Educational Technology:

Benefits, Challenges and Effective Practices for Students Experiencing Learning Disabilities

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Abstract

This meta-synthesis examines the use of technology with special education students experiencing learning disabilities. The primary areas of examination are benefits, challenges and effective practices. During the review of the literature there were nine themes that were evident amongst the 39 articles. These themes related to the benefits, challenges and effective practices for use of technology with students experiencing learning disabilities. The emerging themes that are identified as being benefits to students and teachers who use technology are motivation and interest, accommodation potential, and ease of use. Challenges that came up as emerging themes are training, matching technology to student need, generalization, and technical issues. The effective practices that emerged most prominently were student data driving decision making and evidence or research based practices.

1. Background, Beliefs, and Purpose

1.1 Background

David Warlick, one of the 2011 top ten most influential people in educational technology is quoted as stating, “we need technology in every classroom and in every student and teacher’s hand, because it is the pen and paper of our time, and it is the lens through which we experience most of our world” (Shelton, 2016). Mr. Warlick’s observation of the world we live in today and it reliance on technology has been well established throughout literature and experience. During a 2010 theoretical study it was noted that youth “between the ages of eight and eighteen spend 10 hours and 45 minutes accessing media in a seven and a half hour day including utilizing multiple technologies at once” (Smith, 2010). These youth are the image of the iGeneration or digital children (depending on the preferred term of the day) in which paper and pencil is no longer the most common medium of communication, but rather it is in constant flex as technology adapts, advances and redefines itself.

Technology is flexible, dynamic, and evolving at a rapid pace. (Smith, 2010) There are hundreds of thousands of apps on the market and more are released each day. (Douglas, 2012) The United States Census 2013 data indicates that household computer ownership and internet use is highest among the homes with relatively young householders. (File, 2013) Educator April Chamberlain noted that “education is evolving due to the impact of the Internet. We cannot teach

our students in the same manner in which we were taught. Change is necessary to engage students not in the curriculum we are responsible for teacher, but in school. Period" (Ed Tech Review, 2016). The federal government has developed a National Education Technology Plan which notes that both technology and specifically multimedia technology should be in all curricular areas. (Fitzgerald, 2012) In fact all fifty states now offer online courses and some states have gone even further by requiring virtual learning experiences before graduation. (Fitzgerald, 2012; Cavanaugh, 2013) All of the previous information supports the belief that education should be and is moving towards more technology enhanced learning to meet the needs of all students.

The lives of most youth today are inseparable with technology. The definition of technology is shifting within education. Low-tech tools such as hand held math manipulative tools like protractors, counters, letter tiles, and other tools for learning have always had their place in education and continue to be used in classrooms. However, as society has shifted into new technologies classrooms have adapted as well. High tech tools such as computer assisted instruction or interactive technologies are becoming more and more prominent in education. Between 2001 and 2008 there were 757,328 interactive white boards purchased in the United States for use in schools alone. (Allcopp, 2012) Students are now accessing technology at home and at school for many purposes including technology enhanced learning, credit recovery, Science Technology Engineering Math (STEM), enrichment, etc. The options for technology only expand as technology continues to advance and research continues to identify ways in which it can make academic materials easier to grasp. (Madden, 2012)

One particular group of students who may struggle with academics for a variety of reasons are students experiencing disabilities. Often technology based academic programs are not specifically developed with supports for these students in mind. According to Coy (2014) students experiencing Learning Disabilities (SLD) are the largest group served under the Individuals with Disabilities Education Act (IDEA). To second this assertion, the National Longitudinal Transition Study 2 found that 55.1% of the U.S. special education students from 2000-2009 between ages 13 and16 years were identified as experiencing SLD. (Bouck, 2016) IDEA defines a student experiencing learning disabilities as someone who has "a disorder in one or more of the basic psychological processes involved in understanding or in using language, spoken or written, that may manifest itself in the imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations" (Special Education Guide, 2016). The United States Department of Education Office of Civil Rights noted in 2013 that students experiencing disabilities, including learning disabilities, should "receive all the educational benefits afforded by the technology in an equally effect and equally integrated manner" as their peers (Burdette, 2013). Since educators are expected to meet these unique needs using technology it is important to understand the situation regarding how technology is used and how it can meet the federal expectations. These expectations include being available to families based on free and public education, meeting the student's unique needs, receiving the same benefits of technology as their peers and receiving that technology in an integrated manner. In 2015, one descriptive report notes that approximately 60% of students experiencing disabilities spend 80% of their day in the general education classroom. (Patti, 2015) As noted earlier virtual learning is growing nationwide, in addition students experiencing disabilities are increasingly taking online courses.

(Coy, 2014) Due to the reality of our special education students' school day, special educators must work together with general educators in order to determine how these federal expectations can be met.

Within the special education realm technology literature has two major areas: Assistive Technology (AT) to support the functional needs of students experiencing disabilities and general technology research related to improving student success. Both are important to examine in order to understand the current status of technology amongst the population of students experiencing learning disabilities.

AT is defined as "any item, piece of equipment, or product system, whether acquired commercially off the shelf, modified, or customized, that is used to increase, maintain, or improve functional capabilities of a child with a disability" (IDEA, 2004). Assistive technology falls into two main groups, high tech and low tech. Assistive technology can span from the use of a highlighter to audio books to interactive computer softwares. Students experiencing learning disabilities had the lowest frequency of AT use out of all disability categories. The most common devices used on all disability groups were calculator, followed by computer, then books on audio. (Bouck, 2016) It is evident based on the potential of today's technology, the high percentage of SLD in the overall population and the low percentage of those students with documented AT services that AT is underutilized for SLD students. (Bouck, 2016) The reauthorized Technology Related Assistance Act promotes the awareness and access to Assistive Technology. (TRAA, 2004) Even so, there continues to be a lack of documented AT services to the largest population of students who experience disabilities.

General technology research related to improving student success is vast. A smaller number of studies have looked more closely into technology use for the population of students experiencing disabilities. Students experiencing disabilities have been shown to access technology in school more often than their non-disabled peers. (Okolo, 2014) Even so, they are also shown to access technology less than their non-disabled peers outside of school hours. (Okolo, 2014) According to the National Center for Education Statistics, in 2003, 82% of students with disabilities were found to use computers outside of school. (Nordness, 2011) These statistics demonstrate the numbers of students with disabilities who have access to technology in and out of the school environment. During a review of literature on the subject of special education technology Stetter and Hughes note that technology based solutions in general are underutilized for students with disabilities. (Stetter & Hughes, 2010) These sources provide a background for us to conceptualize the current status of technology use by and with students who experience learning disabilities.

Whether we are discussing assistive technology or general technology use among students with disabilities research suggests we could do more. As noted previously technology is constantly changing. In many ways it is like a revolving door where new innovative technologies are being developed everyday and similarly obsolete technologies go away. Due to this level of constant flux it is vital that technologies be regularly reviewed and assessed for their use with students experiencing learning disabilities. Technology serves as a tool for educators and students to explore and learn about the world and curriculum in a different way than in the past. We are still teaching the same things, but in new ways. As noted by McMahon and Walker in their 2014 *Technology in Action* guide, ”rather than thinking that mobile devices are going to

drastically change how and what educators teach their students it is more productive to think of mobile devices as tools that support what educators are already doing in the classroom." (McMahon & Walker, 2014)

1.2 Author's Beliefs and Experiences

I was born in 1982 and the world as I knew it no longer exists today. Like many students in my generation, the only computers in our elementary school (1988-1994) were in the library and they were using a DOS system fundamentally set up for learning how to search for books in the library database or play a few games during free time. I had no computer at home and didn't even know that the word internet or iPhone would ever exist. We wiped chalkboards down each day and the phone in my home was wired in. That world existed merely 25 years ago and is forever part of a history that will likely never be repeated.

My children are born into a reality that only existed in the imaginary world of the movies when I was 8. At 1 year old they could slide their finger to move objects on a tablet or phone. By 2 years old they were selecting their favorite Apps. At 4 years they are typing their name and

searching the internet for fun videos. By 6 years they could login to computers, recall pass codes, play games, and search the internet based on key words. They touch most electronic devices expecting immediate interaction. The entire world is at their fingertips. They will never need to experience newsprint newspapers, the shelves of encyclopedias, wired phones, or clumsy looking computers or tv monitors unless it is as an assignment for their history class. Their world and mine at the same age differ dramatically.

Education is adapting to this surge of technology advancement in amazing ways. Classrooms today include a large variety of technology tools for teachers and students. These tools include: desktop computers, laptops, tablets, microphone headsets, interactive projectors, document cameras, and a world of other possibilities. These hardware are a huge asset for reaching out to students today. Hardware is only the tip of the iceberg when it comes to technology application in classrooms. Each device includes a plethora of potential software and apps that can be used with students.

Special education students come to the classroom with many varying challenges facing them. The students I work with as an educator face many more challenges than I encountered as a child. Some struggle with attention, some are severely behind in academics, others have social challenges, behavioral or emotional disorders, and still others have physical challenges. As a special education teacher I have the privilege to explore various avenues for helping my students gain access to learning and engage in learning through technology.

I have slowly implemented a variety of software and application programs with my own students to varying degrees of success. As a special educator I am eager to search out new ways to meet my students' needs and provide a level of independence in the learning process. Some

tools I have implemented were district-wide intervention supports identified by administration as tools to help students who struggle in certain areas. Others were tools I found to help my students based on their specific needs. I have also found apps to help my students in a variety of areas from sight word practice to social stories. There is so much out there!

The three research questions that stem from my personal and professional experiences for this study are:

1) What are the benefits of technology centered learning for special education students who experience learning disabilities?
2) What are the challenges of technology centered learning for special education students who experience learning disabilities?
3) Are there any identified effective practices for technology implementation with special education students who experience learning disabilities?

