pedagogy of individual differences. The result of this phase was the development of the nine UDL Guidelines (CAST, 2008). The third, and most recent, phase of research involved extensive reviews of existing educational research to support the UDL checkpoints (CAST, 2010). At the time of this study, a new, fourth category of research has emerged from the National Center on Universal Design for Learning (CAST, 2011). This category focuses on specific applications of UDL within learning environments. The National Center on Universal Design for Learning explains that this is a new and emerging area of research and they greatly encourage contributions from the research field. It is in this category, specific applications of UDL within learning environments that my research could contribute to the literature on Universal Design for Learning.

Finally, in beginning this study, I believed its reflective nature would improve my own practice, and thereby improve the educational experiences of my students. My hope was that my story would also help others meet the challenges of teaching students with disabilities.

Method

In order to study my experiences teaching a student with blindness to read in my inclusive, standards-based, 5th grade English Language Arts classroom, I chose to engage in practitioner research. This research methodology best suited my study because I was asking questions about my own instruction and I wanted to study my own classroom, reflecting on my own teaching practice. This methodology would allow me to capture the iterative cycle of student outcomes and adjustments that I, the teacher, made regarding UDL.

I wanted to study what would happen when a student with a visual impairment (blindness) entered my universally designed English Language Arts classroom. My research questions emerged from my desire to study this topic. My research questions were: How do I, as an inclusive general educator, use the Universal Design for Learning framework to teach reading to a student with a visual impairment? How does the UDL framework support her learning? What challenges remain unaddressed by UDL?

CHAPTER 2
REVIEW OF THE LITERATURE

This chapter defines Universal Design for Learning, and reviews the related literature in Universal Design for Learning, accessible instructional materials, and supported UDL reading accommodations. This chapter will also provide a rationale for the present study.

Universal Design for Learning

The Center for Applied Special Technology (CAST) defines Universal Design for Learning as, "a set of principles for curriculum development that give all individuals equal opportunities to learn. UDL provides a blueprint for creating instructional goals, methods, materials, and assessments that work for everyone--not a single, one-size-fits-all solution but rather flexible approaches that can be customized and adjusted for individual needs" (CAST, 2013). A concise definition of Universal Design for Learning was provided by the Higher Education Opportunity Act of 2008 (HEOA), which stated:

> The term UNIVERSAL DESIGN FOR LEARNING means a scientifically valid framework for guiding educational practice that: (A) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged; and (B) reduces barriers in instruction, provides appropriate accommodations, supports, and challenges, and maintains high achievement expectations for all students, including students with disabilities and students who are limited English proficient. (CAST, 2012, para. 1)

Universal Design for Learning Principles

The pedagogical, neuroscientific, and practical roots of UDL are well established based on years of research in the learning sciences (Rose & Meyer, 2002; Rose et al., 2005; Rose & Meyer, 2006). The UDL framework is based upon three main principles, to provide multiple means of: representation, action and expression, and engagement.

First, because learners differ in the way they receive information that is presented to them, providing multiple means of representation is essential. Next, because learners are different in how they apply strategies while learning and how they express what they know, providing options for action and expression is necessary. Finally, all learners differ in their motivation for learning. What engages one student may do the opposite for another. There is no one ideal means of engagement for students, so it is necessary to provide multiple options for engagement (CAST, 2013).

Universal Design for Learning Guidelines

The UDL Guidelines were developed as the collaborative effort of various individuals and groups in the field of education and are designed to help educators make the application of UDL principles and practices more concrete. The Guidelines are organized based on the three main principles of UDL: representation, action and expression, and engagement. The UDL Guidelines are based on research from several different fields: education, cognitive science, cognitive neuroscience, neuropsychology, and neuroscience. That research has been reviewed, compiled, and organized by educators and researchers at CAST. Table 2-1 outlines the UDL guidelines and highlights the some of literature compiled by CAST from which each guideline is derived (CAST, 2008).

Table 2-1 Universal Design for Learning Guidelines – Research Evidence

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Representation	**Guideline 1:** Provide options for perception by offering ways of customizing the display of information, alternatives for auditory information, and alternatives for visual information.	The literature supporting this guideline focuses on advantages and benefits of: • flexible typography, layout design, color representation, and large print; • captioning and bimodal presentation of information; • text-to-speech, audio-visual presentations, and Braille.	Dalton, Schleper, Kennedy, Lutz, & Strangman, 2005; D'Angiulli, D'Angiulli, Kennedy, Helle, & Heller, 1998; Ely, Emerson, Maggiore, Rothberg, O'Connell, & Hudson, 2006; Hughes & Wilkins, 2002; Koenig, 1992; Matthew, 1997; Montali & Lewandowski, 1996; Moreno & Mayer, 2002; Nugent, 1982; Sinatra, 1990; Sloan & Habel, 1973; Tindall-Ford, Chandler & Sweller, 1997; Tinti & Galanti, 1999; Wetzel & Knowlton, 2000; Xiaowen, Shuang, Brzezinski, & Chan, 2006.

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Representation	**Guideline 2**: Provide options for language, mathematical expressions, and symbols by clarifying vocabulary and symbols; syntax and structure; supporting the decoding of text, mathematical notation, and symbols; promoting understanding across language; and illustrating through multiple media.	The literature supporting this guideline focuses on the effectiveness of: • various tools and strategies designed to reduce those barriers and/or to build vocabulary knowledge and supporting students' understanding of the symbols that they encounter in their learning; • various tools and strategies to support students' understanding of syntactic and structural relationships; • providing automatic text-to-speech for students who have especial difficulty decoding text; the effectiveness of various tools and strategies to support students' second language acquisition; • information through a variety of representation of information through a variety of formats.	Anderson, Fite, Petrovich, & Hirsch, 2006; August, Carlo, Calderon, & Proctor, 2005; Boone & Higgins, 1993; Cennamo, 1993; Christensen, 2008; Chun & Plass, 1996; Cleary & Langley, 2007; Dalton & Strangman, 2006; Dalton, Pisha, Eagleton, Coyne, & Deysher, 2002; de Vries, Monaghan, Knecht, & Zwitserlood, 2008; Dimino, Taylor, & Gersten, 1995; Dommes, Gersten, & Carnine, 1984; Elkind, Cohen, & Murray, 1993; Fradd, Lee, Sutman, & Saxton, 2001; Garcia, 1991; Jiménez, Garcia, & Pearson, 1996; Kerkhofs, Vonk, Schriefers, & Chwilla, 2007; Kidd, Brandt, Lieven, & Tomasello, 2007; Klin, Ralano, & Weingartner, 2007; Lesaux, Rupp, & Siegel, 2007; Levie & Lentz, 1982; Mayer, Heiser, & Lonn, 2001; Mioduser, Tur-Kaspa, & Leitner, 2000; Montali & Lewandowski, 1996; Nagy, 1985; Plass, Chun, Mayer, Leutner, Petig, & Voge, 1998; Prat, Keller, & Just, 2007; Proctor, Dalton, & Grisham, 2007; Schnotz & Bannert, 2003; Schwan & Reimpp, 2004; Stemberger, 2007; Torgesen, 1987; Zywica & Gomez, 2008

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Representation	**Guideline 3:** Provide options for comprehension by activating or supplying background knowledge; highlighting patterns, critical features, big ideas, and relationships; guiding information processing, visualization, and manipulation; and maximize transfer and generalization.	The literature supporting this guideline focuses on the effectiveness of using strategies such as: • anchored instruction, advanced organizers, analogies, and metaphors to activate students' background knowledge; • graphic organizers, advanced organizers, multiple analogies and examples, and study guides to emphasize key ideas and relationships; • explicit prompts, graphic organizers, concept maps, strategy instruction, and chunking information into smaller elements; • strategic note-taking, visual imagery, and explicitly teaching for transfer in order to support students' memory and transfer.	Alvermann, Smith, & Readence, 1985; Blankenship, Ayres, & Langone, 2005; Block, 1993; Brownell, Mellard, & Deshler, 1993; Carr & Thompson, 1996; Casteel, 1990; Dole, Valencia, Greer, & Wardrop, 1991; Dole, Brown, & Trathen, 1996; Dyck & Sunbye, 1988; Fuchs, Fuchs, Finelli, Courey, & Hamlett, 2004; Fuchs, Fuchs, Hamlett, & Appleton, 2002; Fuchs, Fuchs, Phillips, Hamlett, & Karns, 1995; Fuchs, Fuchs, Prentice, Burch, Hamlett, & Owen, 2003; Gajria & Salvia, 1992; Gardill & Jitendra, 1999; Lott, 1983; Luiten, Ames, & Ackerson, 1980; Malone & Mastropieri, 1992; Mason, 2004; Novak, 1990; Pollock, Chandler, & Sweller, 2002; Reith, Bryant, Kinzer, Colburn, Hur, & Hartman, 2003; Robinson, Robinson, & Katayama, 1999; Schwartz, Stroud, Hong, Lee, Scott, & McGee, 2006; Serafino & Cicchelli, 2003; Smolkin & Donovan, 2001; Spires & Donley, 1998; Stern, Aprea, & Ebner, 2003; Van Eck & Dempsey, 2002

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Action and Expression	**Guideline 4:** Provide options for physical action by varying the methods for response and navigation, and optimizing access to tools and assistive technologies.	Literature supporting this guideline focuses on the improvements to learning made possible by providing keyboarding and voice recognition options for several types of students: typically achieving students, students who have high incidence learning disabilities (e.g. dyslexia) or students who have specific writing disabilities (e.g. dysgraphia) and types of options provided such as switch options, overlays, alternative keyboards, etc.	Alper & Raharinirina, 2006; Crealock & Sitko, 1990; Dalton & Hannafin, 1987; Dalton, Herbert, & Deysher, 2003; Joram, 1992; Lange, McPhillips, Mulhern, & Wylie, 2006; Mechling, 2006; Norris, Sullivan, Poirot, & Soloway, 2003; Quinlan, 2004; Roberts, 2005; Rosenbluth & Reed, 1992; Stoner, Beck, Bock, Hickey, Kosuwan, & Thompson, 2006

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Action and Expression	**Guideline 5:** Provide options for expression and communication by using multiple media for communication, multiple tools for construction and composition, and building fluencies with graduated levels of support for practice and performance.	The literature supporting this guideline provides evidence supporting the benefits of • offering alternative media for expression for some or all students, including word-processing, audio recording, video or film, multimedia, images, drawing, animation, graphics. • options such as word processors that include spellcheckers and grammar checkers, calculators, can benefit students with disorders of expression as well as typically achieving students. • providing various scaffolds and supports during that apprenticeship.	Atkinson, Renkl, & Merrill, 2003; Bui, Schumaker, & Deshler, 2006; Daiute & Morse, 1994; Dalton, Tivnan, Riley, Rawson, & Dias, 1995; Danoff, 1993; Doering & Veletsianos, 2007; Dole, Brown, & Trathen, 1996; Englert, Yong, Dunsmore, Collings, & Wolbers, 2007; Etheris, 2004; Figueredo & Varnhagen, 2006; Gersten & Baker, 2001; Goldberg, Russell, & Cook, 2003; Gouzouasis, 1994; Idol-Maestas, 1985; Jones, 1994; Joram, 1992; Kurth, 1987; MacArthur & Graham, 1987; MacArthur, Ferretti, Okolo, & Cavalier, 2001; McNaughton, 1997; McNeill, Lizotte, Kraicik, & Marx, 2006; Mechling, 2005; Morocco, Dalton, & Tivnan, 1992; Tumlin & Heller, 2004; van Essen & Hamaker, 1990; Vincent, 2001; Wilson, 1999; Wood, Bruner, & Ross, 1976; Zydney, 2008

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Action and Expression	**Guideline 6:** Provide options for executive functions by guiding appropriate goal setting, supporting planning and strategy development, facilitating the managing of information and resources, and enhancing capacity for monitoring progress.	The evidence supporting this guideline focuses on the advantages of supports such as: • highly explicit goal-setting instruction, varied models, and embedded prompts and scaffolds to estimate effort and task difficulty; the positive outcomes of explicit strategy instruction for planning and revising; • graphic and cognitive organizers, concept maps, explicit instruction in how to evaluate information, and templates for note-taking; • explicit instruction for self-monitoring, guiding questions for self-questioning and prediction, and curriculum-based measurement.	Alvermann & Boothby, 1986; Anderson-Inman, Knox-Quinn, & Horney, 1996; Bahr, Fuchs, Fuchs, Fernstrom, & Stecker, 1993; Boon, Burke, Fore, & Spencer, 2006; Boon, Fore, Ayres, & Spencer, 2005; Boyle & Weishaar, 1997; Chalk, Hagan-Burke, & Burke, 2005; Chang, 2007;Darch, Carnine, & Kammeenui, 1986; de Bruin, 2007; De La Paz, 2007; Earley, 1985; Englert, Manalo, & Zhao, 2004; Fleming, 2002; Fuchs, Butterworth, & Fuchs, 1989; Fuchs, Fuchs, Karns, Hamlett, Katzaroff, & Dutka, 1997; Fuchs, Bahr, & Reith, 1989; Fuchs & Fuchs, 1992; Graham, MacArthur, Schwartz, & Page-Voth, 1992; Graham, 1997; Kim, Vaughn, & Wanzek, 2004; King, 1991; Kooy, 1992; Malone & Mastropieri, 1992; Mason, 2004; Meltzer, 2007; Punnett, 1986; Rademacher, Schumaker, & Deshler, 1996; Robinson, Katayama, Beth, Odom, Hsieh, & Vanderveen, 2006; Royer & Royer, 2004; Saddler, 2006; Saddler & Asaro, 2007; Torrance, Fidalgo, & Garcia, 2007;Townsend & Clarihew, 1989; Troia & Graham, 2002; Troia, Graham, & Harris, 1999; Willerman & Mac Harg, 1991; Wong, Butler, Ficzere, & Kuperis, 1996; Wong & Jones, 1982; Zipprich, 1995

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Engagement	**Guideline 7:** Provide options for recruiting interest by optimizing individual choice and autonomy; optimizing relevance, value, and authenticity; and minimizing threats and distractions.	The literature supporting this guideline focuses on the benefits of: • providing students with choices in the learning environment; • the use of anchored instruction and other techniques to enhance relevance in order to increase student engagement and achievement; • creating learning environments that vary in their perceived threats and distractions in order to increase student engagement and achievement	Assor, Kaplan, & Roth, 2002; Baker & Wigfield, 1999; Boggiano, Main, & Katz, 1988; Bottge & Heinrichs, 2002; Cameron & Pierce, 1994; Catlin, Lewan, & Perignon, 1999; Early, 1985; Flink, Boggiano, & Barrett, 1990; Flowerday & Schraw, 2000; Fredrickson & Branigan, 2005; Fuchs, Fuchs, Finelli, Courey, Hamlett, & Sones, 2006; Immordino-Yang & Damasio, 2007; Kincaid, Knoster, Harrower, Shannon, & Bustamante, 2002; Lepper & Cordova, 1992; Mayer, Sobko, & Mautone, 2003; Metzler, Biglan, Fusby, & Sprague, 2001; Patall, Cooper, & Robinson, 2008; Reeve, Jang, Carrell, Jeon, & Barch, 2004; Riding & Watts, 1997; Rieth, Bryant, Kinzer, Colburn, Hur, & Hartman, 2003; Schraw, Flowerday, & Reisetter, 1998; Stipek & Weisz, 1981; Sweet, Guthrie, & Ng, 1998; Tafarodi, Mehranyar, Panton & Milne, 2002; Unrau & Schlackman, 2006; Van Eck, 2006; Vye, 1990; Weinstein, 1979; Wiersma, 1992; Wiest, 2002; Zins, Bloodworth, Weissberg, & Whalberg, 2004

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Engagement	**Guideline 8:** Provide options for sustaining effort and persistence by heightening the salience of goals and objectives, varying demands and resources to optimize challenge, foster collaboration and community, and increasing mastery-oriented feedback.	The research supporting this guideline focuses on the effectiveness of: • incorporating periodic or persistent reminders of both the goal and its value in order to support students in sustaining effort and concentration in the face of attractive distracters; the effects of optimizing resources and demands, and teaching within a student's Zone of Proximal Development; • strategies such as cooperative learning groups with scaffolded roles and responsibilities, school-wide programs of positive behavior support with differentiated objectives and supports, and peer tutoring and support; • strategies such as providing feedback that encourages perseverance, focusing on development of efficacy and self-awareness, encouraging the use of specific supports in the face of challenge, and emphasizing individual effort rather than relative performance.	Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Bangert-Downs, Kulik, Kulik, & Morgan, 1991; Bentz & Fuchs, 1996; Blackwell, Trzesniewski, & Dweck, 2007; Calhoon & Fuchs, 2003; Craig, Graesser, Sullins, & Gholson, 2004; Craske, 1988; Craven, Marsh, & Debus, 1991; Dion, Fuchs, & Fuchs, 2005; Donovan, Smolkin, & Lomax, 2000; Drach-Zahavy & Erez, 2002; Dweck & Leggett, 1988; El-Alayli & Baumgardner, 2003; Fowler & Peterson, 1981; Fuchs, Fuchs, Yen, McMaster, Svenson, & Yang, 2001; Fuchs & Fuchs, 2005; Fuchs, Fuchs, & Burish, 2000; Hafner & Hafner, 2003; Harris, Graham, & Mason, 2006; Hughes, Ruhl, Schumaker, & Deshler, 2002; Kamins & Dweck, 1999; Kobayashi, 2003; Locke & Fuchs, 1995; MacArthur, 1991; McLeod, Berdugo, & Meagher, 1998; Montague & Applegate, 2000; Mueller & Dweck, 1998; Orsmond, Merry, & Reiling, 2002; Rothkopf & Kaplan, 1972; Schultheiss & Brunstein, 1999; Skillings & Ferrell, 2000; Simmons, 1994; Simmons, Fuchs, Fuchs, Mathes, & Hodge, 1995; Stahl, Pieschi, & Bromme, 2006; Tomaka, Blascovich, Kibler, & Ernst, 1997; Tomaka, Blascovich, Kelsey, & Leitten, 1993; Vick, Seery, Blascovich, & Weisbuch, 2008; Wood, Bruner, & Ross, 1976; Wolters, Yu, & Pintrich, 1996; Xin, 1999.

Table 2-1 Continued

UDL Principle	UDL Guideline	Foundational Research Concepts	Citations
Provide Multiple Means of Engagement	**Guideline 9:** Provide options for self-regulation by promoting expectations and beliefs that optimize motivation, facilitating personal coping skills and strategies, and developing self-assessment and reflection.	The literature supporting this guideline explores the effectiveness of: • explicitly teaching and scaffolding goal-setting strategies and of empowering students to set their own goals; • strategies such as developing help-seeking strategies, providing scaffolds and feedback for managing frustration, and building internal controls; • developing students' self-questioning, self-monitoring, and self-determination skills	Agran, Wehmeyer, Cavin, & Palmer, 2008; Agran, Calvin, Wehmeyer, & Palmer, 2006; Agran, Blanchard, Wehmeyer, & Hughes, 2001; Bandura & Cervone, 1983; Bouffard-Bouchard, Parent, & Larivee, 1991; Brooks, Todd, Tofflemoyer, & Horner, 2003; Cleary & Zimmerman, 2004; de Bruin, 2007; Duffy, Roehler, Sivan, Rackliffe, Book, & Meloth, 1987; Early, 1985; El-Alayli & Baumgardner, 2003; Elliott & Dweck, 1988; Evans, Belham, & Grudberg, 1994; Hole & Crozier, 2007; Hom & Arbuckle, 1988; Karabenick, 2004; Lancaster, Schumaker, & Deshler, 2002; Marchand & Skinner, 2007; Mercier & Frederiksen, 2007; Newman & Schwager, 1995; Nolan, 1991; Pajares, Britner, & Valiante, 2000; Palmer & Wehmeyer, 2003; Paulsen & Feldman, 2005; Ridley, 1992; Sawyer, 1992; Schunk, 1985; Schunk, 1996; Wehmeyer, Palmer, Soukup, Garner, & Lawrence, 2007; Wolters, Yu, & Pintrich, 1996; Wong & Jones, 1982; Wood & Wood, 1999; Zimmerman, Bandura, & Martinez-Pons, 1992; Zimmerman & Kitsantas, 1996; Zimmerman & Bandura, 1994.

Accessible Instructional Materials (AIM)

A recurring theme throughout the literature on UDL was the need for accessible instructional materials in order for learning environments to be universally accessible (Dalton, Pisha, Eagleton, Coyne, & Deysher, 2002; Dolan, Hall, Banerjee, Chun, & Strangman, 2005; Marino, 2009; Rose, Harbour, Johnston, Daley, & Abarbanell, 2006; Strangman & Dalton, 2005). For the purpose of this study, I reviewed three specific areas of the literature on accessible instructional materials: assistive technology, digital textbooks, and Braille. Within the area of Braille, I also explored implications of Braille in literacy instruction for students with visual impairments. I selected these three categories because of the existing use of these materials in my classroom, with Braille being the newest addition to my repertoire.

Assistive Technology

Assistive Technology (AT) is beneficial for students with disabilities (Edyburn, 2003; Raskind & Higgins 1998; Rose & Meyer, 2002). This is especially true across several domains of literacy (Lange, McPhillips, Mulhern, & Wylie, 2006). Tools such as word processing, hypermedia supported text, text-to-speech, optical character recognition, speech synthesis, and speech recognition are just some of the tools found to be beneficial to students, especially those with disabilities (Lewis, 1998; Male, 2002; Raskind & Higgins, 1998). Outcomes for AT are improved when students have options to personalize/individualize the technology (Judge, 2006; Lueck, Dote-Kwan, Senge, & Clarke, 2001; Mechling, 2006). Despite the evidence supporting the benefits of AT a lack of training and understanding is a major impediment, compounded by a limited research base (Alper & Raharinirina, 2006; Edyburn, 2006; Judge, 2006). Even though the benefits of AT are widely recognized, advances in the field indicate the potential

benefits may have an even greater impact on students accessing the general curriculum than present practices would suggest (Rose, Hasselbring, Stahl, & Zabala, 2005). Many of my students have AT included in their IEPs and universal access to these programs have a positive impact on the other students in the classroom. The idea of traditional AT benefiting students for whom the tool was not explicitly assigned has powerful UDL implications.

Digital Textbooks

Printed textbooks in school classrooms are ubiquitous. Despite their omnipresence, textbooks are not considered an accessible instructional material because of the barriers of printed text. Digital textbooks, however, are an emerging material developed to make the curriculum more accessible. Students with dyslexia and other learning disabilities report a preference for digital textbooks because it eases the demands of reading text (Schneps, Thomson, Sonnert, Pomplun, & Chen, 2013). Students also appreciate the flexibility, navigability, and portability (Pisha & Coyne, 2001). The tools typically included in digital textbooks include text-to-speech, online-glossary, the ability to manipulate the text, options for teacher scaffolds, and links to internet resources. Evidence suggests digital textbooks improve reading outcomes for students with dyslexia and other print disabilities (Horney & Anderson-Inman, 1999; MacArthur & Haynes, 1995). Digital textbooks are no longer the exception in our school district; rather they are the standard for textbook access. The universal availability of the digital textbooks, which include a number of accessibility features, means all of my students have access to tools that have been previously reserved for students with disabilities. The impact on student learning in our district, specifically students with disabilities, has yet to be explored.

