TEACHER EVALUATION OF RESOURCES DESIGNED FOR TEACHING MATHEMATICS TO STUDENTS WITH SIGNIFICANT COGNITIVE DISABILITIES

by

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ABSTRACT

ANGEL HORD LEE. Teacher evaluation of resources designed for teaching mathematics to students with significant cognitive disabilities. (Under the direction of DR. DIANE BROWDER)

Educators of students with significant cognitive disabilities are charged with providing access to grade aligned mathematics for their students. Yet, very few models exist to provide guidance for how to adapt mathematics content for this population of students. The purpose of this research was to examine the current practices of special education teachers related to providing access to grade aligned mathematics content and the usefulness of sample materials designed to improve access to grade aligned mathematics content. An additional purpose was to examine the perceived barriers to providing access. One was designed to build mathematics content knowledge and the second to provide guidance for mathematics instruction aligned to state standards. Results of the current study showed that the majority of special educators were familiar with mathematics standards yet, the frequency of grade-level mathematics instruction was divided. About a third of respondents reported proving math instruction daily while an equal portion reported not teaching grade-level mathematics at all. In terms of barriers to providing access to mathematics, about a fourth of respondents reported that the content was not a priority or was too complex for their students. Respondents indicated that more resources were needed that exemplified how to teach the academic content to this population of students. The resources reviewed for this study received positive reviews from a large majority of respondents who agreed they provided educators with needed models for teaching specific mathematics content. Findings from the current study revealed that special educators may have reached a point where they have at least a basic

understanding of academic content but continue to need models that illustrate how to teach the content.

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CHAPTER 1: INTRODUCTION

Special education for students with significant cognitive disabilities has changed immensely over the past few decades. In the 1980s the emphasis was on a functional approach that focused almost entirely on skills that were considered necessary for daily living (e.g., communication, hygiene) or life outside of school (e.g., meal preparation). The functional skills approach seldom included academics skills except for those that might be used in daily life (e.g., addition and or subtraction for making purchases). By the late 1990s new legislation brought significant changes to services for students with disabilities. The reauthorization of the Individuals with Disabilities Education Act (IDEA 1997) required that students with disabilities participate in state testing. It was recognized that some students were unable to participate in the general assessments and the development of alternate assessments were required. Further notable changes occurred during the 1990s. Many students with disabilities were included in general education classes in order to provide students with disabilities opportunities for socialization. During these opportunities, teachers and parents began to notice that students with disabilities were learning some academic concepts (Cortiella & Wickham, 2008). This marked the beginning of a gradual increase in teaching academic content to students with significant cognitive disabilities.

Alternate assessments were required to be developed by states by the year 2000. However, states were allowed to develop alternate assessments as they saw fit to meet the needs of the population of students for which they were designed, leading to variation among states. These generally assessed the skills in the IEP with no requirement that the assessment be aligned to the academic skills being assessed in the general assessment (Cortiella & Wickham, 2008). The 2000s saw a continued increase in accountability and changes to requirements for state alternate assessments. Students with significant cognitive disabilities were included in state accountability systems, which were designed to hold school systems and districts responsible for academic achievement in core subjects (i.e., reading and math). The assessment scores for students with disabilities were now included in Annual Yearly Progress (AYP) for schools and by 2003, the U. S. Department of Education (DoED) required alternate assessments to be aligned with state academic content standards, which indicated what students should know and be able to do at each grade aligned. These alternate assessments had to be aligned with the state's academic content standards but the alternate assessment could be based on alternate achievement. For students with significant cognitive disabilities, academic progress was measured annually via an alternate assessment based on alternate achievement standards (AA-AAA). The AA-AAS was designed to measure the progress of a small percentage of students who, even with quality instruction, could not be successful on the general assessment.

The DoED federal regulations, paired with No Child Left Behind (NCLB 2001) and another reauthorization of Individuals with Disabilities Education Act (IDEA 2004) demonstrated a clear intent that students with significant cognitive disabilities should have access to their state's general education curriculum and standards (Browder, Spooner, Wakeman, Trela, & Baker, 2006; Courtade, Spooner, & Browder, 2007;

Spooner, Dymond, Smith, & Kennedy, 2006). Since the reauthorization of IDEA 2004, educators have developed an understanding of effective strategies for teaching students with significant cognitive disabilities. With the use of effective strategies, students have continued to demonstrate their potential to acquire academic concepts.

The 2014-2015 school year has brought significant changes to education because the majority of states (45 states, District of Columbia, and 4 territories) have implemented the Common Core State Standards (CCSS; http://www.corestandards.org), a set of national academic standards that frame instruction and assessment for all students. States who have adopted the CCSS will no longer need individual state standards but will base instruction and assessment on one set of common standards for English language arts and mathematics. States may add an additional 15% of their own state standards in order to meet the needs of students. The CCSS were designed to prepare students to be college and career ready, and they include a number of departures from past state standards. For example, the math standards emphasize meaningful access and real world application of the concepts and skills taught in the classroom. The standards in English language arts have a greater emphasis on informational text at the secondary level, something that is very different from previous state standards where narrative literature was a focus.

Accessing the Common Core State Standards

Since the 1990s, teachers and administrators have worked to increase access to the general curriculum for students with significant cognitive disabilities, but the degree to which this has occurred has varied greatly by state and by student (Ryndak, Moore, Orlando, & Delano, 2008-2009). The CCSS represents the standards on which instruction should be aligned for all students including those with significant cognitive disabilities. Although previous legislation has set the stage for continued access to the general curriculum, providing access to curriculum aligned with the CCSS raises the academic bar for students with disabilities and for educators charged with providing academic instruction.

Progress made by students with significant cognitive disabilities continues to be measured via summative assessments (i.e., AA-AAS). These assessments have been developed, with implementation beginning in the 2014-2015 school year. All states that have adopted the CCSS are expected to deliver an assessment that is aligned to the CCSS. Some states have, and will continue to assess extended content standards that are extensions of the CCSS. Extended standards, while linked to the CCSS, are designed to allow students with significant cognitive disabilities access to grade aligned content or a means of progressing towards grade aligned content by providing a set a standards that are reduced in complexity or represents prerequisite skills (e.g., Alabama Department of Education, 2012; North Carolina Department of Education, 2012). Other states are assessing alternate standards that are linked to the CCSS and are not extensions. Regardless of the path a particular state has chosen, instruction and assessments aligned to the CCSS represent higher academic expectations than in previous years for students with significant cognitive disabilities.

The CCSS promotes educational rigor, where students are expected to learn at a high level (National Governors Association Center for Best Practices (NGA), Council of Chief State School Officers (CCSSO), 2010). They have set common expectations for student achievement but have not dictated how to teach the standards, and have not dictated curriculum. Teachers are free to exercise their own judgment around instructional strategies, which means that how students' progress through the standards will not be the same for all students (The Hunt Institute, 2011). For students with significant cognitive disabilities, the CCSS may offer the chance for improved access to academic content.

Instruction of the Common Core State Standards. The potential for students with moderate to significant cognitive disabilities to learn academic content through systematic instruction has been established in the research literature. There is empirical data supporting the use of systematic instruction in literacy (Browder, Ahlgrim-Delzell, Spooner, Mims, & Baker, 2009; Browder, Mims, Spooner, Ahlgrim-Delzell, & Lee, 2008;), math (Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, 2008; Browder, Trela, Courtade, Jimenez, Knight, & Flowers, 2012; Jimenez, Browder, & Courtade, 2008), science (Browder, Trela, Courtade, Jimenez, Knight, & Flowers, 2012; Jameson, McDonnell, Johnson, Riesen, & Polychronis, 2007; Jimenez, Browder, & Courtade, 2009), and most recently, social studies (Schenning, Knight, & Spooner, 2013; Zakas, Browder, Ahlgrim-Delzell, & Heafner, 2013). However, when considering the scope of the CCSS, these studies only represent a small fraction of the content knowledge that is expected to be taught. Teachers are expected to understand and teach academic concepts that they may have never considered teaching before and while the studies mentioned above serve as a foundation for how to teach academics (e.g., time delay, system of least prompts, explicit instruction), special educators do not currently have models for applying these practices to the range or the rigor of the academic content represented in the CCSS (Karvonen, Flowers, & Wakeman, 2013).

According to the Common Core document Applications to Students with Disabilities, in order to meet the high academic standards within the CCSS, educational services must include “Teachers and specialized instructional supports personnel who are prepared and qualified to deliver high-quality, evidence-based, individualized instruction and support services” (NGA, CCSSO, 2010, p. 1). The document also contains information regarding additional supports and services that should be provided including “assistive technology devices and services to ensure access to the general education curriculum and the Common Core State Standards” (NGA, CCSSO, 2010, p. 2). Another consideration for successful implementation of the CCSS is teacher knowledge and understanding of academic content. McLaughlin (2012) suggests that principals provide professional development that helps both general and special educators understand the impact of the CCSS on daily instruction. The author suggests collaboration between special and general educators so that they can develop instructional units together to address a range of students. These ideas are echoed by Browder and Cooper-Duffy (2003) who suggest considerations for meeting the needs of students with significant cognitive disabilities, including the use of systematic instruction strategies to promote participation in academics and collaborative teaming to promote an understanding of academic content and standards.

Quality instruction based on strategies that have been proven effective is necessary for successful student learning. In an attempt to ensure quality instruction, NCLB (2001), mandated the use of evidence-based practices. One example of an evidence-based practice proven effective with students with significant cognitive disabilities is systematic instruction (Ault, Wolery, Doyle, & Gast, 1989; Collins, 2007;

Wolery & Gast, 1984). Systematic instruction strategies are defined as “teaching focused on specific, measurable responses that may be either discrete (singular) or a response chain (e.g., task analysis), and that are established through the use of defined methods of prompting and feedback based on principles and research of applied behavior analysis” (Browder, 2001, p.95).

A number of literature reviews have been conducted on specific types of systematic instruction strategies (e.g., time delay, least intrusive prompts, graduated guidance) and have established these strategies as effective. One review by Ault, Wolery, Doyle, and Gast (1989) found time delay, least intrusive prompts, and graduated guidance to be effective prompting systems when teaching students with moderate to significant cognitive disabilities. Specific to reading instruction, Browder, Wakeman, Spooner, Ahlgrim-Delzell and Algozzine (2006), reviewed studies related to the components of reading established by the National Reading Panel (NRP). Studies in this review support the use of systematic prompting techniques to teach sight words to students with moderate and significant cognitive disabilities. Additionally, a review by Browder Ahlgrim-Delzell et al., (2009) found time delay to be an evidence-based practice. In a meta-analysis specifically related to math, Browder, Spooner et al. (2008) found strong evidence that systematic prompting with feedback, task analysis, and generalization to real life contexts was effective for teaching math to students with significant cognitive disabilities. Finally, Spooner, Knight, Browder, Jimenez, and DiBiase’ (2011) examined the use of evidence-based practices when teaching science. The authors found that using a systematic instruction package to teach science content was an evidence-based practice.

Despite research demonstrating academic gains for students with significant cognitive disabilities, these practices may not be reflected in special education classrooms (Cook, Landrum, Tankersley, & Kauffman, 2003). Burns and Ysseldyke (2009) examined the frequency with which special educators utilized an array of instructional practices. The researchers identified the practices as being effective, moderately effective, and ineffective based on meta-analytic research. Surveys were sent to 500 special education teachers and 1000 school psychologist that and were returned by 174 special education teachers and 333 school psychologists. Results of this survey indicated that while effective practices such as direct instruction were used often (i.e., 90% of teachers used at least once a week), practices that were deemed ineffective such as social skills training were also utilized often (i.e., 75% of teachers used at least once a week).

Jones (2009) conducted a qualitative study that focused only on novice special education teachers. Results of this study, utilizing interviews, observations, and self-report measures, found that novice teachers had low rates of implementation of evidence-based practices. Jones also noted differences between novice teachers' words and actions when interview data was compared to observation data. That is, teachers indicated that they valued research and that evidence-based practices should be utilized in the classroom. However, these views were not apparent during classroom observations. Greenwood and Abbot (2001) synthesized the research of others (e.g., Cole & Knowles, 1993; Gersten, Woodward, & Morvant, 1992; Malouf & Schiller, 1995) regarding the research to practice gap in special education. This synthesis resulted in themes which included (a) the separateness between the research and practice communities, (b) practitioners may not perceive educational research as being relevant, (c) researchers may not always produce interventions that are useable to practitioners, and (d) researchers and practitioners may not get enough opportunities to interact or to engage in professional development.

Collaboration to facilitate instruction of the Common Core State Standards. The use of effective, evidence-based strategies may become more commonplace as increased student academic achievement is demonstrated. In addition to effective instruction, student achievement has been linked to teacher content knowledge (Borko, 2004). One way to increase academic content knowledge is through collaboration with general education teachers. Browder and Cooper-Duffy (2003) noted the importance of collaborative teaming when planning academic instruction. Collaborative teaming may be beneficial for special education teachers who teach predominantly in self-contained classrooms, for teachers (both general and special) who have the opportunity to co-teach, or whose students with significant cognitive disabilities are included in general education classes. Generally, special education teachers have a strong knowledge of instructional practices and of classroom management (Defining Teacher Quality, 2005; Downing, 2006), but for most an in-depth knowledge of the content or how to teach the content has not typically been a priority during teacher preparation or in the classroom (Sharpe & Hawes, 2003; Special Educators, 2004). The requirement to provide access to the general curriculum and implement the CCSS, make it necessary for special educators to establish collaborative relationships with general educators within their school.

Not only will special education teachers be expected to provide access to a new set of content standards, but with an increase of the inclusion of students with disabilities in the general education classroom, the ability of special educators to collaborate with their general education colleagues will be vital. The DoED reported that in 1998 the percentage of students with disabilities ranging from mild to severe who were placed in general education classes increased from 20.7% to 42.4% (DoED, 1998). Findings by McLeskey, Landers, Williamson, & Hoppey (2012) confirmed that there was a trend of more students with disabilities being placed in less restrictive settings. The authors reviewed LRE placement data for students with disabilities from the 1990-91 school year through the 2007-08 school year. One important finding revealed that in 1990, 34% of students with disabilities spent most of their instructional day in a general education setting, but by 2007 that percentage had increased to 58%.

Collaboration is critical to the successful access to curriculum aligned to the CCSS for students with significant cognitive disabilities who are included in the general education classroom. Research has demonstrated that this population of students can benefit from and be successful in the general education setting (Browder &Cooper-Duffy, 2003; Hunt, Farron-Davis, Beakstead, Curtis, & Goetz, 1994; Snell & Brown, 2006). The effectiveness of general/special education collaborative teaming to support the inclusion of students at risk and students with significant cognitive disabilities was investigated by Hunt, Soto, Maier, and Doering (2003). With consistent collaboration and planning, all six of the students demonstrated increases in academic skills. Using a team approach, general educators can provide the content expertise needed to teach the standards while special educators can offer instructional strategies that will promote learning (Browder & Cooper-Duffy, 2003).

Evidence of academic success was noted by Carolyn Teigland (2009), Cecil County Schools' associate superintendent of educational services. Teigland reported the following results from 2004-2008 assessment scores for students with significant cognitive disabilities who received their educational services in an inclusive setting: elementary reading scores increased 31.7%, elementary math scores increased by 23.9%, middle school reading scores increased by 13.8%, and middle school mathematics scores increased by 12.5%.

In a review of the literature related to the inclusion of students with significant cognitive disabilities, Alquraini and Gut (2012) examined the critical components of successful inclusion. Critical components to successful inclusion were considered by the authors to be a) accommodations and adaptations, b) assistive technology, c) instructional strategies, d) collaboration among professionals and paraprofessionals, e) administrative support, f) professional development g) typically developing peers, and h) family support. Studies meeting criteria for the review included subjects in inclusive settings as well as some combination of the critical components. Seventy-two studies met the established criteria; with a number of studies citing collaboration as critical to successful inclusion. Other critical components when including students with significant cognitive disabilities consisted of effective instructional practices, and assistive technology (Alquraini and Gut, 2012). The authors concluded the review by noting that even though there was evidence-based research showing the advantages of inclusion, challenges to the appropriate implementation of inclusion still persist. Continuous collaboration is critical to inclusion of students with significant cognitive disabilities. This level of collaboration requires schools and teachers to be flexible and often requires resource reallocation (Hunt, Soto, Maier, & Doering, 2003).

The reauthorization of the Individuals with Disabilities Education Improvement Act (IDEA, 2004) and No Child Left Behind (NCLB, 2001) have mandated that students with disabilities must have access to and make progress in the general curriculum, which beginning in the 2014-2015 school year will be the CCSS for most states. Karger, 2005 reiterated that access to the general curriculum must include access to, involvement in, and progress in the same grade level academics as peers. The considerations (i.e., evidence-based practices, collaborative planning) suggested by Browder and Cooper-Duffy (2003) may be taken as a progressive pathway leading to academic successes for students with significant cognitive disabilities. With the use of evidence-based practices, students with significant cognitive disabilities are given increased opportunities to make progress in the general curriculum. Collaboration with general educators is needed for students to be involved in the general curriculum. Involvement may occur in the context of the general education classroom but when that is not possible, collaboration with general educators allows special educators to build the content knowledge needed for access to occur in the self-contained classroom.

Teacher supports and resources. A final consideration for providing access to the CCSS is the resources that are needed by teachers. Experts agree that the classroom teacher is the key to student achievement (Borko, 2004; Cohen & Hill, 2000). Teachers who are charged with teaching the CCSS not only need extensive knowledge of best practices, but also an understanding of the academic content appropriate for the grade(s) they currently teach. Numerous resources designed to support implementation of curriculum aligned with the CCSS already exists, both in online formats (e.g., http://www.ascd.org/common-core-state-standards/common-core.aspx#ascd) and as newly developed curriculum (e.g., envision MATH® Common Core), yet these resources were designed for general educators. Special educators require resources that increase academic content knowledge and provide guidance for providing academic instruction to students with a varying range of abilities. Students with significant cognitive disabilities enter the academic content at different ability levels (e.g., working on prerequisite skills, able to complete basic computation) and require an array of supports to achieve success.

Purpose

The purpose of this research was to examine the current practices of special education teachers related to providing access to grade aligned mathematics content and the usefulness of sample materials designed to improve access to grade aligned mathematics content. An additional purpose was to examine the perceived barriers to providing access. Results of this survey have provided a picture of the practices (e.g. collaboration, systematic instruction) being utilized to teach and plan for mathematics instruction for students with significant cognitive disabilities, as well as strategies used to gain an understanding of the mathematics content within the CCSS. Results of this survey have provided information on teacher's perceived effectiveness of mathematics resources that were designed to be used by teachers to plan and implement instruction aligned with the CCSS for students with significant cognitive disabilities.

The following research questions were:

1. What are current practices with regard to access to grade aligned mathematics for students with significant cognitive disabilities?

   1.1 Are teachers who hold dual licensure more likely to teach grade aligned mathematics?

1.2 Are teachers who have received professional development in the CCSS: Math more likely to teach grade aligned mathematics?

1.3 Is there a relationship between the opinion that the content is not relevant and how often mathematics is taught?

2. What are current practices with regard to collaboration with general educators for teaching mathematics to students with significant cognitive disabilities?

   2.1 Is there a relationship between having a connection with general educators and the frequency that collaboration occurs?

3. What are current practices with regard to use of systematic instruction strategies for teaching mathematics to students with significant cognitive disabilities?
4. How do teachers evaluate the usefulness of an online mathematics content module?
5. How do teachers evaluate the usefulness of the resource called Math Activities with Scripted Systematic Instruction (MASSI)?
6. What are the perceived barriers to providing access to grade aligned mathematics to students with significant cognitive disabilities?

Significance of the study

The CCSS will frame instruction for all students in adopted states beginning in the 2014-2015 school year. Many resources, from lesson plans to curriculum maps are being developed to for teachers. However, these resources target general education teachers and may not meet the needs of teachers of students with significant cognitive disabilities. This study was designed to invited feedback on a set of mathematics resources developed for teachers of students with significant cognitive disabilities.

Currently, these mathematics materials are the only set of resources that are aligned with the CCSS and created for the purpose of increasing access to grade aligned mathematics for students with significant cognitive disabilities. Survey feedback was recruited to evaluate the need for improvements or modifications to the mathematics resources. This study was developed to address the gap in empirical literature regarding teacher practices when teaching mathematics to students with significant cognitive disabilities as well as the perceived barriers to practices.

This study has the potential to contribute to the field of special education in several ways. First, results of this survey could provide a current snapshot of the mathematics instructional practices of special educators in two states. This information may be relevant to administrators when planning professional development. Second, this survey will generate data on the usefulness of a specific mathematics resource designed to increase content knowledge of special educators (i.e., Content Module-Perimeter, Area, and Volume) as well as the usefulness of a mathematics resource designed to assist teachers in teaching grade aligned mathematics to students with significant cognitive disabilities (i.e., Measurement and Geometry MASSI). It is important to have these resources validated by classroom teachers and to consider modifications based on survey responses. Finally, this research will examine the perceived barriers to providing access to grade aligned mathematics. This data may be useful to teacher educators at the university level and school personnel who conduct pre-service for beginning teachers as well as professional development for more established teachers. Knowledge of perceived barriers may help administrators understand differences in instruction, and in turn shape professional development. For example, a common response may indicate that grade aligned mathematics is not taught because the content is not appropriate for the students. Professional development exemplifying ways in which students with significant cognitive disabilities can be successful at grade aligned mathematics content may be warranted.

Definitions

Children with severe disabilities: The term children with severe disabilities means children with disabilities who because of the intensity of their physical, mental, or emotional problems need highly specialized education, social, psychological, and medical services in order to maximize their full potential for useful and meaningful participation in society and for self-fulfillment. The term includes those children with disabilities with severe emotional disturbance (including schizophrenia), autism, severe and profound mental retardation, and those who have two or more serious disabilities such as deaf-blindness, mental retardation and blindness, and cerebral-palsy and deafness. (http://definitions.uslegal.com/c/children-with-severe-disabilities/).

Collaboration/Collaborative Teaming: Collaborative teaming may be defined as two or more people working together toward a common goal. Collaborative teaming facilitates the inclusion of students with disabilities in general education environments, and can be viewed as “the glue that holds inclusive schools together” (Janney & Snell, 2000).