1.3 Purpose of the Meta-synthesis

The primary purpose of this meta-synthesis is to examine the literature regarding technology centered learning when used with special education students who experience learning disabilities. There were three research questions within this analysis. First step was to review the benefits and challenges of technology based interventions when used with special education students who experience learning disabilities. The second step was to review effective practices of technology implementation with special education students who experience learning disabilities. In this process I will be reviewing the significant themes that present themselves from the literature.

2. Methods

2.1. Selection criteria

The types of documents that were reviewed include: journal articles referencing the use of technology with special education LD students. The journal articles met a specified criteria for inclusion in this meta-synthesis, the criteria was a follows:

1. The documents explored issues related to special education, technology and/or Learning Disability.
2. The articles explored issues related to K-12 public education.
3. The articles were published in peer reviewed journals related to the field of education, education technology, or special education.
4. The articles were published between fall 2010 and spring 2016 due to the constant turn around of technology related research the timeline was limited to the past 5 years.

2.2. Search procedures

Journal article and web-based searches were conducted to locate resources for this meta-synthesis.

2.2.1 Database searches

I conducted searches within the Educational Resources Information Center (ERIC, Ebscohost), Proquest, and Google Scholar using these specific search terms:

Search 1: (“Learning Disabilities”) AND (“Special Education”) AND (“Technology”)

Search 2: (“Technology”) AND (“Special Education”), reviewed manually for relevance to learning disabilities

The articles in the searches were reviewed to include the following previously noted criteria:

1. The documents explored issues related to special education, technology and/or Learning Disability.
2. The articles explored issues related to K-12 public education.
3. The articles were published in peer-reviewed journals related to the field of education, education technology, or special education.
4. The articles were published between fall 2010 and spring 2016 due to the constant turn around of technology related research the timeline was limited to the past 5 years.

Any articles that did not meet the criteria were removed from the analysis.

These database searches yielded a total of 39 pertinent articles.

Search 1 yielded 35 results

Search 2 yielded 4 additional results that did not name learning disabilities but were relevant to that population

2.3. Coding procedures

I used a coding form to categorize the information presented in each of the 39 documents. This coding form was based on: (a) publication type; (b) research design; (c) participants; (d) data sources; and (e) findings of the studies.

2.3.1. Publication types (Found in Table 1)

Each journal article was classified according to its publication type. The types are listed below:

- Research studies use a formal research design to gather and/or analyze quantitative and/or qualitative data.
- Theoretical works use existing literature to analyze, expand, or further define a specific philosophical and/or theoretical assumption.

- Descriptive works describe phenomena and experiences, but do not disclose particular methods for attaining data.
- Opinion pieces/position papers explain, justify, or recommend a particular course of action based on the author's opinions and/or beliefs.
- Guides give instructions or advice explaining how practitioners might implement a particular agenda.
- An annotated bibliography is a list of cited works on a particular topic, followed by a descriptive paragraph describing, evaluating, or critiquing the source.
- Reviews of the literature critically analyze the published literature on a topic through summary, classification, and comparison.

2.3.2. Research studies (Found in Table 2)

The research studies were further classified by research design. The research designs are listed below:

- Quantitative research utilizes numbers to convey information.
- Qualitative research uses language to explore issues and phenomenon.

- Mixed methods research involves the use of both quantitative and qualitative methods to present information within a single study.

2.3.3. Participants, data sources, and findings (Found in Table 2)

The studies were further analyzed to identify the following variables.

- Research questions being asked in the study.
- Participants including students with learning disabilities, special education teachers, administrators, etc.
- Data Sources including specific measurement tools, surveys, observations, etc.
- Findings were briefly summarized for each study.

2.4. Preliminary data analysis plan

I will be using the Stevick-Colaizzi-Keen method to analyze the articles in this meta-synthesis. John W. Creswell, writes that this is the “most practical, useful approach” (Creswell, 2012).

Steps:

1. First, experience of researcher is described

2. Develop a list of significant statements

3. Take significant statement and group them into meaning units

4. Describe “what” was experienced (textural description)

5. Describe “how” it happens (structural description)

6. Write a composite description of the with both the “what” and the “how” (textural and structural descriptions)

Steps were summarized from Creswell’s article “Qualitative Inquiry and Research Design: Choosing Among Five Approaches”.

3. Results

3.1. Publication Type

There were 39 articles identified during the database search phase. Of these articles the most common type of publication was a research study with 22 articles. These articles use a formal research design to gather and/or analyze quantitative and/or qualitative data. (Allsopp,

2010; Belson, 2013; Boone, 2012; Bouck, 2016; Bouck, 2010; Burdette, 2013; Chai, 2016; Courduff, 2016; De La Paz, 2013; Fede, 2013; Fitzgerald, 2012; Gonzalaz-Ledo, 2015; Hall, 2014; Kennedy, 2010; Marino, 2010; Meyer, 2014; Nordness, 2011; Okolo, 2014; Satsangi, 2015; Straub, 2015; Unzueta, 2012; Douglas, 2012) The next most common publication type was theoretical work with nine articles. Theoretical works use existing literature to analyze, expand, or further define a specific philosophical and/or theoretical assumption. (Allsopp, 2010; Bashan et.al., 2010; Bouck, 2012; Cavenaugh, 2013; Coy, 2014; Kenedy, 2010; Marino & Beecher, 2010; Smith and Okolo, 2010; Basham, 2010) Both guides and reviews of literature had three articles. Guides give instructions or advice explaining how practitioners might implement a particular agenda. (Basham andMarino, 2010; Newton, 2011, Newton, 2011) Where as, reviews of the literature critically analyze the published literature on a topic through summary, classification, and comparison. (Madden, 2012; Stetter and Hughes, 2010; Vasquez, 2012) There were two opinion papers which explain, justify, or recommend a particular course of action based on the author's opinions and/or beliefs. (Smith, 2010; Newton, 2011) Finally, one article was a descriptive article describing phenomena and experiences, but do not disclose particular methods for attaining data. (Patti, 2015)

Table 1: Publication Type

Table 1: Publication Type		
Author(s)	**Year of Publication**	**Publication Type**
Search A:		

Allsopp, D. H., McHatton, P. A., & Farmer, J. L.	2010	Theoretical
Allsopp, D., Colucci, K., Doone, E., Perez, L., Bryant, E., & Holhfeld, T.	2012	Research Study
Basham, J. & Marino, M.	2010	Guide
Basham, J. D., Israel, M., Graden, J., Poth, R., & Winston, M.	2010	Theoretical
Belson, S., Hartmann, D., & Sherman, J.	2013	Research Study
Boone, R. & Higgins, K.	2012	Research Study
Bouck, E.	2016	Research Study
Bouck, E., Doughty, T., Flanagan, S., Szewed, K., Bassette, L.	2010	Research Study
Bouck, E., Fanagan, S., Miller, B, & Bassette, L.	2012	Theoretical
Burdette, P., Greer, D. & Woods, K.	2013	Research Study
Cavanaugh, C., Repetto, J., Wayer, N., & Spitler, C.	2013	Theoretical
Chai, Z., Ayres, K., & Vail, C.	2016	Research Study
Courduff, J., Szapkiw, A., & Wendt, J.	2016	Research Study
Coy, K., Marino, M., & Serianni, B.	2014	Theoretical
De La Paz, S. & Hernandez-Ramos, P.	2013	Research Study
Fede, J., Pierce, M., Matthews, W., & Wells, C.	2013	Research Study

Fitzgerald, N.	2012	Research Study
Gonzalez-Ledo, M., Barbetta, P., & Unzueta, C.	2015	Research Study
Hall, T. E., Cohen, N., Vue, G., & Ganley, P.	2014	Research Study
Kennedy, M., Aronin, S., Newton, J., & Thomas, C.	2014	Research Study
Kennedy, M. J., & Deshler, D. D.	2010	Theoretical
Madden, Kaitlyn	2012	Review of Literature
Marino, M., Black, A., Hayes, M., & Beacher, C.	2010	Research Study
Marino, M. T., & Beecher, C. C.	2010	Theoretical
Meyer, N. & Bouck, E.	2014	Research Study
Newton, D. & Dell, A.	2011	Guide
Nordness, P., Havercost, A., & Volberding, A.	2011	Research Study
Okolo, C. & Diedrich, J.	2014	Research Study
Patti, A. & Garland, K.	2015	Descriptive
Satsangi, R., & Bouck, E. C.	2015	Research Study
Smith, S. J., & Okolo, C.	2010	Theoretical
Smith, S.J	2010	Opinion
Stetter, M. & Hughes, M.	2010	Review of Literature
Straub, C. & Ill, E.	2015	Research Study
Unzueta, C. & Barbetta, P.	2012	Research Study
Vasquez, E. & Straub, C.	2012	Review of Literature

Search B:		
Basham, J, Isreal M., Maynard, K.	2010	Theoretical
Douglas, K., Wojcik, B., &Thompson, J.	2012	Research Study
McMahon, D. & Walker, Z.	2014	Guide
Newton, D. & Dell, A.	2011	Opinion

3.2. Research design, participants, data sources, and findings of the studies

As noted previously, I located 22 research studies that met my selection criteria (Allsopp, 2012; Belson, 2013; Boone, 2012; Bouck, 2016; Bouck, 2010; Burdette, 2013; Chai, 2016; Courduff, 2016; De La Paz, 2013; Fede, 2013; Fitzgerald, 2012; Gonzalas-Lego, 2015; Hall, 2014; Kennedy, 2014; Marino et.all, 2010; Meyer, 2014; Nordness, 2011; Okolo, 2014; Statsangi, 2015; Straub, 2015; Unzueta, 2012; Douglas, 2012). The research designs, research questions, participants, data sources, and findings of each of these studies are identified in Table 2.

