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Language Therapy and Academic Achievement in Mathematics: Speech-Language Pathologists'
Roles and Perspectives

By

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Thesis

Submitted to the Department of Special Education

Eastern Michigan University

in partial fulfillment of the requirements for the degree of

MASTER OF ARTS

in

Speech-Language Pathology

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October 31, 2013

Ypsilanti, MI

DEDICATION

To my parents, Fred and Ruth Ann Richter, and my sister, Rebecca Richter, and brother, Charlie Richter who have been loving, supportive, and encouraging to me.

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ABSTRACT

Speech-language pathologists (SLPs) play an important role in language intervention among school-age children and have the potential to target academic achievement through language therapy. This study explored whether and how SLPs capitalize on language therapy to promote students' math achievement and discussed SLPs' practice addressing academic problems that co-occur with language disorders. Ten elementary school SLPs were interviewed to gather their perspectives on the relationship between language disorders and academic achievement. Results indicated that the SLPs acknowledged their responsibility to address academic difficulties and reported addressing academic difficulties presented by students in their caseload. Reading and writing were identified by most SLPs as the most common academic difficulties addressed by them, and only half of the SLPs promptly listed math as an academic subject they help their students with. The SLPs identified different factors as limiting their direct intervention in math difficulties and discussed potential implications to their intervention.

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Chapter 1: Introduction

Background Information, Problem Statement, Justification, and Significance

According to the American Speech-Language-Hearing Association (ASHA, 2010), speech-language pathologists (SLPs) who work in schools may provide services to students who are eligible for services under any category as described in the Individuals with Disabilities Education Act (IDEA) 2004. Students who fall into most categories under IDEA typically have associated speech and language difficulties, whether or not it is their primary impairment, and receive services from an SLP in the school (Cirrin & Gillam, 2008). The language difficulties of these students put them at a significant risk for social and academic problems (Cirrin & Gillam, 2008). When students have speech or language impairments, they often have co-occurring academic problems and need a plan of intervention to address their academic problems.

One of the reasons students have academic problems is because of their language disorders. Language is very important for students' academic success at school. With regard to the curriculum of academic subjects, language is both an end and a means to an end (Ehren, 2000). According to Ehren (2000), "Students must learn to listen, speak, read, and write in order to participate in the typical communication events that are appropriate for their respective age and grade levels" (p. 220). In order to learn in subject areas such as math, social studies, and science, students use spoken and written language skills and strategies. Furthermore, "academics are based on "languages"; a different "language" is used for each subject (e.g., reading, writing, and math)" (Getty & Summy, 2006, p. 17). Therefore, "a student who has difficulties with receptive and/or expressive language skills during typical communication will most likely exhibit difficulties with academics" (Getty & Summy, 2006, p. 17).

According to ASHA, school-based SLPs should use the Common Core State Standards (CCSSs) as a resource to guide their practice (ASHA, n.d.-b). The CCSSs were designed to reflect the skills and knowledge base that students need to acquire at each grade level, and in each subject, in order to succeed in college and in their future professional careers (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). Since school-based SLPs work with students who have language difficulties and co-occurring academic difficulties, SLP's goals and objectives should align with the CCSSs so that their intervention can help students achieve the standards that have been set for their grade. For accountability purposes, school-based SLPs have the responsibility to implement and integrate the CCSSs into their intervention. SLPs can take on a variety of roles including participation among Response to Intervention (RTI) teams, collaboration with professionals in an academic setting, and leadership in advocating for language issues related to the CCSSs (Blosser, Roth, Paul, Ehren, & Nelson, 2012). According to Schleppegrell (2007), each subject area has its own ways of using language to construct knowledge, and students need to be able to use language effectively to participate in those ways of knowing, including mathematics. Studies have proposed a link between language skills and mathematic achievement (Arvedson 2002; Cowan, Donlan, Newton, & Lloyd, 2005), suggesting that children with language impairments are at risk for deficits in the acquisition of numerical concepts. Indeed, language encompasses several aspects that are relevant to math such as morphology (word structure) and syntax (sentence structure). For example, morphology is used in the math language when *-ion* or *-sion* is added as a suffix to a word such as *equate*, turning the word into a process that must be performed. Syntax plays an important role in the math language because it can alter a comparison that is to be made. For example, "there are more dogs than cats" is different from "there are more cats than dogs."

Whether math language is spoken or written, there are aspects of morphology and syntax that play an important role in the student's success with the math problem.