Common Core State Standard (CCSS): These standards define the knowledge and skills students should have within their K-12 education careers so that they will graduate high school able to succeed in entry-level, credit-bearing academic college courses and in workforce training programs. The standards: (a) are aligned with college and work expectations, (b) are clear, understandable and consistent, (c) include rigorous content and application of knowledge through high-order skills, (d) build upon strengths and lessons of current state standards, (e) are informed by other top performing countries, so that all students are prepared to succeed in our global economy and society, and (f) are evidence-based. (http://www.corestandards.org/about-the-standards)

Evidence-Based Practices (EBP): An evidence-based practice can be defined as an instructional strategy, intervention, or teaching program that has resulted in consistent positive results when experimentally tested (Mesibov & Shea, 2011; Simpson, 2005).

Inclusion: There is no legal definition of inclusive education; therefore, definitions vary. According to Sailor and Roger (2005, p. 2), inclusion is defined as the "placement of special education students in general education settings."

Online learning/online professional development: The need for professional development that could work within teachers' busy schedules and draw from resource that may not have been available locally led to the development of online professional development for teachers. Online learning is financially sound, giving districts the opportunity to archive trainings and eliminate logistics such as teacher location (Dede, 2006).

Students with significant cognitive disabilities: Encompasses approximately 1% of the K-12 population of students and contains the following disability categories: moderate and severe mental retardation, as a primary, secondary, and/or tertiary disability as well as classifications of multiple disabilities, autism, and Deaf-Blindness where intellectual delays are moderate and/or severe. (http://64.4.113.12/x_upload/files/SpEd_doc/Guidance_Significant_Cognitive_Disabilties.pdf) Includes the population of students with disabilities who are assessed via an alternate assessment based on alternate achievement standards. This is the term that is predominantly used in this dissertation.

Systematic Instruction: Teaching focused on specific, measurable responses that may be either discrete (singular) or a response chain (e.g., task analysis), and that are established through the use of defined methods of prompting and feedback based on principles and research of applied behavior analysis. (Browder, 2001, p.95).

Universal Design for Learning (UDL) as defined by the Higher Education Opportunity Act (HEOA) of 2008 means: a scientifically valid framework for guiding educational practices 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.

Acronyms

AA-AAS- Alternate Assessment based on Alternate Achievement Standards

AYP- Annual Yearly Progress

CAST- Center for Applied Special Technology

CCSS-Common Core State Standards

CoP-Community of Practice

IDEA-Individuals with Disabilities Education Act

NCLB-No Child Left Behind

NCSC-National Center and State Collaborative

UDL-Universal Design for Learning

CHAPTER 2: REVIEW OF LITERATURE

Access to General Curriculum for Students with Significant Cognitive Disabilities

Two decades ago students with significant cognitive disabilities were typically educated in segregated schools or within self-contained classrooms in public schools. Interaction between students with significant cognitive disabilities and their typically developing peers occurred in settings such as lunch rooms or perhaps in specialized classes (e.g., music class). There were generally no academic expectations for students with significant cognitive disabilities even when they were included in a general education class. The purpose of inclusion was to provide opportunities for social interactions with non-disabled peers (Cortiella & Wickham, 2008). Interactions between special and general educators may have occurred occasionally, possibly once a week at staff meetings. Instruction for students with significant cognitive disabilities consisted of life skills such as making one's own sandwich or using picture symbols to express basic wants and needs. Some students, regardless of age, may have been taught basic academics such as functional sight words (e.g., stop, lunch) or simple addition.

Two decades later, special education has seen remarkable changes. Although self-contained classrooms remain the setting where most students with significant cognitive disabilities spend the majority of their day, it is now common for students to spend a percentage of their day actively receiving instruction in the general education classroom (McLeskey, Landers, Williamson, and Hoppey, 2012). It is also plausible now for students with significant cognitive disabilities to have standards-based Individualized Education Plans (IEPs) (Courtade & Browder, 2011). These IEPs ensure that students are taught appropriate academic skills and that progress is made towards academic goals. In order to provide quality instruction, special and general educators collaborate to combine knowledge of effective strategies with content knowledge. In large part, these changes are due to changes in federal legislation.

The reauthorization of the Individuals with Disabilities Education Act (IDEA 1997) included significant changes to the education of students with disabilities. Most importantly, IDEA 1997 required that students with disabilities a) have access to the general curriculum, b) be involved in the general curriculum, and c) make progress in the general curriculum (Karger, & Hitchcock, 2003). Prior to the 1997 reauthorization, students with disabilities were entitled to a "free and appropriate public education" (FAPE) in the "least restrictive environment" (LRE) but based on a landmark decision in 1982 (i.e., Board of Ed v. Rowley), these rights did not include a specific level of educational benefit (Karger, & Hitchcock, 2003).

IDEA 1997 provided students with disabilities more than just access to educational services within public schools. For the first time students with disabilities were entitled to access to the same school curriculum as their non-disabled peers. IEPs were required to include measurable goals and benchmarks that aligned with state standards, as well as considerations for supplemental aides, services or modifications needed to enable involvement and progress in the general curriculum. Finally, IEPs were required to document how progress in the general curriculum would be measured. To solidify access, involvement, and progress, students with disabilities were required to participate in state and district-wide assessments. Students who were unable to participate in the general assessment even with accommodations or modifications could participate in an alternate assessment. The purpose of alternate assessments was to measure academic progress of students with significant cognitive disabilities based on alternate achievement standards (http://www.cehd.umn.edu/NCEO/TopicAreas/AlternateAssessments/aa_aas.htm).

IDEA 1997 required that states develop and implement Alternate Assessments based on Alternate Achievement Standards (AA-AAS) by 2000. However, a specific format for the assessment was not mandated, nor was there a requirement that skills aligned with the general education population be assessed (Cortiella & Wickham, 2008). Initially, alternate assessments varied across states, with most states choosing a portfolio assessment (Thompson & Thurlow, 2001; Thompson & Thurlow, 2003), a collection of student work or data sheets measuring a limited number of goals. Although it would take several years to reach the point where AA-AAS actually assessed grade level state standards, early years of alternate assessment saw a relatively quick transition from assessment of a functional curriculum with no link to academic standards to the assessment of academic standards or functional skills linked to academic standards. In its 2001 State Special Education Outcomes report, the National Center for Educational Outcomes indicated that in 1999, 16 states reported that their alternate assessments were not linked in any way to academic standards but in 2001, 4 states reported assessing just functional skills. A similar trend occurred for states assessing academic standards. In 1999, 19 states reported that their states' alternate assessments were linked to academic standards compared to 2001, where 34 states reported having alternate assessments that were either linked to academic standards or to functional academics that could be linked to academic standards (Thompson & Thurlow, 2001). To further acknowledge the importance of general curriculum access, involvement, and progress, the No Child Left Behind Act (NCLB) set forth a requirement that alternate assessments be aligned with grade level content standards (NCLB 2001). Most importantly, NCLB mandated that schools report “adequate yearly progress” for students with disabilities, holding schools accountable for student performance (Cortiella & Wickham, 2008). Schools were required to report the participation and performance of students with disabilities as a subgroup of all students tested. These requirements set the stage for significant changes in the education of students with disabilities, especially students with significant cognitive disabilities. No longer was access to public schools and the general curriculum sufficient, access to grade level content was necessary to perform well on AA-AAS.

Alternate Assessments based on Alternate Achievement Standards provide a means to monitor student performance and progress in the general curriculum. Standards-based IEPs provide a means for ensuring that students who take the alternate assessment are adequately prepared. Standards-based IEPs are individual plans that are based on prioritized grade level content standards. The IEP considers the student’s present level of performance as it relates to a chosen standard and generally by way of objectives, a plan is developed to lessen the gap between present level of performance and grade level expectation. Standards-based IEPs can be a complicated process. Teachers must have a familiarity with grade level standards and must be able to create meaningful access. Resources such as Aligning IEPs to Academic Standards (Courtade-Little, & Browder,

2005) and more recently, Aligning IEPs to the Common Core State Standards (Courtade & Browder, 2011), offer special educators guidelines for creating standards-based IEPs.

Current Debate Regarding Curriculum for Students with Significant Cognitive Disabilities

The emphasis on providing access to the general curriculum has sparked debate among experts in the field of special education. While some experts advocate strongly for access to grade level content via standards-based IEPs others propose a middle ground, utilizing an ecological approach that is individualized to a student's needs (Courtade, Spooner, Browder, & Jimenez, 2012). Still, there are those in higher education who do not support an emphasis on an academic curriculum, concerned that this will result in a lack of focus on the functional skills needed to be successful in adult life (Ayres, Lowrey, Douglas, & Sievers, 2012).

The University of North Carolina at Charlotte (UNCC) houses the General Curriculum Access Projects (GCAP), which strive to develop evidence-based practices for teaching academic content aligned with grade level standards to students with significant cognitive disabilities (www.education.uncc.edu/access). The GCAPs have been the recipient of multiple grants focused on teaching academics to students with significant cognitive disabilities. Browder and colleagues at UNCC are strong advocates for teaching grade aligned content to students with significant cognitive disabilities and have authored numerous publications on the topic. Through the research at UNCC, it has been demonstrated that students with significant cognitive disabilities can learn English language arts (Wood, Browder, & Mraz, in press; Mims, Hudson, & Browder, 2012; Saunders, Spooner, Browder, Wakeman, & Lee, 2013), mathematics (Saunders, Bethune, Spooner, & Browder, 2013; Browder, Jimenez, & Trela, 2012), science (Hudson, Browder, & Jimenez, 2014; Smith, Spooner, Jimenez, & Browder, 2013; Smith, Spooner, & Wood, 2013), and social studies (Schenning, Knight, & Spooner, 2013; Zakas, Browder, Ahlgrim-Delzell, & Heafner, 2013). All of these studies have included grade aligned content with many of the studies occurring in the general education classrooms. In a recent article Courtade, Spooner, Browder, and Jimenez (2012) provided seven reasons why a standards-based curriculum is appropriate for students with significant cognitive disabilities: a) students with significant cognitive disabilities have a right to full educational opportunity, b) a standards-based curriculum is relevant to students with significant cognitive disabilities, c) the potential for students with disabilities is not yet known, d) functional skills are not a prerequisite for academic learning, e) standards-based curriculum is not a replacement for functional curriculum, f) individualized curriculum is limiting when it is the only curriculum, and g) students are creating the changing expectations with their own achievements.

Not all special education experts support a standards-based curriculum for students with significant cognitive disabilities. Ayers, Lowrey, Douglas and Sievers (2012) voiced concern over what they perceive to be an abandonment of functional curriculum. Ayres et al. (2012) contrasted the evidence supporting a standards-based curriculum with the evidence supporting a functional curriculum and concluded that a functional approach when developing curricular materials for students with significant cognitive disabilities led to meaningful learning and greater independence in adult life. The authors argued that IDEA requires that students are given access to the general curriculum to the maximum extent appropriate and that the “appropriateness” should be determined by whether or not the skill being taught will lead to greater post school independence. When planning individualized instruction, rather than working backwards from grade level standards, the authors have argued that educators must begin with the individualized needs of the student and the skills that will increase independence in the natural environment. Ample evidence that functional skills have a direct link to post school independence is presented and compared to the lack of longitudinal data on post school outcomes for students with significant cognitive disabilities whose education has had an academic focus. The authors did not question the research demonstrating that students with significant cognitive disabilities can learn academic content but question whether academic instruction is an efficient use of time if there is no direct link to independence.

Recently, Hunt, McDowell, and Crocket (2012) promoted the idea that academics does not need to replace all instruction of functional skills. The authors suggested the use of a balanced approach. Given the research base supporting the benefits of an ecological approach to curriculum development and the growing body of research supporting the idea that all students can learn academic skills, the authors proposed a six step approach that promoted both academic and functional skills. These six steps include: a) begin by identifying quality of life goals, b) identify grade level content standards that are a priority for the student, c) examine the chosen standards as they relate to the student's quality of life goals, d) identify meaningful performance outcomes for the selected standards, e) address the performance outcomes via IEP goals and objectives and finally, f) teach the skills in the context of meaningful and relevant activities.

Ayres (2012) endorsed the Hunt, McDonnell and Crocket (2012) proposal of using an ecological approach but also noted challenges. While Ayres supported the idea of beginning with an ecological approach that emphasizes the important consideration of quality of life for students with significant cognitive disabilities, he challenged a number of "steps" in the Hunt et al. piece. First, Ayres questioned the ability to operationalize quality of life in a way that could be applied to all students. Similarly, since quality of life cannot be defined, he questioned the ability to determine the tools needed to reach such an outcome. Ayres suggested that knowledge and skills be taught only if they can be applied to real life issues and questioned the Hunt et al. suggestion that "the definition of quality of life outcomes be broadened to include acquisition of knowledge and skills that are good in and of themselves" (p. 141).

Common Core State Standards bring New Opportunities but also Challenges

Although not all experts support standards-based instruction, the United States will move to national standards in 2014. The CCSS is a set of national academic standards that were developed by National Governors Association Center for Best Practices (NGA), and the Council of Chief State School Officers (CCSSO) in collaboration with stakeholders including experts, teachers, school administrators, and parents. Adoption of the CCSS by each state is optional. Currently, the CCSS have been adopted by 47 states and 3 territories within the United States. The expectations for all students, including those with disabilities, will increase. One of the markers of the CCSS is the rigor that is required. Advocates for students with disabilities echo comments within the CCSS that these common standards will provide new opportunities to improve access and provide students with disabilities challenging academic content (McLaughlin, 2012).

The CCSS were written for English/language arts and mathematics for grades K-12. The goal of the CCSS is for all students to graduate high school, college and career ready. To that end the standards are rigorous enough to allow students to compete globally but also emphasize application of skills to real world situations. The CCSS explicitly includes students with disabilities in the section titled Application to Students with Disabilities. This section includes students with disabilities in the goal that all students leave high school ready for their post-high school lives, either in their chosen career or in college. This section emphasizes the need for research-based instructional practices such as Universal Design for Learning (UDL), teachers with the training and knowledge needed to deliver high quality instruction, and assistive technology and supports. Students with significant cognitive disabilities are specifically mentioned in this document with the acknowledgement that these students will require extensive supports in order to provide meaningful access to grade level standards (www.corestandards.org).

Standards-based IEPs will continue to be the avenue by which access is pursued. In fact, the practice of linking academic standards to IEPs is expected to increase dramatically (Samuels, 2013). But even though standards-based IEPs have been considered best practice for over a decade, creating standards-based IEPs that are linked to the CCSS will bring additional challenges for special educators. A deep understanding of all grade level standards across content areas will be needed in order to develop quality, meaningful IEPs. Of greater importance will be the content knowledge required to provide supports and scaffold instruction so that varying levels of students can access the content.

The CCSS are not prescriptive regarding how the standards should be taught. Experts have begun to consider how students with disabilities might access the standards. In the article “Access for All,” McLaughlin (2012) recognized that the CCSS provide new opportunities for students with disabilities to be taught general curriculum content. McLaughlin offers six considerations: a) students with disabilities are a heterogeneous group; individualized planning will be needed, b) educators will need to understand the difference between accommodations and modifications, c) educators will need to understand and use evidence-based practices; sharing knowledge between general and special educators will be essential, d) assessment programs will need to be put in place that allow for continuous monitoring of student progress, e) educators will need resources to develop standards-based IEPs, and f) special and general educators will need ongoing professional development that is collaborative in nature.

Barriers to General Curriculum Access

Classroom teachers appear reluctant to embrace access to the general curriculum for students with significant cognitive disabilities. Teacher beliefs are important because they likely influence instructional practices (Beach, 1994; Brantlinger, 1996; Karvonen, Wakeman, Flowers, Moody, 2013; Stanovich & Jordan, 1998).Teachers of students with significant cognitive disabilities may underestimate their students’ capabilities and in effect, fail to provide appropriate opportunities for learning (Jorgensen, McSheehan, & Sonnenmeier, 2007). Agran, Alper, and Wehmeyer (2002) used survey research to gather opinions of teachers on issues around general curriculum access for students with significant cognitive disabilities. Findings indicated that the majority of respondents did not see access to the general curriculum as a priority for this population of students. In addition, participants reported that although their students regularly attended general education classes, there was very little effort made to provide these students with access to the content. Several significant changes in legislation have occurred since the findings of this survey were published (e.g., CCSS, IDEA 2004). It is possible that teacher opinions around access and efforts to provide access have evolved to meet new expectations.

More recently, a survey was conducted by the National Center and State Collaborative (NCSC) to explore teacher perceptions of students who participate in the AA-AAS (Lee, et al. 2013). This survey included teachers from 18 NCSC partner states, resulting in over 5000 returned surveys. One purpose of this survey was to gather information on the extent to which teachers believed that academic content was important for their students. Rather than report on their own beliefs, teachers were asked to report how their special education colleagues felt about access to academics for students with significant cognitive disabilities. Most teachers reported that 50-75% of their colleagues felt that students with significant cognitive disabilities should have access to the same content as their typical peers in general education. However, when considering students with the most significant cognitive disabilities, teachers reported that 75-100% of their peers felt that functional skills or daily living skills should be mastered before learning academics such as reading and mathematics. This survey also summarized data around teachers' perceptions of the importance of academics for students with mild/moderate disabilities and students with severe/profound disabilities. The data suggest that teachers view academics as important for students with mild/moderate disabilities but not important for students with severe/profound disabilities. Specifically, 11% of teachers reported that all or most of their peers viewed academics as important for this population.

An additional study by Karvonen, Wakeman, Flowers and Moody (2013) examined the impact of teachers' instructional decisions and beliefs on academic achievement of students with significant cognitive disabilities. Survey research was used to collect evidence from 400 teachers across three states. Results indicated that students' level of communication was a strong predictor of proficiency on the AA-AAS. This may be due to a presumption of competence on the teacher's part. In other words, students who are able to express themselves and demonstrate knowledge more readily may be perceived as more able to learn academic content. An additional finding of this study was that the majority of teachers did not refer to academic content standards when planning instruction. Again, this may illustrate a belief that academics are not a priority for students with significant cognitive disabilities.

In addition to teacher beliefs, knowing exactly how to provide instruction that will effectively allow access to, and progress within the general curriculum, has been a struggle for educators. Clayton, Burge, Denham, Kleinert, and Kearns (2006) offer a four-step process designed to assist educators with aligning their instruction to content standards. The authors suggest that the first step is to identify the appropriate grade level standard. In order to provide meaningful access, it may be necessary to analyze the standard to determine its most basic concept. Another important consideration when identifying the content to be taught is the possibility of teaching "functional" content or life skills within the context of the general curriculum. The second step in the process is to decide what the outcomes will be for all students involved in the unit of study. Using the learning outcomes established for all students, the team can then prioritize or reduce in complexity the outcomes for the student with a disability. For example, if one outcome for all students is to identify common elements between folktales from different cultures, then the outcome for a student with a severe disability might be to identify one common element in two folktales from different cultures. The third step in the process is to identify the instructional activities (e.g., note taking, cooperative learning groups) that will occur during instruction. Then, the team will determine how the student will participate in each instructional activity. The instructional team may consider such things as the use of augmentative communication devices, picture symbols, or modified graphic organizers, to allow for active and meaningful participation in activities. The fourth and final step is to make sure that specific objectives from the IEP are being addressed. Having standards-based IEPs already in place makes the final step easily completed.

Grade level content may be considered too complex because students have not received instruction on skills that would have been taught in prior grades. This may be especially true in mathematics, where the skills typically taught in earlier grades serve as prerequisites for skills and concepts taught in later grades. Even among teachers of students with high incidence disabilities, low level mathematics is most often taught at the secondary level. A 2007 survey of 167 secondary special and general educators queried teachers regarding the mathematics content taught (i.e., pre-algebra, algebra, geometry, general math, algebra II/trigonometry, statistics/probability). Results of the survey showed that special educators were more likely to teach pre-algebra and basic math skills as opposed to the higher level math skills included in geometry, algebra, or statistics (Gagnon & Maccini, 2007). The same is true for students with significant cognitive disabilities. For example, counting is generally taught in primary grades and is required for skills taught later such as data analysis. Hunt, McDonnell, and Crocket (2012) recognize that this may, in fact, be a limitation of students with significant cognitive disabilities but suggest that prerequisite skills be taught in the context of grade level content, e.g., teach counting in the context of data collection.

The level of access may vary with the content area. Students with disabilities may not receive access to math content for several reasons. Complex mathematics skills such as computation and mathematics reasoning may be difficult for students with disabilities (Houchins, Shippen, & Flores, 2010). Similarly, progress in mathematics by students with disabilities is hampered by a lack of strategy knowledge and use (Houchins, Shippen, & Flores, 2010). Lack of teacher understanding of math content, including how to provide access to the same mathematics components (e.g., algebra, data analysis) that typical students receive, may also contribute to lower levels of access. In a comprehensive review of mathematics content taught, Browder, Spooner, Ahlgrim-Delzell, and Wakeman (2008) found that only a narrow range of mathematics content was represented in the literature. Studies focused on number/operations and measurement. The lack of empirical data results in limited models for teachers to teach other strands of mathematics such as algebra or data analysis.

A 2011 study by Karvonen, Wakeman, Browder, Rogers and Flowers provided a snapshot of academic content taught to students with moderate to significant cognitive disabilities. Utilizing the Curriculum Indicators Survey (CIS), the authors surveyed 123 teachers across five states during the 2006-2007 school year. Results of this survey indicated that there has been some effort to teach mathematics content that has not historically been taught. For example, 79% of teachers reported teaching content related to patterns, relations, and functions. However, other content that is typically addressed at the secondary level such as data analysis, statistics and probability were reportedly taught by a much lower percentage of teachers (i.e., 48.7% and 36.5% respectively). When the specific mathematics content being taught was analyzed, there appeared to be a focus on functional academics. For example, math instruction concentrated heavily on numeracy, shapes and patterns, potentially linked to counting and money skills.

Summary of Access to General Curriculum for Students with Significant cognitive disabilities

Over the last two decades, major changes have taken place in the field of special education. Students with disabilities were given access to public educational services within public schools, the content of educational services moved from strictly functional to a requirement for access to grade level academic content, and teacher accountability increased with the requirement that students with disabilities participate in alternate assessments. The shift in educational focus from functional to academic has created debate among experts in the field regarding the most appropriate curricular focus for students with significant cognitive disabilities. The same debate exists among special educators and will likely continue as the implementation of the CCSS will further increase the expectation to provide quality access to grade level content. Access to the general curriculum, especially access to mathematics content, can be impacted by teacher beliefs; for example, some teachers may not perceive math content to be a priority for students with significant cognitive disabilities and as a result may focus on teaching functional skills or lower level academics. Teachers themselves may lack content knowledge needed to provide access to math. Without an adequate understanding of the content, it is impossible to plan and implement instructional strategies and to provide the supports that students with significant cognitive disabilities may need to access the curriculum.