3.2.1 Research design

There were 22 articles that fell into the category of research study. Of these 6 were qualitative studies, 8 were quantitative, and 8 were mixed methods. (Allsopp, 2012; Belson,

2013; Boone, 2012; Bouck, 2016; Bouck, 2010; Burdette, 2013; Chai, 2016; Courduff, 2016; De La Paz, 2013; Fede, 2013; Fitzgerald, 2012; Gonzalas-Lego, 2015; Hall, 2014; Kennedy, 2014; Marino et.all, 2010; Meyer, 2014; Nordness, 2011; Okolo, 2014; Statsangi, 2015; Straub, 2015; Unzueta, 2012; Douglas, 2012)

3.2.2 Participants

The range in number of participants in the 15 studies looking at students as their primary participants was 2 to 1,129,252 students. Six of the studies were centered around educators as the primary participants, one of which was a survey of special education directors. The last study was a sampling of Apps meeting specific criteria and identifying where they fit within the Children's Supports Intensity Scale.

3.2.3 Data sources

The data sources ranged from classroom observation to informal qualitative interviews to formal interviews to surveys to statistical analysis. Each of these data sources provides a different way to analyze technology use with special education students who experience learning disabilities and educators working with those students.

Table 2: Research Studies

Table 2: Research Studies						
Authors	**Date**	**Research Design**	**Research Questions**	**Participants**	**Data Sources**	**General Findings**
Search A:						
Allsopp, D., Colucci, K., Doone, E., Perez, L., Bryant, E., & Holhfeld, T.	2012	Qualitative	1. How do teachers of SWD use Interactive White Board Technology (IWBT) in their instruction? 2. What are these teachers' perspectives on the use of IWBT for SWD? 3. What are teachers' perspectives on effective professional development in relation to the integration of IWBT in their curricula/instructional practices?	8 Teachers and their classrooms	Classroom Observations, individualized semi-structured interviews, focus group interviews, and field notes	8 emergent themes related to effective technology use by educators: interactivity, explicitness, feedback, differentiation, visuals, student interest/attention, data-based decision making, and content specific use
Belson, S., Hartmann, D., & Sherman, J.	2013	Mixed Methods	1. How did the use of digital pens with students who used the Cornell note-taking system improve the quality of students' notes? 2. How did the use of digital pens impact the organization, content, selectivity, and potential in the students' notes? 3. What aspects of digital pens were most useful from the students' perspective?	10 High School students on IEPs for reading difficulty (SLD)	Rubric for note taking, using content analysis; baseline and intervention data; survey	Use of the digital note taking pen significantly increased the quality of notes taken by the students

Boone, R. & Higgins, K.	2012	Qualitative	Procedures used in developing the check list: -Review of the literature. -Development of a software evaluation blueprint. -Formative item review. -Content validation. -Second review. -One-on-one field testing. -Development of final product.	Panel of experts and teachers	Individual knowledge and experience	The panel developed a set of software checklists for use with Special Education Students including SLD based on effective practice of experts in the field and tested by teachers. Includes areas of instruction, directions and documentation, feedback and evaluation, content, individualization options, and accessibility for SLD (Boone, 2012)
Bouck, E.	2016	Quantitative	A secondary analysis of the NLTS2 data used to give a national picture of AT access and use.	National Longitudinal Transition Study Data (NLTS2) includes 1,129,252 students ages 13-16	National Longitudinal Transition Study Data	Only 7% of students in NLTS data receive AT services; SLD and other high incidence disabilities had the lowest frequency of use
Bouck, E., Doughty, T., Flanagan, S., Szewed, K., Bassette, L.	2010	Quantitative	Effectiveness of pen top computers on the written expression of secondary students with mild disabilities.	3 students; 1 SLD and 2 Intellectual Disability	Essay analysis based on then identified components (ex: # planning details, # paragraphs, # of errors	Student with SLD demonstrated significant gains during intervention phase using pen top computers and then

					within categories like spelling, capitalization and punctuation, etc.	regressed back to his baseline when required to generalize the information into a new context.
Burdette, P., Greer, D. & Woods, K.	2013	Qualitative	Study looks at the influences driving online learning, the participation of students with disabilities in online learning, and the issues concerning the provision of a free and appropriate public education in an online learning environment.	46 State and Non-state Jurisdiction - Special Education Directors	Survey	Drivers to moving into online instruction: cost, flexibility, access; Increase in the # of states reporting services to SLD and other SpEd students; Challenges are outlined: Accommodation training and staffing for students with disabilities.
Chai, Z., Ayres, K., & Vail, C.	2016	Quantitative	1. Will young English Language Learners (ELL) with disabilities improve their receptive identification of initial phonemes with the help of the iPad app **"**Touch Sound**"**? 2. If young ELLs with disabilities improve their performance, can they maintain the skills after the intervention is completed? 3. Can young ELLs with disabilities generalize the target behavior across materials? 4. Will students learn the incidental learning information (vocabulary) which is presented as models by **"**Touch Sound**"** during intervention?	ELL/SLD 3 students in Pre-K through 2	21 initial phonemes and 6 targets selected	All children mastered their identified phonemes when using the evaluated iPad App Touch Sound; generalized to paper pencil mode with 100% accuracy

Courduff, J., Szapkiw, A., & Wendt, J.	2016	Qualitative	1. What is the process by which special education teachers begin to use and effectively implement technology in their classrooms? 2. What are the factors of effective integration of technology in a special education classroom? 3. What obstacles do special education teachers face when integrating technology in a special education classroom?	10 Teachers in Resource Specialist Program or Special Day Class	demographic surveys, intensive interviews, and classroom observations	4 major themes emerged when looking at successful educators who incorporate technology: taking advantage of opportunities, dispositions, pedagogical beliefs, and small steps
De La Paz, S. & Hernandez-Ramos, P.	2013	Mixed Methods	1. Can involvement in a technology-enhanced historical inquiry multimedia group project facilitate students' content learning and historical understandings? 2. How do students with disabilities compare to peers who are not identified as having learning problems with respect to learning outcomes?	Middle School Students 27 in class, 8 SLD (focus on the 8)	Content learning and quality of writing were quantitatively analyzed; Student interviews, multimedia projects, and journals were qualitatively reviewed	The study evaluated technology enhanced project learning. In this study the knowledge gap between SLD and non-SLD closed; Increased work completion was evident; Engagement was noted as a benefit.

Fede, J., Pierce, M., Matthews, W., & Wells, C.	2013	Mixed Methods	1. Do students who received the Computer Assisted Scheme Based Instruction (CA-SBI) intervention show higher gains on a subset of Massachusetts Comprehensive Assessment System (MCAS) items compared to students who received test prep review? 2. Do students who received the intervention show higher gains on the Process and Application subtest of the Group Mathematics Assessment and Diagnostic Evaluation compared to students who received test prep review? 3. Do students who received the intervention show stronger rates of growth on examiner-made probes compared to students who received test prep review?	16 Grade 5 Students in experimental group and 16 in comparison group; SLD students included in the study	Mass. Comp. Assess. System word problems (MCAS); GMADE; Examiner made progress monitoring probes; Interview	This study looked at Computer Assisted Instruction. Experimental groups showed higher improvement on MCAS, no difference on GMADE; Examiner made probes showed steeper slope for experimental group in growth; Students indicated they were satisfied.
Fitzgerald, N.	2012	Mixed Methods	Study investigates the effects of teaching The Word Identification Strategy through online modules to students with learning disabilities.	5 students aged 5-7, SLD	Prefix/Suffix test; word ID Strat-CBM, reading fluency, comprehension data, and questionnaire	This study reviewed the use of online modules with SLD students. All participants showed growth during technology ELA intervention, but dropped in generalization phase; issues with reliance on adult online course facilitators; satisfaction was high

Gonzalez-Ledo, M., Barbetta, P., & Unzueta, C.	2015	Quantitative	This study examines the effects of a computer graphic organizer on the narrative writing of elementary school students with SLD.	4th and 5th grade boys, SLD, 4 students	# words written; # planning minutes; Common writing elements; survey	The study used computer based graphic organizers with SLD students. Improvement seen in 3 of 4 areas, not in organization, when students used the online writing program.
Hall, T. E., Cohen, N., Vue, G., & Ganley, P.	2014	Mixed Methods	1. Is the implementation of Curriculum Based Measure (CBM) online more efficient and effective for teachers and students than a more traditional offline implementation of CBM when using a Universal Design for Learning (UDL) reading environment? 2. Is the technology-based approach to monitor student performance in reading more effective in improving student performance on standards based measures of reading comprehension? 3. Does implementing technology based CBM in a UDL reading environment facilitate teachers' use of CBM to inform instruction central to state standards?	284 students; 4 middle schools; 14 classrooms; 64 SLD students in the study	Online and Offline CBM; ORF, MAZE, Gates-MacGinitie (GM); Survey	This study used CBMs online and offline for comparisons. SLD self-reported more gains and indicated being more engaged; SLD had increase of 10.4% on GM online sig at .05

Kennedy, M., Aronin, S., Newton, J., & Thomas, C.	2014	Mixed Methods	Study looked at whether secondary level teacher candidates could : 1. Produce a Content Acquisition Podcasts (CAP) using Mayer's principles (2008) and embedded evidence-based practices and 2. report satisfaction with the production process and plan to use this tool when teaching.	40 secondary level pre-service educators; 12 participated in focus group	Meyer's principles rubric (12 principles of multimedia learning) ; Survey; Focus Group	Approximately 84%of educators adhered to Meyer's Principles on first effort for their CAP; teachers enjoy tech enhanced tool; outline of some challenges educators face when using tools and attempting to adhere to principles; teachers often naturally look at technology that appears engaging through pop ups and lots of color/characters, but can be too intense for students experiencing learning disabilities.
Marino, M., Black, A., Hayes, M., & Beacher, C.	2010	Quantitative	1. How are student- and teacher/classroom-level factors and school/district-level factors related to students' science achievement on a multiple choice unit posttest? 2. How are student- and teacher/classroom-level factors and school/district-level factors related to students' science achievement on six open-ended solutions forms?	1,153 middle school students grades 6-8 in 4 districts; included SLD students	pre/post assessment on science concepts; six open-ended solutions forms assessing species environment needs; Degrees of Reading Power scores determined reading ability groups	Students with reading challenges did not have significant differences in the post test at two schools, but did at the other two schools; affluent schools had less impact from technology-based curricula on students with reading difficulties; schools using UDL framework showed the gap closing

Meyer, N. & Bouck, E.	2014	Mixed Methods	1. In comparison to reading on the computer without Text to Speech (TTS), does the use of TTS affect oral reading fluency, comprehension, and task completion time while reading grade-level expository text? 2. What are students' perspectives of using TTS for reading grade-level expository text?	3 students in middle school experiencing LD	Fluency and comprehension measures; work completion times; interviews	Study looked at text to speech (TTS) technology. Although student data did not show significant gains the students felt more confident and engaged
Nordness, P., Havercost, A. & Volberding, A.	2011	Quantitative	Study examines the use of a mathematic flashcard application on an Apple iPod Touch to improve subtraction skills for second grade students with learning and behavioral disabilities.	3 second grade students 2 SLD and 1 with behavior; primary supports in reading, but also in math	subtraction problems on Nebraska Abilities Math Test (N-ABLES)	Computer Assisted Instruction (CAI) shows promise for working on subtraction skills with elementary students who have learning disabilities after having assisted this small sample of students.