Braille

In a meta-analysis of the relevant research in blindness and visual impairment, commissioned by the National Center on Low-Incidence Disabilities, Ferrell, Young, and Cooney (2006) report the research base in the field of visual impairment is lacking because, “the field of visual impairment espouses techniques, procedures, curricula, and service delivery options without evidence, or based on the lowest level of evidence, over and over again” (p. 15). Additionally, most of the research on Braille instruction is incomplete because it often excludes students with physical and intellectual disabilities (McCall & McLinden, 2001). That being said, there is evidence that the use of Braille improves access to the curriculum and improves learning outcomes for students who are blind. For example, most students with visual impairments, as well as their teachers, report the belief that the use of Braille and Braille instruction is an important learning medium (Wittenstein & Pardee, 1996). Wetzel and Knowlton (2000) report Braille reading rates are significantly slower than print reading rates, but drill and practice in Braille can lead to increased reading achievement, faster silent and oral reading rates, fewer reading errors, and greater comprehension (Flanagan, 1966; Flanagan & Joslin, 1969; Kederis, Nolan, & Morris, 1967; Mangold, 1978; Umsted, 1972). Haptic perception is sustained over time (Anater, 1980), suggesting that concrete hands-on experiences might enhance learning. Reducing the number of words in a Braille reading passage may not result in increased speed or comprehension (Martin & Bassin, 1977). Poor Braille quality can slow down reading rate and accuracy (Millar, 1977, 1987). Leaving out words might decrease the amount of time it takes to read, but it does not increase comprehension (although it has a greater impact on news passages than it does on science or fiction passages) (Martin & Bassin, 1977). Braille reading

comprehension is decreased when other stimuli compete for the student's attention (Millar, 1988, 1990).

Additionally, Ferrell, Young, and Cooney (2006) reported the results of their meta-analysis in terms of four of the five components of reading identified by the National Reading Panel. The first component is Alphabetics. The authors explain there is limited evidence that a phonemic approach contributes to literacy because contracted Braille does not have a one-to-one phonemic correspondence. The authors warn us against generalizing from what we know about alphabetics from a sighted population. The next component is Fluency. The authors note a lack of empirical evidence in this category because of a lack of replication of research. This is a continuous theme in the research due to the low numbers of students in schools with visual impairments. The authors, however, were able to conclude that automated practice in Braille reading improves fluency and low vision devices appear to increase speed and quantity of reading. The third component is Comprehension. The authors reported automated practice in Braille reading, and the use of low vision devices, improves comprehension. Again, the authors, due to the lack of replication, could make only limited conclusions.

The fourth and final component discussed in the report is Computer Technology. The authors explain that while there were many examples of assistive technology being used to support students with visual impairments, most of these studies were conducted with students who had already mastered reading and writing. The authors cite two studies related to the use of computer technology to teach students with visual impairment to read and write (Flanagan, 1966; Kederis, Nolan, & Morris, 1967). The authors were very critical research in this area, "as might seem obvious from their date

of publication, these studies examined more primitive forms of technology that are generally not in use today. The methods utilized today to teach blind children to read are essentially the same as those used in the 1950s" (Ferrell, Young, & Cooney, (2006, p.11). In their conclusion, Ferrell, Young, and Cooney (2006), urge the field to examine existing educational environments and situations, rather than relying on outdated research of a different era. Therefore, we know that Braille is an effective means by which to meet an end, but we need to situate the research of the medium in a 21st century inclusive learning environment to evaluate its effectiveness moving forward.

Universal Design for Learning, Supported Reading

Given the research supporting the use of Universal Design for Learning, as well as the benefits of accessible instructional materials, the next category I reviewed has to do with teaching reading in a supported, accessible manner. Specifically, I will discuss text-to-speech, decoding support, vocabulary support, and strategy development support because they are all elements of my existing UDL reading instruction. Many of these tools originated in the field of Assistive Technology and their benefits for students with disabilities was discussed in a previous section. An unintended outcome of the development of these tools is the effect they have on the entire student population, not just those with an identified disability. This phenomenon suggests the importance of exploring points of commonality and difference between AT and UDL (Rose, Hasselbring, Stahl, & Zabala, 2005).

Text-to-Speech

Bimodal reading with text-to-speech (TTS) can promote significant improvements in reading rate, comprehension, reading stamina, phonological awareness and sensitivity, word recognition, and letter naming skills relative to students who do not use

TTS (Elkind, Black, & Murray, 1996; Lonigan, Driscoll, Phillips, Cantor, Anthony, & Goldstein, 2003; Strangman & Dalton, 2005; Strangman & Hall, 2002). In addition to the academic benefits, TTS allowed and motivated students to read more and demonstrated positive effects on self-confidence (Elkind, Black, & Murray, 1996). The research suggests the greater the disability, the more the technology elevated comprehension (Higgins & Raskind, 2005). For example, Montali and Lewandowski (1996) studied the reading comprehension of average and below average readers in 8th and 9th grade under three conditions: reading with text-to-speech, reading onscreen without text-to-speech, and listening to the passage read, and found that below average readers in the bimodal condition outperformed peers reading onscreen without text-to-speech or just listening to the passage, while above average readers in the bimodal condition outperformed peers in the auditory condition,

When synchronized highlighting was combined with TTS, outcomes improved for students with disabilities. Elbro, Rasmussen, and Spelling (1996) studied synchronized highlighting with TTS by providing students in grades 2-6 with the support for 40 days. The intervention had a significant remedial effect for students with reading and language disabilities. Hecker, Burns, and Elkind (2002) studied highlighting and TTS with Kurzweil 3000, an assistive technology product that offers reading supports by providing the support to post-secondary students with attention disorders. The results indicate students with a low baseline reading score, may read faster and comprehend better when using TTS with synchronized highlighting. Pisha and Coyne (2001) conducted a qualitative study of high school students' use of supported eText (including synchronized highlighting with TTS) using a history text chapter and found, when given

the choice, weaker readers report using the feature. Readers who choose not to use the TTS feature reported they used the highlighting to self-pace or locate where they left off in the text.

In the past, when my students had access to talking text, the construct of decoding text was neutralized, which allowed me to better evaluate and assess student learning. It also meant that decoding text was not a required skill for other learning in the classroom, which meant more students were able to participate and learn.

Decoding Support

Decoding support, both with and without technology, has a similar positive impact on student learning. The support can be visual or auditory (Elbro, Rasmussen, & Spelling, 1996), automated (Mostow, Aist, Burkhead, Corbett, Cuneo, Eitelman, Huang, Junker, Sklar, & Tobin, 2003), or student activated (McKenna, 1998, Olson & Wise, 1992). In a previously mentioned study, Elbro, Rasmussen, and Spelling (1996) also found that decoding support, both auditory and visual, had a significant remedial effect on student reading. Similarly, in a study of decoding support, McKenna (1998) gave kindergarten and first grade students the option to click on unfamiliar words to hear a digitized pronunciation and found digitized pronunciation and phonemic support improved word recognition for students. When compared with students receiving regular classroom instruction, Mostow et al. (2003) used speech recognition to monitor the reading accuracy of poor readers in grades 2 and 3. Students who mispronounced words were offered instructional support and the authors found that students with decoding support outperformed the control on word comprehension. Just like with TTS support, readers with the most severe disabilities show elevated phonological gains when supported with syllable and onset-rhyme feedback (Olson & Wise, 1992).

Decoding text is a fundamental skill of reading printed text. When decoding is the learning goal, the construct being assessed, I have found that an all or nothing approach limits the effectiveness of instruction. Even within the skill of decoding, students need scaffolding.

Vocabulary Support

The reading achievement of all students is effected by vocabulary development. Too often English language learners (ELL) and struggling readers are negatively affected by underdeveloped vocabularies. Because of the achievement gap created by this phenomenon, many are calling for increased use of technology as a means to decrease these gaps between student groups in reading (Proctor, Dalton, & Grisham, 2007; Strangman & Dalton, 2005). Al-Seghayer (2001) researched the use of video and still pictures with 30 ELL students and found both to be effective in teaching unknown vocabulary words to this population. Boone and Higgins (1993) asked low, medium, and high performing kindergarten, first, and second grade students to read digitized texts with vocabulary support in the form of animated graphics, computerized pictures, definitions, and synonyms and found that those students outperformed peers in the control group on a standardized vocabulary test.

In a similar study, Higgins and Cocks (1999) had third grade students read a poem aloud and then view short animations related to the target vocabulary words. Students made significant improvement in performance on a test of the target vocabulary. Hebert and Murdock (1994) found that sixth grade students with language learning disabilities performed better on learning vocabulary words when using computer-aided instruction (CAI) with speech output than CAI without speech. Bosseler and Massaro (2003) used a similar CAI to teach vocabulary to students with autism, and

had similar positive results. Chun (2001) provided foreign language learners with access to text with TTS, an online bilingual dictionary, and hyperlinks to glossary entries with more contextual information about the vocabulary. Students given these tools looked up significantly more words than the control, and read and understood the text better than the control.

The research supporting the first UDL principle, provide multiple means of representation, is clear about the various ways students receive information, particularly vocabulary. Embedding vocabulary supports within lessons and learning experiences improves access and participation.

Strategy Development Support

Beyond recognition of text and understanding vocabulary, good readers must have effective strategies in order to comprehend text. Embedding strategy support scaffolds into digital text is one way to help develop these strategies (Rose & Meyer, 2002; Rose, Meyer, & Hitchcock, 2005). Blankenship, Ayres and Langone (2005) embedded cognitive maps into text for three students with behavior disorders and learning disabilities, and found all students improved reading comprehension of content material. Dalton and Proctor (2007) are working to develop universal literacy environments that allow print-challenged students to have access to text with embedded TTS and scaffolded strategy instruction. Dalton, Pisha, Eagleton, Coyne, and Deysher (2002) conducted a study comparing the reading comprehension of two groups of sixth and seventh grade students, one with face-to-face strategy instruction, and another with face-to-face strategy instruction and computer-supported instruction. The latter achieved significantly higher comprehension scores and spent significantly more time on task. Liu and Bera (2005) studied the way sixth grade students used strategy

supports in problem-based hypermedia learning. They found that students with higher performance scores made more productive use of the supports than those with lower scores.

This particular area of supported reading is established within the research that led to the second UDL principle: provide multiple means of action and expression. Reading is receptive and expressive. Students need to be able to recognize “what” they are reading (receptive) and “how” they should use that information (expressive). Students need just as many scaffolds to support the ways in which they make sense of the information they are reading.

Summary and Conclusions

The literature on Universal Design for Learning is well established and based on decades of research in the fields of education, cognitive science, cognitive neuroscience, neuropsychology, and neuroscience. There is clear evidence in the literature to support the principles of UDL (provide multiple and flexible means of representation, action and expression, and engagement) as well as the UDL guidelines. The use of the UDL principles and guidelines clearly improves accessibility for students with disabilities, as well as other students “in the margins” (Rose & Meyer, 2006). The benefits of using accessible instructional materials and supported reading practices are similarly grounded in convincing empirical work. The literature clearly supports the benefits of flexible goals, methods, materials, and assessments to support vast learner variability. However, empirical evidence describing the use of UDL, AIM, and supported reading practices together in inclusive classroom settings is not present in the research base. How do these well-established concepts fit together in the context of an inclusive

classroom setting? Similarly, the literature on teaching reading to students with visual impairment and blindness is lacking, especially in an inclusive setting.

Given the myriad challenges of teaching all learners to high academic standards in inclusive settings, a need for rich, descriptive study of this topic was necessary. This study was designed to address this gap in the literature on UDL, AIM, and teaching reading to the visually impaired. The reflective nature of this study improved my own practice, and thereby improved the educational experiences of my students. My hope is that other educators will read and study my story to further their efforts to meet the challenges of teaching students with disabilities.

This chapter reviewed the literature on UDL, accessible instructional materials, and supported reading instruction in order to provide rationale for this study. UDL holds a lot of promise, but a review of the literature indicates a lack of research on the practical application of this approach. My study will contribute to the emerging literature on UDL. Chapter 3 will define the methods, context, as well as the data collection and analysis procedures used in this investigation.

CHAPTER 3
METHOD

In order to study my experiences teaching a student with blindness to read in my inclusive, standards-based, 5th grade English Language Arts classroom, I chose to engage in practitioner research. This research methodology best suited my study because I was asking questions about my own instruction and studying my own classroom, reflecting on my own teaching practice. This methodology allowed me to capture the iterative cycle of student outcomes and adjustments that I, the teacher, made regarding Universal Design for Learning. This chapter will define practitioner research as the method used to conduct the study, provide a description of my teaching context, and explain the data collection and data analysis methods.

Practitioner Research

Knowledge of practice is the constant questioning of existing understandings within a given practice. It is a quest to understand who, what, when, where, why and how. For teachers, this stance develops because "teachers across the professional life span play a central and critical role in generating knowledge of practice by making their classrooms and schools sites for inquiry, connecting their work in schools to larger issues, and taking a critical perspective on the theory and research of others" (Cochran-Smith & Lytle, 2009, p. 273). Practitioner research is a qualitative method of social research that gives practitioners an opportunity to study and reflect on their own practice in a systematic way for the purpose of improving education, pedagogy and learning (Dana & Yendol-Hoppey, 2009). Through practitioner research, teachers are able to engage in a continuous process of professional development. The relationship between the role of being a teacher and the role of being a researcher is often

misunderstood. Cochran-Smith and Lytle (2009) assert the importance of practitioner research: “Inquiry and practice are understood to have a reciprocal, recursive, and symbiotic relationship, and it is assumed that it is not only possible, but indeed beneficial, to take on simultaneously the roles of both researcher and practitioner” (pp. 94-95). My goal as a teacher researcher was to gain insight into my own practice in an effort to improve the teaching and learning taking place in my classroom, thus I selected practitioner research as my method. This method allowed me to generate the inquiry questions based on existing wonderings in my professional practice. My insider perspective allowed me to tell the story of the iterative process of teaching, learning, and reflecting (Dana & Yendol-Hoppey, 2009). Through intentional questioning about the teaching and learning that took place in my classroom, and an organized systematic data collection process, practitioner research allowed me to facilitate teaching and learning to maximize student potential (Lassonde, Ritchie, & Fox, 2008).

Context

This study took place in a public, suburban elementary school in southwest Florida. At the time of the study, the school enrollment was just over 900 students, pre-k to 5th grade. Sixty-one percent of our students were classified as economically needy (i.e., received free or reduced price lunch). Fifty-three percent of our students lived in homes where the primary language was not English. Twenty percent of our students were identified as having limited English proficiency. Eight percent of our students were classified under the category of Exceptional Student Education (ESE), which included the 3% of our student population identified as “gifted.” The racial demographics of our school were 34% white, 17% black, 42% Hispanic, 3% Asian, 4% multi-racial, 1% other (self-reported).

At the time of the study, I taught English Language Arts (Reading & Writing) and Social Studies to 42 fifth grade students. These students were divided into two heterogeneously grouped classes. I taught one in the morning and one in the afternoon. When students were not in my classroom, they were with another teacher in another classroom learning Math and Science. The diversity in my classroom reflected that of the school, with the exception of Exceptional Student Education (ESE). More than one-fourth of my students (27%) were classified within the category of ESE. The range of academic ability in my classroom was significant. For example, the range in reading Lexile levels in my classroom was 19 to 1250. The 5th grade level target range for Lexile was 700-1000.

The school leadership clustered students receiving additional services (ESE, ELL, Gifted) in order to maximize resources and provide students with appropriate learning support. My classroom was one of the ESE cluster classrooms. As an inclusive school, nearly all learning support was provided in the general education classroom. Six of my students were identified as having a specific learning disability, and four of those students were also identified as having language impairment. Two additional students in the class were identified as having language impairment, but not a specific learning disability. Two of the students in my classroom were classified as Other Health Impairment (OHI), one because of Fetal Alcohol Syndrome and the other Attention Deficit and Hyperactivity Disorder. The remaining two students classified under the category of ESE were identified as having Autism Spectrum Disorder and visual impairment (blindness), respectively. All of these students had, and still have, Individualized Education Programs (IEP) to support their learning. In addition to the

students identified as having some level of learning disability, there were two students in my classroom with 504 plans (Section 504 of the Rehabilitation Act and the Americans with Disabilities Act) because of Bipolar disorder and Attention Deficit Disorder, respectively. During the first half of the school year, we identified three additional students with significant learning challenges and were given additional learning opportunities through the school's Response to Intervention (RtI) process. All three of those students, by the end of this study, were identified with Specific Learning Disabilities and IEPs had been developed. Additionally, we identified five students who demonstrated potential for "gifted" placement, and who, during the study, were evaluated by the gifted department of our district office. Four of the five students evaluated were identified as meeting the requirements for the County's gifted program. To support the significant learner variability present in my classroom, a special education teacher spent 45 minutes a day with each class. The Speech-Language Pathologist spent 45 minutes twice a week with each class. Collaborative planning was a necessity in order to meet the needs of our students, and it occurred before and after school as well as during common planning time.

My Position

My own personal experiences and beliefs impacted my teaching practices and researcher positionality. As stated previously, I have been using the principles of UDL in my classroom with positive results. As I result I have biases toward Universal Design for Learning and inclusion. My biases have evolved as a result of my 11 years of experience teaching in public school, my middle-class background, and my own educational experiences as a student in K-12, college, and graduate school. I believe all students are entitled to a high-quality education. There is no single method of instruction

that can meet the needs of all students and the UDL framework embraces this notion and provides options for all learners. To that end, I also believe that classrooms must be dynamic learning ecosystems. The teaching and learning must be as dynamic as the learners in the classroom. Goals, methods, materials and assessments must be flexible, relevant, and timely. In order for inclusive education to be effective, students must be able to access materials, both physically and cognitively. Consequently my classroom was built upon the vision that all students can learn, that intelligence is not fixed, and we can make progress each and every day toward our goals. Finally, I believe in the values of kindness and caring. I work very hard to ensure my students know I care about them.

To meet the educational needs of my students, I deliberately utilized UDL in my planning, instruction, and evaluation. I used flexible materials for the presentation of content, gave students choices for the way they demonstrated what they knew, and provided multiple options for engagement. For example, at the beginning of the school year, my students learned about the U.S. Constitution. Students had options for how the information was presented to them: they could read from the book, listen to an audio recording of the text book, watch a pre-recorded explanation by myself, view an animated video on BrainPop.com, or listen to a musical explanation of the U.S. Constitution on Flocabulary.com. Students also had options for how they expressed what they had learned: write an essay, illustrate and caption a poster, design a digital presentation, write and perform a play, or record their own voice explaining what they've learned. I had minimal control over the standardized curriculum, or who was assigned to my classroom. However, what I could control was the flexibility of my goals, my methods, my materials, and my assessments.

Because my experiences with UDL prior to this school year were based solely in a high-incidence disability context, I was curious to find out how the UDL framework would support the education of a student with a low-incidence disability, blindness. During the aforementioned unit on the U.S. Constitution, which took place at the beginning to the school year, the student in my class with visual impairment chose to access the content using multiple media. She listened to a pre-recorded video of me explaining the big ideas of the U.S. Constitution, and then she read the Braille textbook. She chose to respond to our essential learning questions by typing using her laptop and Focus 40 keyboard. The learning goals for this particular unit were social studies content focused, which, from a reading disability standpoint, tend to be easier to make accessible than English Language Arts goals. The purpose of my study, then, was to tell the story of my efforts to teach reading to a student who is blind in a universally designed general education classroom. To do this I studied my own practices as they related to teaching this particular student.

My Student

During the time of the study, Rachel (pseudonym) was a 10-year-old white female student in my 5th grade class. Rachel was born with Leber's congenital amaurosis, a rare genetic disorder that causes blindness at birth. She was the only daughter of white, middle-class parents. She had attended public school since the age of 3. Based on state standardized test scores from 4th grade, she entered my classroom as an above average reader and below average writer.

Rachel's primary mode of reading was Braille. For writing, as well as accessing web-based curricular materials, she used a laptop with JAWS for Windows Screen Reading Software and a Focus 40 Braille Display Keyboard. Rachel also used an iPad

mini with the standard voice over accessibility feature. Rachel had a one-on-one classroom aide to support her access to materials, and received support two times a week for mobility and advanced Braille instruction from a district-level teacher of the visually impaired. I was her primary instructor for English Language Arts (Reading & Writing) and Social Studies.

I recruited this student for the study due to her low-incidence disability (i.e. blindness). I discussed the study with her parents and obtained parental consent. After obtaining parent consent, I obtained student assent. While this student was the target of the study and therefore a "participant," she was not asked to do anything that she would not have been asked to do as a regular student in my class.

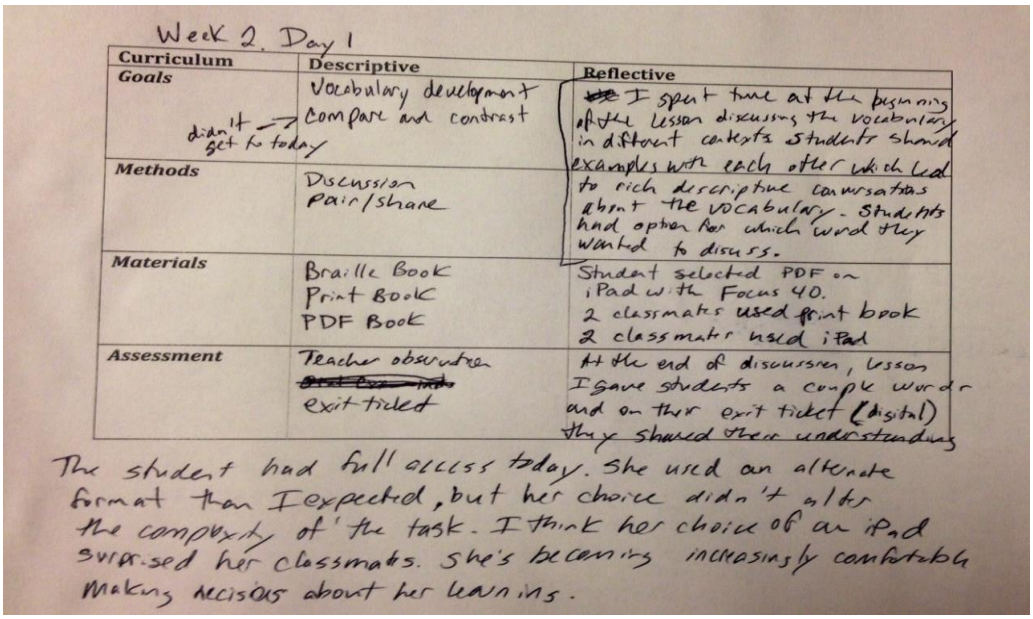
Data Collection

To research the above question, I collected data for a 5-week period in the Spring of 2014 in three different ways: collecting field notes, keeping a daily reflective journal, and engaging in peer debriefing sessions throughout the study. I gathered field notes (Figure 3-1) each day by observing the student as she interacted with the curriculum (goals, methods, materials, and assessments) during guided reading. The purpose of guided reading is to give students the opportunity to apply reading strategies to new text with the support of the teacher. The UDL approach asserts the importance of utilizing flexible goals, methods, materials, and assessments in order to make the curriculum accessible to all learners. Observing the student in this context gave me the opportunity to note the manner in which she interacted with the flexible goals, methods, materials, and assessments in guided reading. During guided reading, I worked with a small group of students with similar reading abilities. After I provided an introduction to the text, each student read a portion of the text. Students figured out new words as they

read for meaning, while I supported their problem solving. After reading the text, we engaged in meaningful conversation about the content. Together we revisited the text to demonstrate and use a variety of comprehension strategies.

I had a set observation protocol in place and utilized both descriptive and reflective notes. The descriptive notes described the goals, methods, materials and assessments used during guided reading. For example, the student used a Braille book instead of the standard printed textbook. The reflective notes described the way in which the student responded to the goals, methods, materials, and assessments. For example, I often wrote about how the student utilized the different reading materials to achieve the goal of the lesson. Guided Reading was an established activity in our classroom and did not require any modifications to be made to our typical routine. Because this method of teaching required a small group with supported instruction from a teacher, I was able to closely study the way the student interacted with the universally designed guided reading lesson.