Service Delivery Model and Access to the General Curriculum

Students with disabilities are educated in what is referred to as a continuum of settings. These settings range from what is considered least restrictive to most restrictive. The majority of students with significant cognitive disabilities receive their education in one of three settings: an inclusive setting, a self-contained classroom, or a public separate school. Findings of a recent review of placement data for students with disabilities from the 1990-91 school year through the 2007-08 school year indicated that 54% of students with intellectual disabilities spend little or no time in general education classrooms (McLeskey, Landers, Williamson, & Hoppey, 2012). The right to access to the general curriculum is not dependent on the service delivery model; regardless of the setting, access to the general curriculum must be provided. In contrast, some experts have argued that students with significant cognitive disabilities can only fully access general curriculum in general education classes (Jackson, Ryndak, Wehmeyer, 2010).

Public separate schools are publicly funded schools that are specifically designed to meet the needs of students with disabilities. These schools are segregated settings where only students with disabilities receive educational services. Although some schools may occasionally host typically developing peers for school-based activities (e.g., field day), in general, there are no opportunities for students who attend public separate schools to interact with their typically developing peers.

Self-contained classrooms are classrooms housed in typical public schools. These classrooms are designed to meet the needs of students with significant cognitive disabilities. A self-contained classroom is staffed with special educators and often teaching assistants, in order to maintain a lower staff-to-student ratio than a typical general education classroom. Since self-contained classrooms are housed in typical (i.e., not separate) schools, students with significant cognitive disabilities may have daily opportunities to interact with their typical peers. However, these interactions are often limited to brief social opportunities (e.g., in the cafeteria at lunch, outside at recess) or non-academic classes (e.g., art, physical education).

Inclusive settings, or inclusion, which can be seen as a service delivery model or a movement (Kilanowski-Press, Foote, Rinaldo, 2010) occurs when students with disabilities receive all or part of their education in the general education classroom. This may occur collaboratively, with a co-teacher who is a licensed special educator teaching in the general education classroom, or the general and special educator collaborating outside of instruction, allowing the special education teacher to pre-teach the content and skills to be taught during planned instruction within the general education class.

Nationally, educators have been moving towards more inclusive settings for students with significant cognitive disabilities for two decades. Williamson, McLeskey, Hoppey, and Rentz (2006) analyzed the placement of students labeled “mentally retarded” from 1989 to 2000. The authors reported that the percentage of students placed in a general education setting for some part of the day increased from 27% to 45%, while student placement in separate settings decreased from 73% to 55%. Recently, these trends were confirmed by McLeskey, Landers, Williamson, and Hoppey (2012). Placement data for students with disabilities from the 1990-91 school year through the 2007-08 school year were analyzed for trends. Similar to previous findings, there was a gradual decline in students being educated in self-contained settings for most or all of the school day.

Access in inclusive settings. Providing students with significant cognitive disabilities access to the general curriculum in an inclusive setting is a complicated matter. On one hand, the full content of any subject matter is being delivered. Therefore, no ceilings are placed on how much a student can learn. All of the content that is delivered to typical students is also potentially accessible to students with significant cognitive disabilities. Additionally, students with significant cognitive disabilities are educated alongside their typically developing peers, which in itself has proven to be beneficial (e.g., replacement of inappropriate behaviors with appropriate socially acceptable behaviors, improved communication) (Matzen, Ryndak, Nakao, 2009). On the other hand, simply being present during instruction does not make the content accessible. It is accepted among experts that students with significant cognitive disabilities require a low student to staff ratio, intense instruction that often requires extensive modifications to content and materials (Manset & Semmel, 1997) and evidence-based practices not commonly used in general education (Muraski, 2006) such as systematic prompting and feedback (McLeskey, 2007; Waldron & McLeskey, 2009). Additionally, the scope of skills taught in a general education classroom may require additional effort from general and special educators to prioritize instruction to make it relevant to the daily lives of students with significant cognitive disabilities (Downing, Peckham-Hardin, Friend, 2006).

The setting in which general curriculum access occurs is currently a highly debated topic. Some experts argue that true access to the general curriculum can only occur in a fully inclusive setting. Jackson, Ryndak, Wehmeyer (2010) make the case that inclusion is an evidence-based practice. According to the authors, for inclusion to be evidence-based, students with significant cognitive disabilities must be educated (for a significant portion of the day) using the general curriculum in the context of an age appropriate general education class. The authors advocate for the use of general education context as opposed to other contexts (e.g., separate settings).

There is some empirical evidence that general education settings are more beneficial to students with disabilities than self-contained settings. In 2001, Peetsma, Vergeer, Roeleveld & Karsten reported the results of a large-scale longitudinal study that analyzed the progress of matched pairs of elementary aged students. Results showed that students with disabilities who were educated in general education settings made more progress in language arts and mathematics than their counterparts who received educational services in self-contained classrooms.

While many experts in the field of special education would like to see an increase in the number of students served in inclusive settings, some experts point out concerns about the quality of general curriculum access. In a review conducted by Volonino and Zigmund (2008), findings indicated that a research-to-practice gap increased when educating students with disabilities in inclusive settings. Findings from this review of reform movements suggest that the instructional practices that are effective for students with disabilities may not be feasible for implementation in a general education class.

In contrast, Wehmeyer, Lattin, Lap-Rincker, and Agran (2003) found benefits for inclusion when investigating the level of general curriculum access for middle school students. The authors used a time-sample observation method to record classroom based activities of 33 middle school students with mental retardation. Results indicated that access to the general curriculum was more likely to occur in the general education classroom. Conversely, findings indicated that students with more significant cognitive disabilities were less likely to engage in activities linked to academic standards.

Regardless of the debate around where access occurs, evidence exists that students with significant cognitive disabilities can learn academics (Browder Ahlgrim-Delzell et al. 2009; Browder, Mims et al. 2008, Jimenez, Browder, & Courtade, 2008) and have the potential to achieve more than what was once thought possible (Cortiella & Wickham, 2008; Downing & MacFarland, 2010). The recognition of academic potential for this population of students will likely result in an increasing emphasis on educating students with disabilities in the general education classroom for greater proportions of the school day (Korinek, McLaughlin, Walters-Thomas, 1995; McLeskey, 2007). This heightens the need to identify established practices that improve access to the general curriculum for students with significant cognitive disabilities. Collaboration among general and special educators and universal design for learning are to essential successful access.

Collaborative Teaming

Collaborative teaming is considered a fundamental practice in inclusive education. Jackson, Ryndak, and Billingsley (2000) used qualitative methods to examine the opinions of experts in the field of moderate to significant cognitive disabilities on what they considered to be useful practices for inclusive education. For the purpose of their survey, experts were considered to be persons who had authored and published articles related to inclusive education in select journals (i.e., Journal of the Association for Persons with Severe Handicaps, Exceptional Children, Teaching Exceptional Children) between 1990 and 1996. Additionally, experts were persons who authored or edited books related to inclusive education between 1990 and 1996. This survey was sent to 146 experts. Several themes developed around the importance of collaboration between general and special education. Jackson, Ryndak, and Billingsley suggested that cultural shifts in the climate of schools were needed. Specifically, practices such as promoting equitable collaboration, and supporting the teaming process by retaining but sharing expertise and/or engaging in role reversal. Jackson, Ryndak, and Billingsley also suggested the idea that general and special educators receive training on how to collaborate, as this has not traditionally been provided.

Members of collaborative teams vary based on individual student needs, but all teams value collaboration between families of students with disabilities, related service providers and educators, and strive to improve interventions and support strategies for the individual student (Janney & Snell, 2008). The need for collaborative teaming between general and special educators has increased as more students with significant cognitive disabilities receive services in the general education classrooms. Fortunately, there is an abundance of research that provides guidance for successful collaborative teaming (Dettmer et al. 2002; Friend & Cook, 2007). Specifically, effective collaborative teams utilize effective communication skills and believe that all team members share responsibility for student success (Choate, 2004, p.459).

The effectiveness of collaborative teaming between general and special educators was the topic of a recent study by Hunt, Soto, Maier, and Doering (2003). The authors used a multiple baseline design to measure the effects of “unified plans of support” on the engagement in class activities, and academic performance of six students, three of whom were students with significant cognitive disabilities. Results indicated that with consistent use of the plans developed via collaborative teaming; students demonstrated increased engagement in classroom activities as well as increased academic performance.

Collaboration between general and special educators for the purpose of providing access to the general curriculum in an inclusive setting often takes the form of co-teaching. Co-teaching “exists as a means for providing the specialized instruction to which students with disabilities are entitled while ensuring access to general curriculum in the least restrictive environment with the provision of supplementary aides and services” (Friend, 2008, p.5). The practice of co-teaching was first suggested by Bauwens, Hourcade, and Friend in 1989 as unification between general and special educators that would result in a shared responsibility for the educational programming of all students in a classroom. Although co-teaching has been practiced for over two decades, its impact is unclear. The first meta-analysis of data-based articles related to co-teaching between general and special educators was conducted by Muraski and Swanson (2001). The authors reviewed 89 articles, finding only 6 that provided the quantitative information needed in order to calculate effect size. Results indicated that co-teaching is a moderately effective (mean effect size of 0.40) practice for affecting student outcomes. However, these results should be taken with caution as only three studies provided effect sizes for studies involving students with disabilities.

With regards to the impact of the CCSS, the role of collaboration has received increased attention from Council for Exceptional Children (CEC). In a recent publication, Margaret McLaughlin, the current president of Council for Exceptional Children, emphasized the need for increased collaboration. General and special educators will need opportunities to share knowledge about instructional strategies and how to apply these strategies to the CCSS. The article, entitled Access for All, is aimed at school principals, who, in the McLaughlin's opinion, will have an unprecedented opportunity to improve access to the general curriculum for students with disabilities (McLaughlin, 2012). Additionally, co-teaching is presented as a way to address the need for high-quality teachers that is emphasized in the CCSS. Charles and Dickens (2012) also propose that collaboration between content area teachers and special education teachers is imperative to successful instruction of the CCSS and suggest the use of Web 2.0 technologies as a way to enhance collaboration and co-teaching. Web 2.0 technologies are commonplace in today's society as well as in many classrooms and include social media sites and wiki pages. Web pages are no longer static where only passive viewing of the content can occur. Web 2.0 technology has allowed for the creation of web pages that are designed to be interactive and collaborative. As the foundation for Universal Design, technology has long played an important role in educational planning for students.

Universal Design for Learning

In 1984, the Center for Applied Special Technology (CAST) was founded by a group of researchers with the goal of using technology to improve the educational experiences of students with disabilities. Although their work first focused on computer technology for students with learning disabilities, the researchers at CAST soon extended their work to include students with sensory and physical challenges. By 1988 the phrase “universal design” was coined. The principles of universal design are based on concepts found in architecture and emphasize the need to consider a wide range of students when planning social, physical, and learning environments so that potential barriers are removed. Fundamentally, universal design is about making environments accessible for a wide range of persons without hindering anyone. By the late 1990s, CAST had established the principles referred to as Universal Design for Learning (UDL). These principles were presented to the Council for Exceptional Children and were subsequently published in a topical brief (i.e., Design Principles for Student Access). With changes in education stemming from IDEA 1990, IDEA 1997 and the mandates for general curriculum access for students with disabilities that resulted from its reauthorization in 2004 (IDEA 2004), it was clear that the principles of UDL could be applied to curriculum and instruction (Rose, Meyer, & Hitchcock, 2005). Hence, CAST was chosen to lead the National Center on Accessing the General Curriculum (http://4.17.143.133/ncac/). The goal of this federally funded project was to provide guidance on how curricula, teaching procedures, and policies can be combined for the purpose of improving access to the general curriculum for students with disabilities.

There are three guiding principles used when applying UDL to curriculum and instruction: representation, expression, and engagement. Curriculum and instruction should include multiple means of representation, meaning that content and related materials are presented in alternate modes. This allows students who learn best from visual or auditory information, or who need varying levels of complexity to have access to the content. For example, providing a guide such as a template for finding the area of a 2-dimensional figure may reduce the cognitive load for this task and allow a student to be successful. Curriculum and instruction should also include multiple means of expression. Multiple means of expression allows students to show what they know in the means that best suits them. For example, students who are unable to show what they know through traditional speech may communicate using voice output devices. Finally, curriculum and instruction should include multiple means of engagement. Providing multiple means of engagement is a means to motivate students and stimulate interest. Some considerations include the impact of novel activities versus routine activities, or working in small groups versus working independently.

In the last decade proponents of inclusion have advocated for the use of UDL (Browder, Spooner, Wakeman, Trela, Baker, 2006; Downing, 2006) and consider it to be an example of best practice (Downing, 2008a; Friend 2008). Although not as extensively researched with students with significant cognitive disabilities, there are several sound studies that demonstrate the effectiveness of UDL. One study, conducted by Dymond et al. (2006) used case study methodology in combination with participatory action research to examine the process of redesigning a high school science course using the principles of UDL. The participants in this case study included one general educator and two special educators where one of the special educators served in the role as a co-teacher. The setting was a general education classroom that included students with significant cognitive disabilities. The principles of UDL were applied, targeting changes to materials, student participation, instructional delivery, assessment, and curriculum. The results indicated that while time consuming, the collaboration between general and special educators for the purpose of applying principles of UDL to curriculum is possible and can yield meaningful results.

Recently, UDL has received increased attention from schools across the country. According to one website designed to provide resources for school improvement, Common Core 360 (http://www.schoolimprovement.com/common-core-360/blog/common-core-implementation-udl/), the implementation of the CCSS has schools rethinking the role of their special educators. This shift stems from principles such as UDL, now being touted as an integral part of CCSS implementation. The CCSS goes includes UDL in the section called “Application to Students with Disabilities” (http://www.corestandards.org/assets/application-to-students-with-disabilities.pdf) where UDL is suggested as a “scientifically valid framework” that may allow students with disabilities to participate successfully in the general curriculum.

Barriers to Inclusion

While strategies like co-teaching and UDL may help promote effective inclusion, noteworthy barriers still exist. Given federal mandates and predominating expert opinion, it is surprising that inclusive education is not more common in the U.S. There are some noted reasons that inclusion has been poorly accepted in schools. Scruggs and Mastropieri (1996) identified 28 investigations where general education teachers were surveyed regarding inclusion of students with disabilities in their classrooms. This research was synthesized in order to produce a summary of responses and to identify patterns. Although most general education teachers supported inclusion in theory, less than one third thought that it would be successful in their own class. Reported reasons included insufficient time, skills, training, or resources. More recent research continues to document barriers including negative teacher attitudes regarding student characteristics (i.e., severity of disability) (Smith & Routel, 2008), grade level, and teaching experience (Smith & Routel, 2008; Weddell, 2005), poor administrative support (Friend & Hurley-Chamberlain, n.d.) and lack of professional development (Friend, 2008; Malian & McRae, 2010). Another important barrier, especially for students with significant cognitive disabilities, is low expectations. Students are often not provided an opportunity to participate in inclusive settings because the perception is that they will not benefit from it (Downing, 2008b).

Summary of Service Delivery Model and Access to the General Curriculum

Students with significant cognitive disabilities are educated in a continuum of setting. This continuum is based on the percentage of the school day that a student receives educational services in a general education classroom. There are differing views on the importance of the educational settings with empirical research supporting the different views. Access to the general curriculum however, must be provided regardless of the educational setting. Our new set of national standards, the CCSS, will set higher academic expectations for all students, including students with significant cognitive disabilities. Collaboration between general and special educators will be crucial to successful access regardless of the setting where instruction occurs. Special educators will benefit from the content knowledge and level of expertise in teaching academics that their general education colleagues possess. Likewise, general educators will benefit from the evidence-based instructional strategies and the knowledge of supports and scaffolds that special educators bring to a collaborative partnership. Both general and special educators will benefit from using the principles of UDL (i.e. representation, expression, and engagement) when planning instruction for a diverse group of students.

Using Evidence-Based Practices to Provide Access to the General Curriculum

IDEA 1997 required students with disabilities to have access to the general curriculum. It also included students with disabilities in large scale assessments, albeit, alternate assessments based on alternate achievements standards (AA-AAS). NCLB 2001 required that each state's alternate assessment be linked to the state's grade level academic standards. Language within NCLB mandates that the AAS reflect the highest achievement possible and that students demonstrate AYP towards proficiency in reading and mathematics, which is in alternate assessment scores that are reported annually. To increase the likelihood that students will meet state standards, reauthorizations of IDEA (2004) and NCLB of 2001 (2006) require the use of evidence-based practices that have been known to promote student progress. In addition, language within the CCSS expresses a need for teachers that are qualified to deliver high-quality, evidence-based instruction. Evidence-based practices are practices that meet a set of established criteria (Horner Carr, Halle, McGee, Odom, & Wolery 2005) designed to evaluate the effects of an intervention. Establishing evidence-based practices for teaching academics to students with significant cognitive disabilities is still in its infancy. The use of evidence-based practices may serve to reduce the well documented research to practice gap (Carnine, 1997; Cook & Cook, 2011; Cook & Schirmer, 2006).

Currently, there is more information on how to teach literacy skills (e.g., decoding, listening comprehension) than there is for mathematics (e.g., number operations, solving linear equations). In two separate reviews (Browder, Wakeman, et al., 2006 and Browder, et al., 2009), a total of 158 studies were found with a focus on teaching literacy. In comparison, a review by Browder, Spooner et al. (2008) found 68 studies with a focus on teaching mathematics. Additionally, the studies found in the math review were limited in scope with most studies targeting skills from measurement standards (e.g., time) or from numbers and operations standards (e.g., counting). A lack of guidance regarding how to teach mathematics to students with significant cognitive disabilities may contribute to a lack of access for this population.

One example of an evidence-based practice proven effective with students with significant cognitive disabilities is systematic instruction. The use of systematic instruction has been identified as an evidence-based practice for teaching reading (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006), mathematics (Browder, et al., 2008), and science (Spooner, Knight, Browder, Jimenez, & DiBiase, 2011). Systematic instruction is defined as "teaching focused on specific, measurable responses that may be either discrete (singular) or a response chain (e.g., task analysis), and that are established through the use of defined methods of prompting and feedback based on principles and research of applied behavior analysis" (Browder, 2001, p.95). Prompting strategies used in systematic instruction include response prompting and stimulus prompting. Stimulus prompts involve modifications to the materials, and response prompts are actions performed by the teacher (Collins, 2007). Specifically, response prompting involves the use of defined prompts in response to an incorrect or no response, as well as a schedule for fading prompts. Four specific strategies were identified as effective in a 1990 review by Demchak: (a) system of least prompts, (b) most-to-least prompts, (c) graduated guidance, and (d) time delay. More recently published research supports the use of prompting hierarchies such as a system of least prompts or time delay as effective interventions for students with significant cognitive disabilities to learn academics (Hudson, Browder, Jimenez, in press; Jimenez, Browder, & Courtade, 2008; Smith, Spooner, Jimenez, & Browder, 2013.

Time delay. Time delay is a strategy where only one predetermined (e.g., model) response prompt is used. Time delay is considered errorless because students are provided a "zero-delay" round of instruction where the correct response is provided and also because the instructor attempts to block incorrect responses so that the student is unlikely to make an error. For example when teaching number identification, the teacher would present the student with a set of flash cards labeled with numbers. Then for each number, the prompt is delivered concurrently with the target stimulus (e.g., teacher says "point to three" while pointing to the number three on a flash card). This process is repeated until each target stimulus has been reviewed. After some predetermined number of zero-delay trials, the teacher then employs a delay round, inserting a predetermined increment of time (e.g., 4 seconds) between the delivery of the target stimulus and the prompt to transfer stimulus control (i.e., fade the prompt). Found to be an effective strategy by Wolery, Ault, Doyle, (1992), time delay has also been found to be the more efficient strategy when compared to other prompting options (Doyle, Wolery, Gast, Ault, & Wiley, 1990). Time delay has been found to be an evidence-based practice when teaching literacy to students with significant cognitive disabilities (Browder, Ahlgrim-

Delzell, Spooner, Mims, Baker, 2009). Although this review was limited to using time delay to teach literacy, time delay has also been shown to be effective when teaching math content (Browder, et.al. in press; Polychronis, McDonnell, Johnson, Riesen, & Jameson, 2004).

Many times research conducted in special education settings is carried out by researchers. It is important that strategies are shown to be effective but still feasible to be implemented by the classroom teacher. A study by Falkenstine et al. (2009) demonstrated the feasibility of time delay in an applied setting, as well as its effectiveness during small group instruction. Falkenstine et al. conducted a multiple probe design with conditions across behaviors to determine the effects of constant time delay on the academic skills of three students with moderate disabilities. The researcher, who was also the classroom teacher taught both chained and discrete skills that included telling time, recognizing geography terms, and reading domain-specific vocabulary. Skills were chosen based on their ability to increase independence or increase participation in the general education classroom. Results indicated that all students reached the mastery criteria of 100% on the targeted skills. This study also reported that all students made gains on non-targeted skills (e.g., spelling state names) via observational learning.

A recent study by Jimenez, Browder, and Courtade (2008) demonstrated the usability of time delay by the classroom teacher as well as by peers. Jimenez et al. used a multiple probe across participants to determine the effect of systematic instruction with a concrete representation on the acquisition of algebra skills. Students were taught to solve linear equations using total task training and a combination of time delay and system of least prompts. The researchers began the intervention by providing a demonstration with no delay of prompting on days one and two of the intervention. On day three a system of least prompt was used in order to fade the assistance needed. Primarily, instruction was delivered by the classroom teacher in a self-contained setting but students were able to generalize the skills to the general education math class where instruction was delivered by peers. Participants in this study included three high school students with moderate developmental disabilities. Results of this study, which was the first to teach algebra to this population of students, demonstrated that the use of systematic instruction was effective in teaching students how to solve algebraic equations. In addition, students were able to generalize this skill across materials and settings.

In a pilot study by Browder, et al. (2012) elementary students with autism or moderate disabilities were taught early numeracy skills. Although not grade level content, early numeracy skills serve as a foundation for grade level math skills and are often necessary when students have not received any prior instruction. This pilot study utilized a treatment package that included the use of time delay to teach number and symbol (e.g., +, =) identification in a self-contained classroom. After skills were pre-taught, students attended general education grade appropriate math classes where time delay was embedded during mathematics lessons. Results for the treatment package as a whole demonstrated an increasing trend for all seven students. When embedded instruction data was compared to early numeracy assessment data, results indicated that generally, all students performed better in the general education classroom with the embedded instruction after receiving small group instruction.