Okolo, C. & Diedrich, J.	2014	Qualitative	1. In what ways do educators use technology to assist students with disabilities? 2. What knowledge do educators have about the use of technology for students with different types of disabilities? 3. What are educators' perceptions of the support they receive for using technology with students who have disabilities? 4. What are educators' perceptions of the need and desire for further professional development? 5. How are decisions made about technology use for students with disabilities, and who is involved in these decisions? 6. What are educators' beliefs about the impact that technology might have on students with disabilities? 7. What are educators' beliefs about barriers to more widespread technology use, and what could be done to alleviate these barriers?	State of Michigan; 1,143 educators (special, gen ed, related services, tech providers, and admin	Survey	Assistive Technology (AT) is not just for low incidence intensive needs; AT has implications for LD

Satsangi, R., & Bouck, E. C.	2015	Quantitative	1. What percentage of area problems do students with a learning disability in mathematics solve accurately when using virtual manipulatives? 2. What percentage of perimeter problems do students with a learning disability in mathematics solve accurately when using virtual manipulatives? 3. What are the attitudes and perceptions of students with a learning disability in mathematics about using virtual manipulatives to solve mathematics problems?	2 HS Students LD in Math	Paper and pencil assessments; virtual manipulative examples	Supports use of virtual manipulatives in mathematics for solving area and perimeter and suggest further research with more participants; deemed highly effective for these three students
Straub, C. & Ill, E.	2015	Mixed Methods	1. For students with LD, to what extent will Online Writing Instruction (OWI) increase: a. The number of persuasive EEs? b. The number of correct minus incorrect word sequences (CIWS)? c. Performance on a mean holistic quality score of a persuasive essay? d. Sandard scores as measured by the Test of Written Language (TOWL)-3? 2. How will students rate importance of goals, procedures, and effectiveness of OWI?	4 adolescent students experiencing LD	Essay Rubric; TOWL - 3; questionnaire; observations	This study looked at synchronous online collaborative writing software. Completion of the strategy instruction led to significant increases; Increases were seen across the data observations for all four students and into generalization for two of the students.

Unzueta, C. & Barbetta, P.	2012	Quantitative	This study investigates strategies to improve the composition writing through computer graphic organizers used during planning on persuasive	4 Hispanic students experiencing LD	6 identified measures of writing: # words, planning time, supporting details, syntax, organization	Computer graphic organizers appear to be effective with SLD.
Search B:						
Douglas, K., Wojcik, B., &Thompson, J.	2012	Qualitative	The study describes the current status of apps for Apple devices (i.e., iPods, iPads, and iPhones that run on an iOS operating system) that could be incorporated into a system of individualized supports for students with disabilities.	508 Apps	Children's Supports Intensity Scale: Home life, community, school participation, school learning, health and safety, social, and advocacy.	Review of Apps used with special education students. 21.2% free, 57.6% between $.99 and $4.99; 46 math apps and 73 literacy apps; apps vary in what they offer, potential for supporting students with various disabilities including SLD.

3.2.4 Findings of the studies

The findings of these studies were primarily positive in regards to the effectiveness of the various tools being assessed. Of the 12 studies that included quantitative analysis reviewing the effectiveness of specific tools with students 10 showed that the tools were effective with the students and two did not. Only six studies actually took the study into a generalization phase. Of those that did show effectiveness and looked at generalization there were four of the six that noted a drop from intervention phase to generalization. Of the remaining two studies one had split results within the generalization phase and the other was successfully generalized by all of the students in the study. These studies all included very few participants.

The studies that looked at educators were mostly qualitative in nature. Findings for these studies often centered on themes that were presented by the educators. There were many themes that surfaced across the studies. These include interactivity, explicitness, feedback, differentiation, visuals, student interest/attention, data-based decision making, content specific use, opportunities, dispositions, pedagogical beliefs, and small steps, AT for SLD, cost, flexibility, and accessibility. Some of these themes will be further analyzed with the full spectrum of articles being analyzed in this study, others were not prominent enough in the full set of studies.

3.2.5 Limitations

The populations in the research studies were often small sample sizes. Half of the research studies, or 11 of the 22 had 10 or fewer participants. Many of the larger samples included only a small percentage of students experiencing learning disabilities in the overall population. The findings of these studies should not be generalized to all students experiencing learning disabilities.

3.3. Emergent themes

During the review of the literature there were nine themes that were evident amongst the 39 articles. These themes related to the benefits, challenges and effective practices for use of technology with students experiencing learning disabilities. The themes that presented themselves include: (a) motivation and interest, (b) accommodation potential, (c) training, (d) ease of use, (e) student data drives decisions, (f) evidence or research based practices, (g) matching technology to student need, (h) generalization and (i) technical issues. These nine themes are presented in table 3.

Table 3: Emergent Themes

Table 3: Emergent Themes	
Theme Clusters	**Formulated Meanings**
Motivation and interest (17 articles)	• Students showed a peaked interest when using technology. (Allsopp, 2012; Bouck, 2012; Newton, 2011; McMahon, 2014) • Technology is more engaging for many students. (Allsopp, 2012; Cavenaugh, 2013; Hall, 2014; McMahon, 2014; Meyer, 2014; Newton, 2011) • Through technology students often feel involved and interact with their learning. (Allsopp, 2012; Madden, 2012) • Technology brings excitement and enthusiasm into the learning environment. (Basham, 2013; Belson, 2013; McMahon, 2014; Meyer, 2014; Nordness, 2011; Patti, 2015) • Students demonstrate that they enjoy technology. (Basham, 2013; Bouck, 2012; Fede, 2013; Nordness, 2011) • Student interest leads to higher work completion. (De La Paz, 2013) • Participants with technology show high satisfaction rates. (Fitzgerald, 2012) • Self-esteem increases are seen with students who use technology. (Hall, 2014; Marino, 2010) • Students feel motivated when they use technology. (Marino, 2010; Meyer, 2014; Nordness, 2011; Smith, 2010) • Many students prefer computers. (Stetter, 2010)
Training (15 articles)	• It can be difficult to find available time for professional development related to the technology. (Allsopp, 2012; Cavanaugh, 2013; Courduff, 2016; Coy, 2014) • Technology presents a large learning curve for many teachers.(Allsopp, 2012) • There is not enough training for staff in technology. (Allsopp, 2010; Courduff, 2016; Madden, 2012; McMahon, 2014; Straub, 2015) • Training is necessary for all involved in the tools use including teachers, students and family. (Bouck, 2012; Patti, 2015; Douglas, 2012; Stetter, 2010)

	• Educators need more training in how to select and match technology to student needs. (Kennedy, 2010) • Training for technology use with special education students is lacking. (Cavanaugh, 2013) • During the research study training was found to be helpful for the success of the tool. (Hall, 2014) • Training in how to match evidence based practices with technology. (Madden, 2012) • Training is a vital component to success in technology implementation. (Newton, 2011)
Accommodation potential (14 articles)	• Technology tools are assistive in nature: font size, color, etc. (Kennedy, 2010) • Assistive technology potential is overlooked for students experiencing learning disabilities. (Basham, 2010; Bouck, 2016) • Research has indicated that the audio playback/read aloud/recording features benefit students with SLD. (Belson, 2013; Hall 2014; Patti, 2015) • There are significant challenges that come with using the accommodations within an online environment. (Burdette, 2013; Cavanaugh, 2013; Coy, 2014) • Even with the challenges, articles note the benefits of accommodations provided through technology applications in online environments. Examples: flexibility of schedule; flexibility of design to meet student needs; access to electronic AT tools; ease of repetition; breaks are easy; adjusted pace (Fitzgerald, 2012; Meyer, 2014; McMahon, 2014) • Students note satisfaction with the computer based accommodations for highlighting and sentence starters. (Hall, 2014) • Technology can remove barriers in learning and assessments that allow greater understanding of student's content knowledge. (Marino, 2010; Basham, 2010; Douglas, 2012) • Certain accommodations such as extended time and multimedia are perfectly designed for SWD. (Vasquez, 2012)
Ease of use (12 articles)	• Technology makes it easy for educators to save and reuse materials/lessons. (Allsopp, 2012) • There is low frustration and ease of use with many technologies. (Belson, 2013) • Students have familiarity and comfort with technology. (Bouck, 2012; Courduff, 2016) • Some components of technology are easily used within daily instruction. (Chai, 2016) • Students tend to learn the software quickly. (De La Paz, 2013)