Figure 3-1 Example of Guided Reading Observation Form



Week 2. Day 1

Curriculum	Descriptive	Reflective
Goals	Vocabulary development Compare and contrast didn't get to today	~~We~~ I spent time at the beginning of the lesson discussing the vocabulary in different contexts. Students shared examples with each other which led to rich descriptive conversations about the vocabulary. Students had option for which word they wanted to discuss.
Methods	Discussion Pair/share	
Materials	Braille Book Print Book PDF Book	Student selected PDF on iPad with Focus 40. 2 classmates used print book 2 classmates used iPad
Assessment	Teacher observation ~~Oral Exit Ticket~~ exit ticket	At the end of discussion, lesson I gave students a couple words and on their exit ticket (digital) they shared their understanding

The student had full access today. She used an alternate format than I expected, but her choice didn't alter the complexity of the task. I think her choice of an iPad surprised her classmates. She's becoming increasingly comfortable making decisions about her learning.

I kept a daily journal during the data collection period (Figure 3-2). At the conclusion of each day, I reflected upon the following questions: How did I use UDL (multiple means of representation, expression, and engagement; flexible goals, methods, materials, and assessments) to support her learning in my classroom? What challenges remain unaddressed by UDL? What evidence do I have of her response to UDL? What does the evidence tell me?

Figure 3-2 Excerpt of Daily Journal

Week 1, Day 4

Today we worked very intensely on examining text features within non-fiction text. I intentionally selected a passage with a wide-variety of text features so the students would have multiple opportunities to practice the skill in a guided environment as well as independently. I found myself thinking about how challenging it is for her to rely upon others to interpret the illustration for her. We've been working on using the initial description from the Braille book as a starting point for her analysis. Today, while working with her shoulder partner in a rally robin Kagan structure, she began her analysis by simply reading the description in her book. Her partner noted that she didn't notice one of the details that the student mentioned. The student thought this was amusing and asked her shoulder partner if there was anything in the illustration that wasn't included in the description from the Braille book. Her partner shared additional details about the illustration and the two had a good time discussing the details of the illustration and sharing stories from their own personal experiences

As I think back to the beginning of the year, I'm reminded that this was a very challenging skill for her because of her blindness. It didn't help that some of the descriptions in the Braile book were lacking in detail. I'm excited to see how she's made progress in this area through UDL. By giving her options for representation and expression she's found new ways to explore the same content as her peers. I also notice that these moments, especially when working in a cooperative setting with a classmate, ease her anxiety about what she can and can't do. By minimizing threats and distractions, and combining those experiences with structured intentional collaborative activities, the environment encouraging opportunities to participate with her peers.

I engaged in two separate peer-debriefing session types during the study: a daily session during my planning time with the student's one-on-one aide, and a weekly session with the district assistive technology specialist (Figure 3-3). I chose these two

professionals because of their knowledge of the student and UDL, respectively. During the planning time with the one-on-one aide, we reflected on the student's participation, activity, and access to the curriculum during the reading lessons and activities. I asked the one-on-one aide to give me feedback on the decisions and choices I made regarding the student's learning, with a particular focus on her daily learning goals, my teaching methods, accessible instructional materials to support her learning, and the ways in which I assessed her learning. If barriers presented themselves, I proposed and considered potential solutions. I took notes during these daily conversations.

Figure 3-3 Excerpt of Weekly Debriefing Session

Q: What has surprised you?
- Flexible materials are improving access for student and her peers.
    - She's using audio support from textbook website with her Braille book. She used a headphone splitter with another student to read/listen to book simultaneously. Duo chose to work together on project following the reading work.
- Design matters
    - There's nothing easy about teaching, but many of the choices I've made within the UDL framework have made this a much less complex process than I originally anticipated.

Q: What barriers are present?
- Independent reading
    - She's not reading as much as I was hoping she would. She has access to books for independent reading, but the barrier seems to be with engagement. It doesn't seem to be a priority for her. She is highly engaged during read aloud and lit circles, though. I can't seem to figure out why there's such a big difference.

Q: How are you providing scaffolds to enhance her existing knowledge?
- Present levels
    - She has good reading skills, but she has the potential to have great

The weekly session with the district assistive technology specialist focused on the impact of UDL and assistive technology tools. The district assistive technology specialist is a national expert on these two topics and, as a peer debriefer did, as

Creswell (2013) states, “keep the researcher honest; ask hard questions about methods, meanings and interpretations; and provide the researcher with the opportunity for catharsis by sympathetically listening to the researcher’s feelings” (p. 251). I kept a written account of this weekly session, too. By utilizing these three different data collection techniques, I was able to study my experiences teaching a student who is blind to read in my inclusive, standards-based, 5th grade English Language Arts classroom.

Data Analysis

In order to analyze the data in a clear and reliable manner, I followed an established set of steps for analyzing qualitative research (Creswell, 2013). My data were organized electronically. My field notes with observation protocol, daily journal, and peer debriefing session notes existed electronically within Google Docs and were backed up into my Dropbox folder each day. All electronic data were protected by password.

Once data were collected, I read through all the text, making marginal notes along the way. These notes allowed me to form my initial codes. I used categorical aggregation to describe codes and derive themes. Categorical aggregation is a method in which the researcher seeks a collection of instances from the data, looking for a correspondence between categories and hoping for issue-relevant meanings to emerge. This method allowed me to draw meaning across multiple instances of data (Creswell, 2013). Upon completion of this method, I was able to begin interpreting the data and developing themes about what I learned in the study. The final step was to provide a rich, thick, in-depth description of the study using narrative, tables, and figures.

When it came time to tell my story in rich, thick, and in-depth manner, I decided to use the UDL Guidelines as an organizational structure to share my experiences. Because my study explored my experiences teaching Rachel to read in a UDL context, I felt the guidelines would provide a clear and logical framework for me to share my story, but also for readers to best understand the experience.

Trustworthiness

Creswell (2013) suggests that researchers use explicit and accepted strategies to establish and document the accuracy of their study. To that end, I included four of Creswell's established and accepted strategies in my study to ensure trustworthiness. First of all, I was engaged for a prolonged period of time in the setting and made observations daily. Next, I established an external check of the research process in the form of a peer reviewer and weekly debrief. Third, I attempted to clarify my researcher bias so that readers would understand my position and assumptions about the inquiry. Finally, I intended to provide a rich, thick description of my inquiry to allow readers many opportunities to determine the transferability of my work.

Limitations

As I tell the story of my experiences using UDL to teach reading to a student who is blind, I recognize there will be certain limitations to the transferability of my work to other educational settings. My sample was limited in that I focused on a white, middle class female student. She was an above average reader coming into my classroom, which is not typical for students who have congenital blindness. She already knew "how to read"; my efforts as her teacher were to help her build upon her existing strengths as a reader, and teach her the required state educational state standards in English-Language Arts.

My lack of experience working with students with low-incidence disabilities, specifically blindness, should also be considered a limitation. While I considered myself to be well-versed on the practical applications of UDL as they related to teaching students with high-incidence disabilities in inclusive settings, the same could not be said for my knowledge of UDL and low-incidence disabilities, hence the reason for the study. My understanding of blindness, and educating students who are blind, at the beginning of this experience was limited.

The context of my teaching experiences may also limit the transferability of my experiences to others in the field of education. State standards, administrative support, district-level flexibility, curriculum guides, and school-based expectations vary significantly and have a direct impact on teaching and learning in classrooms. Readers of this study will have to determine if the information provided transfers to their settings. Limitations aside, my primary purpose in this study was to systematically study and improve my own teaching, and I am confident that my research design has accomplished those goals.

CHAPTER 4
RESULTS

The purpose of my study was to tell the story of my efforts to teach reading with Universal Design for Learning to a student with blindness in an inclusive, standards-based classroom. I used the Universal Design for Learning Guidelines (CAST, 2011) to contextualize and guide my story. I divided this chapter into three main sections: *Provide Multiple Means of Representation, Provide Multiple Means of Action and Expression,* and *Provide Multiple Means of Engagement*. These headings are the three main principles of Universal Design for Learning and provide structure for the Guidelines. The UDL Guidelines are organized based on the three main principles of UDL (Table 4-1). As previously discussed, the purpose of the UDL guidelines is to support anyone who develops curricula, develops lesson or unit plans, or designs learning experiences to meet the needs of all learners. This discussion, as well as the theoretical basis for the UDL guidelines, is reviewed in Chapter 2.

Table 4-1 Universal Design for Learning Principles and Guidelines

I. Provide Multiple Means of Representation	**II. Provide Multiple Means of Action and Expression**	**III. Provide Multiple Means of Engagement**
Perception	Physical action	Recruiting interest
Language, expressions, and symbols	Expression and communication	Sustaining effort and persistence
Comprehension	Executive function	Self-regulation

This description of my teaching was carefully constructed using my field notes and journal entries from my data collection during a five-week unit of instruction in my fifth grade reading class. The unit of instruction included a variety of reading goals, teaching methods, curricular materials, and assessments. This period of time included various aspects of our core reading series: whole group reading, vocabulary

development, close reading, and guided reading. We also engaged in literature circles and read novels aloud to explore elements of fiction, and researched non-fiction topics related to the American Revolution and animal adaptations to explore elements of non-fiction. Additionally, each student engaged in independent reading and we completed standardized test preparation as required by the school district. These events were representative of the day-to-day goals, tasks, and events of my classroom and provided a good sample of what typically took place there.

UDL Principle I: Provide Multiple Means of Representation

Perception

To provide students options for perception, the UDL guidelines call for offering ways of customizing the display of information, alternatives for auditory information, and alternatives for visual information. Rachel had been blind since birth, so providing her options for reading was an absolute necessity, and was the first step I took in designing an accessible learning environment for her. At the end of last school year, I compiled a list of required textbooks, requested the materials from the Florida Instructional Materials Center for the Visually Impaired (FIMC-VI), and Rachel had all of her books in Braille format on the first day of school. These steps were standard procedure for Rachel and other students in our school district with visual impairments.

UDL calls for multiple means of representation, and specific to this guideline, options for perception. Braille was a good medium for Rachel, but it was limited because it did not provide options for customizing display of information, alternatives for audio information, or alternatives for visual information. Her first option for perception was Braille, but I wanted to give her additional options, just as I did for my other students.

My other students had the option of reading the printed text along with audio support. I gave Rachel the same option because our reading textbook was available online in an accessible format with audio support. She was able to read the Braille book while simultaneously listening to the text. Because her reading materials were also available in an accessible PDF format, she utilized her laptop and iPad with her Focus40 keyboard to read the text. Braille was her preferred, and primary, medium for reading and the accessibility of the digital materials allowed for her to practice reading Braille along with audio support.

To illustrate, in week 2 of the study, the students read a fiction passage with a learning goal of drawing conclusions. Because the primary learning goal was not related to decoding printed text, the students were given options for reading. Rachel chose to read the story using her Braille textbook and the audio support provided in the online version. About halfway through the passage, she raised her hand and asked if she could switch out her Braille book and use the PDF on her laptop. She put away her Braille book, opened up her laptop, turned on JAWS, opened the document and proceeded to read the passage using her laptop and Focus 40. When I asked why she switched mid-story, she said that she realized there was a more efficient way to accomplish the same goal. She explained that the reason one was more efficient than the other had to do with the bulkiness of her Braille book compared to the ease of use with her Focus40 and laptop.

During the study, all of my students participated in literature circle discussion groups. This involved students selecting novels to read in a small group, and having structured discussions related to the literary elements of the fictional text. Rachel chose

to read the novel *Shiloh* (Naylor, 1991) and joined four other classmates who made the same selection. I provided the students a hard copy of the novel: four of the students had printed text, and Rachel used her Braille copy. I also provided an audiobook of the novel, mp3 player, and headphone splitter, as an option for perception. I began this approach to literature circles a few years ago as I grappled with the challenge of individual differences in an inclusive, standards-based classroom. I expected my students to analyze grade level fiction, but because of the barrier of printed text, it was not possible for all my students do to this. By turning reading into a dual-modality experience (Elkind, Black, & Murray, 1996; Lonigan, Driscoll, Phillips, Cantor, Anthony, & Goldstein, 2003; Strangman & Dalton, 2005; Strangman & Hall, 2002), I improved access and the quality of discussion around the learning goal improved. I began to obtain (with funds from the PTO, parent donation, personal expense) a couple of audiobooks each year in the same way I purchase printed books for my classroom library.

During the study, all five students chose to use the audiobook along with the printed text. They would read a chapter, take notes on the story elements (some wrote in notebooks, while others typed their notes, including Rachel who used her laptop keyboard and JAWS), and then stop the recording to discuss the novel. While they were reading I noticed all five students studying their books intently while using their fingers to follow along with the text (Rachel included). One particularly memorable moment was when Judd Travers, the novel's antagonist, did something especially antagonizing and the students, who were all reading along together, gasped at the same time. Rachel

slammed her hand down on her book and said, “I just hate that guy. Someone stop the recording because we need to talk.”

During the study I found providing options for customizing the display of information and offering alternatives for audio information to be less of a challenge than the third checkpoint – offering alternatives for visual information. The concept of offering alternatives for visual information did not confound me; rather it was the way it was being presented to Rachel that caused me to rethink the whole concept. Text features such as photos, illustrations, captions, charts, maps, and diagrams abound in fifth grade text. Teaching students to interpret these features is a reoccurring learning goal throughout fifth grade.

In most of the Braille materials from FIMC-VI, visual information is described within the text. Materials produced within our school district are created in the same way. Since I am unable to read Braille and unable to preview all of her Braille materials, I assumed her text features were described in great detail. I discovered my assumption was incorrect one day while reading a non-fiction passage about ecosystems in guided reading. There was an elaborate illustration on the first page containing dozens of different sea creatures. We started our guided reading discussion by making predictions about the passage based on the illustration. While the other students in the group feverishly wrote predictions in their notebooks, Rachel sat quietly in front of her laptop. I asked her why she was not writing down any predictions and she told me that she did not have enough information to make any predictions. When the other students began sharing their responses, Rachel said, “How are they coming up with this stuff,” so I had the students explain the basis of their predictions. Rachel started shaking her head and

said, “Mr. Mundorf, all mine says is ‘living creatures in an ecosystem.’” One of the other students began describing the picture to Rachel. Another student replied, “Oh, I didn’t even notice that,” to which another responded, “Yeah, me neither. I’m glad you pointed that out.” From then on I made it a point to ensure all of Rachel’s text features were described explicitly, and also that I did not assume that our “sighted” students were all seeing the same thing.

Language, Expression, and Symbols

Once students have options for perception, the next step is to provide options for language, expression, and symbols in order to support learners’ variability in the way they understand different forms of representation – both linguistic and non-linguistic. Learners receive support through the clarification of vocabulary, symbols, syntax, and structure. Students also need options to support the decoding of text. Successful UDL implementation promotes understanding across language, and illustrates concepts through multiple media. The online version of our reading textbook had an embedded glossary, which allowed students to click on unknown vocabulary words for pronunciations and definitions. When Rachel used her iPad, she was able to use the “define” feature in any document with accessible text. In addition to definitions, our science techbook (computer-based) provided images, videos, and a contextual description of vocabulary words. She did not know how to use these accessibility features when she came to our class. I had to teach her, and her classmates, how to use them in isolation and within the context of the learning goals. Rachel, as well as her classmates, learned to use these tools to support her reading through in-class individualized, small group, and whole group training, as well as frequent opportunities to use these, and other, technologies to accomplish learning goals. I quickly found out

that this UDL guideline was about much more than giving students definitions to unknown words and concepts; it was about clarifying and supporting the understanding of vocabulary and other concepts, using a variety of means.

Before having Rachel in my class, I had always made it a point to provide visual examples of what I was teaching. However, I never realized how many times I provided visuals without explicitly describing the significance of the visual to the content being taught. For example, during the study we read a novel as a class, *Woods Runner* (Paulsen, 2010), which takes place during the American Revolution. I intentionally found images online so the students could have a visual representation of vocabulary and concepts presented in the novel. When I would show a picture, most of the students would reply with some sort of acknowledging sound, and then I would describe the picture for Rachel because I knew she could not see the photo.

I realized the inefficiency of this practice while trying to explain the concept of a "yoke" to the students. The characters in the story were traveling in an oxen-pulled wagon. The main character mentioned the yoke, so I showed the students a picture of a yoke between two oxen, and explained what it was. This explanation was met with the typical, "Ah, I see", or "Okay, I understand" from some of the students. Then I described what was going on in the picture so Rachel would understand. She nodded her head and asked, "Well, how big is it?" then, "Why do they need one?", then "What are they made of?" Just as I was beginning to respond to her questions, at least half of the hands in the room went up with additional questions. I smiled and said to the class, "Well, I guess I didn't explain that one very well." I proceeded to answer questions, and even had Rachel and another student come to the front of the room to demonstrate how

a yoke is used – we used a yardstick, because there were not any yokes available. Rachel went back to her seat and I asked if I did a better job of explaining that time and she responded, “Yes, now I see...and I think everyone else does, too.”

Using multiple media to illustrate concepts had been common practice in my classroom for many years. We read text, listened to text, watched videos, illustrated concepts, and engaged in much dramatic interpretation. I found, though, that even when presenting in all those different formats, there were many opportunities for misconceptions and confusion. For example, while learning about the American Revolution, I shared a number of video clips from Flocabulary.com, BrainPop.com, and the History Channel online. Having Rachel in my classroom made me hyper-aware of scenes, and even moments, when videos were not being narrated, when ideas and concepts were being described in non-linguistic ways. These moments were typical in TV shows, movies, commercials, even in everyday conversations – facial expressions, body language, etc. I never considered how often these moments occurred, and how confusing these moments could be in a learning environment. When we would watch the various video clips, I found myself narrating for Rachel, so she would understand. She benefited from this, but I found that many other students were benefiting as well. I would pause a video to explain a concept, mostly for Rachel’s benefit, but it would be students other than Rachel with questions and comments about my narration. The narration, intended to benefit one student, ended up improving the experience for others. This was one of many times during the study that I found myself reflecting on how the practice of making accommodations for individual students, or groups of

students, does not take away from the experience of others. In fact, it does the opposite. The accommodations improve the experience for everyone.

Another example of clarifying vocabulary and symbols came during a guided reading passage when a character mentioned “dialing a number on a phone.” We stopped to discuss the phrase, because the character was not referring to a cell phone, nor a push button phone, but rather a rotary phone. Initially, no one in the group could describe a rotary phone. I grabbed a marker and drew the face of a rotary phone on the dry erase board, then pantomimed how it would be used, which of course did not do Rachel any good. She shrugged and said she did not understand, so I told her we would talk about it with the whole class to see if anyone else had a better explanation. When we brought the question back to the group, one of our adult classroom volunteers said he had a rotary phone at home. The next day he returned with a big wooden box with a rotary dial on the front. He let the kids manipulate the dial and explained how the technology worked. As he talked with the kids, I found myself thinking about how important context and background knowledge are for kids when understanding new words and concepts. This is true for all of my students, not just those who are blind.

Comprehension

The final guideline within the first UDL principle (Provide Multiple Means of Representation) focuses on options for comprehension. When a reader is able to adequately perceive the information presented and understands the language, expression, and symbols being used, comprehension becomes the next goal. Readers need to be able to put these components together to create meaning (comprehension). Approaches to achieve this guideline include: activating or supplying background

knowledge, highlighting patterns, critical features, big ideas, and relationships, guiding information processing, and maximizing transfer and generalization.

To begin each week, the students engaged in a discussion responding to a thematic question related to the week's work. Prior to exploring vocabulary, reading text, responding to text, or teaching reading skills, I activated, and in some cases supplied, background knowledge for my students about the thematic topic of the week. I showed the students a short video provided by the textbook publisher to introduce the theme. The students perceived and processed that information individually. They sat and thought, then jotted their initial thoughts in a notebook or computer. Next, we engaged in a Kagan Cooperative Learning structure (ex. *Stand Up, Hand Up, Pair Up; Timed Pair-Share; Rally Robin)* to further build background knowledge. This was followed by a group discussion about the topic, moderated by me. During these events, we recorded the critical elements discussed and displayed the information on a poster in the classroom and online in our class Edmodo group. I also posted the central thematic question in the Edmodo group for students to respond to and discuss.

For example, in the first week of the study, the students discussed the thematic question: *How do people adapt to difficult situations?* We watched the short video and then the kids took thinking time to process their thoughts. Rachel called me over because she had a question about one of the vocabulary words being used – conviction – and after explaining the term, she typed feverishly on her laptop. We then transitioned to a Kagan structure Timed Pair-Share. Rachel's partner went first and described the ways she had to change her behavior after getting in trouble in an earlier grade. When it was Rachel's turn, she shared a story about befriending a new student to our school

who was having a hard time fitting in. When it was time to share with the group, Rachel and her partner volunteered to share their thinking and after both had the opportunity to share, Rachel interjected that both stories were examples of how personal transformation and having conviction to do what was right are a part of adapting to difficult situations. The conversation continued from there and launched our class into a great week of learning.

In addition to background knowledge about themes, teachers and students are also challenged by great variability related to content area background knowledge. To meet this challenge in my classroom, I provided students with options for building background knowledge within the content areas such as science and social studies. For example, fifth graders learn about the American Revolution in social studies. Previously, I mentioned a novel, *Woods Runner* (Paulsen, 2010), that we read as a class to supply background knowledge about the time period. I also included a literacy center each week explicitly for the purpose of developing background knowledge about non-fiction topics. During this study, there were two such centers. For the first part of the study, it was dedicated to topics related to the American Revolution, then we transitioned to a science topic: animal adaptations. During this center, students designed and created KWL charts which, prior to the lesson, document what we know [K], want to know [W], and after the lesson, what we learned [L]. In addition, the students completed concept maps, watched videos, read passages, and created a final product to convey their new understandings. The final products were expected to be focused on a learning goal and needed to show progress of understanding. Rachel used her laptop and word processing program to create the beginning of a KWL chart (K and W), and then she

selected to read two non-fiction passages about the revolution from our social studies series. I created accessible PDF documents and posted them on Edmodo for the students to access. Rachel downloaded the files and used her screen-reading program, JAWS, to listen to the text. Her final product was her completed KWL chart.

Another way to support comprehension is to highlight patterns, critical features, big ideas and relationships. This is especially important in vocabulary development. Students need to be able to recognize and define words, but they also need to be able to understand what words mean in context. Students engaged in a weekly vocabulary center during their independent work time that focused on developing contextual understanding of vocabulary. I presented these vocabulary words in our whole group, close, and guided reading activities during the week. One of the students' options, and the one that Rachel gravitated toward, was completing a Frayer graphic organizer for each of her assigned words. The Frayer approach is beneficial because it encourages a deeper understanding of a word and its relationship to the student (Marzano, Pickering, & Pollock, 2001). Rather than simply focusing on a textbook definition of the term, the students wrote a definition in their own words (using the textbook definition as a reference), described examples and non-examples of the term, and provided facts, characteristic, or a non-linguistic representation of the term.