As previously stated, more and more students with significant cognitive disabilities are being educated in the general education class (Twenty-five Years of

Educating Children, 2001). However, one of the challenges of educating students with significant cognitive disabilities in the general education setting is finding effective strategies that can be implemented within this setting. Systematic instruction has been shown to be effective when used to provide instruction for students with disabilities in the general education setting. Referred to as embedded instruction, teaching trials are explicitly and systematically embedded into the existing ongoing routine and activities that occurs in general education classrooms (McDonnell, Johnson, & McQuivey, 2008). The use of embedded constant time delay has a growing research base and is often the strategy that is used when embedding instruction in inclusive settings (Johnson & McDonnell, 2004; Johnson, McDonnell, Holzwarth & Hunter, 2004; Riesen, McDonnell, Johnson, Polychronis, & Jameson, 2003).

Johnson and McDonnell (2004) evaluated the use of embedded instruction delivered by the general education teacher, on the percentage of correct responses by students with moderate to significant cognitive disabilities. Skills targeted for data collection included recognizing the number that was “greater than”, signing for “help”, and identifying sight words. Results indicated that embedded instruction was effective, as all three students included in the study showed improved performance on the target skills with two of the three reaching mastery. This study also demonstrated that general education teachers can implement embedded time delay with high fidelity (i.e., an average of 94%, 99.6%, and 96.4%) across students.

The majority of embedded instruction is provided by a licensed teacher or a paraprofessional (Jameson, McDonnell, Polychronis, & Riesen, 2008). However, in recent years, researchers have explored the use of peers as the interventionists. Jameson et al. evaluated the effects of a training package on peers' use of embedded time delay to teach target skills to middle school students with significant cognitive disabilities. Target skills were related to content being taught during the instructional block where the intervention occurred (i.e., health class, arts and crafts class). Results showed that peers could be trained to embed time delay quickly and that their instruction was effective, as all three participants acquired the target skills.

Recently, Hudson, Browder, and Wood (2013) conducted a review of the literature related to academic learning in the general education classroom for students with moderate and significant cognitive disabilities. Results indicated that embedded constant time delay was an evidence-based practice for teaching academics to students with moderate to significant cognitive disabilities in the general education classroom.

System of least prompts. A second strategy that has been shown to be effective when providing instruction to students with significant cognitive disabilities is the system of least prompts, also known as least to most prompting or least intrusive prompting. A system of least prompts uses a prompt hierarchy with the instructor chooses the specific prompts, moving from least to most intrusive. A system of least prompts begins with the student having an opportunity to respond independently after an instructional cue is delivered, if the student does not initiate a response in a predetermined period of time, the first level of prompt is delivered. If the student responds correctly, reinforcement is provided and instruction continues. If the student does not respond or an error is made, the instructor delivers the next level of prompt. A system of least prompts has been used in special education for some time. Doyle, Wolery, Ault, and Gast, (1988), and later, Doyle (1992) determined that a system of least prompts was an effective prompting strategy when teaching a variety of skills to students with significant cognitive disabilities. Although there are not currently enough studies in academics to identify the use of SLP as an evidence-based practice, this response prompting strategy has been shown to be a promising practice for e in teaching academics.

Several studies demonstrate a system of least prompts as an effective strategy when teaching mathematics. Xin and Holmdal (2003) taught elementary students functional counting using a system of least to most prompts. Students in this study increased their counting skills by collecting the snacks for the preschool classrooms located in their schools. Students collected a snack list and then counted out the correct numbers of chocolate milk, milk, and juice. After collecting the total number of beverages, students counted and distributed the correct number of beverages to each class. To promote independent behavior, students were provided with picture prompts so that they could eventually self-monitor completion of the task.

Jimenez, Browder, and Courtade (2008) applied a system of least prompts to the instruction of algebra skills. As previously described, the intervention in this study included a combination of time delay and system of least prompts. Students were taught using a task analysis for solving simple linear equations. Although instruction began by using time delay for two consecutive days, the third and all subsequent days used a system of least prompts. Use of this strategy allowed for prompting to continue but with no more assistance than needed. As stated previously, all students were successful at solving linear equations and were able to generalize to a typical high school algebra class.

Building on Jimenez, et al. (2008), which only taught one skill within one standard, Browder, Jimenez and Trela (2012) applied systematic prompting and the use of a task analysis to teach skills aligned to four grade level content areas of mathematics to students with significant cognitive disabilities or autism. This study utilized research on using a literature based approach to teaching math (Zambo, 2005). This approach allows math content to be taught in the context of relevant and meaningful experiences. Browder et al. used a multiple probe across units design to determine the effect of math instruction on the number of steps completed on a math task analysis. The classroom teacher served as the interventionist, using task analytic instruction, a system of least prompts, and a graphic organizer. All participants showed an increase in correct responses across the four standards.

Research to Practice Gap

While evidence-based practices have been identified, a gap exists between what has been discovered through scientific research and practices within special education classrooms across the nation, an issue that experts consider to be one of the most important issues in the field (Abbott, Walton, Tapia, & Greenwood, 1999; Carnine, 1997; Cook & Schirmer, 2006). This research-to-practice gap exists in spite of laws that specifically mandate the use of practices derived from scientifically based research as well as increased accountability measured through the use of standards-based instruction and high-stakes tests (Davis, 2007).

Multiple studies have been conducted in an attempt to understand why a research to practice gap persists (Agran & Alper, 2000; Ayres, Meyer, Erevelles, & Park-Lee, 1994; Boardman, Aryuelles, Vaughn, Hughes and Klingner, 2005; Burns & Ysseldyke, 2009; Kretlow & Blatz, 2011). Boardman, Aryuelles, Vaughn, Hughes and Klingner, (2005) sought to gain teacher perspective on evidence-based practices. Boardman et al.

conducted focus groups consisting of 40 special educators. Thirty of the teachers taught students with learning disabilities and 19 taught students with emotional and behavioral disorders. The results of the focus groups indicated that teachers did not feel pressure from their school districts to use evidence-based practices and that a strategy being an evidence-based practice was not a criterion for choosing to use a particular practice. However, this study did not target teachers of students with significant cognitive disabilities, nor did it specifically address the use of systematic instruction. Burns and Ysseldyke (2009) surveyed special educators and school psychologists to examine the frequency with which evidence-based practices are used when teaching students with disabilities. Results indicated that practices with little empirical support (e.g., social skills training) are used more often than practices with a strong research base. This survey specifically included applied behavior analysis which includes systematic instruction. Kretlow & Blatz (2011) also evaluated teacher perceptions regarding evidence-based practices. Researchers found that teachers are familiar with buzzwords such as evidence-based practice but two important barriers emerged: limited time to search and identify practices supported by research and lack of access to these sources.

Summary of Using Evidence-Based Practices to Provide Access to the General Curriculum

Although there is no question that a research to practice gap has existed, it is also true that special education has evolved a great deal in recent years. With increased inclusion creating the need for collaboration and the implementation of the CCSS creating further accountability for educators in general, it is important to reevaluate the use of evidence-based practices among special educators. If in fact the gap persists, it is important to determine what barriers continue to challenge educators and what, if any, new hurdles have arisen. Additionally, there are no surveys that specifically target teachers of students with significant cognitive disabilities and the strategies they use or do not use to provide instruction.

Professional Development and Access to the General Curriculum

The requirement for students with significant cognitive disabilities to have access to general curriculum has existed for over two decades. Over the past two decades, requirements have evolved to require participation in AA-AAS, and access to grade level content. Student learning, accountability, and teacher preparation continues to be an iterative process. With each passing of new legislation resulting in increased expectations for students, attention is turned to the classroom teacher. There is a repeated acknowledgement that the classroom teacher is the key to student achievement (Borko, 2004; Cohen & Hill, 2000; Karvonen, Wakeman, Flowers, & Moody, 2013). There is a substantial body of research demonstrating a connection between professional development and student achievement (Darling-Hammond, 1999; National Education Goals Panel, 2000; Wenglinski, 2000). There is also a large body of research establishing a link between teacher's content knowledge and student achievement (Barth, 2002; Darling-Hammond & Bransford, 2005; Heritage & Vendlinski, 2006; Hill, Rowan, & Ball, 2005; Ingersoll, 2003; National Mathematics Advisory Panel, 2008). Therefore, teachers' ability to provide quality access to the general curriculum in a way that will promote progress depends to some degree on quality professional development.

The previous strand of this chapter reviewed the research on systematic instruction, citing multiple examples of effective strategies for teaching academics. In fact, it is clear that students with significant cognitive disabilities can learn more than was once expected (Cortiella & Wickham, 2008; Downing & MacFarland, 2010). What is not plentiful in special education literature is information on what teachers need to know about the content in order to apply evidence-based strategies to academic instruction (Brownell, 2011). Texts written on the subject of teaching students with significant cognitive disabilities academics stress the need for collaboration among special and general educators but collaboration may not always be practical (e.g., in segregated schools), additionally, with the continually increasing academic expectations for students with significant cognitive disabilities, collaboration may not be enough. More and more special educators will be expected to teach academics in their classroom. Hill et al. (2008) found that the strongest teachers, e.g., those with students who demonstrate academic gains, have content knowledge that is specific to the subject they are teaching. Content knowledge is necessary for teachers to understand how to represent the content in a way that students can access it.

Realizing the importance of increasing the depth and breadth of teacher qualifications, the No Child Left Behind (NCLB) act of 2001 set forth legislation and funding initiatives towards quality professional development. This legislation included a set of criteria to be met when creating professional development. These guidelines state that professional development must (a) be sustained, intensive, and content focused; (b) be aligned with and directly related to state academic content standards, student achievement standards, and assessments; (c) improve teacher knowledge in the subject that they teach; (d) increase teacher understanding of instructional strategies based on scientifically based research; and (e) be regularly evaluated to assess the impact on teacher effectiveness and student achievement. However, it is evidenced by multiple reports that the vast majority of teacher related professional development does not meet these guidelines (Ansell & Park, 2003; CEO Forum on Education and Technology, 1999; Yoon, Duncan, Lee, Scarloss, Shapley, 2007). In a white paper on teacher quality by the National Academy of Education (Wilson, 2009), it is suggested that there are so few examples of high quality professional development that “the average teacher has minimal chance of experiencing” it (p. 6).

Once again, with the creation of the CCSS, student expectations will increase as will accountability for educators. Preparing teachers to teach the CCSS is an immense undertaking and one that has received a great deal of attention from national experts in the field as well as district administrators. The Center on Education Policy (CEP, 2011) conducted a national survey of school districts around their perceptions of the CCSS, progress towards implementation and the challenges faced. Findings from this survey indicated that less than half of the states that have adopted the CCSS had a plan for professional development. There are approximately 3.2 million K-12 teachers that will need to be prepared to implement the standards by the 2014 school year. High quality professional development will also be crucial as states begin preparing teachers for the CCSS. The standards, known for their rigor and the expectation that they will be more challenging for students may also place a higher cognitive demand on teachers. In mathematics, the challenge for teachers lies with the fact that the CCSS requires a higher level of mathematical analysis (Sawchuk, 2012). Previous state standards may have only emphasized an end result that was the outcome of correct mathematical procedures. The CCSS, on the other hand, stresses the importance of developing an understanding mathematical concepts and why procedures work; students will need to show their reasoning when solving problems. Mathematics experts in higher learning agree that math teachers, and especially beginning elementary teachers, who are generally weaker in math, will require more content related professional development in order to comprehend and implement the CCSS in mathematics (Sawchuk, 2012).

Expectations of students with disabilities and special education teachers will also increase. In their recent white paper exploring the implications of the CCSS for students receiving special education services McNulty and Gloeckler (2011) emphasized that all students will be expected to excel in a general curriculum that is based on the CCSS. For students with significant cognitive disabilities, the CCSS will bring academic expectations higher than those that were based on state standards. Special education teachers, who generally do not have extensive content knowledge in grade level mathematics and English language arts are increasingly responsible for ensuring full access and progress based on grade level academic standards (Bays & Crocket, 2007; Brownell, 2011) Additionally, special educator may not possess the strategies considered necessary to provide the scaffolding and support needed make the content accessible to students with significant cognitive disabilities. The CCSS states that students must receive "teachers and specialized instructional support personnel who are prepared and qualified to deliver high quality, evidence-based, individualized instruction and support services." (McNulty & Gloeckler, 2011, p. 5). In order to meet this requirement, special education teachers will require ongoing high quality professional development and support.

Intentional professional development targeting mathematics may be needed for special educators. Students with disabilities perform consistently lower than their peers in mathematics with an increasing performance gap as student's progress through grade levels (Perie, Grigg, & Dion, 2005; Lee, Grigg, & Dion, 2007). Research by the National Mathematics Advisory Panel (2008) indicates that lack of content knowledge on the teacher's part is a key factor to student success in mathematics. Rosas and Campbell (2010) used qualitative methods to explore the mathematical backgrounds of future special educators. Participants included 26 graduate students who were pursuing an initial license in special education. Results of the study indicated that the participants have very little experience in mathematics and that much of their experience was not positive. An important finding of this study was that the participants themselves lacked basic math proficiency. A lack of basic math proficiency may have less of an effect at the elementary level but becomes more of an issue when teaching math at the secondary level (National Mathematics Advisory Panel, 2008).

Online Learning

Although a workshop model may still be the primary conduit for professional development, online learning is quickly becoming a preferred model (Swan et al., 2000; Tallent-Runnels et al., 2006). Online learning uses the internet as a forum for sharing information and knowledge construction. The task of providing CCSS training has prompted some states (e.g., Delaware, Kentucky) to develop online resources (e.g., lessons aligned with the CCSS) designed to reach all of their teachers. These states also have the potential to track teacher access through state data systems, thus allowing teachers to receive much needed professional development credits (Sawchuk, 2012).

Although online learning has gained momentum in recent years, this is a model that is not new. Chris Dede, who is a leading authority on teacher professional development conducted online, and a professor of learning technology at the Harvard Graduate School of Education began to see the potential of online learning in the early 1990s. In 2005, Dede gathered experts in distance learning and professional development, which led to the publication of Online Professional Development for Teachers: Emerging Models and Methods. This book includes a discussion of the current status of professional development and goes on to review 10 models of online teacher professional development that were chosen as quality examples showing a range of content and pedagogy.

Today, there are numerous opportunities for teachers to engage in online professional development, ranging from webinars to a Twitter session. This relatively new form of professional development allows teachers to cater learning to their individual needs. For example, if a teacher needs to enhance their understanding of historical documents or refresh their skills on teaching linear equations, an online module specific to that content can be found. One company, Teachscape boast more than 2500 videos, focusing on a variety of subjects, strategies and skills that can be accessed by its members online (Davis, 2012).

There are advantages as well as challenges for successful online professional development for teachers. One advantage, according to Dede (2009) is that online professional development gives teachers an opportunity to reflect on content that may be transformational. Material presented may be complex in nature. Using an online module allows the participant to control the pace; pausing when necessary to reflect on content or review complicated material. Online modules may also offer learning that is targeted to the teachers needs and occurs in small doses, which may be more engaging and meaningful (Davis, 2012). Additionally, with the increase in teacher use of Web 2.0 technologies in both their classrooms and personal lives, participants in online professional development are becoming more comfortable sharing their experiences with other professionals. When considering that the United States now has a set of national standards (i.e. CCSS) that teachers will be expected to understand and implement, online professional development, offers a cost and time effective venue for training large numbers of teachers (O'Dwyer et al., 2010; Rothman, 2012). Dede notes that the challenges of online professional development are some of the same challenges of a face to face model. That is getting teachers to participate, whether it be getting teachers to attend or getting teachers to participate in the learning process. Face to face make-and-take workshops have the benefit of providing the teacher with a product that is designed to enhance what they are doing in their classroom; they do not require a great deal of effort on the teachers part. On the other hand, quality online professional development requires more commitment on the part of the teacher. Teachers must reflect on their classroom practices and potentially rethink how and what they teach. Furthermore, they should then discuss what they learned with a community of teachers. Quality of online learning may also be an issue. It may be difficult to verify the content and also to verify that a teacher actually viewed a webinar (Davis, 2012).

Although there is an abundance of online professional development available for teachers, there has been very little empirical research on the subject and seemingly little teacher input into the design (Dede, 2009; Lawless, Pellegrino, 2007). Recently, one of the first large scale studies using a randomized trial design was conducted to investigate the impact of three online professional development courses on teacher content knowledge and instructional practices and consequently, student achievement (O'Dwyer et al., 2010). Researchers from Boston Colleges' Technology and Assessment Study Collaborative in addition to its Center for the Study of Testing, Evaluation and Educational Policy (CSTEEP) conducted a series of four studies over a three year period. These studies, taking place across 13 states, involved over 333 English and math teachers and 7000 students. Teachers who were randomly assigned to the experimental group participated in three online courses focused on content knowledge, incorporating the content knowledge into teaching practices and classroom skills. Results across the four studies showed larger gains in instructional practices among teachers in the experimental group, with many showing a large effect size. Likewise, larger gains were demonstrated for content knowledge among teachers in the experimental group with most showing a medium to large effect size. Student data, which was collected within weeks of teacher's completion of the online courses, demonstrated that the consequential positive effects of the online courses. Students with teachers in both groups (i.e. experimental and control) made gains, however, students of teachers in the experimental group made significantly larger gains in most but not all content areas (e.g., significant gains for geometric measurement, functions, overall math but not proportional reasoning).

One source for online learning is the IRIS Center (www.iriscenter.com). The IRIS Center, which is funded by the U. S. Department of Education's Office of Special Education Programs (OSEP), provides resources for pre-service preparation and professional development in which evidence-based practices have been infused.

Resources developed by the IRIS Center focus on working with students with disabilities and their families and are free for teacher use. The IRIS Website offers materials, including online modules that may be used for professional development on a wide variety of topics including academics (e.g., mathematics), student centered topics (e.g., accommodations), and teacher centered topics (e.g., collaboration). Data has been collected to evaluate the effectiveness of the IRIS modules. Data in the form of pre/post questionnaires seems to indicate that the modules are an effective venue for teacher learning. However, the data shows that these modules are predominantly accessed by general education teachers.

A second suite of modules were developed by experts and then compiled by researchers at East Carolina University. The Modules Addressing Special Education and Teacher Education (MAST) modules (http://mast.ecu.edu/) were funded by an OSEP grant and were designed to be used in teacher preparation as well as professional development. These modules feature a range of topics of interest to special educators including modules specific to teaching academics content to students with significant cognitive disabilities. One limitation of the MAST modules may be that the modules with an academic focus (e.g., Math Instruction) do not help teachers develop an understanding of the specific content, nor do they address how to make grade level content accessible for the diverse population of students with significant cognitive disabilities.

Summary of Professional Development and Access to the General Curriculum

Although some states have already begun implementation of the CCSS, 2014 will mark the required deadline for all states who have adopted the national standards to begin implementation. Quality professional development will be crucial for all teachers to understand, instruct, and assess content based on the new national standards that boast "high expectations for all" (McNulty & Gloeckler, 2011, p. 8). Special educators may have the steepest learning curve as academic expectations for students with disabilities will reach new heights. At the secondary level, special education teachers will be expected to provide access to the same complex content that general education teachers are licensed to teach. Current technology and the creation of national standards have made online learning (e.g., webinars, content modules) vastly popular. Online learning may be an important resource for providing general and special education teachers with targeted content knowledge as well as instructional strategies using evidence-based practices.

Chapter Summary

Access to the general curriculum is required by law for all students, including students with significant cognitive disabilities. Providing access to the general curriculum that will assure progress for students with significant cognitive disabilities is complex and multi-faceted. This review of literature was provided through the lens of the impact on providing quality access to the grade level content that constitutes the general curriculum.

Federal legislation such as IDEA 1997 and NCLB led to momentous changes in the field of special education. Provision of access to the general curriculum for students with disabilities will allow students to be involved in and make progress in the general curriculum (Karger, & Hitchcock, 2003). The general curriculum will be based on national standards, the CCSS, and will challenge both students and educators with increased academic expectations and increased accountability. However, there is not yet data regarding whether or not students with significant cognitive disabilities receive access to grade level content aligned to the CCSS.

For educators to provide a level of access that will promote progress, consideration needs to be given to inclusive strategies like collaboration and UDL. NCLB requires that students with disabilities receive instruction that is aligned with grade level content standards. This emphasis has led to a growing number of students with disabilities being educated in the general equation classroom for at least part of the instructional day (McLeskey, Landers, Williamson, & Hoppey, 2012). Both the increase in inclusive education and the increased focus on academics for students with significant cognitive disabilities has amplified the need for collaboration. A review of the literature shows that collaboration among special and general educators can lead to positive outcomes for both teachers and students (Hunt, Soto, Maier, and Doering, 2003). There is a large body of research that can be used to guide successful collaborative teaming but current research is not tied to the CCSS, which will require special educators to acquire extensive content knowledge in order to provide access.

To provide access, educators also need to know how to teach. There is a large body of research demonstrating the effectiveness of systematic instruction for teaching a variety of skills to students with significant cognitive disabilities (Spooner et al., 2009) and an emerging body of research specifically aimed at using systematic instruction to teach academics (Browder & Spooner, 2011). However, there is a long standing research to practice gap resulting in the continued use of instructional practices that have not been proven effective. As the CCSS is implemented by special educators it will be important to evaluate teacher's ability to apply evidence-based practices such as systematic instruction to grade level content aligned with the CCSS.

Although evidence-based practices exist, the need exist to develop teacher competence in their use as well as to understand the CCSS. Quality professional development is currently an important issue and a huge undertaking, as the majority of states have adopted the CCSS. Given that special educators, generally do not have extensive content expertise, these teachers may require additional trainings either as a part of school wide trainings or in a manner that can be targeted and individualized. Review of the literature suggests that mathematics content knowledge may be of particular concern (National Mathematics Advisory Panel, 2008). Findings by Rosas and Campbell (2010) indicate that special education candidates demonstrate poor knowledge of math content. Recent literature on professional development emphasizes the use of an online learning model (Swan et al., 2000; Tallent-Runnels et al., 2006). Online learning may be a cost effective model that allows educators to target weak areas such as content knowledge of mathematics. There is an abundance of online learning modules but in comparison to what is offered, there is little research on the effectiveness. To date, there is no research on the impact of online learning for teachers of students with significant cognitive disabilities and their ability to provide access to grade level content.