	• Some technologies are user friendly, meaning they are easy for students and teachers to learn and use. (Gonzalez-Ledo, 2015, Patti, 2015; Douglas, 2012; Newton, 2011) • Technology interfaces can be very simple to navigate. (Newton & Dell, 2011) • The portability of technology makes it easier to use. (McMahon, 2014)
Student data drives decisions (10 articles)	• Data-based instructional decision making that includes progress monitoring is noted within the literature as an effective practice. (Allsopp, 2010; Allsopp, 2012; Cavanaugh, 2013; Kennedy, 2010; Marino, 2010; Newton, 2011) • Research that looks at the characteristics of successful teachers who use technology notes that in their classrooms student data is used to make decisions. (Courduff, 2016) • RTI defined as "the practice of providing high quality instruction and intervention matched to student need, monitoring progress frequently to make decisions about changes in instruction and applying child response data to important educational decisions" (Basham et.al., 2010); RTI (which includes universal screening and progress monitoring) is noted in the literature as a effective practice. (Marino, 2010; Smith, 2010; Stetter, 2010) • If you choose the technology carefully many programs provide data support tools for teachers to review and adjust based on student data. (Newton, 2011)

Evidence/research based practices (10 articles)	• Evidence or research based practices are not defined in the literature by a strict set of measures that must be met, but rather what has been deemed throughout many studies as effective or effective practice.
	• Some effective practices that came up in multiple resources were:
	  • Universal Design for Learning (UDL) - (Allsopp, 2010; Basham, 2010; Cavanaugh, 2013; Coy, 2014; Hall, 2014; Madden, 2012; Marino, 2010; Marino & Beecher, 2010; Basham et.al., 2010; McMahon, 2014)
	  • Explicit/Direct Instruction - (Allsopp, 2010; Allsopp, 2012; Coy, 2014; Kennedy, 2014; Smith & Okolo, 2010; Stetter, 2010; Straub, 2015)
	• UDL includes three components:
	  • multiple means of representation: flexible ways of displaying information
	  • multiple means of action/expression: options for demonstrating knowledge
	  • multiple means of engagement: flexibility in getting interest, excitement, and persistence (McMahon, 2014)
	• UDL is noted as having flexibility with presentation of information and reducing barriers in instruction. (Basham et.al., 2010)
	• The definition of explicit instruction is a "structured, systematic, and effective methodology for teaching academic skills." (Archer, 2011)

	• Research has identified sixteen elements of explicit instruction: 1. Focus instruction on critical content. 2. Sequence skills logically. 3. Break down complex skills and strategies into smaller instructional units. 4. Design organized and focused lessons. 5. Begin lessons with a clear statement of the lesson's goals and your expectations. 6. Review prior skills and knowledge before beginning instruction. 7. Provide step-by-step demonstrations. 8. Use clear and concise language. 9. Provide an adequate range of examples and non-examples. 10. Provide guided and supported practice. 11. Require frequent responses. 12. Monitor student performance closely. 13. Provide immediate affirmative and corrective feedback. 14. Deliver the lesson at a brisk pace. 1. Help students organize knowledge. 2. Provide distributed and cumulative practice. (Archer, 2011)
Matching technology to student need (9 articles)	• It is important to spend time selecting technology that addresses learning barriers for LD students (Allsopp, 2010) • We as educators need to be more deliberate and purposeful about matching the appropriate technology with instruction and student needs. (Allsopp, 2010; Basham et.al, 2010) • Selecting or matching the appropriate technology to a student's needs is not easy. (Boone, 2012; Courduff, 2016; Kennedy, 2010; Okolo, 2014) • There are murky and ambiguous pathways to determine useful supports, making it challenging for educators to determine the best tool. (Douglas, 2012) • Educators need more training in how to select and match technology to student needs. (Kennedy, 2010) • Often technology is not developed with specific learning disabilities in mind (Boone, 2012) • RTI requires that there be "high quality instruction and intervention matched to student need" (Basham et.al, 2010; Marino & Beecher, 2010) • Two checklists are noted in the literature for reviewing technology" • One checklist is based on the belief that application selection criteria should be based on same as selecting general software and web-based activities: (a) simplified screens and instructions, (b) consistency of menus and controls, (c) graphics to support non-readers and early readers, (d) audio feedback, (e) set pace and difficulty, (f) easy error correction, and (g) appropriate feedback (Newton, 2011)

	• Includes areas of instruction, directions and documentation, feedback and evaluation, content, individualization options, and accessibility for SLD (Boone, 2012)

Generalization (8 articles)	• There are mixed results on the ability of students experiencing learning disabilities being able to generalize the information they learn through technology to other modes.
	  • Of the 22 research studies in this meta-analysis only 6 looked at generalization.
	  • Four did not show that students were able to generalize the information. (Bouck, 2010; Fitzgerald, 2012; Meyer, 2014; Statsangi, 2015)
	  • One showed that students were able to generalize the information. (Chai, 2016)
	  • The last had split results for the small population of four in the study. (Straub, 2010)
	• One challenge for students with learning disabilities is transferring information from one medium/setting to another and being able to generalize. (Coy, 2014; Smith & Okolo, 2010)

Technical issues (8 articles)	• Computer technology often requires an understanding and ability to deal with compatibility issues. (Allsopp, 2012; Chai, 2013) • Network speed and infrastructure are vital to successful technology use. (Burdette, 2013; De La Paz, 2013; Statsangi, 2015) • Computers and programs have different levels of functionality and efficiency. (Allsopp, 2012; De La Paz, 2013) • It is impossible to avoid challenges with technology such as application difficulties, technical mishaps, or operator error. (Belson, 2013; Chai, 2013; Fitzgerald, 2012) • When using technology the set up can be time consuming or impossible for non-programmers to try to individualize. (Chai, 2013) • SLD students may struggle with some features that teachers might find attractive like brisk pace, graphics, complexity due to student's limited background, language, and processing; (Kennedy, 2014)

4. Discussion

In this section I summarized the major themes that appeared from my analysis of the 39 articles included in the meta-synthesis. The themes that presented themselves include: (a) motivation and interest, (b) accommodation potential, (c) training, (d) ease of use, (e) student data drives decisions, (f) evidence or research based practices, (g) matching technology to student need, (h) generalization and (i) technical issues. In some cases I have connected the emergent themes to my own experiences as a special education teacher.

4.1. Motivation and interest

Technology is a significant part of the lives of many children today. It is engaging for them in addition to being a natural medium for learning and interaction. In 17 of the 39 articles the authors noted some component of motivation or interest as a benefit to using technology with special education students. In seven separate articles the researchers commented on how student interest and enjoyment is peaked when using technology. (Allsopp, 2012; Bouck, 2012; Newton, 2011; McMahon, 2014; Basham, 2013; Fede, 2013; Nordness, 2011; Stetter, 2010) Where as other researchers focus more on how technology is more engaging for the students. (Allsopp, 2012; Cavenaugh, 2013; Hall, 2014; McMahon, 2014; Meyer, 2014; Newton, 2011) According

to some researchers students also feel more involved and interact with their learning when they use technology. (Allsopp, 2012; Madden, 2012) There are also references to technology bringing excitement and enthusiasm to the learning environment. (Basham, 2013; Belson, 2013; McMahon, 2014; Meyer, 2014; Nordness, 2011; Patti, 2015) With high interest, engagement, and interaction with their learning, students feel more motivated when they use technology. (Marino, 2010; Meyer, 2014; Nordness, 2011; Smith, 2010) Another benefit to come forth regarding interest and motivation is that it can lead to higher work completion. (De La Paz, 2013) Students have also shown a high satisfaction rate when using technology. (Fitzgerald, 2012) One of the most positive benefits that is noted when using technology is that it has demonstrated increases in self-esteem. (Hall, 2014; Marino, 2010) Overall, the benefit of motivation and interest when using technology was the most common theme emerging in the meta-synthesis.

Within my own classroom I have seen the power of motivation and interest when using technology with my students. We use a variety of technology infused lessons based on Universal Design for Learning principles as well as supplemental learning programs that support the students' goals. The Promethean board allows students to interact with their learning in a variety of ways. They can work together to solve problems, identify part of speech, listen to audio stories while we follow along with the story as a group, etc. The students demonstrate their interest and engagement by their increased motivation and involvement during these activities. In addition to these technology infused lessons students participate in supplemental learning programs such as Lexia and RAZ Kids. These programs in coordination with classroom level recognition in association with the student's successes on these programs were highly motivating for my students. As struggling readers they started the year unsure and hesitant. Even so, they

easily reached their goals for the year as a reading group on the RAZ Kids program. All of these students showed gains in their reading fluency with the smallest gain being twice their starting correct words per minute and the most being four times their starting correct words per minute. The technology was not the only component to their instruction, but it was highly interesting for the students and motivated them to love reading.

4.2 Training

Educators have busy schedules and many elements that are important to their work. The plethora of professional development options available to educators and limited required professional development for certification renewal can make it difficult to find available time for professional development related to technology. (Allsopp, 2012; Cavanaugh, 2013; Courduff, 2016; Coy, 2014; Madden, 2012; McMahon, 2014; Straub, 2015) Technology presents a large learning curve for many teachers. (Allsopp, 2012) With a lack of professional development time and a large learning curve more some educators, we are often forced to choose between training with technology tools and other trainings to help our students. Research has found that training is a vital component to success in technology implementation and the success of specific technology tools. (Newton, 2011; Hall, 2014) Educators need training in the tools, but also in other ways to use the technology tools in conjunction with other educational practices. Specifically support is needed in areas such as matching technology to student needs (Kennedy, 2010), using technology with special education students (Cavanaugh, 2013), and how to match evidence based practices with technology. (Madden, 2012) Training is not merely for educators,

but rather it is necessary for all involved in the tools use including teachers, students and family. (Bouck, 2012; Patti, 2015; Douglas, 2012; Stetter, 2010)

As an educator I can relate to the lack of time and the overabundance of potential areas we could study in our limited professional development requirements for maintaining certification. The three specific areas noted in the research as being high need included matching technology to student needs, using technology with special education students, and matching evidence based practices with technology. The first high need area, matching technology to student needs was another overall emergent theme that was presented in the literature. The classes I have taken outside of my mandatories have had some discussion of how technology can be used, but not as to what we should look for in regards to meeting the learning needs of special education students. The second high need area identified was using technology with special education students. This is an area I have explored as an educator independently. I have taken a course in technology integration and focused specifically on my own students in special education to help myself find these connections. Though not mandatory these classes are available to those interested. The final area of high need is the training in how to match evidence based practices with technology. Some courses I have taken have had me look at Universal Design for Learning (UDL). In these processes technology integration has been reviewed in conjunction with the tenants of UDL. There is more that could be done to help build a discussion around matching these and other practices with technology. In all of these cases the coursework was non-mandatory and went above and beyond the requirements of my certification. The

situation turns into one in which teachers who are comfortable learning about technology will and those who are not will be less apt to sign up for those classes.