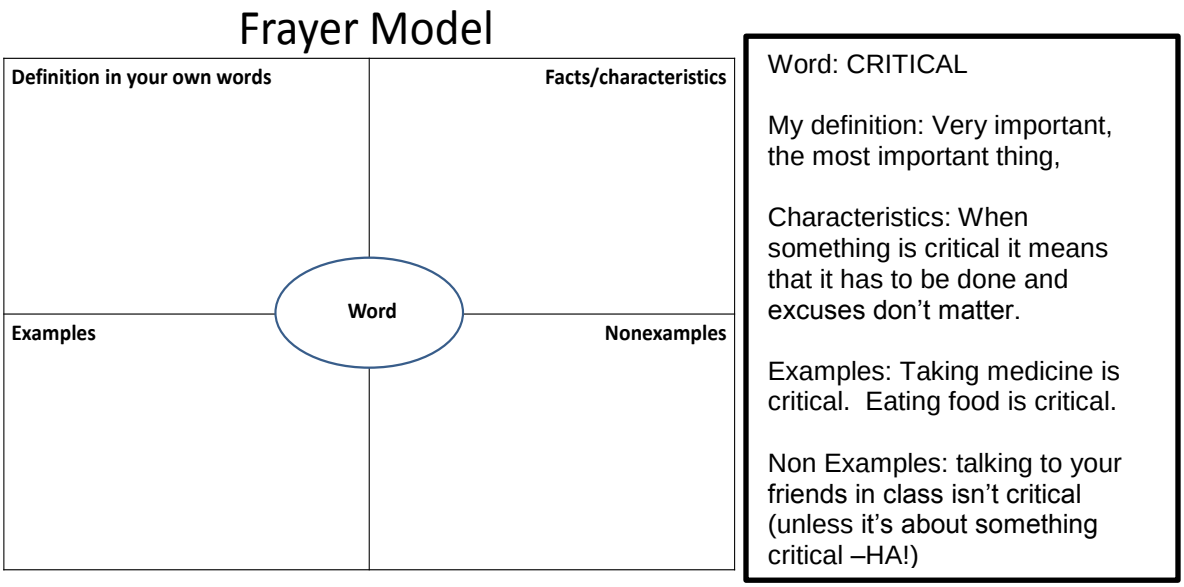
Rachel used her online reading glossary to explore definitions. The glossary was also available in the textbook, both printed and Braille, but Rachel always said she preferred the online version because she could use her iPad. Instead of filling in the chart like her peers did, she typed directly into a word document on her laptop that acted as her own personal glossary. The left side of Figure 4-1 shows the standard set-

up for the Frayer Model. The right side of Figure 4-1 shows an example of Rachel's version of the Frayer Model taken from her vocabulary document. Rachel's version contained the same information as her peers', but she altered the format to meet her needs. During the unit of study, as I reflected on her work each day, I found myself questioning the use of the Frayer model. I had no problem with the graphic organizer itself, but I realized I was limiting my other students in my requirement of that particular approach. The goal of the center was not "completing a graphic organizer," it was to develop grade level vocabulary. Rachel's work in this area made me rethink the way in which I designed centers for all the students. I allowed her to demonstrate her understanding in an alternative format, which improved her experience, and giving the rest of the class the same options improved their experience, too. However, in order to do this, the goal of the center needed to be clear, not only to the students, but also to me.

When I was first informed about Rachel's placement in my class, my initial concerns were related to the first two guidelines within this principle because I thought it was obvious that her blindness would impact her perception and understanding of language. However, once I provided her with accessible instructional materials, I realized that was not a completely accurate statement. Yes, she needed options in those areas, but it did not end there. Those two areas were obvious, because they were visible to everyone. People knew that she could not see the text and text features, in the way that sighted students see the text. But comprehension was not as obvious. We could not "see" if a student was blending the various components of reading together to

create meaning. It was a more complex task, and required as much, if not more scaffolding than the other two guidelines.

Figure 4-1 The Frayer Model showing a standard Frayer Model and Rachel's version.



UDL Principle II: Provide Multiple Means of Action and Expression

Physical Action

Giving students options for physical action is the first guideline within the second UDL principle. This includes varying the methods for response and navigation, and optimizing access to tools and assistive technologies. The second UDL principle and this guideline are not about access to these materials, though. Instead, this guideline focuses on how the tools are used to take action and express knowledge.

Providing students with a variety of tools for physical action took intentional planning and support. This began with the learning environment and my decisions about what would be available to each student. When I designed the environment, I had to consider the individuals who would be using the space, as well as the goals they were expected to meet. I constantly reflected upon my choices and evaluated the

effectiveness of the design, not just for my students with disabilities, but for all the students in my care. My students learned to use instructional technologies such as text-to-speech, apps on mobile devices, editing software on computers, online glossaries, presentation tools, and many others throughout the year to support their learning. They developed their skills through intentionally designed individualized, small group, and whole group training, as well as frequent opportunities to use these, and other, technologies to accomplish learning goals. I explained to my students that in order to know what materials to use they had to first think about what they were expected to do. There was a good deal of trial and error involved, but I anticipated that and included it in the design of the environment and learning experiences.

Rachel used a variety of instructional and assistive technologies to accomplish her learning goals each day. She used a laptop with keyboard and screen-reading program, a Focus-40 Braille display, an iPad mini, a Braille printer, and textbooks in Braille format. She also had access to online textbooks, online glossaries, audiobooks, and various educational apps on the iPad. She was the only student in the class who used Braille materials, but other than those assistive technologies, each student in my class had access to the same tools as Rachel. Students needed options for how they explored and responded to learning goals. All students in my classroom, including Rachel, had options for how they responded and navigated, and had access to all of the technologies. Text-to-speech (TTS) technology, like the technology in Rachel's JAWS screen reader, was a tool that students benefited from using. TTS was available on all desktop and laptop computers, as well as on all mobile devices. As long as decoding

text was not the goal of the learning activity, students were free to use the tool to support their learning.

During the third week of the study, a few visitors from the school district's central office were observing in my classroom. They observed the students at work while I conducted guided reading groups. At the end of class, after dismissing the students to art, one of the visitors asked how I organized the use of materials in the class. Specifically, he wondered how the students knew what they were and were not allowed to use. I explained that students were allowed to use the instructional technologies they needed. He responded with a puzzled expression, and I explained that these technologies, such as desktop computers, mobile apps, online glossaries, text-to-speech, and digital texbooks (including assistive technologies) were there to help students achieve their learning goals. The tools were not, in any way, intended to make the work easier. The tools were there to make the learning more accessible. When establishing procedures at the beginning of the school year, I taught students to think about the learning goal prior to selecting their materials and technologies. Once they established their goal, selecting the option became easier.

Prior to this study, I understood that a variety of learning tools, available to all kids, allowed me to set high, rigorous goals for each of them, while simultaneously giving them options for how they accomplished their goals. Each of my students learned differently and, as a result, needed different materials and technologies. If I only gave certain technologies to certain kids it could result in animosity, jealousy, and a negative stigma associated with the learning tools. More importantly, it would not have given me the flexibility I needed to reach and teach all of my students.

During this study, I learned Rachel needed access to instructional and assistive technologies because of her blindness, but she also needed access because she is a learner with typical developmental and cognitive needs. For example, she needed access to Braille because of her inability to see printed text, but she needed access to the online vocabulary games because it was her preferred way to practice vocabulary with her friends. In this way, her needs reflected those of a typically developing fifth grade student, and her learning choices reflected those that I needed to make available to all students in order to maximize their learning. Through this study I learned that my thought process in planning for her instruction, because of her blindness, was not wholly necessary because I needed to first address the needs of Rachel as a student in my classroom.

Expression and Communication

According to the UDL Guidelines**,** once students have options for physical action, the next step is to provide them with options for expression and communication by using multiple media and tools. It also becomes necessary to build fluencies with graduated levels of support for practice and performance. The goal of the first UDL principle (provide multiple means of representation) is to help the student acquire the information, whereas the goal of the second UDL principle (provide multiple means of action and expression) is to help the student express what they have learned. Rachel had much to share with the world, but if the only way she was permitted to do so was with a pencil and paper, we might never have experienced her true thoughts. Fortunately, Rachel had many educational technologies to choose from to express her understandings and construct her thinking.

Throughout the study students used multiple media to communicate their thinking, and multiple tools to construct and compose their respective thoughts. Unless the learning goal was in conflict with a particular means, students were given the option to write, type, speak, dictate, and/or create (draw, design, etc.) to communicate their understandings. Students used a variety of educational tools – high, medium, and low tech – to support their construction and composition. Using two of these options – Edmodo and Socrative – with Rachel taught me important lessons about expression and communication.

Edmodo is a secure and free social-networking site designed to help teachers and students connect and collaborate in an online environment. Edmodo had been my classrooms' web presence for the past few years because it provided options for presentation, expression, and engagement. I used this site to communicate and share learning goals, materials, and information about what we were learning. Students were able to post content as well, with approval, and share their own understandings with the group. We had discussion groups set up to enhance our existing classroom dialogue. Students monitored their own progress in Edmodo, too. I used Edmodo to poll the class about a variety of topics, communicated with parents through the parent access feature, and provided countless opportunities for students to collaborate. Because it was located online, it was accessible 24/7. For example, as we read novels in literature circles, I created online discussion groups for each novel, embedded poll questions to facilitate questioning and predicting, and created assessments to evaluate student comprehension.

When I first learned that Rachel would be in my class, I was very excited about using Edmodo with her. In my mind it was a perfect fit because I knew she needed accessible materials, the website was digitally accessible (or so I thought), and it would be a way for me to communicate with her and her parents. Unfortunately, none of that was true.

We quickly learned that while Edmodo appeared to be very accessible, it was anything but (at least not for Rachel). At first, we could not even get her screen reader to see the website. Once it did, all it read to Rachel was nonsensical web-design talk. She quickly grew frustrated, and the technology I had been counting on was quickly becoming anathema. I eventually figured out that through the mobile site, not the mobile app, we could give her access to most of the content on the website. She viewed materials posted by her teachers and classmates, but even that was challenging. Despite the barrier, Rachel used Edmodo regularly, and read what her classmates were posting, but did not really use Edmodo as a method of expression. She preferred other technologies, which was understandable. This experience taught me that there is no one tool or technology that will meet the needs of all students, which is why words like “options,” “multiple,” and “flexible” must be a part of every teacher’s vernacular.

During the study, however, something happened involving Edmodo that put a positive spin on this technology. Previously I mentioned Rachel participating in a literature circle group with her classmates. There were four other kids in her group with varying reading levels and communication skills. An important aspect of literature circles involved students discussing the literature. In addition to the face-to-face conversations, each literature circle group had a virtual discussion group on Edmodo to allow students

an option for expressing their thoughts about the novel. Rachel was very comfortable expressing herself in a group. A member of her group, however, was not as comfortable and in many ways limited in her ability to express her thoughts, especially in an impromptu conversation about text that was just read. The student was simply unable to process the information as quickly as her peers, and as a result, sat quietly during the first few small group discussions.

After the third day of silence, I reminded the class that their participation was expected, but they had the option of choosing how they would participate. That evening (a Friday), the quiet student in Rachel's group posted a summary about what was discussed in the group. The next night, she elaborated further on her summary, and on Sunday, she made a prediction about what would happen next. On Monday, just before the group was about to read, Rachel's group was reviewing the key details about what happened in the story on Friday. One of the other members asked if anyone had any predictions, and a few of the students offered ideas. Noticeably silent were Rachel and the quiet student. Rachel appeared to be uneasy, but finally said to the quiet student, "I read what you wrote over the weekend and wanted you to know that I think your prediction is right on target." The silent girl was surprised, but slowly puffed up her body and a bright smile emerged. She shared her prediction, which had already been constructed and communicated in another arena. Then Rachel turned to her group and said with a smile, "There's some good stuff on Edmodo, and you really should read it for yourself next time."

Socrative is a web-based student response system and was an entirely different means of expression and communication than Edmodo. Like Edmodo, however, I used

it in my classroom in the past as a way to collect data on student understanding. Socrative runs on tablets, smartphones, and laptops. Using my device (desktop computer or ipad), I controlled the flow of questions. Students used their devices and interacted in real time with the content. Student responses were visually represented for multiple choice, true/false and short answer questions. If I used a pre-made quiz or activity, I viewed reports online as a Google spreadsheet or as a downloaded Excel file. It was terrific for formative and summative assessments, as well as test preparation.

During state testing time, our school district required teachers at all levels to complete a series of review activities with the students in preparation for the upcoming tests. This review work did not replace existing instruction; rather it was considered additional work to be completed. The work was a good example of what should be expected on the test, and if the students were engaged, it provided a review and many teachable moments about test taking strategies. However, it was not very engaging for the students, which meant their efforts were not truly indicative of their actual abilities and the data generated were irrelevant.

To overcome this challenge, I modified the experience to offer alternatives for action and expression. Instead of reading, answering questions, reviewing answers, and discussing the questions all in one day, I divided the tasks up over a three-day period. The first day students read the passages and responded to the questions, the second day we used Socrative to review the answers, and the third day we clarified misunderstandings. Rachel needed her reading passages to be converted to Braille, which was done without incident through the school district office. My concern, however, was with her mode of expression. I knew she could answer the questions on her laptop

and print the responses because that was what she normally did with formal assessments of this nature, but I was not sure how she would be able to use Socrative. The week before we started, she and I sat down together and discussed the process. We opened the Socrative website on her laptop and hoped for the best. It did not work. JAWS, her screen-reading software, was unable to read the Socrative website. We were both frustrated. “It’s okay, Mr. Mundorf, I’ll just have one of the kids click the answer for me. It’ll be okay”, she said. But I did not want her to be dependent on another student, especially while doing an activity that I designed. Then I remembered her iPad had a standard voice-over accessibility feature (all Apple products have the feature), so we downloaded the free Socrative app and turned on the voice over feature. It worked! It read the text on the screen perfectly! Rachel excitedly explained our efforts to the class and we all cheered together.

Each week we followed our three-day schedule and reviewed the state reading standards. Socrative provided students with immediate feedback on their answers on their personal device (iPad, iPod, desktop computer), and the collective, anonymous efforts were displayed for the group to see. Students cheered, laughed, and celebrated while we were doing test prep. One of my teacher evaluation observations occurred during the data collection period, and our assistant principal was present for one of these test prep sessions. She commented on the final report that she had never seen students so motivated to share their answers on a quiz. She noted that the alternative method of expression led to more accurate results, which would allow us to provide more appropriate interventions to students in need.

The next week, on the day we reviewed our answers using Socrative, Rachel raised her hand in a panic. She hesitantly informed me that she left her iPad at home and would not be able to participate. Just as I was about to respond, one of the students handed Rachel one of the classroom iPads. Rachel felt the device and told the student that it was not hers. The student responded, “I know, but you don’t need yours. You can use voice over on any iPad. Now log on so we can get started.” Rachel smiled and did as she was told.

These experiences made me think about technology in new ways. I learned that technology can be frequently used to provide access to students, but at times the technology itself can be the barrier, like Edmodo was for Rachel. In my reading class, we did not have any standards or goals about technology. Instead, I needed to remember that technology was a means by which I could give kids access to learning content. The technology should serve as a vehicle to allow students to reach their goals. There were times that I was treating certain technologies as the learning goal instead of thinking of them as the means to accomplish the goal. Technologies should be evaluated in terms of their ability to provide options for representation, expression, and engagement for all students.

In my reflections I wrote a good deal about how technology provided access to my students. This did not surprise me because I knew going into this study that technology was a way to make the curriculum more flexible. What did surprise me though was that fact that much of my reflection about technology giving access to students did not focus on their access to the curriculum; rather, it focused on the way technology gave students access to one another. Technology gave the students

different ways to communicate with each other and show one another what they had learned. It gave Rachel access to her classmates and vice versa. For example, during guided reading Rachel read the same text as her peers, either in Braille or using her laptop and Focus 40, which allowed her to engage in meaningful conversation about the text with her teacher and classmates. When I asked students to provide a written response to a question, Rachel typed her thoughts using her laptop and Focus 40, and just like her classmates, was able to share her thoughts with the group. Through these learning experiences, Rachel developed her reading skills, but I also watched as the experiences helped her to develop confidence in her ability to articulate her thinking with her peers. At the beginning of the year she was hesitant to share her thoughts in a guided reading environment, but as this study progressed that passiveness dissipated.

Executive Function

The final guideline within this principal involves supporting students as they plan and execute tasks using their options for action, expression, and communication. This is done by guiding appropriate goal setting, supporting development of strategies and planning, facilitating the management of information and resources, and enhancing the students' capacity for monitoring progress. This guideline was similar to the guideline about comprehension because it was hard to see, and was more about building scaffolds for students to utilize on their journey to independence.

Coming into the school year, Rachel's past teachers shared with me that while Rachel was a motivated and conscientious student, when it came to academic work, she tended to rely on others to create a plan for her before she executed the plan. In order to guide appropriate goal setting for Rachel and her classmates, I first began with very clear learning goals. Before designing a learning experience, I needed to clarify my

expectations for my students. Once I knew what I expected I then had to make those expectations clear to my students. I posted all of my learning goals in a central location along with the learning scale I used to evaluate their progress. The intentional design of this space supported student goal setting and self-monitoring. The initial design impeded Rachel's access because she could not see it. I needed to come up with a way to make it more accessible for Rachel, as well as the students with print disabilities who may have had difficulty reading the printed text. I created a weekly planning sheet to share with the students that included the week's learning goals, essential questions, and learning scales, along with descriptions of the independent learning centers and guided reading target skills. At first I printed the document and distributed it to the students, until I realized that I could better improve access to all students by limiting the amount of printed text and instead providing it digitally. So, I posted the document to Edmodo, which allowed Rachel to download the document to her devices, other students to manipulate the digital text as needed, and students who desired a hard copy to print it out. This allowed each student to have a clear goal for each of the activities in the class, which supported students in setting goals.

Goal setting was an important aspect of learning in our classroom. On the first day of class I explained to my students that I believed in a growth mindset and not a fixed view of intelligence (Dweck, 2006). At the beginning of the year, we worked to establish baseline data to provide a starting point for our goal setting. I had a 5-10 minute data chat with each student every 4-5 weeks. We used the state standards as our guide, and set goals for reading fluency, reading comprehension, independent reading, vocabulary development, and reading skills. Students monitored their progress

using data from our classroom work, district benchmark assessments, state assessments, and student/teacher observations. Throughout the school year, students created charts and graphs to share their progress. During our data chats, students presented their data to me and we used it to evaluate progress and set goals for the future.

During the data collection period, we engaged in the planning and data collection activities described above and Rachel participated along with her classmates using many of the tools and scaffolds that have already been described. There were two major events during the data collection period related to this guideline that are worth noting in greater detail: assessing student learning at the end of the unit in the reading series and student led conferences.

Our reading series was divided into six units of instruction and each unit was designed around a central theme. During the data collection period we worked on unit 4 which focused on the central theme of people and animals adapting. At the end of the unit students gathered their respective scores to analyze and reflect upon. Rachel chose to use her weekly reading test scores to evaluate her progress. She quickly wrote down her five test scores, and then raised her hand to inform me that she was finished. I explained that we needed to take a closer look at that information to see if there was anything we could learn about her learning. She sighed deeply and reluctantly turned back to her computer. She noticed that some of her classmates were graphing their scores and asked if she could do the same. I said she could, but really was not sure how we were going to accomplish that task. Luckily for me, the school day ended soon after her request had been made, so I had some time to search for a solution.

I called the district office to speak with one of the special education coordinators and she suggested creating a bar graph with texture. The next day I created a bar graph using Rachel's data, and colored the bars with a metal screen underneath which caused the bars on the graph to have texture, allowing Rachel to use her sense of touch to see the scores in a different way. When I showed Rachel the graph, her fingers went wild and she said, "Mr. Mundorf, why does it go up and down so much?" I responded by saying, "Well, you tell me. They are your scores." She sat for a bit while I moved around the room and when I came back to her I noticed she had been typing and scanning her laptop while investigating her reading scores. She told me she thought the ups and downs showed that she was inconsistent, which surprised her, and she wanted to figure out why her scores were going up and down. She used her test results to delve deeper into her scores by reexamining the questions on each test. She browsed using her laptop and Focus 40 keyboard, until she made her discovery. She noticed that on all of the assessments her vocabulary scores were consistently high, but as the target skill fluctuated, so did her scores. Her conclusion was that on tests where generalizing was the target skill, she scored lower than on tests when drawing conclusions was the skill. In her reflection, she wrote, "Sometimes I think that reading is all one thing and that you are either good or not good at it. But reading is complicated and it's more than just being able to read words. If I want to be a good reader I need to think about reading as a lot of things instead of just one thing." She proceeded to ask me if she could share her graph, and her conclusions, with her parents at the upcoming student led conferences.

Student led conferences took place at our school twice a year. The first conference occurred within the first 6 weeks of school, and the second conference was

scheduled a few weeks before state testing began, approximately 5 months later. The purpose of student led conferences was to create an environment in which students and families could communicate about their learning goals and grade-level expectations. The first conference tended to focus on baseline information and goal setting, and the second conference focused on progress toward goals.

To prepare students for the first conference, we created a list of reading standards and gathered student data (quantitative and qualitative) to establish a baseline, or starting point. We compared that information to end-of-year grade level expectations generated by the school district. At the conference, the students shared their baseline information, as well as end of year expectations, and set goals with their families. We used these goals, as well as goals generated in class, to help the students make a plan for their own individual progress. Before the second conference, we revisited the standards and goals and collected data (qualitative and quantitative) to demonstrate progress. The students shared the information with their families, celebrated success, and created new goals based on their present levels.

The second conference took place during this study, and Rachel's parents were in attendance. They attended the fall conference, too. The three of them entered the room and sat at Rachel's table. Her laptop and Focus 40 were out, and she casually logged in and opened up her script (rehearsed during the school day), goals, data, and the Internet, just in case she needed to access additional information. Confidently, she read, "Thank you for coming to my student-led conference. I'm making good progress and am looking forward to showing you what I've been learning. I've been doing a lot of reading this year. Every week we read a few different stories to learn about different

topics and improve our reading skills. Each week I take an assessment about what I've learned. I'd like to share my progress on these assessments with you." She proceeded to dazzle her parents as she clicked from document to document, window to window and read through her script using her Focus 40 keyboard. When it came time to share her textured graph, she said to her parents, neither of which are Braille readers, "You'll like this one because you can see it. Mr. Mundorf helped me make it." She shared her reflections and together they celebrated and set new goals. After the conference, I received an email from Rachel's parents thanking me for helping Rachel organize her work so she could share it so clearly. They noted a change in their daughter, specifically that she seemed more motivated and focused on her learning. I explained to them that it was Rachel who organized the work; my part was providing clear goals and access to accomplish the goals.

Within the UDL guidelines, the goal of the second UDL principle is to develop strategic, goal directed learners. For that to occur, students must first have options for physical action, expression, and communication, but that is just the beginning. Tools for action, expression, and communication can be provided, but if students do not understand why they need the tools or how they will use the tools to accomplish their goals, then what is the point?

Working with Rachel within this guideline has taught me about the importance of including scaffolds within the areas of goal setting, planning, and progress monitoring. Rachel needed scaffolds in these areas to enhance her ability to reflect upon and set goals based on her progress. Without the supports, she would have settled for a simplistic explanation of her work. She did not need the accommodation because she

was blind, nor was it necessary because of low academic performance; she needed the accommodation because of her developmental and cognitive needs. I have learned that scaffolds in this area are not just for those with disabilities; all students need varying levels of support, especially when dealing with executive function. I needed to provide more explicit direction as to the expectations and procedures for completion of this analysis. Rachel helped me realize that executive functioning does not come naturally, but can be accomplished with appropriate scaffolds.

UDL Principle III: Provide Multiple Means of Engagement

Recruiting Interest

Recruiting interest is the first guideline within the third and final UDL principle. This UDL guideline calls for teachers to give students opportunities for individual choice and autonomy, as well as helping students to find relevance, value, and authenticity within the learning experience. The guideline also emphasizes the importance of minimizing threats and distractions for students. Choice is an important aspect of engagement; it is important to remember that in a standards-based curriculum the standards are not optional, however the means by which a student learns and demonstrates can be flexible.

Choice abounded in my classroom. The main reason I provided students options for representation and expression was to help them understand and see multiple pathways in learning and that within those choices existed their paths to progress. So much within the curriculum was standardized and without option; however within the curriculum there existed opportunities to embed individual choice and autonomy. When we worked in independent reading centers, students shared the same instructional goals, but each goal had multiple options for completion. For example, all students had

a weekly vocabulary goal. Rachel preferred to look up words in her online glossary, type definitions, and complete a version of a Frayer graphic organizer. She also liked to play a vocabulary guessing game with her classmates using the website from our reading series. That was her pathway to accomplishing her weekly vocabulary goals, but it was not the only option. Other students chose to illustrate concepts, listen to explanations online, and collaborate with each other to design posters, or dramatize the vocabulary. Rachel told me she enjoyed our class because “it’s the same for everyone and different for everyone at the same time.”