As this chapter has described, there are several barriers that hinder teachers from providing access. These include the idea that academics are not important or unachievable for this population, a lack of content knowledge, and a lack of understanding of how to apply evidence-based practices to academics. The need exits for research demonstrating how teachers can overcome these barriers. Much of the data demonstrating teachers’ response to demands for access has been derived from teacher surveys (e.g., Agran, Alper, and Wehmeyer, 2002; Burns and Ysseldyke, 2009; Jones, 2009; Kretlow & Blatz, 2011). Other empirical data has come from observational studies (Dymond, et al. 2006; Jones, 2009). Currently, there are no surveys that gather a teacher perspective on providing access to content aligned with the CCSS for students with significant cognitive disabilities after receiving a set of mathematics resources. When gathering teacher perspective, it is important to consider teacher beliefs, use of evidence-based practices, participation in collaborative teaming, professional development, as well as resources needed to provide quality access and potential barriers to quality access.

CHAPTER 3: METHODS

Introduction

The purpose of this research was to examine the current practices of special education teachers related to providing access to grade level mathematics content and the usefulness of sample materials designed to improve access to grade level mathematics content. An additional purpose was to examine the perceived barriers to providing access. The research was a non-experimental quantitative study using survey methods. The survey was developed using Dillman’s (2009) Tailored Design model. Descriptive statistics were used to summarize survey responses. Non-parametric test were used for further analyses when appropriate.

Participants

Participants in this study included a purposeful sample size of 171 of special education teachers and administrators from two states (i.e., FL, MD). Participants were either currently teaching or supported teachers (e.g., administrators or coordinating teachers) of students who participated in the AA-AAS. The participants for this study were recruited by state and local administrators from each of the two states. All communication regarding the training was made through the state administrators. The location of the trainings was determined by the state administrator.

Sample Size, Power, Precision

A survey was used to elicit responses from special educators regarding the perceived usefulness of a set of mathematics resources as well as their current practices related to teaching grade aligned mathematics content to students with significant cognitive disabilities. The goal for this study was to recruit a purposive sample of 200 teachers from two states was asked to complete the survey. Purposive sampling was used to allow this survey to be completed in a timely and efficient manner while still providing the opportunity to sample an adequate number of special educators. Based on a sample size of 200 participants, a 95% confidence interval of 6.9 based on percentages (1 to 100 scale) was estimated and determined to be reasonable for this study. The actual sample size was 171. The sample size may vary by question due to missing responses.

When using a survey there are four types of error to be addressed (Dillman, Smyth, Christian, 2009). These include coverage error, non-response error, sampling error and measurement error. Coverage error occurs when not all members of the population of interest have an equal chance of being included in the sample, which introduces the risk that the sample may not be representative of the population of interest. Because purposive sampling was used, coverage error may be a limitation of this study; only special educators from two states were recruited and there are limitations to generalizing results across all states. Nonresponse error occurs when the participants who do not return the survey differ from those who do. This study limited nonresponse error by collecting survey responses after face-to-face training sessions. Although participants in the trainings were not required to complete the survey, they were required by their state administrators to commit to be in attendance for the entire training, therefore no attrition of participants occurred throughout the day. Additionally, teachers received professional development credits for attending the training and received additional credits for completing the survey. Sampling error occurs when only some members and not every member of a population are surveyed. In order to limit sampling error the goal was to obtain a sample size of 200 participants. Finally, measurement error occurs when the answers to questions are inaccurate, possibly due to poor wording of questions. Measurement error was limited by conducting a pilot study to evaluate both the survey questions and the implementation procedures.

Instrumentation

Each survey included a cover letter stating the purpose of the survey, which reminded participants that all answers were confidential and thanked participants for their participation. A copy of the survey can be found in Appendix A. There were 28 questions in the survey. The questions in the first section were used to gather personal and demographic information. There were six questions to be answered in the first section. Responses were fill in the blank (e.g., grade currently teaching) or close-ended, nominal scale (e.g., educational setting) items. The second section contained two questions based on the CCSS. One question had a close-ended ordinal response and one response that was dichotomous (i.e., yes, no). The second question in this section included a follow-up questions that only specific participants were asked to answer (i.e., if yes then…). The third section contained four questions designed to gain general information related to teaching mathematics, collaboration, and previous experience with the resources that were the subject of the survey (i.e., content module and MASSI). Within this section there was a four-part question where a close-ended response was requires (i.e., none, basic, good), a three-part questions where dichotomous response were required (i.e., yes, no), and a two-part question where a close-ended response was required (i.e., never, monthly, weekly, daily). There was one follow-up question that allowed the participants to check all that applied. The fourth section related specifically to the Perimeter, Area, and Volume Content Module. There were five questions in this section that utilized either a close-ended forced choice or a close-ended "check all that apply" option. These questions were used to rate the usefulness of the content module for increasing the understanding the mathematics content, and for applying the content to a range of students with significant cognitive disabilities. This section contained one eight-part question with each part requiring a yes/no response, one question with a close-ended forced choice (i.e., yes, no, no change), and one questions with a "check all that apply" option. This section also asked two follow-up questions relating to barriers to teaching mathematics content. The follow-up questions used a "check all that apply" format. The fifth and final section related specifically to the Math Activities with Scripted Systematic Instruction (MASSI). The questions were not specific to a particular grade or grade band; therefore, questions were the same for all participants. There were ten questions related to the MASSI. One question required a dichotomous response (i.e., yes or no), four questions with a close-ended "check all that apply" option, four close-ended with a forced choice and finally, there was one five-part questions where each part required a yes or no response. Two of these questions were follow-up questions that were used to elicit further information. The follow-up questions would have only been answered by participants that answered the pervious question in a certain way (e.g., if you answered no, …). Questions in this section were used to rate the usefulness of the MASSI and how likely participants would be to use it to teach their students. The questions in this section related to teaching a range of students with significant cognitive disabilities, instructional strategies, and barriers to teaching mathematics content.

Dillman, Smyth, and Christian (2009) make several recommendations for how to construct quality survey questions and quality surveys that will increase the likelihood that participants will complete the survey. Questions in this survey were ordered by categories (e.g., Content Module, MASSI). Questions that were more easily answered or less sensitive occurred first in each section. The survey questions themselves were developed with Dillman's criteria in mind. The questions were user friendly and not ridden with educational jargon. The format was varied, with some questions having a forced response and others allowing more than one option to be checked. The response "Not applicable" was not used as an answer choice but was used in some follow-up questions (e.g., if you answered no…). Responses were brief and to the point.

To establish content validity, an item by item analysis was conducted by one special education expert and one state level administrator. These experts considered wording and clarity of questions of questions and responses. They also considered the appropriateness of the survey questions in relation to the research questions. The survey was also piloted with a small sample of six former special education teachers who were working towards a PhD in special education. The pilot teachers were professional acquaintances of the researcher and were recruited via email. These teachers provided feedback related to the survey questions, the format and the procedures used for implementation. Pilot teachers were asked specific questions that relate to Dillman's criteria for constructing quality questions (e.g., Is the vocabulary used in the questions and responses clear?). Edits were made based on the analysis of the experts, and the feedback from pilot teachers and administrator.

Procedures

A recruitment email was sent to several states level administrators proposing a training of mathematics materials that would include the opportunity to survey teachers. The email summarized the study and included a timeline, training agenda, the number and type of participant needed. Emails were sent to states that were likely to be able to meet the target goal of 100 teachers per state. Four states were targeted (i.e., Maryland, South Carolina, Florida, and California); two states were not able to participate. However, Florida and Maryland chose to move forward. A contact person that had access the state's current teachers and was willing to set up and organize the training within the state was established. After a contact person was established for each state, the logistics of the training was established (i.e., locations, dates, criteria for participation, target number of teachers, agenda).Participants were invited to participate by the state level contact. As participants registered to attend the training, they were asked to bring laptops or tablets so that they could access the online resources that would be reviewed.

On a designated date, the researcher traveled to the participating state to provide an overview of NCSC Mathematics Curriculum and Instruction resources and collect survey data. Existing training protocols for the district/state were followed (e.g., sign in procedures, professional development credits). Teachers were provided with an overview of materials which and then the opportunity to complete the survey. The training consisted of a review of NCSC Mathematics Curriculum and Instruction resources. Using a PowerPoint paired with the NCSC wiki, each resource was reviewed. The training introduced special educators to the content modules, curriculum resource guide, the instructional resource guide and the MASSIs. For each resource, a description and the purpose was reviewed. Mathematics resources related to Equations were used during the overview while survey questions were related to mathematics resources related to Geometry. Teachers were given multiple opportunities throughout the overview to ask questions. The overview of all mathematics materials took three hours. After the overview of mathematics resources was completed, teachers were asked to review a subset of resources (i.e. Content Module, MASSI) to review as well as the survey to complete. Most participants accessed these resources via the NCSC wiki, however, hard copies were available to those who requested them. The survey was handed out in hard copy form and was completed individually. Participants were reminded that their participation was voluntary and that their answers were confidential. One hour was provided for participant to complete the survey. However, most participants completed it in approximately 30 minutes. The subset of resources reviewed for the survey focused on Geometry, specifically, the Measurement and Geometry MASSI, and the Perimeter, Area, and Volume Content Module. Although not required for completion of the survey, the Instructional Resource Guide was also provided in case teachers needed to refer to information within. The density and newness of these resources made the overview a necessity. Without this presentation, it would have possibly taken participants several hours to review the resources before completing the survey. If these resources were commonly used by teachers and were not novel resources, the overview may not have been needed.

Materials. The NCSC Curriculum and Instruction materials were new to teachers and represented complex content not previously taught by special educators. For this reason, an overview of selected NCSC materials was included in this study. Materials are described below and can be viewed in the appendices. The overview included the following mathematics resources: a) Instructional Resource Guide, b) mathematics Curriculum Resource Guide, c) Content Modules, and d) a sample lesson plans entitled NCSC Math Activities with Scripted Systematic Instruction (MASSIs). After the overview, participants in this study were asked to review additional mathematics resources prior to completing the survey. The survey package included the survey items, (see Appendix A), a Perimeter, Area, and Volume Content Module (see Appendix B for sample pages), and the Measurement and Geometry MASSI, (see Appendix C for sample pages). To view the entire Perimeter, Area, and Volume Content Module see https://wiki.ncscpartners.org/index.php/Perimeter,_Area_and_Volume_Content_Module ; to view the Measurement and Geometry MASSIs for all grade bands see https://wiki.ncscpartners.org/index.php/Mathematics_Activities_for_Scripted_Systematic_Instruction

Training Overview. Trainings sessions were provided for participants via face-to-face meetings. The trainings provided an overview of the NCSC Curriculum and Instruction for mathematics, making sure that participants understood the purpose of each document. These resources were not stand alone documents. Some resources (e.g., Content Modules) provided background information that aided in the understanding and implementation of other resources (e.g., MASSI). The trainings provided participants with the background knowledge and the basic level of understanding that was needed in order to complete the survey. The trainings were similar to professional development that some of the participants had already received but the majority of participants were not familiar with these resources, making the trainings a necessary component.

MASSI. The MASSIs were sample lesson plans for providing intensive instruction on targeted math skills. MASSIs were developed so that they could be used alone or be embedded in general education lessons with a mixed ability group or taught to a small group or an individual student. Strategies used in the MASSIs were based on evidence-based practices. Each MASSI was written in an explicit format, the majority of each MASSI was scripted. However, to reduce the amount of scripting, and the length of the MASSIs, recurring systematic instruction strategies were noted by icons. These icons referred the reader to the NCSC Instructional Resource Guide (IR Guide) for detailed explanations of the strategy being used. Teachers who were unfamiliar with the systematic instruction strategies used may have needed to refer to the Instructional Resource Guide. The MASSIs included the basic materials needed for implementation, including response boards, data sheets for progress monitoring and skills tests. Knowing that special education teachers may be responsible for teaching students at different grade levels and ranges of ability levels, the MASSIs were written by grade band (i.e., elementary, middle school, and high school) and were organized in a way that allowed for instruction with graduating levels of difficulty. For this study, participants received an overview of the Equations MASSI and were asked to complete the survey based on a review of the Measurement and Geometry MASSI that was appropriate for the grade band that they taught.

Instructional Resource Guide. The IR Guide was a companion document to the MASSIs. This resource provided examples of the evidence-based prompting and systematic instruction used in the MASSIs (i.e., model-lead-test, multiple exemplar training, system of least prompts, time delay). Additionally, the IR Guide included a sample for each strategy. As opposed to being scripted, instructional strategies in the MASSI were denoted with an icon. If teachers were unfamiliar with these strategies, they could refer to the IR Guide for explanations of the prompting strategies. The IR Guide was reviewed during the training and was available to participants completing the survey. To view the IR Guide see https://wiki.ncscpartners.org/index.php/Instructional_Resource_Guide

Curriculum Resource Guide. Whereas the Content Modules focused on teacher understanding, the Curriculum Resource Guides (CR Guide) focused on how specific content is taught, beginning with how the content was taught in the general education classroom and ending with what instruction could have looked like for students with differing abilities and complex needs (e.g., provided examples for differentiating instruction for students who were visually or hearing impaired, or students with no prerequisite knowledge) The CR Guides were designed to help teachers better understand how academic content could be made meaningful by providing multiple examples of how the specific content could be applied to real world contexts. The CCSS emphasized that students should be taught using College and Career Ready standards. The CR Guides included ways to promote college and career readiness in meaningful ways for students of all ages. To view the CR Guides, see https://wiki.ncscpartners.org/index.php/Curriculum_Resource_Guides

Content Modules. A suite of eight math content modules were developed as a high level resource for teachers. These online modules were designed to help special educators understand math concepts that were complex or difficult to teach (e.g., Linear Equations, Ratios and Proportions), and to facilitate collaboration among special and general educators. Content Modules also supported other resources such as the MASSIs by defining mathematical terms needed during instruction (e.g., rise, run), and provided a step by step review of mathematical processes (e.g., finding the equation of a line when given a point on the line and its slope). Through the use of the principles of UDL, the modules provided teachers with potential adaptations and modifications to be considered when designing materials and instruction. Content Modules could be utilized by educators teaching in elementary grades, middle school, and high school. They were designed to be brief, taking less than 45 minutes.

Research Design

This study utilized a quantitative, non-experimental research design. A cross sectional survey design was used to gather evaluative data directly from a sample of special educators. Descriptive statistics were used to summarize the data. Non-parametric statistics were used for further analysis.

Data Analysis

Survey data was collected from participants at each of the trainings. Each survey was labeled with a number that served as an identification number and no names were included on the survey. A database was created in SPSS and codes established for each question and each response option. The hard copies of the surveys were coded first by the researcher and then the response codes were entered into SPSS. After all data was entered, frequencies were run for each survey question. Frequencies were then reviewed for any abnormalities (e.g., a code of 3 when there should have only been 1s and 2s); corrections were made to any noted errors. Twenty percent of all surveys entered into SPSS were checked for accuracy of data entry. Descriptive statistics were used to describe the responses to each survey question. Based on the descriptive data, hypotheses were generated about differences between teacher variables and response outcomes and stated as additional research questions. These hypotheses were tested using non-parametric statistics (i.e., chi square). All of the research questions could be answered with descriptive statistics but statistical analyses of some variables provided deeper and more rounded information.

Research questions and data analysis included:

1. What are current practices with regard to access to grade aligned mathematics for students with significant cognitive disabilities?
   - 1.1 Are teachers who hold dual licensure more likely to teach grade aligned mathematics?
   - 1.2 Are teachers who have received professional development in the CCSS: Math more likely to teach grade aligned mathematics?
   - 1.3 Is there a relationship between the opinion that the content is not relevant and how often mathematics is taught?
2. What are current practices with regard to collaboration with general educators for teaching mathematics to students with significant cognitive disabilities?
   - 2.1 Is there a relationship between having a connection with general educators and the frequency that collaboration occurs?

3. What are current practices with regard to use of systematic instruction strategies for teaching mathematics to students with significant cognitive disabilities?
4. How do teachers evaluate the usefulness of an online mathematics content module?
5. How do teachers evaluate the usefulness of the resource called Math Activities with Scripted Systematic Instruction (MASSI)?
6. What are the perceived barriers to providing access to grade aligned mathematics to students with significant cognitive disabilities?

Chapter Summary

This study used survey research to gather information from special educators and administrators from two states regarding current classroom practices and experiences. Additionally, the survey was used to gather feedback related to a subset of NCSC Mathematics Curriculum and Instruction resources. These resources were available publicly for teacher use. Teacher feedback on these resources was crucial for a quality final product. Survey responses were collected via face to face trainings where participants received an overview of NCSC Mathematics Curriculum and Instruction resources before reviewing a subset on which the survey items were based. Collected data was summarized using descriptive statistics. Further non-parametric statistics were utilized when appropriate.

CHAPTER 4: RESULTS

This study was conducted to examine the current practices of special educators regarding access to grade aligned mathematics content and to examine the perceived barriers to providing access. An additional purpose was to collect feedback regarding the usefulness of sample teacher resources designed for the purpose of increasing and imp access to grade aligned mathematics content. The chapter is organized by the description of respondents and the outcome of the four research questions and additional questions stated in chapters 1 and 3. Frequencies of responses are reported for the demographics of participants, the current practices of participants related to teaching mathematics, teacher perceptions regarding the usefulness of reviewed resources and barriers to teaching mathematics to students with significant disabilities.

Description of Respondents

This survey was delivered during five one-day trainings focusing on mathematics resources designed to assist teachers when planning and delivering mathematics instruction to students with significant disabilities. This training was attended by special education teachers, as well as administrators who support and provide training to special education teachers. Although the goal was to obtain 200 surveys, only 171 participants attended these trainings. Each participant completed the voluntary survey, resulting in a 100% return rate, and eliminating any response error.

Complete demographics for the survey respondents are included in Table 1. As a whole, this group of participants had extensive experience in the field of special education with the majority of respondents indicating more than 10 years of experience (65%) and 15% indicating 7-10 years of experience. The majority of respondents indicated that they will administer the alternate assessment (AA-AAS) this year (62%); however, 25% indicated that they have never administered the AA-AAS. Most respondents reported either a special education license (41%) or dual licensure in special education and general education (e.g., elementary education) (51%).

Respondents reported their current teaching setting, grades taught, and type of student(s) taught. The most frequent teaching setting indicated by respondents was a self-contained classroom in a public school. Less than 8% of respondents reported teaching in a fully inclusive or resource setting. The majority of respondents reported teaching grades 9-12 (27%), followed closely by respondents who are not currently teaching (26%), and teachers of middle school grades (22%). Respondents not currently teaching were people who provide support to the teachers such as administrators or coordinating teachers. Educators teaching multiple grade bands (10%), were responsible for teaching students across a wide range of grades (e.g., K-12). Most respondents (85%) taught or supported multiple types of students. Of the 15% of respondents that reported teaching only one type of student, most (6%) of respondents taught students with autism, 3% of respondents reported teaching students with multiple disabilities, 3% of respondents reported teaching students with severe disabilities, 2% of respondents reported teaching students with moderate intellectual disabilities, and no respondents indicated that they only taught students with visual impairments.

Table 1: Demographics for the survey respondents (*n*=171)

	Survey respondents	
Demographic	*n*	%
Experience		
Less than 1 year	10	6.0
1-3 years	14	8.4
4-6 years	9	5.4
7-10 years	25	15.1
10+ years	108	65.1
No response	5	-
Licensure		
SPED	68	40.5
Gen. Ed.	7	4.2
Dual -academic	85	50.6
Dual -non academic	8	4.8
No response	3	-
Setting		
Center based/segregated school	24	14.4
Self-contained/public school	83	49.7
Combination self-contained/inclusive	13	7.8
Full time inclusive	4	2.4
Resource	9	5.4
Other	1	.6
No response	4	-
Grades taught		
K-5	25	15.0
6-8	37	22.2
9-12	45	26.9
Multiple grade bands	16	9.6
Not teaching/support	44	26.3
No response	4	-
Type of student		
Students with autism spectrum disorder	9	6.1
Students with moderate ID	3	2.0
Students with severe ID	5	3.4
Students with multiple disabilities	5	3.4
Students with visual impairments	0	0
Cross categorical	126	85.1
No response	23	-

The resources introduced to the participants at the trainings were newly developed and dense. However, it was possible that there was some level of familiarity with these resources among the participants. For this reason, a survey question was included to gather information related to level of familiarity with the mathematics resources. Less than half of respondents (46%) had previously viewed any of the mathematics Content Modules presented during the training. A little over half of the respondents (58%) had previously viewed at least one of the MASSIs. Finally, only 8% of respondents had implemented any of the MASSIs (see Table 2).

Table 2: Level of familiarity with mathematics resources

Resources	*n*	%	Total Responses
Viewed any of the mathematics Content Modules	77	45.6	169
Viewed any of the MASSIs	71	58.2	170
Implemented any of the MASSI	13	7.7	168

1. What are current practices with regard to access to grade aligned mathematics for students with significant disabilities?

In order to answer the first research question, respondents answered survey items related to their familiarity with mathematics content and how often they provided mathematics instruction. The majority of respondents indicated that they were at least somewhat familiar with the Common Core State Standards in mathematics (68%). Four participants did not answer this question, leaving a sample size of 167. Additional frequencies are shown in Table 3. Frequencies are reported regarding whether or not respondents had received professional development, 61% reported attending professional development specifically related Common Core State Standards: Mathematics. Respondents were asked to rate their confidence level when teaching mathematics as good, basic, or none for each grade band (i.e., K-2, 3-5, 6-8, 9-12), regardless of the grade band they were currently teaching. Table 4 shows the frequencies for these confidence levels. A decline in confidence level is noted as higher grade bands are considered. The response rates for this question varied by the grade band and ranged from 157 to 160 respondents. When considering teaching math skills appropriate for elementary grade bands (i.e., K-2, and 3-5) the majority of respondents (83% and 71% respectively) rated their level of confidence as good but when respondents rated their level of confidence for teaching math skills appropriate at the secondary level (i.e., grades 6-8 and 9-12), the majority of respondents rated their confidence level as basic (51% and 52% respectively) while fewer rated their confidence level as good (43% and 27% respectively) at the secondary level.