4.3 Accommodation potential

By its nature technology offers tools that are assistive. (Kennedy, 2010) Fourteen of the thirty-nine articles mentioned the potential of accommodations within technology. Whether referring to audio playback, recording, font type or size, background or font color, extended time, etc.; technology offers many features that are often found on the Individualized Education Plans (IEP) of students who experience learning disabilities. The potential of this technology has often been overlooked for students who are experiencing learning disabilities. (Basham, 2010; Bouck, 2016) Certain features of technology have been assessed in literature and indicate they benefit students who experience learning disabilities. These include audio playback, read aloud, recording, extended time and multimedia. (Belson, 2013; Hall 2014; Patti, 2015; Vasquez, 2012) An area noted in multiple articles is the challenges and benefits associated with accommodations within an online environment. (Burdette, 2013; Cavanaugh, 2013; Coy, 2014) Challenges that are mentioned include the ability to monitor use, train students, and have support staff for students. Even with the challenges, articles note the benefits of accommodations provided through technology applications in online environments. Examples include flexibility of schedule, flexibility of design to meet student needs, access to electronic AT tools, ease of repetition, breaks are easy, and adjusted pace. (Fitzgerald, 2012; Meyer, 2014; McMahon, 2014) Not only does research suggest that students experiencing learning disabilities benefit from technology

based accommodations at the same time research indicates they are not receiving accommodations as often as they could. Research also notes that those students receiving technology based accommodations such as highlighting and sentence starters are satisfied with the support it provides. (Hall 2014) These potential technology accommodations can remove barriers in learning and assessments that allow greater understanding of student's content knowledge. (Marino, 2010; Basham, 2010; Douglas, 2012) The disconnect between what is available and what is used still exists even though we as educators are striving for more information and ways to identify and implement the technology based opportunities for our students experiencing learning disabilities.

My own experience mirrors much of what the literature describes under the potential accommodations that technology could provide to students experiencing learning disabilities. Of those students that I have worked with the accommodations or assistive technology has been limited to calculators and read aloud. The students have greatly appreciated and seemed satisfied with having the supports as well as demonstrating higher content knowledge mastery when they do not have to worry about reading or calculating the material presented. Even so, this has been limited primarily to assessments and not daily instructional accommodations. When recognizing how often the potential technology based accommodations are overlooked and the extent of options available under that umbrella I can see a huge disparity in what can be offered to students and what has typically been offered. This is an area in which we as practitioners can improve.

4.4 Ease of use

One major benefit of most technology is that it is easy to use. Students and educators alike find themselves emerged in technology both inside and outside of the classroom. There are many factors related to ease of use noted within the twelve articles that discussed this emerging theme. Those related to students include the low frustration (Belson, 2013), familiarity and comfort with technology (Bouck, 2012; Courduff, 2016), and tendency to learn software quickly (De La Paz, 2013). Other elements that were noted regarding ease of use were geared more towards the educator, such as: technology makes it easy for educators to save and reuse materials/lessons (Allsopp, 2012) and some components of technology are easily used within daily instruction (Chai, 2016). Other technology specific areas noted that apply to all users is that technology can be user friendly or easy to learn and use (Gonzalez-Ledo, 2015, Patti, 2015; Douglas, 2012; Newton, 2011), some technology interfaces provide simplicity (Newton, 2011) and the portability of many technology devices makes them easier to use (McMahon, 2014).

Based on personal experience not all technology meets these criteria and it is often difficult to identify which technologies are “user friendly”. Many of the tools I have used have been easy to use, but many that I have encountered have not. As an educator I experiment with new tools long before I put them in front of my students. Only those that have user friendly interfaces end up being used in my class. Technology can be easy to use for many students but it can also pose challenges for other students. It is important to understand the background of our students and other educators as implementation of new technology occurs. The students in my classroom have often demonstrated a natural ability to negotiate and connect through technology.

For most of the students it is second nature, but not all. I have a select few students who have not had the same opportunities as others in regards to becoming familiar with technology. They too eventually pick it up, but have a much steeper learning curve. As with most of what we do as educators we must gauge our students prior knowledge and scaffold their learning to help them be successful whether the technology is easy to use for most students or not.

4.5 Student data drives decisions

Gauging how to continue teaching students based on their current and past performance is nothing new. How we do it has changed quite a lot though. Even in one room school houses educators would use informal assessments to determine how to decide which way to continue with a student's education. This is teaching in its most natural state. Today we find common formative assessments and track them over time, meet with teams, and often assess and collect data through high tech means. Researchers have spent hours asking whether looking at student data matters and many have determined that data-based instructional decision making that includes progress monitoring is an effective practice for educators to incorporate. (Allsopp, 2010; Allsopp, 2012; Cavanaugh, 2013; Kennedy, 2010; Marino, 2010; Newton, 2011) One specific framework based originally out of the 2004 reauthorization of IDEA is Response to Instruction/Intervention (RTI), which incorporates the concept of progress monitoring. RTI is defined as "the practice of providing high quality instruction and intervention matched to student need, monitoring progress frequently to make decisions about changes in instruction and applying child response data to important educational decisions" (Basham et.al., 2010) This

model has also been noted by researchers within literature as being a effective practice for educators. (Marino, 2010; Smith, 2010; Stetter, 2010) Various forms of this model are used in many districts. Another effective practice identified in literature that specifically identifies the monitoring of student data is explicit or direct instruction. (Archer, 2011) In general, research that looks at the characteristics of successful teachers who use technology notes that in their classrooms student data is used to make decisions. (Courduff, 2016) Research has strongly supported the use of data-based decision making to guide instruction.

It is not always easy to collect the data to drive decision making, because there are many high tech programs that do not provide the level of data collection that effectively helps educators make these decisions. There are some great programs that do not supply a data collection tool for teacher review. In these situations we must look at what is being measured and assess them outside of the program which can be a challenge for students, such as those experiencing learning disabilities, who struggle with generalization and transfer. If you choose the technology carefully many high tech programs do provide data support tools for teachers to review and adjust based on student data. (Newton, 2011) As educators we have the opportunity to look at what programs and supports are best for our students, while also taking into consideration what data we need to make good decisions for our students.

4.6 Evidence/research based practices

Evidence or research based practices are not defined in the literature by a strict set of measures that must be met, but rather what has been deemed throughout many studies as effective practice. Twenty-five percent of the articles specifically discussed evidence or research based practices as effective practice in education. Two of the more commonly noted evidence or research based practices were: Universal Design for Learning (UDL), which was mentioned in all of the articles (Allsopp, 2010; Basham, 2010; Cavanaugh, 2013; Coy, 2014; Hall, 2014; Madden, 2012; Marino, 2010; Marino & Beecher, 2010; Basham et.al., 2010; McMahon, 2014) and Explicit/Direct Instruction, which was mentioned in 7 of the articles (Allsopp, 2010; Allsopp, 2012; Coy, 2014; Kennedy, 2014; Smith & Okolo, 2010; Stetter, 2010; Straub, 2015). Both practices are briefly described below.

UDL includes three components: multiple means of representation defined as flexible ways of displaying information, multiple means of action/expression defined as options for demonstrating knowledge, and multiple means of engagement defined as flexibility in getting interest, excitement, and persistence (McMahon, 2014). UDL is noted as having flexibility with presentation of information and reducing barriers in instruction. (Basham et.al., 2010) The 2015 Every Student Succeeds Act specifically notes the importance of using UDL principles for achieving student success. (ESSA, 2015)

The definition of explicit instruction is a “structured, systematic, and effective methodology for teaching academic skills.” (Archer, 2011) There are sixteen specific elements of explicit instruction that have been identified: (a) focus instruction on critical content, (b) sequence skills logically, (c) break down complex skills and strategies into smaller instructional

units, (d) design organized and focused lessons, (e) begin lessons with a clear statement of the lesson's goals and your expectations, (f) review prior skills and knowledge before beginning instruction, (g) provide step-by-step demonstrations. (h) use clear and concise language, (i) provide an adequate range of examples and non-examples, (j) provide guided and supported practice, (k) require frequent responses, (l) monitor student performance closely, (m) provide immediate affirmative and corrective feedback, (n) deliver the lesson at a brisk pace, (o) help students organize knowledge, and (p) provide distributed and cumulative practice. (Archer, 2011) These elements of explicit instruction overlap with components of UDL principles and the RTI mandate from the IDEA 2004 reauthorization.

4.7 Matching technology to student need

As special educators we spend much of our time pondering the best tools to help our students be successful. Selecting or matching the appropriate technology to a students needs is not easy. (Boone, 2012; Courduff, 2016; Kennedy, 2010; Okolo, 2014) There are murky and ambiguous pathways to determine useful supports, making it challenging for educators to determine the best tool. (Douglas, 2012) Even so, it is important to spend time selecting technology that addresses learning barriers for students experiencing learning disabilities. (Allsopp, 2010) We as educators need to be more deliberate and purposeful about matching the appropriate technology with instruction and student needs. (Allsopp, 2010; Basham et.al, 2010) This becomes more challenging each day as the high tech options for educators to review expand at astronomical rates. In order to effectively filter through the options available for our students

to find the best match educators need more training in how to select and match technology to student needs. (Kennedy, 2010) The reality is that often technology is not developed with specific learning disabilities in mind. (Boone, 2012) Knowing this and recognizing the some effective practices that are defined in literature such as RTI requires that there be "high quality instruction and intervention matched to student need." (Basham et.al, 2010; Marino & Beecher, 2010) That match is vital to helping students be successful.