Students need to be successful with the use and understanding of language in order to succeed in academic subjects. When the typical day-to-day instruction in the classroom is insufficient for a student to master the language required for the curriculum, schools offer intervention services to help the students. At schools, SLPs are often the professional who helps these students with the underlying language of the academic school subjects. When there is a need for intervention, SLPs are required to plan for interventions based on evidence-based practice, and tailor them to the students' needs (ASHA, 2010).

SLPs offer assistance in addressing the linguistic and metalinguistic foundations of curriculum learning for students with disabilities, as well as other learners who are at risk for school failure, or those who struggle in school settings. In the case of mathematics, not only are these language aspects a part of the math curriculum, but math requires cognitive functioning, which is covered in the SLP's scope of practice. ASHA's scope of practice for SLP services targeting cognition includes attention, memory, sequencing, problem solving, and executive functioning, all of which are important in developing success in math (ASHA, 2010). Students who have difficulty with any or a combination of these cognitive aspects may struggle academically in math.

Although studies have been emphasizing a link between language skills and academic achievement in mathematics, there is a lack of research on school SLPs' perspectives on the impact of their service on academic achievement, especially in relation to mathematics. The purpose of this study was to investigate SLPs' perspectives on their role in promoting academic achievement among school-age children. This study explored SLPs' level of awareness and

perceived importance of language therapy on mathematic achievement and overall academic success. More specifically this study investigated whether and how SLPs capitalize on language therapy to promote students' math achievement in school settings, as well as their overall practice and experiences addressing academic problems that co-occur with language disorders. Understanding SLPs' perspectives and practices regarding language therapy and academic difficulties, including math, is crucial to promote effective practices and student academic success.

Purpose of the Study

Having been employed at a mathematics learning center for three years, this researcher has worked with students who have co-occurring mathematic academic difficulties and language disorders. As a math tutor, it became clear to this researcher that the relationship between language skills and mathematic achievement can be easily overlooked.

This study intended to investigate SLPs' perspectives on the importance of language therapy on mathematic achievement and overall academic success. More specifically this study explored whether and how SLPs capitalize on language therapy to promote students' math achievement in school settings and discussed SLPs' practice and experiences addressing academic problems that co-occur with language disorders.

Justification and Significance

Although studies have been emphasizing a relationship between language skills and academic success, there is a lack of literature discussing SLPs' perspectives on their role in working with students in speech and language therapy sessions to address academic problems, specifically in the mathematics realm. Understanding SLPs' perspectives and practices regarding

language therapy and mathematics is important to promote effective practices and student academic success.

Research Questions

The study aimed to answer the following questions: What are SLPs' perspectives on the relationship between language disorders and academic math difficulties? Do SLPs target the language of math in cases where there is a co-occurrence of language disorders and academic math difficulties? Do SLPs employ language therapy to promote students' math achievement in school settings, and if so, how do they do that?

Chapter 2: Review of the Literature

Relationship of Language and Academics

Language is the foundation for learning and is very important to a student's academic success. According to Schleppegrell (2007), each subject area has its own ways of using language to construct knowledge, and students need to be able to use language effectively to participate in those ways of knowing. Getty and Summy (2006) also state, “academics are based on ‘languages’ in which a different ‘language’ is used for the different subjects” (p. 17). A student who has difficulties with receptive and/or expressive language skills during typical communication will most likely exhibit difficulties with academics.

Language has been pointed out as fundamental to education because it is the major form of representation of cultural knowledge and the principal medium of instruction (Cowan et al., 2005). Children whose spoken language development is impaired can be at risk for learning difficulties. When learning a new academic subject, language plays a key role in the success of the student. Schleppegrell (2007) states that learning the language of a new discipline is part of learning the new discipline, and, in fact, language and learning cannot be separated.

It is a common myth that math is the least language dependent subject in schools (Schleppegrell, 2007). In fact, as described in Schleppegrell (2007), math is an academic subject that requires a considerable use of language. According to Schleppegrell, both language and math have an apparent innate quality in which the applications and adaptations for both language and math far outstrip instruction. In fact, there is a lot of language in math, which is why students with speech-language impairment may have difficulty with math.

There are multiple systems used to convey meaning in math. These systems include oral and written language, mathematic symbols, and visual representations (Schleppegrell, 2007).