Table 3: Level of familiarity with Common Core State Standards in mathematics (*n*=167)

Level	*n*	%
Not at all familiar	12	7.1
Slightly familiar	41	24.4
Somewhat familiar	83	49.4
Very familiar	31	18.1
Total	167	99.4

Table 4: Special educators' confidence level when teaching grade aligned mathematics

Grade band	None		Basic		Good		
	n	%	*n*	%	*n*	%	Total
K-2 concepts	2	1.2	22	13.4	136	82.9	160
3-5 concepts	2	1.2	41	25.2	116	71.2	159
6-8 concepts	6	3.5	83	50.6	71	43.3	160
9-12 concepts	31	19.3	83	51.6	43	26.7	157

The next group of question inquired about the frequency with which mathematics instruction occurred. The majority of responses fell at opposite ends of the response continuum with 38% indicating that they taught grade aligned mathematics daily and 40% indicating that they never taught grade aligned mathematics to their students (see Table 5). Participants in the trainings reviewed a MASSI that would be used to teach grade aligned skills related to measurement and geometry. About one third (38%) of survey respondents reported teaching measurement and geometry skills similar to those taught in the MASSI. Respondents were not asked how often they taught measurement and geometry skills, only if they did or did not teach them. Table 6 shows the percentages of special educators who taught mathematics skills such as those in the Measurement and Geometry MASSI by grade aligned. This table includes only the respondents who indicated they teach a specific grade band. The 37 respondents who indicated they were not current teachers were not included in this table. Nineteen participants did not answer this question. About one half (52%) of respondents who taught elementary aged students, 43% of middle school teachers, 42% of high school teachers, and 36% of teachers teaching multiple grade bands reported teaching measurement and geometry skills. Respondents were also asked if they had created their own lesson plans similar to the MASSIs. Twenty-six percent (*n*=42) of respondents reported they had created such math lessons.

Table 5: How often do respondents teach grade aligned mathematics? (*n*=152)

Frequency	*n*	%
Daily	58	38.2
Weekly	21	13.8
Monthly	13	8.6
Never	60	39.5
Total	152	100.0

Table 6: Percentage of special educators who teach mathematics skills such as those in the Measurement and Geometry MASSI by grade aligned

Grade levels	*n*	%	Total
Elementary	13	52.0	25
Middle School	16	43.2	21
High School	19	42.2	45
Multiple Grade Bands	5	35.7	14

1.1 Are teachers who hold dual licensure more likely to teach grade aligned math?

A chi square was used to determine if there was a significant difference between groups of educators based upon their responses. This analysis considered differences by types of licensure (i.e., sped license only or dual academic license) and the reported frequency of mathematics instruction. Respondents classified as having a dual license reported having a teaching license in special education as well as in an academic content area(e.g., math, reading) From these results, there was no relationship between the type of licensure a teacher had and the frequency with which mathematics instruction was provided, $\chi^2 = 0.651$, df = 3, p = .885. Table 7 shows the frequency of math instruction among respondents who held a special education license and those who held a dual license in special and general education. The two groups were similar, with 34% of special education licensed respondents and 39% of dual licensed respondents reporting that they never taught grade aligned mathematics. The two groups were also similar in the percentages that reported that they taught grade aligned mathematics daily. Thirty-nine percent of special education licensed and 40% of dual licensed respondents reported teaching mathematics on a daily basis.

Table 7: Frequency with which mathematics was taught based on licensure type

Frequency for teaching math	Never		Monthly		Weekly		Daily		Total	
	n	%	n	%	n	%	n	%	n	%
SPED	21	34.4	6	9.8	10	16.4	24	39.3	61	44.9
Dual license	29	38.7	5	6.7	11	14.7	30	40.0	75	55.1
	50	36.8	11	8.1	21	15.4	54	39.7	136	100.0

1.2 Are teachers who have received PD in the CCSS: Math more likely to teach grade aligned math?

Whether or not respondents had professional development related to CCSS-mathematics did not have an effect on the frequency with which they taught mathematics. Of the respondents that indicated they had received professional development, slightly less than half 44% indicated they never taught grade aligned mathematics, while only 34% indicated they taught grade aligned mathematics daily. Likewise, of the respondents that indicated they had received professional development related to CCSS mathematics, the majority (55%) indicated they did not teach measurement and geometry related skills, while slightly less than half (41%) indicated that they did teach measurement and geometry skills. A chi square was used to determine relationships among groups based on their responses. Based on the results there was no relationship between receiving professional development and the frequency with which mathematics was taught $\chi^2 = 2.697$, df = 3, p = .441.

1.3 Is there a relationship between the opinion that the content is not relevant to students with significant disabilities and how often math is taught?

A chi square was used to determine if there was a relationship between groups of teachers and the frequency with which math instruction was provided. This analysis considered differences by two groups of educators (i.e., those who indicated that grade aligned math was not relevant to their students as a barrier to providing math instruction and those that did not) and the reported frequency of mathematics instruction. From these results, there was no relationship between the relevance of mathematics content and the frequency with which mathematics instruction was provided, $\chi^2 = 0.854$, df = 3, p = .836.

Frequencies for the two groups are included in Table 8. Among respondents who reported teaching mathematics daily, the group who listed content knowledge as a barrier (37%) was similar to the group who felt the content was relevant (42%). Findings were similar for the group or respondent who reported never teaching mathematics. See Table 8 for frequencies.

Table 8: Frequency for teaching mathematics based on belief about content

Belief about Content	Never		Monthly		Weekly		Daily		Total	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Content not relevant	15	36.6	5	12.2	6	14.6	15	36.6	41	100.0
Content relevant	28	31.5	8	9.0	15	16.9	38	42.7	89	100.0
Total	43	33.1	13	10.0	21	16.2	53	40.8	130	100.0

2. What are current practices with regard to collaboration with general educators for teaching mathematics to students with significant cognitive disabilities?

Collaboration with general educators may contribute to greater access to mathematics instruction for SWSCD. In contrast, the minority of respondents reported collaborating with general educators. When asked what would be needed to successfully teach grade aligned mathematics, only 28% of respondents indicated that they would need opportunities to collaborate with a general education teacher. When asked what would be needed in order to create their own MASSIs, only 37% of respondents reported that they would need opportunities to collaborate with a general education teacher. One survey item inquired about the frequency of collaboration with a general educator when planning mathematics instruction. Table 9 shows the frequencies of collaboration reported by respondents. One hundred and thirty six participants responded to a question asking why collaboration may not occur. Thirty five participants did not answer this question. The majority of respondents (67%) indicated that they never collaborate with general education teachers. The percentage of respondents who do not collaborate is much higher than the percentage of respondents who teach at center-based schools (14%) who might not participate simply because of lack of physical access. A follow-up question was asked to gather information regarding "why" collaboration may not occur. Respondents were asked to select all that applied. A lack of time was selected most often (46%), followed by the content not being relevant for the students being taught (28%), having no access to general education teachers (19%), having no relationship with general education teachers at the current teaching location (12%), and finally a lack of understanding of mathematics content (8%) (see Table 10).

Table 9: How often do special educators collaborate with general educators to plan mathematics instruction? (*n*=168)

Frequency	*n*	%
Daily	9	5.4
Weekly	9	5.4
Monthly	22	13.1
Never	112	66.7
Not applicable	16	9.5
Total	168	100.0

Table 10: Reasons collaboration with general educators may not occur

Reasons	*n*	%	Total Respondents
Lack of time	73	46.3	136
The content is not relevant to my students	44	32.4	136
No access to general educators	30	18.8	136
No relationship with general educators at my school	19	11.9	136
Lack of understanding of mathematics content	13	8.1	136

2.1 Is there a relationship between having a connection with general educators and the frequency that collaboration occurs?

A chi square could not be used to analyze these findings because one of the two groups was small (*n*=17), resulting in several cells with less than the expected cell count of five. Frequencies for the two groups are included in Table 11. Among respondents who reported that they never collaborate, only 100% indicated I have no relationship with general educators at my school as a barrier to collaboration while (73%) did not indicate a lack of relationship with general educators as a barrier.

Table 11: Frequency of collaboration based on relationship with general educator

Relationship Status	Never		Monthly		Weekly		Daily		Total	
	n	%	n	%	n	%	n	%	n	%
No relationship- a barrier	17	100.0	0	0.0	0	0.0	0	0.0	17	100.0
No relationship-not a barrier	82	72.6	15	13.3	8	7.1	8	7.1	113	100.0
Total	99	76.2	15	11.5	8	6.2	8	6.2	130	100.0

3. What are current practices with regard to use of systematic instruction strategies for teaching mathematics to students with significant cognitive disabilities?

This survey contains several questions that inquire about the barriers to providing access to mathematics instruction. One barrier respondents were asked to consider was a lack of knowledge of effective strategies used to teach mathematics content. Since systematic instruction has been proven to be an effective strategy when teaching academics to students with disabilities, respondents were asked how often they used systematic instruction to teach mathematics content. About two thirds of the respondents (65%) indicated that when teaching mathematics, they used systematic instruction strategies. Table 12 shows the frequencies for how often systematic instruction was used to teach mathematics content based on a sample size of 136. Thirty-five participants did not answer this question.

Table 12: How often is systematic instruction used to teach mathematics? (*n*=136)

Frequency	*n*	%
Daily	88	64.7
Weekly	34	25.0
Never	14	10.3
Total	136	100.0

4. How do teachers evaluate the usefulness of an online mathematics content module?

Participants in the training were provided with an overview of a set of online content modules designed to be a resource for special educators. The purpose of the content modules is to increase mathematics content knowledge. When completing the survey, respondents were asked to review one specific content module (i.e., Content Module on Perimeter, Area, and Volume). Based on 170 responses, the majority of respondents (81%) found the information in the module to be helpful in increasing content knowledge related to perimeter, area, and volume, 5% did not find it to be helpful, and 14% indicated there was no change because they already knew the information (see Table 13). One participant did not respond to this question. One question was asked to gather specific information related to how the content modules would be helpful. The number of participants who responded to this question ranged from 155 to 163. Respondents were asked to answer yes or no to each statement describing how the content module might be useful. Table 14 shows the numbers and percentages of respondent who answered "yes" to each question. Over 90% of respondents felt the content modules would be useful when embedding academics into functional skills, when planning instruction for students with multiple disabilities, and when planning academic instruction for a select few students. Over 80% of respondents agreed that the content modules would be helpful when planning instruction for the entire class, helpful for improving content currently being taught, and would increase the likelihood of teaching the mathematics content. Seventy-two percent of respondents agreed that the content modules could improve learning in an inclusive setting. Finally, 59% agreed that the content modules would be helpful when collaborating with general education teachers.

Table 13: Was the information in the content module helpful for building knowledge of perimeter, area, and volume? (*n*=170)

	n	%
Yes	138	81.2
No	9	5.3
No change	23	13.5
Total	170	100.0

Table 14: Ways in which the content module will be useful

Uses for Content Module	*n*	%	Total Responses
Help to embed academics into functional activities	152	92.7	163
Useful when planning instruction for students with multiple	152	92.1	164
disabilities	142	91.0	155
Useful when planning academic instruction for a few students	140	89.2	156
Useful when planning academic instruction for the class	134	85.4	154
Improving on the content I currently teach	133	84.2	156
Increase the likelihood of teaching the content	113	72.0	156
Improve learning in an inclusive setting	92	59.0	155
Collaborating with general education teachers			

Two follow-up questions were asked related to the usefulness of content modules. These questions related to the content modules increasing the likelihood of teaching mathematics and the UDL information being useful to students with multiple disabilities. These questions were directed at respondents who did not indicate that the content modules would increase the likelihood of teaching mathematics or useful for teaching students with multiple disabilities. Therefore, these questions were answered by a small number of respondents (*n*=50; *n*=23). Table 15 shows the frequencies for reasons why respondents did not feel that the content module would increase the likelihood of teaching mathematics content. The reason indicated most often (28%) was that the content modules themselves would not be sufficient to increase the likelihood of teaching mathematics and additional resources would be needed. The second most frequently selected reason that the content module would not increase the likelihood of teaching mathematics was that the content was not appropriate for the students (24%), followed closely by the content not being a priority (20%). Table 16 shows the frequencies for the reasons why respondents did not feel the UDL information included in the content module would be useful for planning and teaching mathematics to students with multiple disabilities. Of the respondents that answered this question (*n*=23), most felt that there were not enough details included (43%) or that the information provided was not helpful for their students (39%).

Table 15: Reasons why content module would not increase likelihood of teaching mathematics content (*n*=50)

Reasons	*n*	%
Module is a good start but more resources are needed	14	28
The content is not appropriate for my students	12	24
The content is not a priority for my students	10	20
Only a small percentage of my students can learn this content	7	14
I am not sure how to make this content meaningful for my students	4	8
I am unsure of the strategies to use to teach the content	3	6
Total	50	100

*Participants who stated the content module was useful would have been directed to skip this question

Table 16: Reasons why the UDL was not useful (*n*=23)

Reasons	*n*	%
This section did not include enough details	10	43
This section was not helpful for my particular students	9	39
This section was not clear	4	17
Total	23	100

*Participants who stated the UDL section was useful would have been directed to skip this question.

5. How do teachers evaluate the usefulness of the resource called Math Activities with Scripted Systematic Instruction (MASSI)?

Participants in the training were provided with an overview of MASSIs, which are sample lesson plans designed for teaching grade aligned mathematics skills to SWSCD. Respondents completing the survey were asked to review a specific MASSI (i.e., Measurement & Geometry) prior to answering the questions. Respondents were asked to rate the likelihood of using the MASSI to teach grade aligned mathematics. These frequencies are provided in Table 17. The results were positive with 83% of respondents indicating they were likely or very likely to use the MASSI. The sample size for this question was 148; 23 participants did not answer this question.

Table 17: Likelihood of using the MASSI to teach grade aligned mathematics (*n*=148)

Likelihood	*n*	%
Not likely	5	3.4
Somewhat likely	21	14.2
Likely	59	39.9
Very likely	63	42.6
Total	148	100.0

Three questions were asked to inquire about the effects of the MASSI and applications that the MASSI may have. MASSIs utilize evidence-based strategies to teach grade aligned mathematics content. Respondents were asked about how the information in the MASSI may have affected their understanding of evidence-based practices. Results of this question are reported in Table 18. Fifteen respondents did not answer this question. The responses selected most often were that the information helped educators apply the strategies used in the MASSI (i.e., evidence-based strategies such as time delay) to other mathematics content (38%) and that the information provided ideas for how to apply the strategies to other content areas (42%).

One question was asked to inquire about how the MASSI might be useful for students included in general education settings. Table 19 provides the frequency for each response in this question. Twelve participants did not answer this question. Only a minimal number of participants (2%) felt that the MASSI would not be applicable to the general education setting. Pre-teaching the content prior to being taught in the general education setting was selected as an application of the MASSI by 69% of respondents. Setting up parallel activities for use with a peer tutor was selected as an application by 64% of respondents. Setting up instructional centers that all students may use was selected by 60% of respondents.

The majority of respondents (85%) taught a range of students, making it important that resources developed be applicable to students with varying ability levels. One question was asked to gather information related to the use of the MASSI with a range of students. Results of this question are summarized in Table 20. Missing responses for this question ranged from 16-20. When evaluating the application of the MASSI to a range of students, 79% of respondents indicated that they were teaching students who did not have the prerequisites needed to benefit from the MASSI and 78% indicated that in order to make the content taught in the MASSI accessible to students with multiple disabilities, additional resources would be needed. About one half of respondents (51%) indicated that they taught students that would not benefit from lessons taught using the MASSI. Slightly less than half of the respondents (39%) indicated that even with the real world application included in the MASSI, they considered the skills to be too abstract for their students. A small percentage of respondents (19%) indicated that the skills taught in the MASSI were too easy for at least some of their students.

Table 18: Effect of MASSI on understanding of evidence-based

Effects	*n*	%	Total Responses
Gave me ideas on how to apply strategies to other content areas	65	41.7	156
Helped me apply the strategies to math content			
No changes-I already use these practices	59	37.8	156
I use other strategies to teach mathematics content	53	34.0	156
Evidence based practices were not clear	7	4.5	156
	2	1.3	156

Table 19: Application of MASSI to general education setting

Uses in a Gen. Ed. setting	*n*	%	Total Respondents
Pre-teaching the content	111	68.9	159
Peer tutor in the general education class	103	64.0	159
Instructional centers that all students can use	96	59.6	159
Not applicable to general education setting	4	2.5	159

Table 20: Application of MASSI to a range of students

Answered "Yes" to the following questions	*n*	%	Total Respondents
Some students do not have prerequisites needed to benefit from the MASSI	124	79.0	155
More resources needed for students with multiple disabilities	121	77.6	154
Some students would not benefit from using the MASSI	78	50.6	153
For some students, skills in the MASSI are too abstract	61	39.4	153
For some students, skills in the MASSI are too easy	29	18.5	155

The MASSIs that have been developed represent a small portion of the mathematics content that special educators may be responsible for teaching. Therefore, teachers may need to develop additional MASSIs. Respondents were asked to rate their confidence level for developing new MASSIs. Results of this question are shown in Table 21. Most respondents (82%) indicated that they were at least somewhat confident that they could develop additional MASSIs. Six participants did not respond to this question.

Table 21: Confidence level for creating a MASSI to teach grade aligned mathematics? (*n*=165)

Level	*n*	%
Not confident	30	18.2
Somewhat confident	92	55.8
Confident	31	18.8
Very confident	12	7.3
Total	165	100.0

6. What are the perceived barriers to providing access to grade aligned mathematics to students with significant cognitive disabilities?

When asked how often grade aligned math was taught, only 35% of respondents reported teaching grade aligned mathematics daily; and 36% reported grade aligned mathematics was never taught. When asked whether or not skills similar to those in the Measurement and Geometry MASSI were taught, the majority, 60% of respondents indicated they were not. This survey included questions that inquired about the perceived barriers to providing access to grade aligned mathematics. Table 22 provides the barriers to teaching grade aligned mathematics and the frequencies for which each barrier was selected. Respondents who indicated they taught grade aligned mathematics would have been directed to skip this question; 89 participants did not answer this question. The majority of respondents who answered this question (45%), indicated that the skills taught in the Measurement and Geometry MASSI were too complex for their students. This data was analyzed according to the instructional setting. Respondents from center-based programs and from self-contained classrooms most frequently selected that the content was too complex for their students as the reason why they would not use the MASSI (54% and 23% respectively). Respondents who taught in a setting that included a combination of self-contained and inclusion, most frequently (15%) selected that the skills taught were not a priority for their students as the reason for not using the MASSI.

Table 22: Barriers to teaching skills similar to those in the Measurement & Geometry MASSI (*n*=82)

Barriers	*n*	%
Skills considered to be too complex for SWSCD	37	45.1
Skills not viewed as a priority for SWSCD	21	25.6
Educators are unsure of what strategies to use to teach this content	17	20.7
Educators feel they do not have the content knowledge needed	7	8.5
Total	82	100.0

*Participants who stated they currently teach Measurement & Geometry skills would have been directed to skip this question

Respondents were asked why they may not use the MASSI to provide mathematics instruction. Table 23 lists the provided reasons and the frequency with which each reason was selected by respondents. Eighty-two participants did not answer this question. The reason selected most often was that the content was considered too complex for the students (54%). Twenty-eight percent of respondents selected the content not being a priority as a reason they would not use the MASSI. Twelve percent of respondents selected being unsure of what strategies to use as a reason for not using the MASSI and finally, 6% felt they did not have the content knowledge needed to teach the content.

Table 23: Barriers to using a MASSI to teach mathematics (*n*=89)

Barriers	*n*	%
The mathematics content is considered to be too complex for SWSCD	48	53.9
Measurement & Geometry skills not viewed as a priority for SWSCD	25	28.0
Educators are unsure of what strategies to use to teach this content	11	12.4
Educators feel they do not have the content knowledge needed	5	5.6
Total	89	100.0

*Participants who stated they would use the MASSI would have been directed to skip this question

When asked how often grade aligned mathematics was taught, 38% of respondents indicated it was taught daily. A follow-up question was asked to inquire as to what would be needed to ensure access to grade aligned mathematics. Results of this question are shown in Table 24. About half of the respondents (56%) indicated a need for *more resources that illustrate how to teach the content*. *More training in the content area* was indicated as a need by 36% of respondents and *opportunities to collaborate with general education teachers* was indicated as a need by 29% of respondents. Results were based on a sample size of 149, as 22 participants did not answer this question.

Table 24: What is needed to ensure access to grade aligned mathematics content? (*n*=149)

Needs	*n*	%
More resources for "how" to teach the content	83	55.7
More training in the content	53	35.6
Opportunities to collaborate with general education teachers	43	28.9

The majority of respondents (97%) reported that they would use a MASSI to provide mathematics instruction. However, MASSIs do not currently exist for the full range of mathematics content at each grade aligned. To ensure access to the full range of mathematics content, educators will have to create additional lessons similar to the MASSIs. When participants were asked how confident they were that they could create their own MASSI, 82% reported they were at least somewhat confident after just the one training provided by the researcher. Participants in the training were shown multiple resources that could be used when planning and providing mathematics instruction. Respondents were asked what additional resources would be needed in order to develop new MASSIs. Based on 162 respondents, Table 25 shows the frequency for which each resource was selected. Nine participants did not answer this question. The two resources selected most often were classroom release time (46%), and training in how to adapt the content (46%).

Table 25: In addition to the resources currently available, what else is needed to create a MASSI? (*n*=162)

Needs	*n*	%
Classroom release time	76	46.3
Training in how to adapt the content	75	45.7
Opportunities to collaborate with general education teachers	61	37.2
Training in the CCSS for mathematics	55	33.5
Training in specific content (e.g., fractions)	53	32.5

CHAPTER 5: DISCUSSION

The purpose of this research was to examine the current practices of special education teachers related to providing access to grade aligned mathematics content and the usefulness of sample materials designed to improve access to grade aligned mathematics content. An additional purpose was to examine the perceived barriers to providing access. The research was a non-experimental quantitative study using survey methods. The survey was developed using Dillman's (2009) Tailored Design model. Descriptive statistics were used to summarize survey responses. A non-parametric test (i.e., chi square) was used to determine if differences existed between groups based on responses.