Recruiting interest also involved making learning relevant and authentic for students. This was challenging in a standards-based curriculum, but not impossible. Providing students opportunities to give input and engage in self-reflection made learning more meaningful. Before we read a new novel aloud in class I asked students to suggest and vote on titles. Similarly, I collected student input on options for projects and activities. If I provided students with a list of options for an assignment, I included one entitled “independent study” which allowed students to create a unique project based on their own ideas. For example, during the study we researched different animal adaptations. To share their understandings, I gave the students options for expression. They could write a report, create a labeled poster, or design and deliver a PowerPoint presentation. With each option, I provided a list of project requirements. One group of students asked if they could do a dramatic interpretation. Confused, I asked them to elaborate and they explained they were going to act out different animal adaptations in two ways: what happens because of the adaptation and what would happen if the

animal did not have the adaptation. They were able to articulate how the option would align with a learning goal, so I approved their independent study idea.

Independent reading was another area in which I tried to make the learning relevant and authentic through choice. I expected each student to read independently, but what they read and the way in which they read was up for negotiation. When Rachel first heard this expectation in August, she was visibly upset. I pulled her aside and she told me that she did not like to read very much, and like most reading teachers, I told her it was because she had not found the right book. Through FIMC-VI, I ordered 20 or so award-winning, popular novels in Braille format. I just knew the right book was all she would need. She obediently selected a book and began reading, but without the enthusiasm I had expected. She complied and she completed the task during the first half of the year, but still confided in me that it was not really her thing. She said the books were good, but she really did not enjoy the act of reading.

As this study began, I found myself frustrated because I could not figure out what to do. As our literature circles began, my solution emerged. Watching Rachel read *Shiloh* (Naylor, 1991) with her classmates was one of the highlights of my teaching career. She laughed, she complained, she interacted with her classmates, and each day we finished she would say something like, “I can’t wait to read this again tomorrow.” As I thought about it more and more, I realized that the one thing that was different about the two reading experiences was the audio support. Upon further reflection, I realized that her Braille reading speed of 80-90 words per minute was staggeringly slower than her actual processing speed. For Rachel, reading novels independently was like watching a movie in slow motion. My next move was to give her an audiobook

option to go along with her independent reading. She was very excited, and asked if I had the novel *Petey* (Mikaelsen, 1998). Unfortunately, I did not have that novel in my award-winning library of Braille books. She shrugged her shoulders and I felt like we were back where we started. She could read the books, and would continue to comply if I asked her, but it was not meaningful or engaging to her.

During one of my conversations with the school district's assistive technology specialists, I shared my frustration and he asked if I had ever considered using Bookshare. I had heard of Bookshare, but did not know anything about it. He explained that Bookshare was an online-repository of books available specifically for students with print disabilities. Because of Rachel's medical condition, she qualified for an account. We established the account, and explored the vast library. I subsequently learned that Bookshare was the world's largest online accessible library of copyrighted content, and through an award from the U.S. Department of Education Office of Special Education Programs (OSEP), was free to qualifying schools and students. The next day I asked Rachel if she wanted to read *Petey* (Mikaelsen, 1998). She asked if I was joking and I explained Bookshare to her. She started bouncing up and down in her seat, and we downloaded the book that minute. Using her iPad and Focus 40 keyboard, she was able to read the book and listen simultaneously, which was exactly what she wanted. Before *Petey* and Bookshare, Rachel typically took about six weeks to read a 200-page book, and sometimes it took even longer. She read *Petey* (Mikaelsen, 1998), a 256-page book, in a little under two weeks.

The challenge of recruiting Rachel's interest in independent reading taught me a valuable lesson about learner engagement. In this instance, Rachel's learning barrier

was not related to representation or expression. She had options to read the text, and she had options to express what she learned about the text. Her barrier was engagement, but it was not that she was unengaged by the content. She was very excited about the books themselves, but when the options limited her ability to read and respond, her engagement level dropped significantly. This made me think about my other students who appeared to be either disengaged or struggling academically in certain areas, and I questioned if my analysis of their barrier was accurate. Were they struggling because the content was too challenging, or did it have to do with the manner in which the content was being presented? Were they bored because the content was not interesting to them, or did it have to do with the way they were allowed to share their understandings?

Realizing these different possibilities for explaining students' disengagement led me to call a round of one-on-one meetings with certain students to discuss these questions. I learned in these conversations that in some cases the options I was providing were creating barriers. For example, one of the students I spoke with expressed reservation about forced social interaction with a specific peer during a Kagan Cooperative Learning structure. He explained that it was not the structure, nor the content that was the challenge, but rather it was the forced partnership with a particular student that made him uncomfortable and disengaged. These barriers were not related to representation and expression, but rather engagement. I learned to consider the options from an engagement standpoint as strongly as I did in terms of representation and expression.

Sustaining Effort and Persistence

According to the UDL Guidelines, once students' interests are recruited, the next step is to support students' abilities to sustain effort and persistence as they work toward the learning goal. Per the guidelines, this is achieved by heightening salience of goals and objectives, varying demands and resources to optimize challenge, fostering collaboration and community, and increasing mastery-oriented feedback. Rachel was a capable, motivated student, but according to her parents, had a tendency "to get lazy and just get things done without doing her best" throughout her school career.

Ensuring the clarity of goals and objectives was the starting point for this guideline. Not only did students need to know *what* the goals and objectives were, but they also needed to know *why* we had those goals and objectives. As previously discussed, we had goals, essential questions, and learning scales posted and accessible to all students (central bulletin board, student independent work checklists, online). I revisited these goals and objectives throughout learning experiences. Our student/teacher data chats, end of unit data analysis, and student-led conferences reinforced expectations for each student. We talked about what was expected and we also modeled those expectations, too. I provided exemplars (different representations, of course) to provide clarity about what was expected of each student.

Because of the tremendous learner variability present in my classroom, it was also crucial for me to vary demands and resources to optimize challenge. Rachel was an individual learner with her own unique learner qualities, as were all of the students in my classroom. Having differentiated goals, methods, materials and assessments, centered on a clear learning goal, allowed me to personalize the learning experiences for my students. Our emphasis on growth and progress resulted in a community

focused on collaboration and teamwork, rather than competition and rivalry. This collaborative spirit did not occur naturally; rather, its development was a part of my intentionally designed space.

Two critical elements to our classroom community were our school district's commitment to Positive Behavioral Intervention and Supports (PBIS) and our school's dedication to Kagan Cooperative Learning Structures. Clear expectations, consequences, and routines abounded at our school because of our training and understanding of PBIS. My ability to minimize threats and distractions to my learners was enhanced because of the similar foundational concepts of UDL and PBIS. Similarly, Kagan Cooperative Learning Structures increase student engagement and learning, while teaching kids the important social skills they need to work in a collaborative environment. For example, one of the teambuilding activities we used was called *Find the Fiction*, in which students had to write three statements: two true and one false. One at a time, the students each stood to read their statements, while the other students wrote down their best guess as to which statement was false. The teammates announced their guesses and the sharing student announced their false statement. Students celebrated and the next student took their turn. This was a common Monday morning structure throughout the school year to give students an opportunity to share about their weekends and learn more about each other. There was one particular Monday during the study that Rachel's group was not very talkative. They had been working on a group activity together and were frustrated with their collective progress. We played *Find the Fiction* and within one round of the game they were laughing and

working together. These good feelings transferred to the academic work and led them towards the completion of their project.

I also needed to make sure my feedback contributed to their ability to sustain and persist toward learning goals. I included a number of opportunities for the students and me to give each other feedback. We focused on mastery-oriented feedback and sought information that was substantive and informative rather than competitive and comparative. We used this feedback to evaluate instruction, learning goals, and options for learning.

Considering the role of my feedback in helping students persist toward learning goals was a new thought process for me. My development in this area was not specifically related to Rachel, but it came as a result of analyzing my work with Rachel and reflecting about teaching and learning at the end of each day. Upon reflecting, I came to the conclusion that my feedback was not bad, but it was not necessarily good. It was neutral and probably not as effective as I had always assumed it was. I realized I was so intentional about multiple aspects of my classroom, when it came to feedback I basically just said whatever popped into my mind. Most of the time it was substantive and informative, rather than competitive and comparative, but it certainly was not mastery-oriented and focused. For example, during guided reading my typical comments prior to this realization would be generic and say things such as, “oh, that’s great!” or “that’s exactly right” or “not quite, let’s try again”. Once I became aware of this ineffective practice, I began using statements such as, “Let’s take a look at the learning scale and see where your answer fits.” or “Excellent! Let’s review the learning goal and

think about how we could better show understanding." This realization came to me early on in the study and I was able to be much more explicit in my feedback as a result.

Self-Regulation

The final guideline within this principle is to develop students' abilities to self-regulate through the teacher's promotion of expectations and beliefs that optimize motivation; facilitation of personal coping skills and strategies; and development of students' self-assessment and reflection. I wanted my students to be purposeful and motivated as they worked toward their respective learning goals. Many of the ways we provided options for self-regulation have already been discussed: clear goals, differentiated materials, growth mindset, self-reflection, learning scales, access to tools, self-assessment, and mastery-oriented feedback. To me, though, self-regulation was about students believing in themselves and knowing how to overcome obstacles along the way.

A student that self-regulates is able to persevere when things do not go their way. My job as a teacher, then, is to facilitate personal coping skills and strategies. Early on in the school year, we read the novel *Wonder* (Palacio, 2012), a story about a 5th grade boy with a cranio-facial abnormality attending school for the first time. The novel pushed us to discuss words like "ordinary" and "normal" and we collectively agreed that those words were not real things. I remember Rachel saying, "Mr. Mundorf, there's no such thing as an ordinary fifth grader. We're all different." One of her classmates chimed in and agreed, saying that there was no such thing as ordinary fifth graders, only extraordinary fifth graders.

When we finished the book, we engaged in a week of thematic discussions as a group. Each student was given an opportunity to talk and we passed the "talking slinky"

around until we had exhausted our thoughts on the theme of the day. Our principal observed one day and heard the kids talking about challenges such as bullying, divorce, moving, and differences. After class she told me that she thought the academic benefit of the activity was obvious, but the socio-emotional impact of our dialogue would last forever. I had forgotten about this activity until recently when I overheard Rachel consoling a troubled classmate who was frustrated about his inability to do a task. She said, “You’re going to be fine. One of the things I have learned this year is that there is always a way to get to where you want to go, you just have to be able to think about the different options.” The student smiled, and Rachel continued, “Remember when we read *Wonder?* August (the main character) could have given up on that first day of school, but he didn’t, he kept going because he had people who believed in him. Well, I believe in you. You can do this. You’re going to be fine”. They proceeded to reminisce about the novel, not the literary elements, but the themes of perseverance, empathy, and kindness.

The goal of the third UDL principle is to develop purposeful, motivated learners. As I reflected on this goal as well as my experiences during this study with this particular UDL principle, I was once again reminded that Rachel was now an 11-year-old, fifth grade student. She needed to be provided with options for engagement because she and her classmates were unique individuals with different experiences and learning preferences. In order to be purposeful and motivated in her learning she needed to be engaged. Her engagement may have been affected by her blindness, but her engagement in learning should not have been defined by her blindness.

Similar to the previous guideline, I discovered what I was and was not doing in this area as I reflected on my work with Rachel. Prior to this study, I was sure I included this guideline in my explicit intentional use of UDL. As I reflected on Rachel's behavior I recognized that I very rarely mentioned self-regulation in my daily writing; the only time I mentioned this self-regulation in my notes was when it randomly occurred. Most of the moments I observed had nothing to do with me, though. I was simply observing students and caught them self-regulating. The more I reflected about this, I concluded that self-regulation was not something that could be explicitly scripted. Instead students needed opportunities to practice this skill within the context of their school day and I needed to intentionally plan those opportunities. Using their own reading test scores, I had each student reflect on their individual progress, skill mastery, and areas of need for goal setting. I recognized the importance of intentionally teaching self-regulation strategies, and providing options for students to apply those strategies.

Conclusion

The purpose of this chapter was to tell the story of my experiences teaching reading to a student with blindness using the Universal Design for Learning framework. I used the UDL guidelines to contextualize and organize my experiences. To conclude this chapter, I would like to discuss my experiences within the context of my research question and sub questions. I wanted to study what would happen when a student with a visual impairment (blindness) entered my universally designed English Language Arts classroom. My research questions emerged from my desire to study this topic. My research questions were: How do I, as an inclusive general educator, use the Universal Design for Learning framework to teach reading to a student with a visual impairment?

How does the UDL framework support her learning? What challenges remain unaddressed by UDL?

What happens when a student with a visual impairment (blindness) enters my universally designed English Language Arts classroom? Simply stated, having her in my classroom has made me a better teacher. Her blindness made me acutely aware of obviously inaccessible moments, which subsequently, upon reflection, led me to a greater awareness of the unseen moments of inaccessible learning for all of my students in the areas of representation, action and expression, and learner engagement. This heightened awareness of accessibility for all students improved my ability to reach and teach each of the students in my class.

Teaching Rachel and analyzing my practice have increased my awareness of the importance of clear learning goals and supporting students in their progress toward said goals. Good instructional scaffolds do not decrease the cognitive complexity of a task. UDL is not about making things easier for students; UDL is about giving kids access to challenging, rigorous learning goals and experiences. In order to embed good instructional scaffolds, learning goals must be abundantly clear to both teachers and students. Once those learning goals are established, scaffolds and choices can be embedded. If goals are not clear, then assessments cannot be designed to accurately evaluate progress toward learning goals. If goals are not clear, then choices and scaffolds may unintentionally decrease the academic rigor of the learning experience. In order for a student like Rachel, or any other student with exceptional learning needs, to be included in a general education classroom, choices and scaffolds must be present.

The integrity of this inclusivity is maintained by establishing clear, tight goals prior to embedding flexibility and options.

Rachel improved outcomes for her classmates. Her participation improved learning experiences for others. Her personality traits were a positive contribution to our classroom community. Because she was a participant in all activities, other students benefited from her participation and her academic abilities. Not a day went by in which another student did not marvel at her ability to participate in a meaningful way. I knew that having standards did not mean everything had to be standardized, but having Rachel in class provided a daily reminder of that important notion. Not only did her presence and participation remind me on a daily basis, but it also was a constant reminder to the rest of the students.

Throughout the study, I was amazed by how much she was able to do, without intervention from an adult or peer, because of the universal design of the classroom and learning experiences. A big part of this had to do with our use of accessible instructional materials and assistive technology. Her options were not an exception; they were the norm. Because all of the text we read was accessible, and available in multiple formats, she was able to use her assistive technology (iPad, Focus40, JAWS, laptop) along with our standard classroom materials, to do everything her peers were doing. And because our goals were clear, there was no time in which she did not participate in an activity or learning experience in our classroom because of her blindness. Rachel's learning was supported by UDL in a very positive way, but not in the way I anticipated. I knew she would need accommodations because of her blindness, and I thought the entire framework would focus on supporting her because she was blind. In the end, there were

only four guidelines she needed because of her blindness: options for perception, language/expression/symbols, physical action, and expression and communication. Those four were necessary because she was blind, but all nine were necessary because she was a learner with typical cognitive and developmental needs.

Challenges abounded for Rachel in school, but they were all manageable. I learned that her challenges, while different from her sighted peers, were no more challenging than any other student as long as her environment and learning experiences were universally designed. The biggest challenge for Rachel that was not addressed by UDL had to do with low-expectations and ableism from well-meaning people. There were many moments during the study, and throughout the year, when individuals (adults and children) articulated low expectations for Rachel because she was blind. None of these instances were mean-spirited or malicious in nature, quite the contrary actually. Rachel had quite a network of supportive adults and friends, and they wanted the very best for her, but at times those good intentions lowered expectations for her learning. There were times during the year that Rachel was excused from taking an assessment, or participating in an activity in another class, because of the inaccessible nature of the task. This was not a common occurrence, but because of the accessibility present in my classroom due to UDL, it became glaringly obvious when she was excluded. Similarly, there were times that her peers, while not trying to be exclusive, would leave her out of conversations and interactions during unstructured time before school, during lunch, and outside at recess. Again, it was not that they purposefully left her out, but she was still left out of these opportunities for social interaction. This taught all of us an important lesson about inclusivity: If you are not

actively including people, you are probably excluding them. Inclusivity does not occur on its own, it needs to be intentional.

By reflecting on my practice related to teaching Rachel reading, collaborating with other educators throughout the study, and analyzing the learning environment each and every day, I am a better teacher today than I was at the beginning of the study. Rachel's inclusion in my classroom enhanced my understanding of UDL which made me a more effective teacher for all of my students.

CHAPTER 5
IMPLICATIONS AND FUTURE RESEARCH

The purpose of my study was to tell the story of my efforts to teach reading to a student with blindness in a universally designed general education classroom, to find out if the Universal Design for Learning (UDL) framework could support the teaching of students with a variety of learning needs, including both low and high-incidence disabilities. In this final chapter, I will provide a summary of the dissertation, which includes an overview of each chapter, and then I will discuss the implications of the study. I will conclude with recommendations for future research.

Summary and Overview of the Dissertation

In Chapter 1, I described my present teaching situation and the questions I had revolving around my ability to teach reading to a student with blindness. I explained my experiences teaching students with high incidence disabilities in an inclusive, general education classroom using the UDL framework. I also described the significance of my study and the research questions that would guide my study: What happens when a student with blindness enters my universally designed English Language Arts classroom? How do I, as an inclusive general educator, use the UDL framework to teach reading to a student with a visual impairment? How does the UDL framework support her learning? What challenges remain unaddressed by UDL?

In Chapter 2, I defined UDL, and reviewed the related literature on UDL, accessible instructional materials, and supported UDL reading accommodations. I articulated the necessity for a rich, descriptive study of this topic to bridge the literature on UDL, AIM, and teaching reading to the visually impaired. I also explained the reflective nature of this study would improve my own practice, and thereby improve the

educational experiences of my students. My hope was that my story would also help others meet the challenges of teaching students with disabilities.

Chapter 3 provided a rationale for the chosen method of the study. I chose to engage in practitioner research to study my experiences as a reading teacher to a student with blindness in a UDL environment because I was asking questions about my own instruction. I wanted to study my own classroom and reflect on my own teaching practice. I felt this method would allow me to capture the iterative cycle of student outcomes and adjustments that I, the teacher, made regarding UDL.

Chapter 4 was a description of my approach to teaching reading with Universal Design for Learning to a student with blindness. I used the UDL Guidelines (CAST, 2011) to contextualize and guide my story. I felt the events described in Chapter 4 were representative of the day-to-day goals, tasks, and events of my classroom and provided a good sample of what typically took place in our classroom.

Implications

As I reviewed, analyzed and reflected upon my experiences teaching reading to a student with blindness, four major implications were present across the data:

- In order for classrooms to meet the needs of all learners, students and teachers need options within the curriculum.
- Students and teachers need clarity about goals and options for meeting those goals.
- Optimal UDL implementation requires the collaboration of students and teachers.
- A positive classroom community supports UDL.

Curricular Options

In order for teachers to meet the needs of their learners, students must have choices embedded in their school day. The research evidence supporting UDL (Table 2-

1) espouses the benefits of providing students with choices in the learning environment. Students are not the only ones who need choices, however. In order for teachers to meet the needs of their learners, teachers must also have access to instructional and material choices (Meyer, Rose, & Gordon, 2014).

One of the reasons why Rachel was successful in my class was that she had options for representation, action and expression, and engagement. The reason why it was possible for her to have those choices was because I, the teacher, had options to choose from. Our district-approved curriculum included textbooks and materials designed with access in mind. Digital textbooks with TTS, interactive glossaries, and standards-based online-learning activities were just a few of the resources provided to me, and other teachers, by the school district. The classrooms in the school district were also equipped with presentation tools (projector and interactive white board), computers with Internet access, and a wide-variety of instructional technology programs. Other options, such as mobile devices and audio books were available as a result of grants and other efforts on my part to solicit funds for the purpose of enhancing the learning environment.

In Chapter 4, I described a time during the study in which Rachel read a fiction passage with her Braille textbook and the audio support provided by the online textbook. About halfway through reading she switched out her Braille book and downloaded an accessible PDF to use her laptop and Focus 40. The technology provided her access, but it was the various choices that allowed her the ability to maximize her learning experience. Many of the options provided to Rachel were in the form of choosing technology tools, though not all. Prior to the study, I would have

probably identified technology as a potential solution to the challenge of teaching a student who is blind. In Chapter 2, I reviewed literature related to the benefits of digital textbooks and embedded reading supports for students with reading disabilities (Horney & Anderson-Inman, 1999; MacArthur & Haynes, 1995; Pisha & Coyne, 2001; Schneps, Thomson, Sonnert, Pomplun, & Chen, 2013) because I predicted those same tools would benefit Rachel. There was no doubt that technology provided access to Rachel in my classroom. However, I see technology in a different light after this experience. Technology, and the role of it in a classroom setting, should be thought of as a medium, not the solution. Technology is the easy part; learning is the challenge. Simply putting technology in front of a student with blindness, or any student for that matter, and expecting learning to occur is an unrealistic expectation (Coyne, Pisha, Dalton, Zeph, & Smith, 2010). Technology provides access, but it is teaching and design that turn that access into learning.

Clarity About Goals and Options for Meeting Those Goals

UDL is a framework, not a program, and its purpose is to create learning environments that respond to all learners. The importance of clear goals is outlined in the research evidence supporting UDL (Table 1). However, upon thoughtful reflection I realized that providing clarity was about more than just articulating clear goals. Clarity is crucial in UDL implementation from the purpose of UDL to the methods and materials used to implement it (Meyer, Rose, & Gordon, 2014). Working with Rachel has taught me about the importance of clear goals, but also about the necessity for clarity in understanding teaching methods, materials, assessments, and responsibilities. A clear understanding of the UDL guidelines enhanced my ability to lesson plan, problem solve,

provide appropriate interventions and accommodations, and reflect on my teaching with structure.

In Chapter 4, I shared a story describing the development of my understanding of clear goals. Rachel had successfully individualized the Frayer Model (Figure 4-1) and during my end-of-day reflections I found myself questioning the rigidity of using one specific method of vocabulary development. I questioned the equity of allowing Rachel to demonstrate her understanding in an alternate format, while limiting the options of the other students. I had lost sight of the goal which, subsequently, decreased access for the rest of the class.

Being Rachel's teacher has taught me that standards help educators to have clarity and that clarity allows us to deliver content in a non-standardized manner. Clarity allowed me to be very intentional in my design; there was always a reason for my actions, a purpose for the different methods and materials, assessments and activities (McLaughlin, 2012). Clarity also allowed me to individualize and customize learning experiences for my students. Vygotsky's (1978) sociocultural theory of human learning espouses that the potential for cognitive development is limited to a zone of proximal development (ZPD). If learning is too difficult, learners can be discouraged and give up. On the other hand, if learning is too simple, learners may become bored and lose interest. The ZPD is the "just right" zone of learning. Without a clear understanding of standards, goals, methods, materials, and assessments, it would be impossible for me to be able to deliver content and design learning experiences for my diverse student population (Rose & Rose, 2007).

Collaboration of Students and Teachers

During any given day there can be anywhere from two to four adults who spend some time in my classroom supporting students: special education inclusion teachers, the Speech and Language Pathologist, and one-on-one aides for individual students. Additionally, I feel fortunate to work in a school where I feel comfortable reaching out to the principal and assistant principal for instructional assistance. Furthermore, the staff at the central office, especially in the special education department, is just a phone call away.

In Chapter 4, I described a very frustrating time period of the study as I tried to recruit Rachel's interest in independent reading. I had exhausted all of my ideas and needed to reach out for assistance. Because of a previously established relationship with various stakeholders, I was comfortable asking for help. I thought of these stakeholders as resources and collaborators who could help me help this particular student. Because of these relationships, and a collaborative mindset, I was able to obtain a solution to the problem – Bookshare.

These relationships were frequently utilized during this study, and throughout the school year, and were an essential component of this process. When students struggled with vocabulary, fluency, or other reading skills, it was standard practice for the special education inclusion teacher, speech-language pathologist, and myself to meet in order to problem solve. At the beginning of the school year, as I first got to know Rachel as a learner, I would reach out to the district office staff on a daily basis to ask questions and troubleshoot different challenges. Successful implementation of UDL is not a solo act.