Oral and written language are seen in mathematics classrooms through verbal and written explanations by the teachers. Verbal explanations are commonly used to teach mathematical concepts to students. Mathematic symbols (e.g. +, -, \times , \div , =) require descriptions of meaning and specific patterns of relationships. Visual representations are used to convey specialized representations of information to students. In addition, language and math both include parts of speech.

Arithmetic word problems are difficult for all children, even more so for children with low oral language skill (Cowan et al., 2005). To solve an arithmetic word problem successfully, a child must process and comprehend the linguistic message, access background knowledge of the relationships between sets of numbers, determine the underlying problem structure/schema, select a solution strategy and calculate the solution. Complex story problems place greater demands on mathematical and language understanding because the child has to understand the story in order to identify the arithmetic problem embedded in the words. Cowan and colleagues (2005) suggest that the linguistic demands of story problems contribute to the challenges children with language impairments have, and impact their ability to solve those problems. The authors compared three groups of children: a group of 55 children (7-9 years old) with specific-language impairment (SLI), a group of 57 age-matched children with no known history of speech or language difficulties, and a group of 55 language-matched children (mean age of 6 years old) with no known history of speech or language difficulties. These children were compared on different tasks involving working memory, counting basic calculations of addition and subtraction, addition combinations story problems, transcoding-reading (e.g., reading printed multi digit numbers aloud), transcoding-writing (e.g., writing spoken multi-digit numbers), matching spoken and printed numbers, and relative magnitude. The researchers found, overall,

the SLI group performed lower than the age-matched control group for all skills assessed.

Different factors were described as impacting the children's abilities including nonverbal reasoning, working memory functioning, language comprehension, and instruction.

Schleppegrell (2007) states that as with all school learning, a key challenge in mathematics teaching is to help students move from everyday, informal ways of constructing knowledge into the technical and academic ways that are necessary for disciplinary learning in all subjects. The relationship between language and academics, more specifically impaired spoken language and learning difficulties, is a key factor in helping students succeed academically.

There are several language aspects that are a part of math. When a student learns math, it is from one or a combination of either the teacher's verbal explanation, reading, and/or manipulation of objects. According to Donlan, Cowan, Newton, and Lloyd (2007), the development of conceptual understanding is a central issue in mathematical development which can be complicated by the fact that conceptual understanding is frequently inferred from verbal justification. Although language difficulties seem to impact mathematical development, it is possible that children with specific language impairment develop math conceptual understanding through non-verbal reasoning before procedural knowledge is compromised by linguistic deficits. In a study by Donlan et al. (2007), 48 children (8 years old) with SLI were compared to age-matched peers and to language-matched peers (mean age of 6 years old) on their ability to count aloud, perform simple addition and subtraction calculations presented in spoken form, compare multi-digit numbers, and verify addition and subtraction statements containing numerals that were unfamiliar. The researchers found that the children with SLI had difficulties with production of count word sequences, basic calculation, and understanding of the place-value principle in Hindu-Arabic notation; however, understanding of arithmetic principles was

approximate to the age-matched control group. Many children with SLI in the study were able to grasp the logical principles that underlie arithmetic which means they can understand the concept but have procedural deficits. Such results led the researchers to conclude that the development of knowledge of arithmetic principles may indeed be supported by a separable system.

How oral language impairment affects the development of mathematical cognition during the school years has received little attention. Research has suggested that by learning a spoken language for number, children learn to reason numerically (Becker, 1993). If this is true then children who have language impairment might be considered at risk for deficits in numerical cognition. To investigate this assumption, Arvedson (2002) looked at enumeration and numerical reasoning levels of 19 children (ages 3;7-5;2) with SLI and compared them to 19 age-matched and 19 grammatical ability-matched peers (ages 2;0-3;5). The author found that children with SLI had numerical understanding above their level of grammar and were better able to demonstrate their numerical understanding when language was not required. The author also found that some aspects of numerical cognition are language-dependent. The numerical tasks that were language-dependent in this particular study were reproduction of sets, numerosity of sets, and transformation of sets. These tasks required the children to follow directions, use mental representations, and understand how adding and subtracting changes an array of items.