Some studies have begun looking at how to assist educators in making the right match for students as well as effective practices for educators. Two checklists are noted in the literature for reviewing technology applications. The first checklist, noted by Newton in 2011, is based on the belief that application selection criteria should be based on same as selecting general software and web-based activities. There are 7 components to the checklist that are mentioned: (a) simplified screens and instructions, (b) consistency of menus and controls, (c) graphics to support non-readers and early readers, (d) audio feedback, (e) set pace and difficulty, (f) easy error correction, and (g) appropriate feedback. (Newton, 2011) The second checklist was developed by Boone in 2012 with support from expert panelists and educators. This checklist is more in depth and includes the areas of instruction, directions and documentation, feedback and evaluation, content, individualization options, and accessibility for SLD. (Boone, 2012) Attached in Appendix B is the version of this checklist that was developed for students experiencing learning disabilities. Each of these tools are designed to help educators in matching the right technology with the students' needs in mind.

4.8 Generalization

There are mixed results on the ability of students experiencing learning disabilities being able to generalize the information they learn through technology to other modes. Eight of the total thirty-nine articles noted challenges in the area of generalization for students experiencing learning disabilities. Six of these were research studies that looked at generalization within small populations of students. Four of which did not show that the students were able to generalize the information. (Bouck, 2010; Fitzgerald, 2012; Meyer, 2014; Statsangi, 2015) One small study of three students showed that students were able to generalize the information. (Chai, 2016) And the final had split results between successful generalization and unsuccessful generalization. (Straub, 2010) Other literature noted that one challenge for students with learning disabilities is transferring information from one medium or setting to another and being able to generalize. (Coy, 2014; Smith & Okolo, 2010)

Within the classroom this has many implications for how to approach technology enhanced instruction. When students struggle generalizing the information into new settings the teacher must look at how to integrate multiple mediums of learning in order to enhance their transfer of the knowledge from one format to the next. Students experiencing learning disabilities are not likely to make that jump independently or even within a couple of opportunities to practice. They often require a more intense repetition of practice. This must be taken into account when looking at technology enhanced or technology based learning.

4.9 Technical issues

Technology has its many benefits, but with that comes the woes as well. There are a storm of potential issues that can become a barricade for learning in the classroom. Educators must not only understand what and how to teach, but how to deal with technical issues in technology. These issues often do not present themselves at times that are the most convenient for teachers. Eight of the thirty-nine articles made note of this challenge. Some potential areas of concern in regards to technical issues include: compatibility (Allsopp, 2012; Chai, 2013), network speed and infrastructure (Burdette, 2013; De La Paz, 2013; Statsangi, 2015), and varying levels of functionality and efficiency (Allsopp, 2012; De La Paz, 2013). The reality is that it is impossible to avoid challenges with technology such as application difficulties, technical mishaps, or operator error. (Belson, 2013; Chai, 2013; Fitzgerald, 2012) The technology can present other technical issues as well. Some programs provide few options for individualizing the program to meet specific student needs, such as students experiencing learning disabilities might require. (Chai, 2013) These are the same students who may struggle with some features that teachers might find attractive like brisk pace, graphics, complexity due to student's limited background, language, and processing. (Kennedy, 2014)

It is not uncommon for the network to drop during the day or the computers to have glitches requiring a teacher to halt instruction and manage the technical issue. As educators we understand that the best resolution to these issues is to understand the software and hardware we will encounter in our work, but more important than anything, have a back up plan. What is learned on a computer was once learned in another format and we must be prepared in those

moments when we are unable to fix a technical issue quickly to continue on with engaging non-technology enhanced lessons. Technology integration can be an amazing blessing and a terrible headache as well. Teachers should be prepared, know their equipment, and always have a backup plan.

5. Conclusion

The findings of this meta-synthesis highlight the overlapping themes which emerged when reviewing the three research questions of this study: To reiterate, these questions were: (1) What are the benefits of technology centered learning for special education students who experience learning disabilities?, (2) What are the challenges of technology centered learning for special education students who experience learning disabilities?, and (3) Are there any identified effective practices for technology implementation with special education students who experience learning disabilities?.

The research questions focused on the benefits, challenges and effective practices of using technology with students experiencing learning disabilities were primarily answered within the emerging themes in section 3.3 and all of section 4 discussing those themes. The themes that presented themselves, in order of most often identified, include: (a) motivation and interest, (b) accommodation potential, (c) training, (d) ease of use, (e) student data drives decisions, (f) evidence or research based practices, (g) matching technology to student need, (h) generalization and (i) technical issues.

The emerging themes that are identified as being benefits to students and teachers who use technology are motivation and interest, accommodation potential, and ease of use. Motivation and interest was the most common theme that emerged overall and the most common benefit that emerged as well. Some key words in these articles that related to motivation and interest included engagement, involvement with learning, interaction, excitement, enthusiasm, enjoyment, high satisfaction, interest, and motivation. Some findings that were noted as a result of the interest and motivation were higher work completion and increases in self-esteem. Accommodation potential was the second benefit based theme that presented itself. This theme presented key ideas such as the natural assistive nature of many technology applications, the lack of assistive technology use with students experiencing learning disabilities, and the way these tools can help remove barriers for students. Some tools that were discussed include, but are not limited to: font size, font color, audio playback, read aloud, recording, highlighting, sentence starters, flexibility of schedule, flexibility of design to meet student needs, access to electronic AT tools, ease of repetition, breaks are easy, adjusted pace, and multimedia. Ease of use was the final emerging benefit. Although we all understand that technology is not inherently easy, many applications of technology make things easier than they are without technology in place. For example teachers benefit from being able to save and reuse materials as well as having many technologies available that are easily used during daily instruction. Students are naturally connected with technology due to the familiarity and comfort they often have with it. They are able to learn and use the technologies easily so long as they are designed in user friendly formats and have simple interfaces. These three benefits were the first, third and fourth most common emerging themes from the set of nine emerging themes in this study.

The emerging themes that are identified as being challenges are training, matching technology to student need, generalization, and technical issues. The most commonly identified challenge was training. Literature indicated that training for staff, families and students are often lacking. Time for training and making technology training a priority was also indicated as part of the issue. Training regarding matching technology to student needs was also mentioned as an area of great need. Matching technology to student needs was the second most often noted challenge in the literature. This was highly associated with training concerns and the need to find a more consistent tool for analyzing the best tools for students experiencing learning disabilities. The two remaining challenges were the last of the nine emerging themes. Generalization pertains directly to the population in this study, students experiencing learning disabilities. These students have been found to struggle with generalizing or transferring information from one context to another. No solution is identified, but the concern was noted with some suggestions regarding building in multiple opportunities to practice generalization. The final area is one we can all connect with, technical issues. Technical issues stem from many areas including, but not limited to: compatibility, network speed and infrastructure, as well as varying levels of functionality and efficiency. Technical issues play a role anytime we are working with technology and they are unpredictable. As educators we strive to always have a backup plan for activities in case technical issues create a lull in instruction. These four challenges were the second, seventh, eighth and ninth emerging themes from the set of nine emerging themes in this study.

The effective practices that emerged most prominently were student data driving decision making and evidence or research based practices. Using student data to drive decisions is a

constant conversation in todays' classrooms. As an effective practice we look for tools that provide the data to help us make decisions. Researchers noted that educators who demonstrated strong incorporation of technology also used that technology to collect data and make educational decisions. The other commonly referenced effective practice was using evidence or researched based practices. Two of the more commonly noted evidence or research based practices in the literature were: Universal Design for Learning (UDL) and Explicit/Direct Instruction. The literature made reference to some ways in which technology can be used within these practices, but more research on how effectively these research based practices are being incorporated into technology tools is needed. The two areas of effective practice, student data driving decision making and evidence or research based practices, emerged as themes five and six from the set of nine emerging themes in this study.

Overall, this study found that the benefit of technology use with students experiencing learning disabilities outpaces the challenges. Students enjoy using technology, it keeps them interested and engaged when it is effectively implemented. For this generation high-tech applications have been part of their lives from the moment they were born. It is their world. There is a wealth of potential accommodations and assistive technologies that are increasing everyday as technology grows and expands.

6. Recommendations

Educators and administrators must prepare the environment to minimize the impact of the challenges identified within the literature. Providing training for educators working with students experiencing learning disabilities in the appropriate technologies to meet the student needs, allowing for incorporation into special or general education classrooms, and specific learning of high tech tools is vital. In addition coming up with effective means and training in how to assess technology for use with students experiencing different struggles with learning is vital. As are making sure the environmental and technological infrastructure is able to handle the increasing use of technology in classrooms by students experiencing learning disabilities. We need to look beyond what we have always done with technology and consider assistive technology options for helping students who are experiencing learning disabilities access the curriculum and resources in order to be more successful. This includes looking into issues with generalization that are more challenging for SLD students and finding ways to build in opportunities to practice those skills across settings.

Even with the benefits and challenges to technology use with students who experience learning disabilities we as educators must always look back at effective practice. Certainly, effective practices can be enhanced with technology, but with the ever increasing options available to students and educators it is a challenging endeavor. Identifying which technology is best for the needs of students is not clearly defined. Some studies have begun reviewing what is available for students experiencing learning disabilities. A small study reviewed a set of 508 Apps for use with students experiencing disabilities. Of those only 46 were designed for math and 76 were designed for English and Language Arts. (Douglas, 2012) The reality is that studies like these become obsolete quickly. According to the International Business Times Apple's App

store is growing by over 1,000 Apps per day! (Matthew, 2015) It seems impossible to keep up with such a pace.