Fixsen, Naoom, Blase, Friedman, and Wallace (2005) identified stages of implementation and CAST adapted these stages to include five recursive phases of

UDL implementation: explore, prepare, integrate, scale, and optimize. The UDL framework requires the whole system to work together to ensure all learners are adequately challenged to achieve high standards. As I was the only one in my school to utilize the UDL framework, students experienced its benefits in my classroom. But if more teachers at my school understood the framework and collaborated with one another, we could improve the educational experiences of our students (Ryndak, Reardon, Benner, & Ward, 2007).

Positive Classroom Community

On the outside of our classroom door, a sign reads, “Together, We are Better.” I used this motto during the school year to unite my students around a common understanding that by collaborating we could improve outcomes for all. We engaged in team building and class-building structures through Kagan. We held morning meetings in an effort to build a culturally responsive classroom. We participated in classroom discussions, group activities, and celebrated group and individual progress. We did all these things to merge social, emotional, and academic learning (Price, 2005). We also did these things to create a climate of trust, caring, and risk-taking. I do not believe it would have been possible to implement a UDL model without a strong sense of classroom community (Minow, 2009).

In chapter 4, I shared a story about Rachel and her classmates playing a Kagan Team Building Game *Find the Fiction.* Rachel and her classmates were having a tough time working together on a particular project and with each rough spot their interaction became less and less positive. After a weekend away, the students engaged in a predictable, non-academic cooperative learning structure and through the activity were able to recapture their positive feelings toward one another. Minimizing threats and

distractions is also a key point within the UDL framework. Developing and maintaining a positive classroom community fosters a supportive classroom environment (Wenger, McDermott, & Snyder, 2002).

Another aspect of Vygotsky's (1978) sociocultural theory of human learning is his description of learning as a social process. The learning that takes place in our classroom is enhanced because of our commitment to a strong classroom community. Trust, caring, and risk-taking are critical in making choices, exploring options, collaborating with others, and evaluating one's own progress. Assistive technology and UDL allowed Rachel not only to access content, but to access her classmates. Rachel's disability was obvious when first meeting her, and at the beginning of the school year many students held back in the way they interacted with her. It was almost as if their visual perception of their visually impaired classmate activated an innate discomfort toward the newness of her disability. By creating community and shared commonality, we developed an environment that rejected that prejudice and promoted learning as a social process (Hartmann, 2011).

Recommendations for Future Research

Universal Design for Learning is a broad topic still needing to be evaluated from different viewpoints and contexts. My study explored the topics of UDL and teaching reading to a student with blindness, but I could have just as easily studied how a student with fetal-alcohol syndrome, autism spectrum disorder, or giftedness impacted my UDL teaching. Exploring the impact of different students on UDL implementation holds much promise for the further development of the framework, as well as the implementation of UDL on a large scale.

As described above, the UDL guidelines provided me with a framework for lesson planning, but they also were incredibly beneficial when it came to academic interventions, reflection, and problem solving. One of my findings was that Rachel needed all of the guidelines in different forms because she is a learner, but only needed four guidelines because of her blindness. So her unique accommodations were limited to certain areas, but she benefited from all of the guidelines.

I wonder if this is true of all students. Do all students need accommodations in some areas? When it comes to the actual implementation of these accommodations, do teachers know how to go about selecting and implementing them? How are these decisions made? How do we help teachers make those decisions? Do teachers assume students with disabilities need more accommodations than their non-disabled peers? The UDL guidelines, while well supported by research, are rich with opportunities for future research related to implementation and practical application.

The UDL guidelines also provide a road map for students to be more metacognitive in their learning. What would happen if we put the UDL guidelines in the hands of students and asked them to create a portfolio of their own learning within the context of the UDL guidelines? In addition to content area academic standards, what if we also required students to develop their own personal learning portfolios. What would the impact be on student learning or socio-emotional development?

Throughout the study, students used tools to support their learning. My own clarity about the availability and function of different assistive and instructional technologies proved to be an asset during this study. Educational technologies exist to support each of the UDL guidelines. We know that students vary in their learning needs

and we have tools to address these needs, but do teachers know how to use the tools? Do parents know how to use the tools? Do students?

Finally, UDL requires a conceptual shift. To implement UDL, we must place the onus of change on the learning environment and not on the individual student. I have yet to teach a teacher, parent, or principal about UDL and be told that they are not interested. Conceptually it makes sense to many, but once the idea has to materialize in practice it becomes difficult. What can we do within schools and professional development to aide in this implementation? What is already being done? Does this conceptual shift need to occur during teacher preparation programs?

Conclusion

Universal Design (UD) is ubiquitous in architecture and product development. Those two fields have fully adopted the UD approach as best practice. It is not possible to buy a television without Closed Captioning; a building cannot even be built in the 21st century without embedded accessibility; and Apple has dozens of accessibility features standard on all models. These changes grew from the words of architect Ron Mace, the founder and program director of The Center for Universal Design. He said we should consider the needs of the broadest possible range of users in designing environments and products for all people. The literature on the significant learner variability in schools is clear (CAST, 2011) and if public education does not adapt we run the risk of being irrelevant in a flexible, customizable world.

When my daughter was two years old, we discovered the website for Sesame Street. On this website, users were able to search Sesame Street's entire database of songs and performances going all the way back to the early years of the show. My daughter and I created a playlist based on her needs and preferences, and assembled

a pretty impressive collection of songs and performances about numbers, letters, words, colors, and, my favorite, Grover explaining the difference between near and far. We watched the videos on the iPad, laptop, and our desktop computer. My daughter would request to watch a particular video to sing her ABCs with Elmo or a specific scene in which John-John and Grover count to ten. It was exciting to watch because she was completely engaged and able to access learning experiences based on her needs.

I will never forget the first time we watched Sesame Street on broadcast television. We happened to be home when the program started and as soon as my daughter heard the opening song, she started dancing and singing along. After the opening credits, a skit about food came on and my daughter looked at me as though I had done something wrong. “No, daddy,” she said. “Let’s sing ABCs with Elmo.” I explained to her that that song was not on right now and she would have to wait. Let’s just say she was not thrilled with my suggestion. Somehow we made it through the first scene and as the screen faded to black during the transition to the next scene, I remember whispering to myself, “please ABC, please ABC.” As you can probably guess, the next scene was not the Elmo ABC song. My almost-two-year-old daughter looked at me and the television with the same level of disgust, and then proceeded to walk up to the TV screen. She placed her hand on the screen and began making a swiping motion just like she would on an iPad. Nothing about our television was fancy enough to involve a touch screen, so her actions were met with additional disappointment. She looked at me and, with tears in her eyes, said, “Why?” I then proceeded to explain that the producers of the television show made a schedule of the different songs and scenes to show on TV before the show starts. We had to follow their

schedule. She looked at me, still crying, and said, “Well I don’t want to watch it anymore.” And she left the room.

How ironic that the same show that earlier had given her such wonderful learning experiences, was now bringing her to tears. Had the content changed? No, it was still Sesame Street. But the flexibility and customizability had been lost. And as I watched my daughter walk away from the living room, with tears in her eyes, I thought to myself, we need schools to be flexible to meet the kids they serve. But then I found myself really wondering, are our schools even designed for the students they serve? Are our schools more like SesameStreet.org or are our schools more like the episode of Sesame Street airing today on PBS at 10:00am? My hope is for the former, but my experiences as a student and teacher indicate otherwise.

Ahmir Khalib Thompson, known professionally as Questlove, is a musician, journalist, producer, and member of the Grammy Award-winning band *The Roots.* In Questlove’s memoir, *Mo' Meta Blues: The World According to Questlove* (2013), he describes, among other life events, his experiences in school in Philadelphia. One particularly compelling anecdote provided in this part of the book came when he wrote about when school became irrelevant to him. He described the moment as feeling as though it felt like he was eating a meal prepared for someone else. As I read his words, I immediately remembered my daughter’s frustrated tears when she could not access the learning experiences she so desired from Sesame Street. That is what Questlove was feeling, too. A standardized model for learning that did not meet his needs, nor will it meet my daughter’s needs when she starts kindergarten this fall. The curriculum must be designed to meet her needs, her peers’ needs, and not the other way around.

Through my experience teaching Rachel, I developed a greater understanding of a most important lesson: having standards does not mean everything must be standardized. Students with disabilities need Universal Design for Learning to meet the rigorous standards of the 21st century, but my experiences as Rachel's teacher also taught me that all of her peers needed similar options and flexibility to be the best they could be, too. Rachel needed flexible options for presentation, action and expression, and engagement, and so does every other student.

LIST OF REFERENCES

Agran, M., Blanchard, C., Wehmeyer, M., & Hughes, C. (2001). Teaching students to self-regulate their behavior: The differential effects of student-vs. teacher-delivered reinforcement. *Research in Developmental Disabilities, 22*(4), 319-332.

Agran, M., Cavin, M., Wehmeyer, M., & Palmer, S. (2006). Participation of students with moderate to severe disabilities in the general curriculum: The effects of the self-determined learning model of instruction. *Research and Practice for Persons with Severe Disabilities, 31*(3), 230-241.

Agran, M., Wehmeyer, M. L., Cavin, M., & Palmer, S. (2008). Promoting student active classroom participation skills through instruction to promote self-regulated learning and self-determination. *Career Development for Exceptional Individuals, 31*(2), 106-114.

Al-Seghayer, K. (2001). The effect of multimedia annotation modes on L2 vocabulary acquisition: A comparative study. *Language, Learning, & Technology, 5*(1), 202-232.

Alper, S., & Raharinirina, S. (2006). Assistive technology for individuals with disabilities: A review and synthesis of the literature. *TAM Board Members, 21*(2), 47-64.

Alvermann, D. E., & Boothby, P. R. (1986). Children's transfer of graphic organizer instruction. *Reading Psychology, 7*(2), 87-100.

Alvermann, D. E., Smith, L. C., & Readence, J. E. (1985). Prior knowledge activation and the comprehension of compatible and incompatible text. *Reading Research Quarterly, 20*(4), 420-436.

Anater, P. F. (1980). Effects of auditory inference on memory of haptic perceptions. *Journal of Visual Impairment & Blindness, 74*, 305-309.

Anderson-Inman, L., Knox-Quinn, C., & Horney, M. A. (1996). Computer-based study strategies for students with learning disabilities: Individual differences associated with adoption level. *Journal of Learning Disabilities, 29*(5), 461-484.

Anderson, D. R., Fite, K. V., Petrovich, N., & Hirsch, J. (2006). Cortical activation while watching video montage: An fMRI study. *Media Psychology, 8*(1), 7-24.

Assor, A., Kaplan, H., & Roth, G. (2002). Choice is good, but relevance is excellent: Autonomy-enhancing and suppressing teacher behaviours predicting students" engagement in schoolwork. *British Journal of Educational Psychology, 72*(2), 261-278.

Atkinson, R. K., Renkl, A., & Merrill, M. M. (2003). Transitioning from studying examples to solving problems: Effects of self-explanation prompts and fading worked-out steps. *Journal of Educational Psychology, 95*(4), 774-783.

August, D., Carlo, M., Calderon, M., & Proctor, C. P. (2005). Development of literacy in Spanish-speaking English language learners: Findings from a longitudinal study of elementary school children. *Perspectives, 31*(2), 17-19.

Bahr, M. W., Fuchs, D., Fuchs, L. S., Fernstrom, P., & Stecker, P. M. (1993). Effectiveness of student versus teacher monitoring during prereferral intervention. *Exceptionality, 4*(1), 17-30.

Baker, L., & Wigfield, A. (1999). Dimensions of children's motivation for reading and their relations to reading activity and reading achievement. *Reading Research Quarterly, 34*(4), 452-477.

Bandura, A., & Cervone, D. (1983). Self-evaluative and self-efficacy mechanisms governing the motivational effects of goal systems. *Journal of Personality and Social Psychology, 45*(5), 1017-1028.

Bandura, A., Barbaranelli, C., Caprara, G. V., & Pastorelli, C. (1996). Multifaceted impact of self-efficacy beliefs on academic functioning. *Child Development, 67*(3), 1206-1222.

Bangert-Downs, R. L., Kulik, C., Kulick, J. A., & Morgan, M. (1991). The instructional effects of feedback in test-like events. *Review of Educational Research, 61*(2), 213-238.

Bentz, J. L., & Fuchs, L. S. (1996). Improving peers' helping behavior to students with learning disabilities during mathematics peer tutoring. *Learning Disability Quarterly*, *19*(4), 202-215.

Bines, H. & Lei, P. (2011). Disability and education: The longest road to inclusion. *International Journal of Educational Development, 31,* 419–424.

Blackwell, L. S., Trzesniewski, K. H., & Dweck, C. S. (2007). Implicit theories of intelligence predict achievement across an adolescent transition: A longitudinal study and an intervention. *Child Development, 78*(1), 246-263.

Blankenship, T. L., Ayres, K. M., & Langone, J. (2005). Effects of computer-based cognitive mapping on reading comprehension for students with emotional behavior disorders. *Journal of Special Education Technology, 20*(2), 15-23.

Block, C. C. (1993). Strategy instruction in a literature-based reading program. *The Elementary School Journal, 94*(2), 139-151.

Boggiano, A. K., Main, D. S., & Katz, P. A. (1988). Children's preference for challenge: The role of perceived competence and control. *Journal of Personality and Social Psychology, 54*(1), 134-141.

Boon, R. T., Burke, M. D., Fore III, C., & Spencer, V. G. (2006). The impact of cognitive organizers and technology-based practices on student success in secondary social studies classrooms. *Journal of Special Education Technology, 21*(1), 5-15.

Boon, R. T., Fore, C., Ayres, K., & Spencer, V. G. (2005). The effects of cognitive organizers to facilitate content-area learning for students with mild disabilities: A pilot study. *Journal of Instructional Psychology, 32*(2), 101-118.

Boone, R., & Higgins, K. (1993). Hypermedia basal readers: Three years of school-based research. *Journal of Special Education Technology, 12*(2), 86-106.

Bosseler, A., & Massaro, D. W. (2003). Development and evaluation of a computer-animated tutor for vocabulary and language learning in children with autism. *Journal of Autism & Developmental Disorders, 33*(6), 653-672.

Bottge, B. A., & Heinrichs, M. (2002). Weighing the benefits of anchored math instruction for students with disabilities in general education classes. *The Journal of Special Education, 35*(4), 186-200.

Bouffard-Bouchard, T., Parent, S., & Larivee, S. (1991). Influence of self-efficacy on self-regulation and performance among junior and senior high-school age students. *International Journal of Behavioral Development, 14*(2), 153-164.

Boyle, J. R., & Weishaar, M. (1997). The effects of expert-generated versus student-generated cognitive organizers on the reading comprehension of students with learning disabilities. *Learning Disabilities Research and Practice, 12*(4), 228-235.

Brooks, A., Todd, A. W., Tofflemoyer, S., & Horner, R. H. (2003). Use of functional assessment and a self-management system to increase academic engagement and work completion. *Journal of Positive Behavior, (5)3*, 144-152.

Brownell, M. T., Mellard, D. F., & Deshler, D. D. (1993). Differences in the learning and transfer performance between students with learning disabilities and other low-achieving students on problem-solving tasks. *Learning Disability Quarterly, 16*(2), 138-156.

Bui, Y. N., Schumaker, J. B., & Deshler, D. D. (2006). The effects of a strategic writing program for students with and without learning disabilities in inclusive fifth-grade classes. *Learning Disabilities Research & Practice, 21*(4), 244-260.

Calhoon, M. B., & Fuchs, L. S. (2003). The effects of peer-assisted learning strategies and curriculum-based measurement on the mathematics performance of secondary students with disabilities. *Remedial and Special Education, 24*(4), 235-245.

Cameron, J., & Pierce, W. D. (1994). Reinforcement, reward, and intrinsic motivation: A meta-analysis. *Review of Educational Research, 64*(3), 363-423.

Carr, S. C., & Thompson, B. (1996). The effects of prior knowledge and schema activation strategies on the inferential reading comprehension of children with and without learning disabilities. *Learning Disability Quarterly, 19*(1), 48-61.

CAST (2008). Universal design for learning guidelines version 1.0. Wakefield, MA: Author.

CAST (2010). Universal design for learning guidelines version 1.0: research evidence. Wakefield, MA: Author.

CAST (2011). Universal design for learning guidelines version 1.0: emerging research. Wakefield, MA: Author.

CAST (2013). What is UDL? Wakefield, MA: Author.

Casteel, C. A. (1990). Effects of chunked text material on reading comprehension of high and low ability readers. *Reading Improvement, 27*(4), 269-275.

Catlin, K. S., Lewan, G. J., & Perignon, B. J. (1999). Increasing student engagement through goal-setting, cooperative learning & student choice. (Master's Action Research Project, Saint Xavier University and IRI/SkyLight).

Cennamo, K. S. (1993). Learning from video: Factors influencing learners' preconceptions and invested mental effort. *Educational Technology, Research and Development, 41*(3), 33-45.

Chalk, J. C., Hagan-Burke, S., & Burke, M. D. (2005). The effects of self-regulated strategy development on the writing process for high school students with learning disabilities. *Learning Disability Quarterly, 28*(1), 75-88.

Chang, M. M. (2007). Enhancing web-based language learning through self-monitoring. *Journal of Computer Assisted Learning, 23*(3), 187-196.

Christensen, K. R. (2008). Interfaces, syntactic movement, and neural activation: A new perspective on the implementation of language in the brain. *Journal of Neurolinguistics, 21*(2), 73-103.

Chun, D. M. (2001). L2 reading on the Web: Strategies for accessing information in hypermedia. *Computer Assisted Language Learning, 14*(5), 367-403.

Chun, D. M., & Plass, J. L. (1996). Effects of multimedia annotations on vocabulary acquisition. *The Modern Language Journal, 80*(2), 183-198.

Chun, D. M., & Plass, J. L. (1996). Facilitating reading comprehension with multimedia. *System, 24*(4), 503-519.

Cleary, A. M., & Langley, M. M. (2007). Retention of the structure underlying sentences. *Language & Cognitive Processes, 22*(4), 614-628.

Cleary, T. J., & Zimmerman, B. J. (2004). Self-regulation empowerment program: A school-based program to enhance self-regulated and self-motivated cycles of student learning. *Psychology in the Schools, 41*(5), 537-550.

Cochran, D.W. (2008). Universal design for learning: reaching all students with digital media. *The Creative Educator*, *(5)*1,14-16.

Cochran-Smith, M., & Lytle, S. L. (2009). *Inquiry as stance: Practitioner research for the next generation.* New York: Teachers College Press.

Coyne, P., Pisha, B., Dalton, B., Zeph, L.A., & Smith, N.C. (2010). Literacy by design: A universal design for learning approach for students with significant intellectual disabilities. *Remedial and Special Education. 33*(3), 162-172.

Craig, S. D., Graesser, A. C., Sullins, J., & Gholson, B. (2004). Affect and learning: An exploratory look into the role of affect in learning with AutoTutor. *Journal of Educational Media, 29*(3), 241-250.

Craske, M. L. (1988). Learned helplessness, self-worth motivation and attribution retraining for primary school children. *The British Journal of Educational Psychology, 58* (Pt. 2), 152-164.

Craven, R. G., Marsh, H. W., & Debus, R. L. (1991). Effects of internally focused feedback and attributional feedback on enhancement of academic self-concept. *Journal of Educational Psychology, 83*(1), 17-27.

Crealock, C., & Sitko, M. (1990). Comparison between computer and handwriting technologies in writing training with learning disabled students. International *Journal of Special Education, 5*(2), 173-183.

Creswell, J.W. (2013). *Qualitative inquiry and research design: choosing among five approaches* (3rd ed.). Thousand Oaks, CA: Sage Publications.

D'Angiulli, A., D'Angiulli, A., Kennedy, J. M., Helle, M. A., & Heller, M. A. (1998). Blind children recognizing tactile pictures respond like sighted children given guidance in exploration. *Scandinavian Journal of Psychology, 39*(3), 187-190.

Daiute, C., & Morse, F. (1994). Access to knowledge and expression: Multimedia writing tools for students with diverse needs and strengths. *Journal of Special Education Technology, 12*(3), 221-256.

Dalton, B., & Proctor, C. P. (2007). Reading as thinking: Integrating strategy instruction in a universally designed digital literacy environment. In D. S. McNamara (Ed.), *Reading comprehension strategies: Theories, interventions, and technologies* (pp. 421-439). Mahwah, NJ: Lawrence Erlbaum Assoc Inc.

Dalton, B., & Strangman, N. (2006). Improving struggling readers' comprehension through scaffolded hypertexts and other computer-based literacy programs. In M. C. McKenna, L.D. Labbo, R.D. Kieffer and D. Reinking (Eds.), *International handbook of literacy and technology volume II* (pp. 75-92). Mahwah, NJ: Lawerence Erlbaum Associates Publishers.

Dalton, B., Herbert, M., & Deysher, S. (2003). 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, Arizona.

Dalton, B., Pisha, B., Eagleton, M., Coyne, P., & Deysher, S. (2002). *Engaging the text: Final report to the U.S. Department of Education.* Peabody: CAST.

Dalton, B., Schleper, D., Kennedy, M., Lutz, L., & Strangman, N. (2005). *A universally designed digital strategic reading environment for adolescents who are deaf and hard of hearing.* Final Report to Gallaudet University. Wakefield, MA: CAST.

Dalton, B., Tivnan, T., Riley, M. K., Rawson, P., & Dias, D. (1995). Revealing competence: Fourth-grade students with and without learning disabilities show what they know on paper-and-pencil and hands-on performance assessments. *Learning Disabilities Research and Practice, 10*(4), 197-214.

Dalton, D. W., & Hannafin, M. J. (1987). The effects of word processing on written composition. *Journal of Educational Research, 80*(6), 338-342.

Dana, N. F., & Yendol-Hoppey, D. (2009). *The reflective educator's guide to classroom research: Learning to teach and teaching to learn through practitioner inquiry, 2nd Edition.* Thousand Oaks, California: Corwin Press.

Danoff, B. (1993). Incorporating strategy instruction within the writing process in the regular classroom: Effects on the writing of students with and without learning disabilities. *Journal of Reading Behavior, 25*(3), 295-322.

Darch, C. B., Carnine, D. W., & Kammeenui, E. J. (1986). The role of graphic organizers and social structure in content area instruction. *Journal of Reading Behavior, 18*(4), 275-295.

Darling-Hammond, L. (2009). *The flat world and education: how america's commitment to equity will determine our future.* New York: Teachers College Press.

de Bruin, A. B. H. (2007). Improving metacomprehension accuracy and self-regulation in cognitive skill acquisition: The effect of learner expertise. *European Journal of Cognitive Psychology, 19*(4/5), 671-688.

De La Paz, S. (2007). Managing cognitive demands for writing: Comparing the effects of instructional components in strategy instruction. *Reading & Writing Quarterly, 23*(3), 249-266.

de Vries, M. H., Monaghan, P., Knecht, S., & Zwitserlood, P. (2008). Syntactic structure and artificial grammar learning: The learnability of embedded hierarchical structures. *Cognition, 107*(2), 763-774.

Dimino, J. A., Taylor, R. M., & Gersten, R. M. (1995). Synthesis of the research on story grammar as a means to increase comprehension. *Reading & Writing Quarterly, 11*(1), 53-72.

Dion, E., Fuchs, D., & Fuchs, L. S. (2005). Differential effects of peer-assisted learning strategies on students' social preference and friendship making. *Behavioral Disorders*, *30*(4), 421-429.

Doering, A., & Veletsianos, G. (2007). Multi-scaffolding environment: An analysis of scaffolding and its impact on cognitive load and problem-solving ability. *Journal of Educational Computing Research*, 37(2), 107-129.

Dolan, R. P., 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), 4-31.

Dole, J. A., Brown, K. J., & Trathen, W. (1996). The effects of strategy instruction on the comprehension performance of at-risk students. *Reading Research Quarterly, 31*(1), 62-77.