The Math Language

Studies have suggested that math should be thought as a language (Wakefield, 2000; Nesher & Katriel, 1986). There are several reasons math can be thought of as a language. Harley (1995) briefly defined language as a system of symbols and rules that enable communication. Harley's view, by definition, qualifies mathematics as a language because language is a system of symbols and rules that enable communication. Nesher and Katriel (1986) suggested that

language and mathematics intersect and at some point overlap. This overlap is due to the language aspects that are evident in math. There are several attributes that are shared between language and mathematics such as abstractions, which can be described as verbal or written symbols that are used to represent ideas or images (Wakefield, 2000). These abstractions are used to communicate.

The National Council Teachers of Mathematics (NCTM) has acknowledged that mathematics can be thought of as a language, which must be meaningful if students are to communicate mathematically and apply mathematics productively (NCTM 1998; 1989). According to Wakefield (2000), in both language and mathematics symbols, rules are uniform and consistent. Expressions are linear and serial, and the understanding of mathematics increases with practice just as it does with language. Success in language requires memorization of symbols and rules, which holds true for mathematics as well. A few more items that contribute to the language and math relationship are that translations and interpretations are required for novice learners, and meaning is influenced by symbol order (Wakefield, 2000).

Mathematics can also be thought of as a second language because there are many similarities between learning math and learning a second language. For example, new languages are best learned in a state of cultural immersion, and language educators agree with this because it forces the individual to learn (Wakefield, 2000). When a student is in math class, it is best for them to learn in a community where math is spoken on a regular basis to take the role of immersion (Wakefield, 2000). It is also said by Wakefield (2000) that people learn second languages by listening, which coincides with the idea that spoken math exposure should occur before written math.

Mathematical language is also an important factor in students' development of thinking (Morgan, 2005). Students need to have the vocabulary of math to be able to talk about mathematical concepts such as division, perimeters, or numerical difference because without this knowledge progress will not be made (Morgan, 2005). In order to learn the math language, students need the following skills: problem-solving, reasoning and proof, communication, connections, and representations (National Council of Teachers of Mathematics, 2000). Without these skills, students may struggle with math and fail academically. The school SLP is often the professional who helps students who are struggling with those skills, and therefore needs to be aware of relationship of between language and mathematics in order to provide an effective intervention.

Role of the SLP

Speech-language pathologists can take on different roles for speech and language therapy in the school setting. It is up to the speech-language pathologist to use his or her clinical judgment and follow evidence-based practice guidelines to choose an appropriate service delivery model. ASHA recognizes several delivery models in school settings; however, it has long emphasized the importance of the collaborative service delivery model (ASHA, 1991). Under this model, SLPs work as a member of a transdisciplinary team consisting of educators, parents, and the student. All team members are typically aware of the student's entire curriculum, and team members share responsibility for specific educational goals. Under such a model, most special services, as well as regular instruction, take place within the classroom. According to ASHA, such a service approach allows for maximum curriculum integration, and facilitates generalization of targeted skills, where SLPs can meet and enhance the academic and language

needs of students in an ecologically valid context to facilitate student progress and academic achievement.

Under the Individuals with Disabilities Education Improvement Act of 2004, progress within the general curriculum needs to be addressed in the individualized education program (IEP). According to ASHA (2010), SLPs are being urged to provide educationally relevant therapy to the students on their caseload, which includes therapy that impacts acquisition of curriculum. To comply with the IDEA, school SLPs have the responsibility to relate therapy to progress in the general education curriculum. They need to assist students in the acquisition of language underpinnings of the curriculum. In order to do that, they need to be familiar with the curriculum, as well as identify the specific language skills and strategies required of students in the general education curriculum to target appropriate goals for curriculum-relevant therapy (Ehren, 2000).

ASHA (2010) recognizes the importance of collaboration among professionals in the schools. Speech-language pathologists' views about instruction may complement and augment other professionals working with students on their caseload (ASHA, 2010). According to Ehren (2000) school SLPs taking part in in-classroom services may have two main concerns: they are becoming classroom teachers or aides, and/or they feel they are not providing their students with proper therapy. However, SLPs need to know and recognize that they are different from classroom teachers. They know that they have different expertise and can use that to complement the teachers using a different knowledge and skill base than the classroom teachers (Ehren, 2000). SLPs should not teach in the realm of subject teaching; however, they can assist students to acquire the language underpinnings of the curriculum. In order to do this, SLPs must be

grounded in curriculum content so they can use their expertise and therapeutic skills to provide therapy to children in schools.