Current Practices with Regard to Access to Grade aligned Mathematics

The first research question to be answered was related to access to grade aligned mathematics for students with significant cognitive disabilities. Overall, the respondents indicated that they were familiar with mathematics standards and understood the content. However, the frequency of mathematics instruction reported by respondents was polarized, with two equal groups of respondents falling at opposite ends of the continuum for teaching grade aligned mathematics. About one-third of the respondents reported that they taught grade aligned mathematics content daily and about one-third of the respondents indicated they never taught grade aligned mathematics. A review by Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, (2008) revealed that only two of the five established mathematics domains (i.e., measurement skills and computation) were reflected in the literature related to students with significant disabilities participating in math instruction, suggesting that teachers lack models for teaching content across the domains. Given the lack of instructional models from research, the percentage of respondents that reported providing daily mathematics instruction may be a sign of progress. However, the percentage of respondents reporting never teaching grade aligned mathematics is concerning given the legal requirements that students receive access to the general curriculum (IDEA 2004).

A little more than half of the respondents who taught elementary school indicated that they taught mathematics skills similar to those in the Elementary Measurement and Geometry MASSI (e.g., solving word problems using perimeter and area). A little less than half of respondents who taught at the secondary level indicated that they taught mathematics skills similar to those in the Middle School or High School Measurement and Geometry MASSIs (e.g., solving a linear equations to find a missing attribute when given volume). The most notable drop was among the respondents who taught multiple grade bands, where only a third reported teaching these skills. Teaching multiple grade bands (e.g., K-12, 6-12) may make it more difficult to plan for and provide instruction aligned with grade aligned standards. Given that the skills taught in the MASSIs are grade aligned and perhaps higher level skills than is commonly taught, the results of this survey imply that some teachers are no longer limiting instruction to basic skills. These results suggest progress since the review of mathematics instruction by Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, (2008) which found that most of the studies focused on basic skills such as counting and money use and confirms the findings of the 2011 survey by Karvonen, Wakeman, Browder, Rogers and Flowers which also found that there were efforts to teach mathematics content that historically has not been taught.

The frequency with which math was taught did not appear to be impacted by the type of teaching license held. Respondents who possessed a dual license in both special education and general education were just as likely to indicate that they never taught grade aligned mathematics as were respondents with only a special education license. The link between content knowledge and the ability to plan and provide effective instruction for typically developing students is clear (Borko, 2004). However, there is very little literature to date conveying specifically what special educators need to know about academic content in order to effectively teach students with significant disabilities (Brownell, 2011). Based on the current results, possessing content knowledge may not be enough to plan access to grade aligned mathematics for this special population. Although there is a clear link between professional development and student achievement (Borko, 2004; Cohen & Hill, 2000; Karvonen, Wakeman, Flowers, & Moody, 2013), the focus of professional development must include how to adapt academic content for students with significant cognitive disabilities so that teachers can provide instruction that is both content rich and effective. In the current study, a little over half of the respondents indicated that they had received professional development related to the CCSS in mathematics. Similar to holding dual licensure, results of this study suggested that professional development did not have an impact on the frequency with which grade aligned mathematics was taught.

The current study also examined teachers' confidence levels when teaching mathematics to students with significant disabilities. Confidence levels may be derived from knowledge of the content and effective strategies for teaching the content and can be critical factors for teachers when deciding what and how to teach mathematics skills (Gagnon, & Maccini, 2007). Most respondents rated their confidence level for teaching elementary math as good, which was the highest response provided on the survey. However, confidence levels decreased to basic or none when considering teaching math at the secondary level. Instruction of mathematics content at the secondary level brings about a unique set of challenges, both for teachers and students. A survey by Gagnon and Maccini (2007), that included general and special educators teaching at the secondary level, reported that educators were less familiar with higher level mathematics topics that are typically taught at the secondary level. The same was true for instructional practices, as general and special educators reported limited use of practices that have been empirically validated as effective with students with disabilities. Students with significant cognitive disabilities have not traditionally had access to grade aligned mathematics content and therefore, often do not have the prerequisites needed to make progress in mathematics content that is typically taught at the secondary level. Hunt, McDonnell, and Crocket (2012) acknowledge this challenge but suggest that prerequisites be taught in the context of grade aligned content.

Overall, while respondents reported receiving professional development and being familiar with mathematics standards, this content knowledge did not transfer into consistent grade aligned mathematics instruction, especially at the secondary level. This suggests that educators' need additional training and guidance in order to make grade-level mathematics content meaningful and accessible for students with significant cognitive disabilities.

Current Practices with Regard to Collaboration with General Educators

Over half (67%) of the respondents reported that they never collaborate with general educators to plan mathematics instruction. A small number of respondents (11%) indicated that they collaborate weekly or daily. This is in direct contrast to the literature suggesting that collaboration is an essential practice for inclusive education (Jackson, Ryndak, & Billingsley, 2000) and is necessary for effective instruction of the CCSS in mathematics (Charles & Dickens, 2012).

Survey respondents identified the reasons why collaboration did not occur. The primary reason was a lack of time, with about half of the respondents selecting this as a barrier. About a fourth of the respondents reported that they did not collaborate because the academic content was not relevant to their students. This finding suggests there is more work to be done to convince some special educators that grade aligned academic content can be made relevant and meaningful for students with significant cognitive disabilities and that there can be a balance between teaching functional and academic skills. This 25% lack of buy in is in contrast to the findings of a 2002 survey by Agran, Alper, and Wehmeyer, where the majority of respondents indicated they did not believe that access to the general curriculum was appropriate for students with significant cognitive disabilities.

A lack of understanding of the mathematics content was selected least often as the reason for not collaborating. This is surprising given the literature that special educators lack the content knowledge needed to teach grade aligned mathematics (Bays & Crocket, 2007; Brownell, 2011). These results may further support the idea that simply providing special educators with knowledge of mathematics content without providing models for how to apply the content to students with significant disabilities is not enough to ensure access. Special educators may not see the value in collaboration because their general education colleagues, most likely cannot provide models for adapting the content for this population of students.

Despite the lack of collaboration among respondents, about half of the respondents agreed that the Content Modules would be useful when collaborating with general educators. This may be due to the fact that the Content Modules provide information about the academic content and then explain how the components of UDL can be applied so that the content is accessible to student with cognitive disabilities. Also when considering what would be needed to create a new MASSI, about a third of respondents indicated that opportunities to collaborate with general educators would be needed. Both of these responses suggest that when the special educators have specific examples of how to apply the content, collaboration with general educators seems more relevant.

Current Practices with Regards to the Use of Systematic Instruction Strategies

Most respondents (90%) indicated that they use systematic instruction strategies to teach mathematics either weekly or daily. More respondents reported using systematic instruction to teach mathematics than reported teaching grade aligned mathematics daily, weekly, or monthly. This may be because respondents may have included teaching off grade aligned mathematics when answering this question. However, these results may indicate that the respondents who reported teaching grade aligned mathematics were also using evidence based practices such as systematic instruction.

There are a number of studies examining the use of EBP among educators. These studies have documented a gap between what research has shown to be effective and actual classroom practices (Burns & Ysseldyke, 2009; Kretlow & Blatz, 2011). However, none of the studies to date have included teachers of students with significant cognitive disabilities or specifically examined the use of systematic instruction, which is an EBP for teaching students with significant disabilities (Ault, Wolery, Doyle, & Gast, 1989; Collins, 2007; Wolery & Gast, 1984). Results of the current study, may support the idea that the research to practice gap is decreasing, at least when providing systematic instruction. Another potential reason for the use of systematic instruction strategies when teaching mathematics may be the availability of published curricula (e.g., *Teaching to Standards: Math*; Trela, Jimenez, & Browder, 2008) derived from research with students with significant cognitive disabilities (Browder, Trela, Courtade, Jimenez, Knight, & Flowers, 2012). Published curricula designed specifically for teaching mathematics to students with significant disabilities may provide teachers with easy to use lessons where systematic instruction has been embedded into scripts for teachers to follow.

Evaluation of an Online Mathematics Content Module

Participants in the training were shown a number of online resources designed to assist them with teaching grade aligned mathematics. When completing the survey, respondents were given an online resource that was designed to increase specific mathematics content knowledge (i.e., Perimeter, Area, and Volume Content Module). Teachers and administrators participating in this survey overwhelmingly found this resource to be helpful (81%). Only a small percentage (14%) said there was no change because they already knew the content covered in the module. The indication that only a small percentage of respondents were already familiar with this content was interesting given that over a third of respondents that reported they currently teach skills similar to those taught in the Measurement and Geometry MASSI. Respondents may have had basic knowledge of the content but not the depth or scope of knowledge contained in the Content Module.

Despite the content module being positively received, some respondents indicated that it was not enough and that more resources were needed. There was also a small percentage of respondents (13%) who felt that the information in the content module would not be useful because it was either not appropriate or not a priority for their students. In addition, there were a few respondents who felt the content modules would not be useful because only a small percentage of their students could learn the content.

A large majority (92%) of respondents found the section in the module on how to plan instruction for students with multiple and complex disabilities to be useful when planning for students with complex needs. UDL is a research based practice that, in the past decade, has been shown to be successful when planning academic instruction for students with significant cognitive disabilities (Dymond et al., 2006) and advocated for by experts in the field (Browder, Spooner, Wakeman, Trela, Baker, 2006; Downing, 2006).

The few respondents who did not find the UDL section of the Content Module useful indicated that more details were needed. One reason for this may have been the format of the UDL information in the online document. Other sections of the Content

Module, (which was accessed via an online wiki) were presented via a PowerPoint that chunked information, provided examples and was supported by visuals. The UDL section was a text heavy table without the benefit of visuals that might make the information more easily applied. A text heavy table may not be the most effective format for delivering the UDL content. A possible contribution to these results may have been caused by the nature of how the survey data was collected. In this study, there was not an opportunity for participants to interact with others about the resources they were reviewing or even to interact with the materials themselves through doing activities. It has been noted by Dede (2009) that participants taking part in online professional development need opportunities to engage with a learning community, exchanging ideas about the information and materials included in the online training. It is possible that if the Content Module was delivered to a small group of educators who had the opportunity to collaborate even asynchronously the UDL information may have been more appealing.

Evaluation of the MASSI

The third research question to be answered was how teachers evaluated the usefulness of one MASSI (i.e., Measurement and Geometry MASSI). The MASSI was a detailed lesson plan that could be used for teaching grade aligned math skills to students with significant cognitive disabilities. Because it was a new and novel resource, the MASSI had never been viewed by over half of the respondents. In order to familiarize the respondents with the MASSI, an overview of the format was provided.

The literature suggests that teachers of students with significant cognitive disabilities may underestimate their students' capabilities and in effect, fail to provide appropriate opportunities for learning (Jorgensen, McSheehan, & Sonnenmeier, 2007).

Karvonen, Wakeman, Flowers, and Moody (2013) reported similar findings indicating that students who were pre-symbolic communicators (e.g., communicates using objects, or gestures as opposed to symbols or text) were less likely to achieve proficiency on the AA-AAS, possibly indicating a lack of opportunities to learn. Overall, the current study resulted in very different findings, with the majority (87%) of respondents indicating that they would likely use the MASSI to teach grade aligned mathematics. These results are encouraging given the literature that has shown that this population of students can learn academics when provided with quality instruction that includes the use evidence-based strategies (Browder, Ahlgrim-Delzell et al. 2009; Browder, Mims et al. 2008, Jimenez, Browder, & Courtade, 2008). The use of EBP that have been shown to promote student progress are required by IDEA (2004) and NCLB of 2001 (2006) and may serve to reduce the well documented research to practice gap (Carnine, 1997; Cook & Cook, 2013; Cook & Schirmer, 2006).

An important component of the MASSIs was the use of systematic instruction strategies, thus providing needed models for teaching mathematics (Browder, Spooner, Ahlgrim-Delzell, & Wakeman, 2008.) In the current survey, about two-thirds of the respondents also indicated that the EBP modelled in the MASSI would help them apply the strategies to other mathematics content. This is especially important because the MASSIs that have been developed only cover a small percentage of the mathematics content that teachers will be expected to teach. The majority of respondents were at least somewhat confident that they could create similar lesson plans to teach grade aligned mathematics.

Since students with disabilities receive their education in a variety of settings, it was the intent that the MASSI would have some applications to the general education setting. The majority of respondents indicated that the MASSIs could be used to pre-teach academic content, set up parallel activities or centers in the general education class. These findings address some of the concerns related to providing instruction in inclusive settings such as the low student: staff ratio that is often required by students with significant disabilities and general educators not being familiar with the evidence-based strategies that are effective (Muraski, 2006; Volonino & Zigmund, 2008). The results of this survey did not indicate that there was a high level of inclusion occurring or that collaborating with general educators occurred frequently among the respondents. However, the literature indicates that inclusion is increasing (McLeskey, Landers, Williamson, & Hoppey, 2012) and collaboration with general educators is unarguably an important practice when providing access to grade aligned academics (McLaughlin, 2012).

The demographics of respondents showed that the majority of educators were teaching very diverse groups of students. Some were responsible for grade spans of more than five grades (e.g., K-5, K-12) and many taught cross categorical classes. Cross categorical classes may include students with varying ability levels or students with multiple disabilities such as cognitive disabilities paired with sensory impairment (i.e., visual or hearing impairments). Although the MASSI was reported to be a useful resource by respondents, it was clear that in order to provide access to the wide range of students being served, more resources were needed. Many respondents indicated that they had some students who may not benefit from instruction using the MASSI because they did not have the prerequisites needed or because the content was too abstract. Hunt, McDonnell and Crocket (2012) acknowledged that many students with significant cognitive disabilities will not have needed prerequisites but advocated that these prerequisites should be taught in the context of grade aligned content.

The content modules as well as the MASSI add to the short list of online comprehensive resources available to educators of students with disabilities. As districts attempt to address the steep learning curve for special educators that is expected to occur as a result of greater academic expectations (McNulty & Gloeckler, 2011), the NCSC wiki may be a component of quality professional development. Resources delivered online, such as the content modules and the MASSI may be an important resource for providing general and special education teachers with targeted content knowledge as well as instructional strategies using evidence-based practices

Barriers to Providing Access to Grade aligned Mathematics

Respondents who indicated they did not teach measurement and geometry skills or may not use the MASSI to teach such skills were directed to answer follow-up questions to determine the reasons why. The barrier that was selected most often both for teaching measurement and geometry skills as well as for using the MASSI was that the mathematics content was too complex for their students. However, these results should be viewed with caution because these results represent about one-fourth of the respondents. Most respondents did not indicate having barriers.

For the few who identified barriers, the lack of content knowledge was not viewed as a barrier to providing access to mathematics. In fact, less than 5% of respondents indicated that a lack of content knowledge was a barrier to teaching measurement and geometry skills or to using the Measurement and Geometry MASSI.

The final barrier considered was a lack of knowledge around how to make grade aligned mathematics accessible to students with significant cognitive disabilities. When asked what would be needed to ensure access to grade-level mathematics, over half of the respondents indicated that more resources that exemplify how to make mathematics content accessible were needed. Similarly, about half of the respondents indicated more resources on how to adapt mathematics content would be needed in order to create additional math lessons similar to the MASSIs. Houchins, Shippen, and Flores (2010) suggested that progress for students with high incidence disabilities was hampered by teacher's lack of content knowledge as well as knowledge of how to provide access to grade aligned mathematics. Albeit a different population of students, results of this study indicate that progress has been made in terms of content knowledge but lack of resources on how to teach the content continues to be a barrier.

Patterns in the Findings

There were several patterns found through further analysis of the responses in the current study. One pattern was that about one fourth of the respondents did not embrace access to grade-level mathematics for their students. This was demonstrated both through results showing the percentage of respondents who reported never teaching measurement and geometry skills and through repeated indications that the content was either not appropriate or not a priority for their students. A deeper analysis of respondents who may have contributed to this theme found that as a group they were more likely to have more than ten years of experience, but less likely to have had professional development on the

CCSS. In terms of the settings they taught in, most taught in self-contained classroom but almost as many taught in center-based programs and almost all reported that they never collaborated with general educators. In terms of the students they were responsible for teaching, almost all of the respondents in this group indicated that they had students who did not have the prerequisites needed to benefit from the MASSIs. About half of this group indicated a need for more training in the content area and the other half indicated a need for more resources on how to adapt the content.

Another finding of this study related to mathematics content knowledge. In this study, most respondents reported attending professional development and being at least somewhat familiar with the CCSS for Mathematics. Most reported at least a basic understanding of mathematics skills at all grade bands. Very few respondents selected a lack of content knowledge as a barrier to collaborating, or to teaching mathematics. These results suggest that many educators have are now included in professional development related to the CCSS or to academics in general.

The most important pattern found was that most respondents did not need to be convinced of the importance or scope of the content, but needed information on how to adapt the standards for their students. A lack of models for teaching mathematics was noted in the 2008 review by Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman and although some progress has been made with the NCSC resources that are available to teachers, further development is needed. These findings were consistent with Karvonen, Wakeman, Flowers, and Moody (2013), who suggested that some special educators have recognized the importance of academics for students with significant disabilities, while others continued to struggle. The UDL section of the Content Module and the MASSI provided the respondents with resources that exemplified the how and respondents were overwhelmingly positive about these models. They reported that the Content Module would increase the likelihood of teaching the content and that seeing the MASSI helped them see how they could apply the strategies used in the MASSI to other mathematics content. In contrast, most did not identify lack of content knowledge as a barrier nor did they collaborate with general educators who would be resource for the content. In contrast, they indicated they could see specific applications (MASSIs and UDL section of Content Modules) as being useful for collaboration. To sum up, while mathematics content knowledge is important, it is not enough to ensure access. Based on the results of this study, special educators require less about the *what* and more about the *how*.

Contributions of this Study

This study contributes to the field of special education in several ways. First, the outcome of this survey provided a current snapshot of the instructional practices of special educators in two states related to teaching standards-based mathematics. Results of this study provided updated results from prior surveys on the use of EBPs (Burns and Ysseldyke, 2009), teacher beliefs around general curriculum access (Agran, Alper, and Wehmeyer, 2002; Lee, et al. 2013) and type of mathematics taught (Gagnon & Maccini, 2007; Karvonen, Wakeman, Browder, Rogers & Flowers, 2011). Second, this survey generated data on the usefulness of specific mathematics resources (i.e., Content Module-Perimeter, Area, and Volume, MASSI). There have been very few studies on teaching mathematics to students with significant disabilities (Browder, Jimenez, & Trela, 2012; Browder, Trela, Courtade, Jimenez, Knight, & Flowers, 2012; Saunders, Bethune, Spooner, & Browder, 2013) and although this study did not include student data, it did include extensive data regarding how well received the mathematics resources were. A key contribution of this study is the finding that the resources provided for teaching grade aligned mathematics received positive feedback and that teachers found them beneficial and useful. Finally, the current study examined the perceived barriers to providing access to grade aligned mathematics.

Limitations and Implications for Future Research

There were several limitations to the current study. First, the use of purposeful sampling created a potential for coverage error. Respondents in this study were from only two states, there was not an opportunity for special educators from other states to participate in the survey. Additionally, the number of respondents from the two states was not comparable, with 74% of respondents being from one state and 26% being from the second, possibly skewing the results. The demographics of this sample also created limitations. The sample included a wider range of professionals in the field of special education than the target population. Although this survey was designed to survey special education teachers, one-fourth of the participants in the trainings were support staff such as administrators at the school or district level. Administrators completing the survey were more likely to deem some questions as not applicable, thus lessening the amount of useful data. Finally, about two-thirds of respondents had 10 or more years of experience. The majority of respondents with 10 or more years of experience were administrators. There were very few novice teachers represented (i.e., less than three years of experience). This made it impossible to compare results based on years of experience. The two states that participated in the survey had benefitted from professional development from staff at UNC Charlotte, especially in the area of systematic instruction.

There is no way to know if any of the specific participants had attended these trainings but it is possible that states that had not had the benefit of these trainings may have answered differently. Future research should attempt to include a sample that is more representative of the population of special educators within the United States. A more representative sample could be obtained by limiting participants to special educators currently teaching and including participants from multiple states across the United States.

The current study also only examined barriers specific to one point in time. Future research might examine the use of the MASSIs as a professional development intervention in an experimental design. Research would target teachers who did not presume confidence or did not view the mathematics content as appropriate and would use a pre-post to see if using the MASSI to teach mathematics changed attitudes or practices.

Although the current study provided a snapshot of mathematics instruction, it did not include questions that would provide a more focused and in depth view of successful grade aligned mathematics instruction for students with significant disabilities. Future research, possibly qualitative in nature, is needed to determine what successful mathematics instruction looks like for this population especially for the small number of contexts where it is being provided in general education.

A final limitation is related to the survey questions themselves. Prior to replication of this study, revisions to the survey may result in more accurate data. Revisions to the survey may include more precise wording to make it clear when to skip a question (e.g., *"If you answered 'no' to question…"*). Revisions may also include changing the wording of some questions. For example, changing *grade aligned* to *grade aligned* in order to avoid any confusion pertaining to the mathematics content. This may be especially important if the survey is being completed without the benefit of the overview training that was included in this study.

Finally, results of this survey indicated that collaboration among special and general educators does not occur frequently, and suggested that a lack of time was the leading reason. Future research is needed to determine how collaboration can effectively take place and what positive impact collaboration may have on both special and general educators.

Implications for Practice

One of the most important findings of the current study was the majority of respondents welcomed resources on how to teach grade-aligned mathematics. Most special educators are willing to try new resources for teaching academics. They are open to the possibility that students with significant cognitive disabilities can learn and should have the opportunity to learn. However, the resources needed are not currently available. Teachers do not have the time to create the resources on their own. They are teaching a wide range of students, most of whom require individualized planning and many require individual instruction. Results of this survey show that teachers are willing to use quality resources provided to them. Therefore, efforts need to be put into creating resources that are evidence based, teacher friendly and can easily be adapted for use with a range of students.

Another implication for professional development is to delineate training to meet the needs of teachers like the 25% in this survey who did not have buy in. There are still educators who do not feel that this level of academics is appropriate or a priority for students with significant disabilities. Purposeful resource development paired with purposeful professional development that is responsive to participants' concerns is needed that will demonstrate how grade aligned mathematics can be made meaningful for the range of students that take alternate assessments. To this end, professional development should be explicit, using real students or case studies to as examples during trainings. Whenever possible, professional development should include video evidence of student learning. Classroom teachers are often quick to assume that the students being discussed during trainings are not "their students" and therefore the strategies are not applicable. When teachers are able to see the student's responses to mathematics instruction or see a teacher implementing systematic instruction with fidelity, it can have a profound impact on his or her instruction. It also must be acknowledged that the limited resources available on teaching standards-based mathematics may not meet the needs of all students. Students with the most complex and multiple disabilities may need models and resources beyond those created in the MASSIs and Content Modules.