Dole, J. A., Valencia, S. W., Greer, E. A., & Wardrop, J. L. (1991). Effects of two types of prereading instruction on the comprehension of narrative and expository text. *Reading Research Quarterly, 26*(2), 142-159.

Dommes, P., Gersten, R., & Carnine, D. (1984). Instructional procedures for increasing skill-deficient fourth graders' comprehension of syntactic structures. *Educational Psychology, 4*(2), 155-165.

Donovan, C. A., Smolkin, L. B., & Lomax, R. G. (2000). Beyond the independent-level text: Considering the reader? Text match in first graders' self-selections during recreational reading. *Reading Psychology, 21*(4), 309-333.

Drach-Zahavy, A., & Erez, M. (2002). Challenge versus threat effects on the goal–performance relationship. *Organizational Behavior and Human Decision Processes, 88*(2), 667-682.

Duchastel, P. C., & Merrill, P. F. (1973). The effects of behavioral objectives on learning: A review of empirical studies. *Review of Educational Research, 43*(1), 53-69.

Duffy, G. G., Roehler, L. R., & Rackliffe, G. (1986). How teachers' instructional talk influences students' understanding of lesson content. *The Elementary School Journal, 87*(1), 3-16.

Duffy, G. G., Roehler, L. R., Sivan, E., Rackliffe, G., Book, C., Meloth, M., et al. (1987). Effects of explaining the reasoning associated with using reading strategies. *Reading Research Quarterly, 22*(3), 347-368.

Dweck, C. S., & Leggett, E. L. (1988). A social-cognitive approach to motivation and personality. *Psychological Review, 95*(2), 256-273.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. New York: Random House.

Dyck, N., & Sunbye, N. (1988). The effects of text explicitness on story understanding and recall by learning disabled children. *LD Research, 3*(2), 68-77.

Earley, P. C. (1985). Influence of information choice and task complexity upon goal acceptance, performance and personal goals. *Journal of Applied Psychology, 70*(3), 481-491.

Edyburn, D.L. (2006). What's new about assistive technology outcomes in education? *Technology Special Interest Section Quarterly, 16*(2), 1-4.

El-Alayli, A., & Baumgardner, A. (2003). If at first you don't succeed, what makes you try,try again? Effects of implicit theories and ability feedback in a performance-oriented climate. *Self & Identity, 2*(2), 119-135.

Elbro, C., Rasmussen, I., & Spelling, B. (1996). Teaching reading to disabled readers with language disorders: A controlled evaluation of synthetic speech feedback. *Scandinavian Journal of Psychology, 37*(2), 140-155.

Elkind, J., Black, M. S., & Murray, C. (1996). Computer-based compensation of adult reading disabilities. *Annals of Dyslexia, 46*(1), 159-186.

Elkind, J., Cohen, K., & Murray, C. (1993). Using computer based readers to improve reading comprehension of students with dyslexia. *Annals of Dyslexia, 43(1)*, 238-259.

Elliott, E. S., & Dweck, C. S. (1988). Goals: An approach to motivation and achievement. *Journal of Personality and Social Psychology*, *54*(1), 5-12.

Ely, R., Emerson, R. W., Maggiore, T., Rothberg, M., O'Connell, T., & Hudson, L. (2006). Increased content knowledge of students with visual impairments as a result of extended descriptions. *Journal of Special Education Technology, 21*(3), 31-43.

Englert, C. S., Manalo, M., & Zhao, Y. (2004). I can do it better on the computer: The effects of technology-enabled scaffolding on young writers' composition. *Journal of Special Education Technology, 19*(1), 5-22.

Englert, C. S., Yong, Z., Dunsmore, K., Collings, N. Y., & Wolbers, K. (2007). Scaffolding the writing of students with disabilities through procedural facilitation: Using an internet-based technology to improve performance. *Learning Disability Quarterly, 30*(1), 9-29.

Etheris, A. I. (2004). Computer-supported collaborative problem solving and anchored instruction in a mathematics classroom: An exploratory study. *International Journal of Learning Technology, 1*(1), 16-39.

Evans, S. W., Pelham, W., & Grudberg, M. V. (1994). The efficacy of notetaking to improve behavior and comprehension of adolescents with attention deficit hyperactivity disorder. *Exceptionality, 5*(1), 1-17.

Ferrell, K.A., Young, J., & Cooney, J. (2006) *Forty Years of Literacy Research in Blindness and Visual Impairment Technical Report.* National Center on Low-Incidence Disabilities.

Figueredo, L., & Varnhagen, C. K. (2006). Spelling and grammar checkers: Are they intrusive? *British Journal of Educational Technology, 37*(5), 721-732.

Fixsen, D. L., Naoom, S. F., Blase, K. A., Friedman, R. M. & Wallace, F. (2005). *Implementation research: a synthesis of the literature.* Tampa, FL: University of South Florida, Louis de la Parte Florida Mental Health Institute, The National Implementation Research Network (FMHI Publication #231).

Flanagan, P. J. (1966). Automated training and braile reading. *New Outlook for the Blind, 60*(3), 141-146.

Flanagan, P. J., & Joslin, E. S. (1969). Patterns of response in the perception of braille configurations*. New Outlook for the Blind, 63(8)*, 232-244.

Fleming, V. M. (2002). Improving students' exam performance by introducing study strategies and goal setting. *Teaching of Psychology, 29*(2), 115-119.

Flink, C., Boggiano, A. K., & Barrett, M. (1990). Controlling teaching strategies: Undermining children's self-determination and performance. *Journal of Personality and Social Psychology, 59*(5), 916-924.

Flowerday, T., & Schraw, G. (2000). Teacher beliefs about instructional choice: A phenomenological study. *Journal of Educational Psychology, 92*(4), 634-645.

Fowler, J. W., & Peterson, P. L. (1981). Increasing reading persistence and altering attributional style of learned helpless children. *Journal of Educational Psychology, 73*(2), 251-260.

Fradd, S. H., Lee, O., Sutman, F. X., & Saxton, M. K. (2001) Promoting science literacy with English language learners through instructional materials development: A case study. *Bilingual Research Journal, 25*(4), 417-439.

Fredrickson, B. L., & Branigan, C. (2005). Positive emotions broaden the scope of attention and thought-action repertoires. *Cognition and Emotion, 19*(3), 313-332.

Fuchs, D., & Fuchs, L. S. (2005). Peer-assisted learning strategies: Promoting word recognition, fluency, and reading comprehension in young children. *The Journal of Special Education, 39*(1), 34-44.

Fuchs, D., Fuchs, L. S., & Burish, P. (2000). Peer-assisted learning strategies: An evidence-based practice to promote reading achievement. *Learning Disabilities Research & Practice, 15*(2), 85-91.

Fuchs, L. S., & Fuchs, D. (1992). Identifying a measure for monitoring student reading progress. *School Psychology Review, 21*(1), 45-58.

Fuchs, L. S., Bahr, C. M., & Rieth, H. J. (1989). Effects of goal structures and performance contingencies on the math performance of adolescents with learning disabilities. *Journal of Learning Disabilities, 22*(9), 554-560.

Fuchs, L. S., Fuchs, D., Finelli, R., Courey, S. J., & Hamlett, C. L. (2004). Expanding schema-based transfer instruction to help third graders solve real-life mathematical problems. *American Educational Research Journal, 41*(2), 419-445.

Fuchs, L. S., Fuchs, D., Finelli, R., Courey, S. J., Hamlett, C. L., Sones, E. M., et al. (2006). Teaching third graders about real-life mathematical problem solving: A randomized controlled study. *The Elementary School Journal, 106*(4), 293-311.

Fuchs, L. S., Fuchs, D., Hamlett, C. L., & Appleton, A. C. (2002). Explicitly teaching for transfer: Effects on the mathematical problem-solving performance of students with mathematics disabilities. *Learning Disabilities Research & Practice, 17*(2), 90-106.

Fuchs, L. S., Fuchs, D., Karns, K., Hamlett, C. L., Katzaroff, M., & Dutka, S. (1997). Effects of task-focused goals on low-achieving students with and without learning disabilities. *American Educational Research Journal, 34*(3), 513-543.

Fuchs, L. S., Fuchs, D., Phillips, N. B., Hamlett, C. L., & Karns, K. (1995). Acquisition and transfer effects of classwide peer-assisted learning strategies in mathematics for students with varying learning histories. *School Psychology Review, 24*(4), 604-620.

Fuchs, L. S., Fuchs, D., Prentice, K., Burch, M., Hamlett, C. L., & Owen, R. (2003). Explicitly teaching for transfer: Effects on third-grade students' mathematical problem solving. *Journal of Educational Psychology, 95*(2), 293-305.

Fuchs, L., Butterworth, J., & Fuchs, D. (1989). Effects of ongoing curriculum-based measurement on student awareness of goals and progress. *Education and Treatment of Children, 12*(1), 63-72.

Gajria, M., & Salvia, J. (1992). The effects of summarization instruction on text comprehension of students with learning disabilities. *Exceptional Children, 58*(6), 508-516.

Garcia, G. E. (1991). Factors influencing the English reading test performance of Spanish-speaking Hispanic children. *Reading Research Quarterly, 26*(4), 371-392.

Gardill, M. C., & Jitendra, A. K. (1999). Advanced story map instruction: Effects on the reading comprehension of students with learning disabilities. *The Journal of Special Education*, *33*(1), 2-17.

Gersten, R., & Baker, S. (2001). Teaching expressive writing to students with learning disabilities: A meta-analysis. *The Elementary School Journal, 97*(5), 475-500.

Goldberg, A., Russell, M., & Cook, A. (2003). The effect of computers on student writing: A meta-analysis of studies from 1992 to 2002. *Journal of Technology, Learning, and Assessment, 2*(1), 1-24.

Gouzouasis, P. (1994). Multimedia constructions of children: An exploratory study. *Journal of Computing in Childhood Education, 5*(3), 273-284.

Graham, S. (1997). Executive control in the revising of students with learning and writing difficulties. *Journal of Educational Psychology, 89*(2), 223-234.

Graham, S., MacArthur, C., Schwartz, S., & Page-Voth, V. (1992). Improving the compositions of students with learning disabilities using a strategy involving product and process goal setting. *Exceptional Children, 58*(4), 322-334.

Hafner, J. C., & Hafner, P. M. (2003). Quantitative analysis of the rubric as an assessment tool: An empirical study of student peer-group rating. *International Journal of Science Education, 25*(12), 1509-1528.

Harris, K. R., Graham, S., & Mason, L. H. (2006). Improving the writing, knowledge, and motivation of struggling young writers: Effects of self-regulated strategy development with and without peer support. *American Educational Research Journal, 43*(2), 295-340.

Hartley, J., & Davies, I. K. (1976). Preinstructional strategies: The role of pretests, behavioral objectives, overviews and advance organizers. *Review of Educational Research, 46*(2), 239-265.

Hartmann, E. (2011). Universal design for learning: Highlighting information on deaf-blindness. National Consortium on Deaf-Blindness. Retrieved from: http://documents.nationaldb.org/products/udl.pdf.

Hebert, B. M., & Murdock, J. Y. (1994). Comparing three computer-aided instruction output modes to teach vocabulary words to students with learning disabilities. *Learning Disabilities Research and Practice, 9*(3), 136-141.

Heckert, L., Burns, L., & Elkind, J. (2002). Benefits of assistive reading software for students with attention disorders. *Annals of Dyslexia, 52*(4), 243-272.

Hehir, T. (2002). *Eliminating ableism in education*. Harvard Educational Review, 72(1), 1-32.

Higgins, E. L., & Raskind, M. H. (2005). The compensatory effectiveness of the Quicktionary reading pen II on the reading comprehension of students with learning disabilities. *Journal of Special Education Technology, 20*(1), 29-38.

Higgins, N. C., & Cocks, P. (1999). The effects of animation cues on vocabulary development. *Journal of Reading Psychology, 20*(1), 1-10.

Hole, J. L., & Crozier, W. R. (2007). Dispositional and situational learning goals and children's self-regulation. *British Journal of Educational Psychology*, *77*(4), 773-786.

Hom, H. L., & Arbuckle, B. (1988). Mood induction effects upon goal setting and performance in young children. *Motivation and Emotion, 12*(2), 113-122.

Horney, M., & Anderson-Inman, L. (1999). Supported text in electronic reading environments. *Reading & Writing Quarterly: Overcoming Learning Difficulties, 15*(2), 127-168.

Hughes, C. A., Ruhl, K. L., Schumaker, J. B., & Deshler, D. D. (2002). Effects of instruction in an assignment completion strategy on the homework performance of students with learning disabilities in general education classes. *Learning Disabilities Research & Practice (Blackwell Publishing Limited), 17*(1), 1-18.

Hughes, L. E., & Wilkins, A. J. (2002). Reading at a distance: Implications for the design of text in children's big books. *The British Journal of Educational Psychology, 72*(2), 213-226.

Idol-Maestas, L. (1985). Getting ready to read: Guided probing for poor comprehenders. *Learning Disability Quarterly, 8(*4*)*, 243-254.

Immordino-Yang, M. H., & Damasio, A. R. (2007). We feel, therefore we learn: The relevance of affective and social neuroscience to education. *Mind, Brain, and Education, 1*(1), 3-10.

Jackson, R. (2005). *Curriculum access for students with low-incidence disabilities: The promise of universal design for learning*. Wakefield, MA: National Center on Accessing the General Curriculum.

Jiménez, R., García, G. E., & Pearson, P. D. (1996). The reading strategies of bilingual Latina/o students who are successful English readers: Opportunities and obstacles. *Reading Research Quarterly, 31*(1), 90-112.

Jimenez, T., Graf, V., & Rose, E. (2007). Gaining access to general education: the promise of universal design for learning. *Issues in Teacher Education, 16*(2), 41-54.

Jones, I. (1994). The effect of a word processor on the written composition of second-grade pupils. *Computers in the Schools, 11*(2), 43-54.

Joram, E. (1992). The effects of revising with a word processor on written composition. *Research in the Teaching of English, 26*(2), 167-193.

Judge, S. (2006). Constructing an assistive technology toolkit for young children: Views from the field. *Journal of Special Education Technology, 21*(4), 17-24.

Kamins, M. L., & Dweck, C. S. (1999). Person versus process praise and criticism: Implications for contingent self-worth and coping. *Developmental Psychology, 35(3)*, 835-847.

Karabenick, S. A. (2004). Perceived achievement goal structure and college student help seeking. *Journal of Educational Psychology, 96*(3), 569-581.

Kederis, C. J., Nolan, C. Y., & Morris, J. E. (1967). The use of controlled exposure devices to increase braille reading rates. *International Journal for the Education of the Blind, 16*(4), 97-105.

Kerkhofs, R., Vonk, W., Schriefers, H., & Chwilla, D. J. (2007). Discourse, syntax, and prosody: The brain reveals an immediate interaction. *Journal of Cognitive Neuroscience, 19*(9), 1421-1434.

Kidd, E., Brandt, S., Lieven, E., & Tomasello, M. (2007). Object relatives made easy: A cross-linguistic comparison of the constraints influencing young children's processing of relative clauses. *Language & Cognitive Processes, 22*(6), 860-897.

Kim, A. H., Vaughn, S., & Wanzek, J. (2004). Graphic organizers and their effects on the reading comprehension of students with LD: A synthesis of research. *Journal of Learning Disabilities, 37*(2), 105-118.

Kincaid, D., Knoster, T., Harrower, J. K., Shannon, P., & Bustamante, S. (2002). Measuring the impact of positive behavior support. *Journal of Positive Behavioral Interventions, 4*(2), 109-117.

King, A. (1991). Improving lecture comprehension: Effects of a metacognitive strategy. *Applied Cognitive Psychology, 5*(4), 331-346.

Klin, C. M., Ralano, A. S., & Weingartner, K. M. (2007). Repeating phrases across unrelated narratives: Evidence of text repetition effects. *Memory & Cognition, 35*(7), 1588-1599.

Kobayashi, M. (2003). The role of peer support in ESL students' accomplishment of oral academic tasks. *Canadian Modern Language Review/La Revue Canadienne Des Langues Vivantes, 59*(3), 337-369.

Koenig, A. J. (1992). The relative effectiveness of reading in large print and with low vision devices for students with low vision. *Journal of Visual Impairment and Blindness, 86*(1), 48-53.

Kooy, T. (1992). The effect of graphic advance organizers on math and science comprehension with high school special education students. B.C. *Journal of Special Education, 16*(2), 101-111.

Kurth, R. J. (1987). Using word processing to enhance revision strategies during student writing activities. *Educational Technology, 27*(1), 13-19.

Lancaster, P. E., Schumaker, J. B., & Deshler, D. D. (2002). The development and validation of an interactive hypermedia program for teaching a self-advocacy strategy to students with disabilities. *Learning Disability Quarterly, 25*(4), 277-302.

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.

Lassonde, C. A., Ritchie, G. V., & Fox, R. K. (2008). How teacher research can become your way of being. In C. A. Lassonde & S. E. Israel. (Eds.). *Teachers Taking Action: A Comprehensive Guide to Teacher Research*. Newark: DE: International Reading Association.

Lepper, M. R., & Cordova, D. I. (1992). A desire to be taught: Instructional consequences of intrinsic motivation. *Motivation and Emotion, 16*(3), 187-208.

Lee, S., Wehmeyer, M., Soukup, J., & Palmer, S. (2010). Impact of curriculum modifications on access to the general education curriculum for students with disabilities. *Exceptional Children, 76*(2), 213-33.

Lesaux, N. K., Rupp, A. A., & Siegel, L. S. (2007). Growth in reading skills of children from diverse linguistic backgrounds: Findings from a 5-year longitudinal study. *Journal of Educational Psychology, 99*(4), 821-834.

Levie, W. H., & Lentz, R. (1982). Effects of text illustrations: A review of research. *Educational Communication & Technology Journal, 30*(4), 195-232.

Lewis, R. B. (1998). Assistive technology and learning disabilities: Today's realities and tomorrow's promises. *Journal of Learning Disabilities*, *31*(1), 16.

Liu, M., & Bera, S. (2005). An analysis of cognitive tool use patterns in a hypermedia learning environment. *Educational Technology Research and Development, 53*(1), 5-21.

Locke, W. R., & Fuchs, L. S. (1995). Effects of peer-mediated reading instruction on the on-task behavior and social interaction of children with behavior disorders. *Journal of Emotional and Behavioral Disorders, 3*(2), 92-99.

Lonigan, C. J., Driscoll, K., Phillips, B. M., Cantor, B. G., Anthony, J. L., & Goldstein, H. (2003). A computer-assisted instruction phonological sensitivity program for preschool children at-risk for reading problems. *Journal of Early Intervention, 25*(4), 248-262.

Lott, G. W. (1983). The effect of inquiry teaching and advance organizers upon student outcomes in science education. *Journal of Research in Science Teaching, 20*(5), 437-451.

Lueck, A. H., Dote-Kwan, J., Senge, J. C., & Clarke, L. (2001). Selecting assistive technology for greater independence. *RE: View, 33*(1), 21-33.

Luiten, J., Ames, W., & Ackerson, G. (1980). A meta-analysis of the effects of advance organizers on learning and retention. *American Educational Research Journal, 17*(2), 211-218.

MacArthur, C. A. (1991). Effects of a reciprocal peer revision strategy in special education classrooms. *Learning Disabilities Research and Practice, 6*(4), 201-210.

MacArthur, C. A., & Graham, S. (1987). Learning disabled students' composing under three methods of text production: Handwriting, word processing, and dictation. *Journal of Special Education, 21*(3), 22-42.

MacArthur, C. A., & Haynes, J. B. (1995). Student assistant for learning from text (SALT): A hypermedia reading aid. *Journal of Learning Disabilities, 28*(3), 50-59.

MacArthur, C. A., Ferretti, R. P., Okolo, C. M., & Cavalier, A. R. (2001). Technology applications for students with literacy problems: A critical review. *The Elementary School Journal, 101*(3), 273-301.

Male, M. (2002). *Technology for inclusion: Meeting the special needs of all students* (4th ed.). Boston, MA: Allyn and Bacon.

Malone, L. D., & Mastropieri, M. A. (1992). Reading comprehension instruction: Summarization and self-monitoring training for students with learning disabilities. *Exceptional Children, 58*(3), 270-279.

Mangold, S. S. (1978). Tactile perception and braille letter recognition: Effects of developmental teaching. *Journal of Visual Impairment & Blindness, 72*(7), 259-266.

Marchand, G., & Skinner, E. A. (2007). Motivational dynamics of children's academic help-seeking and concealment. *Journal of Educational Psychology, 99*(1), 65-82.

Marino, M. T. (2009). Understanding how adolescents with reading difficulties utilize technology-based tools. *Exceptionality, 17*(2), 88-102.

Marzano, R. J., Pickering, D., & Pollock, J. E. (2001). *Classroom instruction that works: Research-based strategies for increasing student achievement.* Alexandria, VA: Association for Supervision and Curriculum Development.

Martin, C. J., & Bassin, C. B. (1977). Effects of two telegraphic deletion schemes on the reading behavior of braille readers. *Journal of Special Education, 11*(2), 233-241.

Mason, L. H. (2004). Explicit self-regulated strategy development versus reciprocal questioning: Effects on expository reading comprehension among struggling readers. *Journal of Educational Psychology, 96*(2), 283-296.

Mason, L. H. (2004). Explicit self-regulated strategy development versus reciprocal questioning: Effects on expository reading comprehension among struggling readers. *Journal of Educational Psychology, 96*(2), 283-296.

Matthew, K. (1997). A comparison of the influence of interactive CD-ROM storybooks and traditional print storybooks on reading comprehension. *Journal of Research on Computing in Education, 29*(3), 263-275.

Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology, 93*(1), 187-198.

Mayer, R. E., Sobko, K., & Mautone, P. D. (2003). Social cues in multimedia learning: Role of speaker's voice. *Journal of Educational Psychology, 95*(2), 419-425.

Mazer, B. (2003). Validation of the assessment of computer task performance for children. *Technology and Disability, 15*(1), 35-43.

McCall, S., & McLinden, M. (2001). Literacy and children who are blind and who have additional disabilities—the challenges for teachers and researchers. *International Journal of Disability, Development & Education, 48*(4), 355-375.

McKenna, M. C. (1998). Electronic texts and the transformation of beginning reading. In D. Reinking, M. C. McKenna, L. D. Labbo & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 45-59). Mahwah, NJ: Lawrence Erlbaum.

McLaughlin, M. (2012). Access for all: Six principles for principals to consider in implementing CCSS for students with disabilities. *Principal*, *9*(1), 22-26.

McLeod, P. J., Berdugo, G., & Meagher, T. W. (1998). Utility of educational objectives: A study of learner and program director perceptions of their value in clinical courses. *Teaching and Learning in Medicine, 10*(3), 152-157.

McNaughton, D. (1997). Proofreading for students with learning disabilities: Integrating computer and strategy use. *Learning Disabilities Research and Practice, 12*(1), 16-28.

McNeill, K. L., Lizotte, D. J., Krajcik, J., & Marx, R. W. (2006). Supporting students' construction of scientific explanations by fading scaffolds in instructional materials. *Journal of the Sciences, 15*(2), 153-181.

Mechling, L. (2005). The effect of instructor-created video programs to teach students with disabilities: A literature review. *TAM Board Members, 20*(2), 25-36.

Mechling, L. C. (2006). Comparison of the effects of three approaches on the frequency of stimulus activations, via a single switch, by students with profound intellectual disabilities. *The Journal of Special Education, 40*(2), 94-102.

Meltzer, L. (2007). *Executive function in education: From theory to practice.* New York, NY: Guilford Press.

Mercier, J., & Frederiksen, C. H. (2007). Individual differences in graduate students' help-seeking process in using a computer coach in problem-based learning. *Learning & Instruction, 17*(2), 184-203.

Metzler, C. W., Biglan, A., Rusby, J. C., & Sprague, J. R. (2001). Evaluation of a comprehensive behavior management program to improve school-wide positive behavior support. *Education and Treatment of Children, 24*(4), 448-479.