When an SLP decides to provide in-classroom services, his/her main responsibility should be to provide direct and indirect services to students on the caseload (Ehren, 2000). The SLP must keep in mind the focus is therapeutic by applying clinical curriculum-relevant procedures in the educational setting. For example, the classroom teacher has assigned a math worksheet for the students to complete. The SLP should not help the student complete the problems but should instead help the students interpret the language and set up the problems to be solved. This is a curriculum-relevant therapy approach and has the potential to directly facilitate academic success (Ehren, 2000).

Being familiar with the curriculum is necessary for the analysis of language underpinnings. Therefore, "Identifying the specific language skills and strategies required of students in the general education curriculum is the first step in targeting appropriate goals for curriculum-relevant therapy and assisting classroom teachers in addressing any difficulties the students may encounter" (Ehren, 2000, p. 222). It is ultimately the SLP's job to analyze language underpinnings that are proving to be difficult for the students on their caseload and provide specific therapy to address the underpinnings.

Chapter 3: Methodology

Study Design

This study explored SLPs' perspectives and roles through a qualitative research approach. Semi-structured interviews were used to gather school SLPs' perceptions on the co-occurrence of language disorders and academic math difficulties as well as information on what SLPs do in therapy to help students exhibiting such problems to improve academically. Open ended questions were asked along with follow up questions for clarification when needed.

Participants

The participants in this study included 10 SLPs who work in public elementary schools in Southeast Michigan. They were recruited via email or phone call across Southeast Michigan. Contact information was derived from school websites and word-of-mouth. Informed consent was obtained from all participants, and no incentive was offered for participation. No participant was excluded based on years of work experience or caseload diversity.

Table 1 outlines the demographic characteristics of the participants of this study. The SLPs' years of experience working as an SLP ranged from one to 35 years, and their years of experience working as an SLP in a public school ranged from one to 35 years. Four of the SLPs who were interviewed worked with preschool students as their youngest population. One SLP worked with a range of students from kindergarten to twelfth grade. Five out of the 10 SLPs interviewed worked with kindergarten through fourth- or fifth-graders. The caseload size of the SLPs ranged from 30-70 students. Eight out of 10 SLPs worked solely as an SLP in public schools and two out of 10 SLPs had previously worked as an SLP in a different setting.

Participants of this study were recruited via email. They were informed through written forms and verbally of all procedures and goals of the study before committing to participate.

Each participant was asked to meet for an individual interview which lasted between 30-60 minutes. Consent forms were given to each participant before each interview stating that participation is voluntary and they have permission to withdraw from the study at any time. Pseudonyms and random initials were used throughout this document to keep participants and their schools anonymous to the extent required by the Human Subjects Approval.

Table 1

Participant Demographic Characteristics

SLP	Years as SLP	Years as school SLP	Grade Levels Served	Caseload
1	13	13	Preschool-5	47
2	22	7	K-5	55
3	14	12	K-5	33
4	35	35	K-5	70
5	2	2	K-4	64
6	3	3	Preschool-1	45
7	8	8	Preschool-5	35
8	1	1	K-5	49
9	29	29	Preschool-5	56
10	30	30	K-12	30

Data Gathering Procedures

With the participant's permission, each interview was audiotaped and later transcribed by the researcher to allow for detailed analysis of the responses. During the scheduled interview,

participants were asked open-ended questions as well as follow-up questions to allow for additional information or clarification on a previous statement. Interview questions included:

SLP Interview Questions

- How many years of experience do you have working as an SLP?
- How many years of experience do you have working as an SLP in a public school?
- What grade levels do you serve?
- How large/diverse is your caseload?
- What type of service delivery model or models do you use (pull-out: individual &/or group sessions; in-classroom service; consultative; etc.)?
- What influences your selection of a service delivery model for a particular student?
- What are the differences between academic goals across the ages/grades you provide services to?
- What are the differences in initial assessment across the ages/grades you provide services to?
- What are the differences of intervention across the ages/grades you provide services to?
- What are the differences of evaluation across the ages/grades you provide services to?
- What academic challenges do you observe on your caseload?
- What are the most common academic challenges you observe on your caseload?
- Do you address academic difficulties of students on your caseload? If so, how?