If we can't study individual effectiveness and appropriateness in this way while keeping up with the pace of technology development and turnover than the next step is to look at how we categorize the options available to us. Two checklists are noted in the literature for reviewing technology. One checklist is based on the belief that application selection criteria should be based on same as selecting general software and web-based activities and include the areas of (a) simplified screens and instructions, (b) consistency of menus and controls, (c) graphics to support non-readers and early readers, (d) audio feedback, (e) set pace and difficulty, (f) easy error correction, and (g) appropriate feedback. (Newton, 2011) The second includes areas of instruction, directions and documentation, feedback and evaluation, content, individualization options, and accessibility for SLD specifically. (Boone, 2012) These studies start the process, but we have much further to go in order to implement an effective set of guidelines for technology tools which serve the needs of our students experiencing learning disabilities. We must be vigilant in what we choose for our students, adapt to changes, stay the course and most importantly keep open minds as we negotiate the ever-changing world of high tech education.

Appendix A: Bibliography

Journal Search Resources

Search 1: Technology, Special Education and Learning Disabilities articles

Allsopp, D. H., McHatton, P. A., & Farmer, J. L. (2010). Technology, mathematics PS/RTI, and students with LD: What do we know, what have we tried, and what can we do to improve outcomes now and in the future?. Learning Disability Quarterly, 33(4), 273-288.

Allsopp, D., Colucci, K., Doone, E., Perez, L., Bryant, E., & Holhfeld, T. (2012) Interactive whitebord technology for students with learning disabilities: A year long exploratory study. Journal of Special Education Technology, 27 (4), 1-15.

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Bouck, E., Fanagan, S., Miller, B, & Bassette, L. (2012) Technology in action. Journal of Special Education Technology, 27 (4), 47-57.

Burdette, P., Greer, D. & Woods, K. (2013) K-12 Online learning and students with disabilities: Perspectives from state special education directors. Journal of Asynchronous Learning Networks, 17:3, 65-72.

Cavanaugh, C., Repetto, J., Wayer, N., & Spitler, C. (2013) Online learning for students with disabilities: A framework for success. Journal of Special Education Technology, 28 (1), 1-8.

Chai, Z., Ayres, K., & Vail, C. (2016) Using and iPad app to improve phonological awareness skills in young English-language learners with disabilities. Journal of Special Education Technology, 31 (1), 14-25.

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Coy, K., Marino, M., & Serianni, B. (2014) Using universal design for learning in synchronous online instruction. Journal of Special Education Technology, 29 (1), 63-74.

De La Paz, S. & Hernandez-Ramos, P. (2013) Technology-enhanced project-based learning: Effects on historical thinking. Journal of Special Education Technology, 28 (4), 1-14.

Fede, J., Pierce, M., Matthews, W., & Wells, C. (2013) The effects of a computer-assisted, schema-based instruction intervention on word problem-solving skills of low-performing fifth grade students. Journal of Special Education Technology, 28 (1), 9-21.

Fitzgerald, N. (2012) Exploring the efficacy of online strategy instruction for improving reading abilities of students with learning disabilities. Journal of Special Education Technology, 27 (1), 33-47.

Gonzalez-Ledo, M., Barbetta, P., & Unzueta, C. (2015) The effects of computer graphic organizers on the narrative writing of elementary school students with specific learning disabilities. Journal of Special Education Technology, 30 (1), 29-42.

Hall, T. E., Cohen, N., Vue, G., & Ganley, P. (2014). Addressing learning disabilities with UDL and technology strategic reader. Learning Disability Quarterly, 0731948714544375.

Kennedy, M., et.al. (2014) Creating multimedia-based vignettes with embedded evidence-based practices: A tool for supporting struggling learners. Journal of Special Education Technology, 29:4, 15-30.

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Okolo, C. & Diedrich, J. (2014) Twenty-five years later: How is technology used in education of students with disabilities? Results of a Statewide Study. Journal of Special Education Technology, 29 (1), 1-20.

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Smith, S. J., & Okolo, C. (2010). Response to intervention and evidence-based practices: Where does technology fit?. Learning Disability Quarterly, 33(4), 257-272

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Stetter, M. & Hughes, M. (2010) Computer-assisted instruction to enhance the reading comprehension of struggling readers: A review of the literature. Journal of Special Education Technology, 25 (4), 1-16.

Straub, C. & Ill, E. (2015) Effects of synchronous online writing instruction for students with learning disabilities. Journal of Special Education Technology, 30 (4), 213-222.

Unzueta, C. & Barbetta, P. (2012) The effects of computer graphic organizers on the persuasive writing of Hispanic middle school students with specific learning disabilities. Journal of Special Education Technology, 27 (3), 15-30.

Vasquez, E. & Straub, C. (2012) Online instruction for K-12 special education: A review of empirical literature. Journal of Special Education Technology, 27 (3), 31-40.

Search 2: Special Education and Learning Disabilities articles, reviewed manually for technology based tools to identify relevance to study (many additional articles were read and deemed to not meet one of the criterion)

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JSET Journal of Special Education Technology

Software √-List

GENERAL FORM FOR ALL STUDENTS WITH DISABILITIES

POSITIVE ATTRIBUTES OF EDUCATIONAL SOFTWARE	√	X
INSTRUCTION	**YES**	**NO**
Learning cues or prompts support complex tasks.		
Lessons can be interrupted and returned to without starting over.		
Problem solving, reflection, and creativity are promoted over rote learning.		
Ideas and concepts are shown in multiple representations (e.g., text & graphic).		
Small teaching sets simplify content.		
Strategies for transfer of skills are provided.		
A self-correction process leads student to the answer.		
Independent exploration is available and is encouraged.		
Outlining is used as a instructional strategy.		
Questioning is used as an instructional strategy.		
Repetition is used as a instructional strategy.		
Advance organizers, summaries, or outlines used as instructional strategies.		
Instructional transitions from one level to another include content overlaps.		
Important points or concepts are visually highlighted (e.g., bold).		
Software adapts to student input and branches to appropriate instructional level.		
DIRECTIONS AND DOCUMENTATION	**YES**	**NO**
Directions are provided on screen.		
Directions are simple.		
Instructions can be repeated for student.		
Relevant features of a task are clearly communicated.		
Teacher documentation is easy to understand.		
Specific instructional objectives are outlined for the teacher.		
Prerequisite skills for all aspects of the software are listed.		
State and national standards are addressed in documentation.		
Hardware requirements are clear.		
FEEDBACK AND EVALUATION	**YES**	**NO**
Feedback is consistent.		
Feedback is immediate.		
Feedback is obvious.		
Feedback is positive and relevant to action taken by student.		
Feedback on incorrect responses indicates where or how error occurred.		
Student responses are recorded automatically by the software.		
Final performance evaluation is provided.		
Evaluation provides information on learner strengths and weaknesses.		
Learner progress records can be viewed or printed.		

Appendix B: Checklist (Boone, 2012)

Software √-List

GENERAL FORM FOR ALL STUDENTS WITH DISABILITIES (PAGE 2)

POSITIVE ATTRIBUTES OF EDUCATIONAL SOFTWARE:	√	X
CONTENT	**YES**	**NO**
Content is free of grammatical errors.		
Content information is accurate.		
Content is free from bias (e.g., ethnic, gender).		
Content is relevant to the curriculum.		
Realistic, real-life situations are used in activities and content.		
Difficulty level of content is appropriate.		
Content is interesting.		
Audio is appropriate to instructional content.		
A variety of difficulty levels are available.		
INDIVIDUALIZATION OPTIONS	**YES**	**NO**
Student can control rate, amount, and sequence of presentation.		
No time constraints are set on student response.		
Content and activities can be modified by the teacher.		
Rate, amount, and sequence of content can be controlled by the teacher.		
INTERFACE AND SCREEN DESIGN	**YES**	**NO**
Screen design features are consistent and clear.		
Screen is uncluttered.		
Navigation elements are clearly available on all screens.		
Graphics are not overwhelming or distracting.		
ACCESSIBILITY	**YES**	**NO**
Alternate input devices work with the program.		
Digital speech output is provided for all text.		
Verbal directions have corresponding on-screen text available.		
Minimal keyboarding skills are required.		
Text spacing assures readability.		
Accuracy of input is minimized (e.g., typing errors can be corrected).		
Navigation though the program is simple.		

Software √-List

LEARNING DISABILITIES

POSITIVE ATTRIBUTES OF EDUCATIONAL SOFTWARE	√	X
INSTRUCTION	**YES**	**NO**
Generalization of skills is supported in the instructional design.		
Skill-building component is included.		
Multiple opportunities for response to similar items is provided.		
No time constraints are set on student response.		
Skills and content are broken down into small teaching sets.		
Answer or response format is as simple as possible.		
DIRECTIONS AND DOCUMENTATION	**YES**	**NO**
Directions focus student on tasks to be completed.		
Tutorial is available to student while working on the activity.		
Help features available for sequencing activities or instructions.		
Directions do not compete or interfere with content comprehension.		
FEEDBACK AND EVALUATION	**YES**	**NO**
Explicit feedback sequences explain reasons for errors.		
Explicit feedback sequences lead student through process to correct answer.		
Procedures are consistent for correction and evaluation.		
CONTENT	**YES**	**NO**
Variety of difficulty levels are available.		
Ideas and concepts shown in multiple representations (e.g., text, video, graphics).		
INDIVIDUALIZATION OPTIONS	**YES**	**NO**
Diagnostic and prescriptive strategies provided for placement of student in program.		
Self-pacing provided for student.		
Motor skills and manipulative acts are kept simple.		
ACCESSIBILITY	**YES**	**NO**
Motor skills and manipulative acts are kept simple.		

I give permission to add this Thesis into the University of Alaska Southeast Scholar Works system.

Kristine Stout 8/1/2016