Meyer, A. Rose, D.H., & Gordon, D. (2014). *Universal Design for Learning: Theory & Practice.* Wakefield, MA. CAST Professional Publishing.

Mikaelsen, B. (1998). *Petey.* New York: Hyperion Books for Children.

Millar, S. (1977). Tactual and name matching by blind children. *British Journal of Psychology, 68*(3), 377-387.

Millar, S. (1987). Perceptual and task factors in fluent braille. *Perception, 16*(4), 521-536.

Millar, S. (1988). Prose reading by touch: The role of stimulus quality, orthography, and context. *British Journal of Psychology, 79*(1), 87-103.

Millar, S. (1990). Articulatory coding in prose reading: Evidence from braille on changes with skill. *British Journal of Psychology, 81*(2), 205-219.

Minow, M. (2009). Designing learning for all learners. In D.T. Gordon, J.W. Gravel, & L.A. Shifter, eds. *A Policy Reader in Universal Design for Learning*. Cambridge, MA: Harvard Education Press.

Mioduser, D., Tur-Kaspa, H., & Leitner, I. (2000). The learning value of computer-based instruction of early reading skills. *Journal of Computer Assisted Learning, 16*(1), 54-63.

Montague, M., & Applegate, B. (2000). Middle school students' perceptions, persistence, and performance in mathematical problem solving. *Learning Disability Quarterly, 23*(3), 215-227.

Montali, J., & Lewandowski, L. (1996). Bimodal reading: Benefits of a talking computer for average and less skilled readers. *Journal of Learning Disabilities, 29*(3), 271-279.

Moreno, R., & Mayer, R. E. (2002). Verbal redundancy in multimedia learning: When reading helps listening. *Journal of Educational Psychology, 94*(1), 156.

Morocco, C. C., Dalton, B., & Tivnan, T. (1992). The impact of computer-supported writing instruction on fourth-grade students with and without learning disabilities. *Reading & Writing Quarterly, 8*(1), 87-113.

Mostow, J., Aist, G., Burkhead, P., Corbett, A., Cuneo, A., Eitelman, S., Huang, S., Junker, B., Sklar, M. B., & Tobin, B. (2003). Evaluation of an automated reading tutor that listens: Comparison to human tutoring and classroom instruction. *Journal of Educational Computing Research, 29*(1), 61-117.

Mueller, C. M., & Dweck, C. S. (1998). Praise for intelligence can undermine children's motivation and performance. *Journal of Personality and Social Psychology, 75*(1), 33-52.

Nagy, W. E. (1985). Learning words from context. *Reading Research Quarterly, 20*(2), 233-253.

Naylor, P. R. (1991). *Shiloh.* New York, NY: Atheneum.

Newman, R. S., & Schwager, M. T. (1995). Students' help seeking during problem solving: Effects of grade, goal, and prior achievement. *American Educational Research Journal, 32*(2), 352-376.

Nolan, T. E. (1991). Self-questioning and prediction: Combining metacognitive strategies. *Journal of Reading, 35*(2), 132-138.

Norris, C., Sullivan, T., Poirot, J., & Soloway, E. (2003). No access, no use, no impact: Snapshot surveys of educational technology in K-12. *Journal of Research on Technology in Education, 36*(1), 15-27.

Novak, J. D. (1990). Concept maps and vee diagrams: Two metacognitive tools to facilitate meaningful learning. *Instructional Science, 19*(1), 29-52.

Nugent, G. C. (1982). Pictures, audio, and print: Symbolic representation and effect on learning. *Educational Communication and Technology: A Journal of Theory, Research, and Development, 30*(3), 163-174.

Olson, R. K., & Wise, B. W. (1992). Reading on the computer with orthographic and speech feedback*. Reading and Writing, 4*(2), 107-144.

Orsmond, P., Merry, S., & Reiling, K. (2002). The use of exemplars and formative feedback when using student derived marking criteria in peer and self-assessment. *Assessment & Evaluation in Higher Education, 27*(4), 309-323.

Pajares, F., Britner, S. L., & Valiante, G. (2000). Relation between achievement goals and self-beliefs of middle school students in writing and science. *Contemporary Educational Psychology, 25*(4), 406-422.

Palacio, R.J. (2012). *Wonder.* New York, NY: Alfred A. Knopf

Palmer, S. B., & Wehmeyer, M. L. (2003). Promoting self-determination in early elementary school: Teaching self-regulated problem-solving and goal-setting skills. *Remedial and Special Education, 24*(2), 115-126.

Patall, E. A., Cooper, H., & Robinson, J. C. (2008). The effects of choice on intrinsic motivation and related outcomes: A meta-analysis of research findings. *Psychological Bulletin, 134*(2), 270-300.

Paulsen, G. (2010). *Woods runner.* New York, NY: Wendy Lamb.

Paulsen, M. B., & Feldman, K. A. (2005). The conditional and interaction effects of epistemological beliefs on the self-regulated learning of college students: Motivational strategies. *Research in Higher Education, 46*(7), 731-768.

Pisha, B., & Coyne, P. (2001). Jumping off the page: Content area curriculum for the Internet age. *Reading Online, 5*(4).

Pisha, B., & Coyne, P. (2001). Smart from the start: The promise of Universal Design for Learning. *Remedial and Special Education, 22*(4), 197-203.

Plass, J. L., Chun, D. M., Mayer, R. E., Leutner, D., Petig, W., & Voge, W. (1998). Supporting visual and verbal learning preferences in a second-language multimedia learning. *Journal of Educational Psychology, 90*(1), 25-36.

Pollock, E., Chandler, P., & Sweller, J. (2002). Assimilating complex information. *Learning and Instruction, 12*(1), 61-86.

Prat, C. S., Keller, T. A., & Just, M. A. (2007). Individual differences in sentence comprehension: A functional magnetic resonance imaging investigation of syntactic and lexical processing demands. *Journal of Cognitive Neuroscience, 19*(12), 1950-1963.

Price, D. (2005). *Learning communities and student success in post-secondary education.* A Background Paper. New York, New York: MDRC.

Proctor, C. P., Dalton, B., & Grisham, D. L. (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.

Punnett, B. J. (1986). Goal setting and performance among elementary school students. *Journal of Educational Research, 80*(1), 40-42.

Quinlan, T. (2004). Speech recognition technology and students with writing difficulties: Improving fluency. *Journal of Educational Psychology, 96*(2), 337-346.

Rademacher, J. A., Schumaker, J. B., & Deshler, D. D. (1996). Development and validation of a classroom assignment routine for inclusive settings. *Learning Disability Quarterly, 19*(3), 163-177.

Raskind, M. H., & Higgins, E. L. (1998). Assistive technology for postsecondary students with learning disabilities: An overview. *Journal of Learning Disabilities, 31*(1), 27-40.

Reeve, J., Jang, H., Carrell, D., Jeon, S., & Barch, J. (2004). Enhancing students' engagement by increasing teachers' autonomy support. *Motivation and Emotion, 28*(2), 147-169.

Riding, R. J., & Watts, M. (1997). The effect of cognitive style on the preferred format of instructional material. *Educational Psychology, 17*(1), 179-183.

Rieth, H. J., Bryant, D. P., Kinzer, C. K., Colburn, L. K., Hur, S. J., & Hartman, P. (2003). An analysis of the impact of anchored instruction on teaching and learning activities in two ninth-grade language arts classes. *Remedial and Special Education, 24*(3), 173-184.

Roberts, K. D. (2005). The use of voice recognition software as a compensatory strategy for postsecondary education students receiving services under the category of learning disabled. *Journal of Vocational Rehabilitation, 22*(1), 49-64.

Robinson, D. H., Katayama, A. D., Beth, A., Odom, S., Hsieh, Y. P., & Vanderveen, A. (2006). Increasing text comprehension and graphic note taking using a partial graphic organizer. *The Journal of Educational Research, 100*(2), 103-111.

Robinson, D. H., Robinson, S. L., & Katayama, A. D. (1999). When words are represented in memory like pictures: Evidence for spatial encoding of study materials. *Contemporary Educational Psychology, 24*(1), 38-54.

Rose, D., Sethuraman, S., & Meo, G., (2000). Universal Design for Learning. *Journal of Special Education Technology, 15*(2), 26-60.

Rose, D. H., Harbour, W. S., Johnston, C. S., Daley, S. G., & Abarbanell, L. (2006). Universal design for learning in postsecondary education: Reflections on principles and their application. *Journal of Postsecondary Education and Disability, 19*(2), 17.

Rose, D., Hasselbring, T. S., Stahl, S., & Zabala, J. (2005). Assistive technology and universal design for learning: Two sides of the same coin. In D. Edyburn, K. Higgins & R. Boone (Eds.), *Handbook of special education technology research and practice* (pp. 507-518). Whitefish Bay, WI: Knowledge by Design.

Rose, D., & 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. (2006). *A practical reader in universal design for learning.* Cambridge, MA: Harvard Education Press.

Rose, D.H., Meyer, A., & Hitchcock, C. (2005). The universally designed classroom: Accessible curriculum and digital technologies. Cambridge, MA: Harvard Education Press.

Rose, D., & Rose, K. (2007). Executive function processes: A curriculum-based intervention. In L. Meltzer (Ed.), *Executive function in education* (pp. 287-308). New York: Guilford Press.

Rosenbluth, G. S., & Reed, W. M. (1992). The effects of writing-process-based instruction and word processing on remedial and accelerated 11th graders. *Computers in Human Behavior, 8*(1), 71-95.

Rothkopf, E. Z., & Kaplan, R. (1972). Exploration of the effect of density and specificity of instructional objectives on learning from text. *Journal of Educational Psychology, 63*(4), 295-302.

Royer, R., & Royer, J. (2004). Comparing hand drawn and computer generated concept mapping. *Journal of Computers in Mathematics and Science Technology, 23*(1), 67-81.

Ryndak, D. L., Reardon, R., Benner, S.R., & Ward, T. (2007) Transitioning to and sustaining district-wide inclusive services: A 7-Year study of a district's ongoing journey and its accompanying complexities. *Research & Practice for Persons with Severe Disabilities, (32)* 4, 228-246.

Saddler, B. (2006). Increasing story-writing ability through self-regulated strategy development: Effects on young writers with learning disabilities. *Learning Disability Quarterly, 29*(4), 291-305.

Saddler, B., & Asaro, K. (2007). Increasing story quality through planning and revising: Effects on young writers with learning disabilities. *Learning Disabilities Quarterly, 30*(4), 223-234.

Salomon, G., Globerson, T., & Guterman, E. (1989). The computer as a Zone of Proximal Development: Internalizing reading-related metacognitions from a reading partner. *Journal of Educational Psychology, 81*(4), 620-627.

Sawyer, R. J. (1992). Direct teaching, strategy instruction, and strategy instruction with explicit self-regulation: Effects on the composition skills and self-efficacy of students with learning disabilities. *Journal of Educational Psychology, 84*(3), 340-352.

Schnotz, W., & Bannert, M. (2003). Construction and interference in learning from multiple representation. *Learning & Instruction, 13*(2), 141-156.

Schraw, G., Flowerday, T., & Reisetter, M. F. (1998). The role of choice in reader engagement. *Journal of Educational Psychology, 90*(4), 705-714.

Schultheiss, O. C., & Brunstein, J. C. (1999). Goal imagery: Bridging the gap between implicit motives and explicit goals. *Journal of Personality, 67*(1), 1-38.

Schunk, D. H. (1985). Participation in goal setting: Effects on self-efficacy and skills of learning-disabled children. *Journal of Special Education, 19*(3), 307-317.

Schunk, D. H. (1996). Goal and self-evaluative influences during children's cognitive skill learning. *American Educational Research Journal, 33*(2), 359-382.

Schwan, S., & Riempp, R. (2004). The cognitive benefits of interactive videos: Learning to tie nautical knots. *Learning & Instruction, 14*(3), 293-305.

Schwartz, N. H., Stroud, M., Hong, N. S., Lee, T., Scott, B., & McGee, S. M. (2006). Summoning prior knowledge: The influence of metaphorical priming on learning in a hypermedia environment. *Journal of Educational Computing Research, 35*(1), 1-30.

Serafino, K., & Cicchelli, T. (2003). Cognitive theories, prior knowledge, and anchored instruction on mathematical problem solving and transfer. *Education and Urban Society, 36*(1), 79-93.

Simmons, D. C. (1994). Importance of instructional complexity and role reciprocity to classwide peer tutoring. *Learning Disabilities Research and Practice, 9*(4), 203-212.

Simmons, D. C., Fuchs, L. S., Fuchs, D., Mathes, P., & Hodge, J. P. (1995). Effects of explicit teaching and peer tutoring on the reading achievement of learning-disabled and low-performing students in regular classrooms. *The Elementary School Journal, 95*(5), 387-408.

Sinatra, G. (1990). Convergence of listening and reading processing. *Reading Research Quarterly, 25*(2), 115-130.

Skillings, M. J., & Ferrell, R. (2000). Student-generated rubrics: Bringing students into the assessment process. *The Reading Teacher, 53*(6), 452-455.

Sloan, L.L., & Habel, A. (1973). Reading speeds with textbooks in large and in standard print. *The Sight-Saving Review, 43*(2), 107-112.

Smolkin, L. B., & Donovan, C. A. (2001). The contexts of comprehension: The information book read aloud, comprehension acquisition, and comprehension instruction in a first-grade classroom. *The Elementary School Journal, 102*(2), 97-122.

Spires, H. A., & Donley, J. (1998). Prior knowledge activation: Inducing engagement with informational texts. *Journal of Educational Psychology, 90*(2), 249-260.

Stahl, E., Pieschl, S., & Bromme, R. (2006). Task complexity, epistemological beliefs and metacognitive calibration: An exploratory study. *Journal of Educational Computing Research, 35*(4), 319-338.

Stemberger, J. P. (2007). Children's overtensing errors: Phonological and lexical effects on syntax. *Journal of Memory & Language, 57*(1), 49-64

Stern, E., Aprea, C., & Ebner, H. G. (2003). Improving cross-content transfer in text processing by means of active graphical representation. *Learning & Instruction, 13*(3), 191-203.

Stipek, D. J., & Weisz, J. R. (1981). Perceived personal control and academic achievement. *Review of Educational Research, 51*(1), 101-137.

Stoner, J. B., Beck, A. R., Bock, S. J., Hickey, K., Kosuwan, K., & Thompson, J. R. (2006). The effectiveness of the picture exchange communication system with nonspeaking adults. *Remedial & Special Education, 27*(3), 154-165.

Strangman, N., & Dalton, B. (2005). Using technology to support struggling readers: A review of the research. In D. Edyburn, K. Higgins & R. Boone (Eds.), *The handbook of special education technology research and practice* (pp. 545-569). Whitefish Bay, WI: Knowledge by Design.

Strangman, N., & Hall, T. E. (2002). *Text Transformations*. Wakefield, MA: NCAC.

Sullivan, N., & Pratt, E. (1996). A comparative study of two ESL writing environments: A computer-assisted classroom and a traditional oral classroom. *System, 24*(4), 91-501.

Sweet, A. P., Guthrie, J. T., & Ng, M. M. (1998). Teacher perceptions and student reading motivation. *Journal of Educational Psychology, 90*(2), 210-223.

Sweller, J., & Levine, M. (1982). Effects of goal specificity on means-ends analysis and learning. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 8*(5), 463-474.

Tafarodi, R. W., Mehranvar, S., Panton, R. L., & Milne, A. B. (2002). Putting oneself in the task: Choice, personalization, and confidence. *Personality and Social Psychology Bulletin, 28*(5), 648-658.

Thompson, A. (2013). *Mo' meta blues: the world according to questlove*. New York. Grand Central Publishing.

Tindall-Ford, S., Chandler, P., & Sweller, J. (1997). When two sensory modes are better than one. *Journal of Experimental Psychology: Applied, 3*(4), 257-287.

Tinti, C., & Galanti, D. (1999). Interactive auditory and visual images in persons who are totally blind. *Journal of Visual Impairment & Blindness, 93*(9), 579-583.

Tomaka, J., Blascovich, J., Kelsey, R. M., & Leitten, C. L. (1993). Subjective, physiological, and behavioral effects of threat and challenge appraisal. *Journal of Personality and Social Psychology, 65*(2), 248-260.

Tomaka, J., Blascovich, J., Kibler, J., & Ernst, J. M. (1997). Cognitive and physiological antecedents of threat and challenge appraisal. *Journal of Personality and Social Psychology, 73*(1), 63-72.

Torgesen, J. K. (1987). Using verbatim text recordings to enhance reading comprehension in learning disabled adolescents. *Learning Disabilities Focus, 3*(1), 30-38.

Torrance, M., Fidalgo, R., & García, J. N. (2007). The teachability and effectiveness of cognitive self-regulation in sixth-grade writers. *Learning and Instruction, 17*(3), 265-285.

Townsend, M. A. R., & Clarihew, A. (1989). Facilitating children's comprehension through the use of advanced organizers. *Journal of Reading Behavior, 21*(1), 15-31.

Troia, G. A., & Graham, S. (2002). The effectiveness of a highly explicit, teacher-directed strategy instruction routine: Changing the writing performance of students with learning disabilities. *Journal of Learning Disabilities, 35*(4), 290-305.

Troia, G. A., Graham, S., & Harris, K. R. (1999). Teaching students with learning disabilities to mindfully plan when writing. *Exceptional Children, 65*(2), 235-252.

Tumlin, J., & Heller, K. W. (2004). Using word prediction software to increase typing fluency with students with physical disabilities. *Journal of Special Education Technology, 19*(3), 5-14.

Umsted, R. G. (1972). Improving braille reading. *New Outlook for the Blind, 66*(6), 169-177.

Unrau, N., & Schlackman, J. (2006). Motivation and its relationship with reading achievement in an urban middle school. *Journal of Educational Research, 100*(2), 81-101.

Van Eck, R. (2006). The effect of contextual pedagogical advisement and competition on middle-school students' attitude toward mathematics and mathematics instruction using a computer-based simulation game. *Journal of Computers in Mathematics and Science Teaching, 25*(2), 165-195.

Van Eck, R., & Dempsey, J. (2002). The effect of competition and contextualized advisement on the transfer of mathematics skills a computer-based instructional simulation game. *Educational Technology Research and Development, 50*(3), 23-41.

van Essen, G., & Hamaker, C. (1990). Using self-generated drawings to solve arithmetic word problems. *Journal of Educational Research, 83*(6), 301-312.

Vick, S. B., Seery, M. D., Blascovich, J., & Weisbuch, M. (2008). The effect of gender stereotype activation on challenge and threat motivational states. *Journal of Experimental Social Psychology, 44*(3), 624-630.

Vincent, J. (2001). The role of visually rich technology in facilitating children's writing. *Journal of Computer Assisted Learning, 17*(3), 242-250.

Vye, N. J. (1990). *The effects of anchored instruction for teaching social studies: Enhancing comprehension of setting information.* Annual Meeting of the American Educational Research Association, Boston, MA.

Vygotsky, L. (1978). Interaction between learning and development. In *Mind in Society*. Cambridge, MA: Harvard University Press.

Wahl, J. & Duffield, J. (2005). Using flexible technology to meet the needs of diverse learners: What teachers can do. WestEd, 1-11.

Wehmeyer, M. L., Palmer, S. B., Soukup, J. H., Garner, N. W., & Lawrence, M. (2007). Self-determination and student transition planning knowledge and skills: Predicting involvement. *Exceptionality, 15*(1), 31-44.

Weinstein, C. S. (1979). The physical environment of the school: A review of the research. *Review of Educational Research, 49*(4), 577-610.

Wenger, E., McDermott, R., & Snyder, W.C. (2002). *Cultivating communities of practice: a guide to managing knowledge.* Cambridge, MA: Harvard Business School Press.

Wetzel, R., & Knowlton, M. (2000). A comparison of print and Braille reading rates on three reading tasks. *Journal of Visual Impairment & Blindness, 94*(3), 146.

Wiersma, U. J. C. (1992). The effects of extrinsic reward on intrinsic motivation: A meta-analysis. *Journal of Occupational and Organizational Psychology, 65*(2), 101-114.

Wiest, L. R. (2002). Aspects of word-problem context that influence children's problem-solving performance. *Focus on Learning Problems in Mathematics, 24*(2), 38-52.

Willerman, M., & Mac Harg, R. A. (1991). The concept map as an advance organizer. *Journal of Research in Science Teaching, 28*(8), 705-712.

Wilson, M. (1999). Student-generated multimedia presentations: Tools to help build and communicate mathematical understanding. *Journal of Computers in Mathematics and Science Teaching, 18*(2), 145-156.

Wittenstein, S. H., & Pardee, M. L. (1996). Teachers' voices: Comments on Braille and literacy from the field. *Journal of Visual Impairment & Blindness, 90*(3), 201.

Wolters, C. A., Yu, S. L., & Pintrich, P. R. (1996). The relation between goal orientation and students' motivational beliefs and self-regulated learning. *Learning and Individual Differences, 8*(3), 211-238.

Wong, B. Y. L., & Jones, W. (1982). Increasing metacomprehension in learning disabled and normally achieving students through self-questioning training. *Learning Disabilities Quarterly, 5*(3), 228-240.

Wong, B. Y., Butler, D. L., Ficzere, S. A., & Kuperis, S. (1996). Teaching low achievers and students with learning disabilities to plan, write, and revise opinion essays. *Journal of Learning Disabilities, 29*(2), 197-212.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17*(2), 89-100.

Wood, H., & Wood, D. (1999). Help seeking, learning and contingent tutoring. *Computers & Education, 33*(2-3), 153-169.

Xiaowen, F., Shuang, X., Brzezinski, J., & Chan, S. S. (2006). A study of the feasibility and effectiveness of dual-modal information presentations. *International Journal of Human-Computer Interaction, 20*(1), 3-17.

Xin, J. F. (1999). Computer-assisted cooperative learning in integrated classrooms for students with and without disabilities. *Information Technology in Childhood Education, 1*(1), 61-78.

Zimmerman, B. J., & Bandura, A. (1994). Impact of self-regulatory influences on writing course attainment. *American Educational Research Journal, 31*(4), 845-862.

Zimmerman, B. J., Bandura, A., & Martinez-Pons, M. (1992). Self-motivation for academic attainment: The role of self-efficacy beliefs and personal goal setting. *American Educational Research Journal, 29*(3), 663-676.

Zimmerman, B. J., & Kitsantas, A. (1996). Self-regulated learning of a motoric skill: The role of goal setting and self-monitoring. *Journal of Applied Sport Psychology, 8*(1), 60-75.

Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (2004). The scientific base linking social and emotional learning to school success. In J. E. Zins, R. P. Weissberg, M. C. Wang & H. J. Walberg (Eds.),*Building Academic Success on Social and Emotional Learning: What Does the Research Say?* (pp. 3-22). New York: Teachers College Press.

Zipprich, M. A. (1995). Teaching web making as a guided planning tool to improve student narrative writing. *Remedial and Special Education, 16*(1), 3-15.

Zydney, J. M. (2008). Cognitive tools for scaffolding students defining an ill-structured problem. *Journal of Educational Computing Research, 38*(4), 353-385.

Zywica, J., & Gomez, K. (2008). Annotating to support learning in the content areas: Teaching and learning science. *Journal of Adolescent and Adult Literacy, 52*(2), 155-165.

BIOGRAPHICAL SKETCH

Jon Mundorf is an award-winning National Board Certified fifth grade teacher. He received his Bachelor of Science in education from Bowling Green State University in 2001 and his Master of Education from Florida Gulf Coast University in 2007. Jon enjoys sharing his classroom experiences with other educators and has done so at conferences and workshops throughout North America. He also consults with schools and school districts on topics such as accessibility, inclusive teacher pedagogy, technology integration, and Universal Design for Learning. Jon is the co-designer of the Regional Training Center's graduate course *Universal Design for Learning: Reaching All Learners in the Digital Age*. He is a member of the Harvard Graduate School of Education’s UDL Summer Institute faculty and the CAST UDL faculty cadre. Jon resides in Naples, Florida, with his wife and children.