This data may be useful to special education faculty teaching at the university level and school personnel who conduct pre-service for beginning teachers as well as professional development for more established teachers. Given that a small portion of the respondents consistently did not feel that grade aligned mathematics was appropriate, it may be important for teacher preparation classes and professional development to continue to include a rationale as to why academics are important for all students. Even though a clear research to practice gap has been shown (Cook & Cook, 2011; Cook & Schirmer, 2006; Volonino & Zigmund, 2008), results of this survey indicated less of a need for professional development around evidence-based practices in general and more on specific applications to the mathematics content. There also appeared to be more of a need for professional development that would encourage collaboration between special and general educators focused on specific models (e.g., sample lesson plans) as well as professional development related to how to adapt grade-level mathematics content for students with significant disabilities.

Chapter Summary

The current study sought to provide a snap shot of mathematics instruction among teachers of students with significant cognitive disabilities and to evaluate a sample of mathematics resources. Findings of this study revealed both progress towards access to grade aligned mathematics as well as lingering barriers. Overall, respondents reported having at least a basic understanding of both mathematics content and state standards. When provided with a model (i.e., MASSI) for teaching grade-level mathematics respondents reacted favorably and reported they would use the MASSI with their students. In spite of findings that appeared to indicate increased content knowledge and a willingness to provide access to grade aligned mathematics, special educators continue to be hindered by a lack of models for teaching grade-level mathematics to this population of students. While a smaller portion of educators continued to be hindered by barriers such as beliefs that the academic content is not appropriate.

The findings of this study have provided important information regarding the current practices of special educators when planning and providing mathematics instruction to students with significant cognitive disabilities. Additionally, the findings have delineated steps needed to ensure access to grade aligned mathematics to a range of students. Although future research is needed to continue to validate strategies for teaching mathematics to the wide range of students within this population, it was clear from the findings of this study that the resources reviewed were considered to be a good start. Also, more resources are needed that illustrate how grade-level mathematics content can be made accessible to students with significant cognitive disabilities. Making the content accessible will be multi-faceted but must include how to adapt the content and how to teach the content in a context that is meaningful for students.

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APPENDIX A: SURVEY INSTRUMENT

C & I Mathematics Resources and Teaching Practices

1) How many years have you been a special education teacher?

- ○ Less than 1 year
- ○ 1-3 years
- ○ 4-6 years
- ○ 7-10 years
- ○ 10+ years

2) What experience do you have administering the alternate assessment (AA-AAS)?

- ○ I will administer the AA-AAS this year
- ○ I will not administer the AA-AAS this year but have administered it in the past three years
- ○ I will not administer the AA-AAS this year but have administered it in the past five+ years
- ○ I have never administered the AA-AAS

3) In what area(s) are you licensed to teach?

4) What grade(s) do you currently teach?

5) What type of students do you currently teach? (check all that apply)

- ☐ Students with autism spectrum disorder
- ☐ Students with moderate intellectual disabilities
- ☐ Students with severe intellectual disabilities
- ☐ Students with multiple disabilities
- ☐ Students with visual impairments
- ☐ Other:

6) What educational setting do you currently teach in?

- ○ Center-based program/segregated school
- ○ Self-contained classroom in a public school
- ○ Combination of self-contained and inclusive setting
- ○ Full time inclusive setting
- ○ Resource

7) Rate your confidence level when teaching grade level mathematics for <u>each</u> grade band.

	None	Basic Understanding	Good Understanding
K-2 Concepts such as Number Operations in Base Ten	○	○	○
3-5 Concepts such as Number Operations-Fractions	○	○	○
6-8 Concepts such as Area and Volume	○	○	○
9-12 Concepts such as Arithmetic with Polynomials and Rational Expressions	○	○	○

8) Have you previously-

	Yes	No
Viewed any of the NCSC Mathematics Content Modules?	○	○
Viewed any of the NCSC MASSIs?	○	○
Implemented any of the NCSC MASSIs?	○	○

9) Rate your overall familiarity with the Common Core State Standards (CCSS) in mathematics for the grade (s) you currenty teach.

○ Not at all familiar ○ Slightly familiar ○ Somewhat familiar ○ Very familiar

10) Have you received professional development based specifically on the CCSS?

○ Yes ○ No

11) If you answered "yes" to question 10, approximately how much time have you spent in professional development on the CCSS?

○ Less than 1 day
○ 1day
○ 2-3 days
○ 3-4 days
○ Other: [ ]

12) Please answer the following questions based on your current teaching practices.

	Never	Monthly	Weekly	Daily
How often do you teach grade level mathematics content?	○	○	○	○
How often do you collaborate with a general education teacher to plan mathematics instruction?	○	○	○	○

13) What are the reasons why collaboration may not occur?

☐ A lack of time
☐ I do not have a good understanding of grade level mathematics
☐ The content is not relevant for my students
☐ I do not have a relationship with general education teachers at my school
☐ I do not have access to general education teachers (e.g., I teach in a center-based program)

STOP! Please review the Content Module first.

Please answer the following questions after reviewing the Perimeter, Area, and Volume Content Module.

14) Was the information in the module helpful for building knowledge of area, perimeter, and volume?

○ Yes ○ No ○ No changes-I already knew this information

15) What are the ways in which the information in this and other content modules will be useful?

	Yes	No
It will increase the likelihood of teaching this content to my students?	○	○
Designing academic instruction for a few of my students	○	○
Designing academic instruction for my class	○	○
Improving the quality of learning that occurs in an inclusive setting	○	○
Helping find creative ways to embed academics into functional activities	○	○
Collaborating with general educators	○	○
Improving on content that I currently teach	○	○
Will the information on UDL included in the Sharing the Sky section be useful when teaching students with multiple or complex disabilities?	○	○

16) If you answered "no" to the module increasing the likelihood that you will teach this content, please check the reasons why. (check all that apply)

- ☐ This content is not appropriate for my students
- ☐ This content is not a priority for my students
- ☐ I am not sure how to make this content meaningful for my students
- ☐ The module is a good start but additional resources are needed
- ☐ I am unsure of the strategies to use to teach this content
- ☐ Only a small percentage of my students can learn this content

17) If the UDL information in the Sharing the Sky section was not helpful, please check the reasons why? (check all that apply)

- ☐ The information in the Sharing the Sky section was not clear
- ☐ The Sharing the Sky section did not include enough detail
- ☐ The Sharing the Sky section was not helpful for my particular students
- ☐ Other:

18) In order to successfully teach grade level content like what is exemplified in the module, I need:

- ☐ More resources that exemplify "how" to teach the content
- ☐ More training in the content
- ☐ Opportunities to collaborate with general education teachers
- ☐ I already teach grade level content like what is exemplified in the module
- ☐ Other:

The following questions will relate specifically to the Measurement and Geometry MASSI. Please review the MASSI designed for the grade band that you teach. Refer to the IR Guide as needed.

19) Do you currently teach the skills from the Measurement and Geometry MASSI?

○ Yes ○ No

20) If you answered no question 19, please check the reasons why? (check all that apply)

☐ The skills taught in the MASSI have not been a priority for my students
☐ I do not have the content knowledge to teach this content
☐ The content is too complex for my students
☐ I am unsure of what strategies to use to teach this content

21) How often do you use systematic instruction strategies such as those used in the MASSI (e.g., time delay, system of least prompts) to teach mathematics?

○ Never ○ Weekly ○ Daily

22) How did the MASSI affect your understanding of evidence-based practices such as time delay and system of least prompts?

○ No change-I already use these practices
○ They helped me know how to apply these procedures to mathematics content
○ They gave me ideas for applying these procedures to other content that I teach
○ The evidence-based practices were not clear to me
○ I use other strategies for teaching mathematics content such as: (list in comment box)

23) After reviewing the MASSI, how likely are you to use it to teach your students?

○ Not likely ○ Somewhat likely ○ Likely ○ Very likely

24) What are the reasons that you may not use the MASSI? (check all that apply)

☐ The skills taught in the MASSI have not been a priority for my students
☐ I do not have the content knowledge to teach this content
☐ The content is too complex for my students
☐ I am unsure of what strategies to use to teach this content

25) What are the ways in which the MASSI may be useful in the general education setting? (check all that apply)

☐ Pre-teaching the content prior to it being taught in the general education setting
☐ Parallel activities with a peer tutor in the general education setting
☐ Setting up an instructional center that all students may use
☐ The strategies in the MASSI are not applicable to the general education setting
☐ Other:

26) The MASSIs are designed to meet the needs of a range of students. When answering the following questions, consider the range of students that you teach.

	Yes	No
Do you have students that you feel would not benefit from lessons taught using the MASSI?	◯	◯
Do you have students for whom the skills taught in the MASSI are too easy?	◯	◯
Do you have students who do not have the prerequisites skills needed to benefit from the MASSI?	◯	◯
Do you need additional resources that illustrate how make grade level mathematics content accessible to students with multiple or complex disabilities?	◯	◯
Even with the real world application, the skills in the MASSI are too abstract.	◯	◯

27) The MASSIs have been developed to address only a small percentage of mathematics content. How confident are you that you could create your own MASSI?

◯ Not confident ◯ Somewhat confident ◯ Confident ◯ Very confident

28) What else would you need to create your own MASSI?

- ☐ Collaboration with a general education teacher
- ☐ Training in specific content (e.g., fractions)
- ☐ Training in the CCSS for mathematics
- ☐ Training on how to adapt the content
- ☐ Classroom release time
- ☐ I could not create my own MASSI
- ☐ I have already created my own MASSI
- ☐ I have created my own math lessons based on grade level mathematics similar to the MASSIs

APPENDIX B: SAMPLE PAGES FROM PERIMETER, AREA, AND VOLUME CONTENT MODULE

http://www.worthwhilesmile.com/air-balloons-kaleidoscope/

Plot the course

The rationale

Whether you need to build a fence around your yard or are shipping a package to family or friends far away, everyday people use the principles of perimeter, area, and volume to accomplish these tasks. The ability to use measurement is personally relevant for all students, including those with disabilities, because understanding of measurement help people communicate their ideas of size to others. The mathematical strand of measurement allows for a variety of hands-on activities that include manipulatives. This hands-on approach is often highly beneficial for students who may require concrete application of concepts such as area, surface area, and volume in order to support academic achievement.

Module Goal

The goal of this module is to provide detailed instructions on the more difficult concepts of perimeter, area, surface area, and volume to teachers of students with disabilities at the elementary, middle, and high school level. This module promotes a mathematical understanding of these concepts so that a teacher can begin to plan how to teach the concepts to students. Additionally, this module will provide instructors with potential adaptations and modifications to consider when designing materials and instruction for students with severe disabilities.

Module Objectives

After viewing the content module, teachers will:

1. Apply various strategies to determine perimeter, area, surface area, and volume of two and three dimensional shapes

2. Apply formulas to determine perimeter, area, surface area, and volume of various polygons and shapes

3. Solve word problems pertaining to area, surface area, and volume of various two and three dimensional shapes

Sharing the Sky

UNIVERSAL DESIGN FOR LEARNING

For Perimeter

Some examples of options for teaching Perimeter to students who may present instructional challenges due to:

	Visual Impairment or Deaf/Blind	Physical impairment: Little/ no hand use	Lacks basic numeracy concepts	Motivational/ attention issues
Representation	Use pieces of card stock to make a box; raise edges of shape using Velcro; use a talking calculator when solving formulas; use a ruler with raise letters or Braille representation	Count the tiles when determining area using a step by step process; which progresses through numbers; student scan an array of possible options and use a switch to select the number to complete the equation template	Use a trundle wheel to measure the length of the sides; color code the equation template and calculator buttons so students can solve equation by matching colors; use a talking calculator	Use a talking calculator to solve perimeter equation; find the perimeter of motivating objects (e.g., swimming pool)
Expression	Student states answer or scans raised numbers to select correct answer.	Student scans and selects number that represents answer; uses a switch to indicate correct answers	Using number cards that include dots representing each number; student selects numbers versus writing them	Same as above
Engagement	Use different types of textures to raise edges of box side or cardstock	Pair student with another student without a physical impairment and have them decorate the box together	Talking calculator; use number cards which include dots or objects to represent the number; color code measurement of the box with number presented within an array	Same as above

For Area and Surface Area

Some examples of options for teaching Area and Surface Area to students who may present instructional challenges due to:				
	Visual Impairment or Deaf/Blind	Physical impairment: Little/ no hand use	Lacks basic numeracy concepts	Motivational/ attention issues
Representation	Use raised lines on figures (e.g., yarn; Wikisticks) Use boxes, plates, and other objects that are familiar to the study (e.g., clock, desk); use rulers with raised numbers; make shapes out of materials with texture like carpet or velcro	Use computer representation of figures that can be manipulated with switch;	Use boxes, plates, and other real objects; place cubes on surface to count area (e.g., square inches)	Use materials with novelty, textures. Have an immediate effect- e.g., find area of cd and then play it. Find surface area of box and open it to get prize. Include a personally relevant story about an area problem.
Expression	Student states answer or scans raised numbers to select correct answer.	Student scans and selects number that represents answer; uses a switch to indicate correct answers	Student selects numbers versus writing them,	Have student write answers with novel pencil or use an IPAD; determine area of "fun" objects (e.g., table with a party table cloth, cover of their favorite book)
Engagement	Teach students to use their hands to scan the area of each item. Use talking calculator for computing the area.	Teach students to click and select shapes and numbers to indicate area.	Have measures affixed to object that student learns to place into equation template; student uses calculator to solve equation.	Assign the area computations as a job task. Student is "paid" 1 minute on computer for each one completed.

For Volume

Some examples of options for teaching Volume to students who may present instructional challenges due to:				
	Visual Impairment or Deaf/Blind	Physical impairment: Little/ no hand use	Lacks basic numeracy concepts	Motivational/ attention issues
Representation	Provide empty containers filled with cubes; clearly define volume as the cubes inside the containers.	Count the cubes when determining volume using a step by step process which progresses through numbers; student scan an array of possible options and use a switch to select the number to complete the equation template; use computer representation of figures that can be manipulated with switch; place shapes or coordinate planes on a slant board or eye gaze board	Use cubes that are numbered and can be removed once counted and placed on a number line.	Use materials with novelty, textures. Have an immediate effect- e.g., find volume of x-box and then play it. Include a personally relevant story about an volume problem; use a talking calculator to solve volume equation; find the volume of motivating objects
Expression	Student states answer or scans raised numbers to select correct answer; use voice output devices for student to select the correct answer; teach a symbol that means “volume” (e.g. four plastic cubes glued together)	Student scans and selects number that represents answer; uses a switch to indicate correct answers; use an eye gaze board to select answer; use a blink response to count cubes or select answer; phrase questions so that they require a “yes/no” response, these can easily be answered using an eye gaze, head turn, two switches, etc; count cubes out loud having student move in some voluntary way (e.g., nod head, tap hand, tap foot) to count along	Student selects numbers versus writing them; selection of correct answer is done after a model; student points to each cube while teacher or peer counts aloud; student answers “yes/no” questions regarding volume after tiles have been counted aloud (e.g., 1,2,3,4. The volume of this square is 9 cubic inches, is that correct?); matches the volume to the correct number (matches 9 to 9).	Have student write answers with novel pencil or use an IPAD; determine volume of “fun” objects (e.g., box of favorite cereal)
Engagement	Teach students to place cubes in empty containers. Teach that the volume can be counted by removing the cubes one at a time to count them.	Use a computer with AT where the student can click to answer; use figures that are large enough to accommodate the movements that the student is able to make; pair student with another student without a physical impairment and have them complete the problem together	Have measures affixed to object that student learns to place into equation template; student uses talking calculator to solve equation; limit area to numbers less than 10	Assign the area computations as a job task; student is “paid” 1 minute on computer for each one completed.

APPENDIX C: SAMPLE PAGES FROM A MASSI

MASSI: Math Activities with Scripted Systematic Instruction
Activity: Preparing Posters for Spirit Club
Grade Band: Grades 6-8
Concept: Measurement/Geometry

Common Core State Standard	Core Content	MASSI OBJECTIVES
6.G.1 Find the area of right triangles, other triangles, special quadrilaterals, and polygons by composing into rectangles or decomposing into triangles and other shapes; apply these techniques in the context of solving real-world and mathematical problems.	6th 6.GM.1d1 Find area of quadrilaterals	Using formula to calculate area of rectangles
6.G.4 Represent three-dimensional figures using nets made up of rectangles and triangles, and use the nets to find the surface area of these figures. Apply these techniques in the context of solving real-world and mathematical problems.	7th 7.GM.1h2: Find the surface area of three-dimensional figures using nets of rectangles or triangles	Using nets and formula to calculate surface area of rectangles
8.G.4 Understand that a two-dimensional figure is similar to another if the second can be obtained from the first by a sequence of rotations, reflections, translations, and dilations; given two similar two-dimensional figures, describe a sequence that exhibits the similarity between them.	8th 8.ME.1e1 Describe the changes in surface area, area, and volume when the figure is changed in some way (e.g., scale drawings)	Using formula to calculate changes in area

Be sure to provide specific practice to students on the skills that correspond to their grade level.

Combined materials provided: finished examples of posters decorated for local team, paint (may want to sabotage by labeling something like "recommended for an area of ____"), stickers, markers, glue, pictures of school/local team's mascot and players, tiling squares

Teacher materials: Multiple sizes of poster board, calculator, measuring tape/yardstick, box, printed nets (see materials), laminated equation for area and surface area. Note: Although this lesson has a lot of steps, a large majority of the steps break down the calculations into discrete steps.

SCRIPT FOR LESSON

BUILD THE ESSENTIAL UNDERSTANDING: CONCEPT AND SYMBOLS: Perimeter, Area, Length, Width, Surface Area, Height, and Tiling to Find Area (Skip this section for students who understand these relationships and can identify these concepts).

INTRODUCE ACTIVITY: Today we are going to learn about how to be good spirit club members. We are going to be in a spirit club to cheer for and support the (insert school team name or local sports team). We are going to make posters to hold up to support our team. In order to make the posters correctly, we must first learn about area and surface area. Show students an already completed/decorated poster. This is my spirit poster. See how I painted it, and then I decorated it with buttons, pictures, and markers. Before we get started decorating our posters, we need to review some vocabulary.

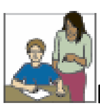
INTRODUCE THE PROBLEM: We need to know what the words “perimeter,” “area,” “length,” “width,” “height,” and “surface area” mean.

MODEL THE PROCESS: Hold up your poster. Use your finger to trace the outside edge of the poster. The perimeter is the edge that goes along the outside of the poster. Show me the perimeter of this poster. Wait for students to point or eye gaze towards the perimeter of your poster. Correct? Praise: Good. No response? Guide student to make the response.

STUDENT PRACTICE: Give each student a blank poster board. Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

CHECK AND SCORE

Step	Teacher Says/Does	Student Response
1.	Now let’s practice with your poster. Show me the perimeter of your poster.	Student uses finger to trace the outside edges of the poster.



MODEL THE PROCESS: Now let’s review area. Use the poster to indicate area with hand showing the full area. Area is the space inside the perimeter. Show me the area of this poster. Wait for students to point or eye gaze towards the area of your photo.

STUDENT PRACTICE: Give each student a blank poster board. Use LEAST INTRUSIVE PROMPTS script as needed to help students with each step.

CHECK AND SCORE

Step	Teacher Says/Does	Student Response
2.	Now let’s practice with your poster. Show me the area of your poster.	Student uses hand to indicate the area of the poster.

8th BUILD A GRADE ALIGNED COMPONENT: Calculating changes in area

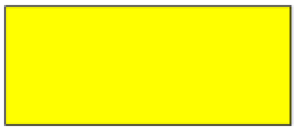
STUDENT PRACTICE: Give each student worksheet 4. This particular step (calculating area) was taught in the 6th grade level portion of the MASSI. If students are unable to complete this step, go back and re-teach the 6th grade portion. Ok, we've made a few posters for our pep rally, but let's make one more poster. Let's calculate the area of this poster board so we can make sure we get enough paint. Give students each a piece of poster board that is intentionally very small. Make sure the length and width are labeled on the poster board. Use LEAST INTRUSIVE PROMPTS script to help student with each step as needed.
**Note: Have the students write the numbers into the formula on the worksheet, but do not score writing ability. If students are unable to write the number, they can use number stamps, Velcro numbers, or direct the teacher to write it for them.
CHECK AND SCORE

Step	Teacher Says/Does	Student Response
63	Look at your worksheet. This says length (pointing to the length space in the equation). What is the length of your poster board?	Student writes/stamps/uses Velcro numbers/points to/eye gazes to the length.
64	This says width (pointing to the width space in the equation). What is the width of your poster board?	Student writes/stamps/uses Velcro numbers/points to/eye gazes to the width.
65	Now enter the formula into your calculator to solve for area of your poster board. Wait for students to independently enter the length into the calculator or say "What's next?"	Student enters the length into the calculator.
66	Wait for students to independently enter the times button or say "What's next?"	Student enters the multiplication sign into the calculator.
67	Wait for students to independently enter the width or say "What's next?"	Student enters the width into the calculator.
68	Wait for students to independently enter the equals button or say "What's next?"	Student enters the equals button into the calculator.
69	"What is the area of the poster board?"	Student says or writes the area of the poster onto the worksheet.

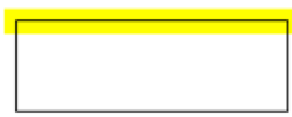
INTRODUCE PROBLEM: Good job finding the area of the first poster, here is enough paint to cover that area. Oh, no, I just realized that this poster board is too small… the players won't be able to see it from the stands. I think we should make a bigger poster. Here, let's use this new, bigger piece of poster board. Give each student a larger piece of poster board.

Student Vocabulary Card:

Perimeter = The edge along the outside of the shape.

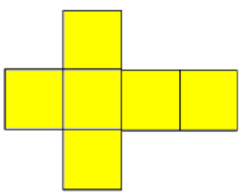


Area = The space inside the perimeter.

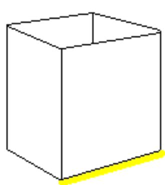


Length = The longest side of the rectangle.

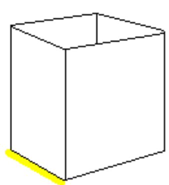
Width = The shortest side of the rectangle.



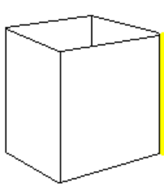
Surface Area = The space inside the perimeter of the net.



Length = The longest side.



Width = The shortest side.



Height = The part that goes up and down.