- In your opinion, how important it is for SLPs to address the academic difficulties experienced by students on their caseload?
- In your opinion, is there a relationship between language skills/difficulties and academic achievement in math? If so, how are those related?
- Do you address math difficulties in the therapy you provide to students who are struggling academically? If so, how exactly do you do that?
- How much time on average do you work on academic goals each week?
- Do you assess the effectiveness of your intervention on student's academic achievement? If so, how do you assess that?
- How effective do you think the service you provide is in addressing students' academic difficulties?
- What do you think could contribute to the effectiveness of your service for those students who are struggling academically, especially in math?
- Have you ever attended a workshop that focused on academic achievement?
- Have you received any specific training to address academic difficulties in therapy?
- What interaction do you have with the students' classroom teachers and other staff in your school?

Chapter 4: Data Analysis and Findings

The data collected through the interviews was transcribed and analyzed for common themes. Interview questions guided the development of data categories, and participants' responses were cross-referenced to assist with the identification of common themes. Analysis of the interviews revealed four main themes, which are discussed in the following sections.

Theme A: Relationship between Language Difficulties and Academic Achievement in Math

All SLPs who participated in this study stated there is an important relationship between students' language skills and their academic achievement in math. The relationship was described as dependent on the different components of math. A clear distinction was delineated between what the SLPs labeled as "concrete" versus "abstract" math.

The distinction between "concrete" and "abstract" appeared to be problem based. For instance, SLP1 stated, "A lot of the concrete just like adding and subtracting students with language deficits usually do fine...because it's very visual, it's very concrete, but as soon as you throw in a story problem that's where they struggle." Basic number facts such as single-digit addition and subtraction are often memorized by students. Once a story problem is introduced, a reading component is brought into the problem and students often struggle. Although math is comprised of numbers, these numbers may be mixed with words and concepts which lead to academic difficulties. SLP8 stated, "Some of my students with language impairments...math is a strength for them when it's strictly number based. A lot of them really struggle as soon as you put language in there." SLP4 stated, "Math is a language too." She went on to explain that math is so much more than numbers by stating, "What happens is...they can do the calculation part but math is so much more. You need to know how to do times and addition and subtraction...but that doesn't mean you understand the concepts of it or you can apply it."

The SLPs cited all or a combination of the following common language based areas when describing how math is directly related to language: concepts, vocabulary, problem solving, and following directions. In reference to concepts, SLP9 stated, "If they do not have the understanding of the concepts, especially the younger grades, like *many, few, several*...they get lost in the verbage and they cannot complete the task." Students with language impairments have difficulty understanding concepts because they are abstract and more difficult to understand than more concrete items.

In addition to concepts, vocabulary is another important area that is directly related to language. Vocabulary that is used in math is very important to the students' understanding of math in the classroom. If the student does not know the vocabulary the teacher is going to be using, they will struggle to learn it. One SLP mentioned, "A lot of my kids have a hard time with...math vocabulary. We do a lot with what does adding mean, what are adding words, what does subtracting mean." Another SLP said she will go over not only the vocabulary the students are currently working on, but also over the vocabulary words the students will work on in the future. By working on vocabulary that will be used in the future in the classroom, the SLPs are anticipating the needs of the students, and hoping to facilitate their learning.

Following directions and problem solving were also mentioned as underlying factors in the relationship between math and language skills. However, no SLP clearly explained such underlying relationship, making only generic comments when trying to describe it. For instance, SLP1 said, "...they need to be able to process multiple steps," but did not make any specific reference to what exactly was involved in the process as related to learning math. When asked to elaborate on the relationship between following directions and problem solving as related to

students' ability to understand math, one SLP mentioned, "I haven't had much time to explore it." (SLP8).

Organization was also mentioned by one SLP as being an important skill for students who are struggling in math. SLP9 raised an important point by saying, "If they are writing all over the place how are they going to do the columns and add things up?" This comment is very important because although children may memorize basic one digit math facts, as they get older and start doing multiple digit additions, their work must be organized so they do not make calculation mistakes due to disorganized writing. In addition to the writing characteristic of organization, there are other aspects of organization that are relevant and may negatively impact math, such as showing work when solving math problems at any grade level, organizing and implementing a solution strategy methodically for word problems that increase with difficulty as grade levels increase, and following math guidelines such as *order of operations*.

Theme B: Addressing Math Difficulties

SLPs who work in the public schools have the responsibility of working with students who have speech and language impairments that negatively affect their academic performance. According to ASHA, one of the responsibilities of school based SLPs is to assess students with disabilities and determine whether or not their disorder impacts their education; if it does, the SLP can address personal, social/emotional, academic, and vocational needs that impact educational goals (ASHA, 2010). The participants in this study acknowledged such responsibility and described it as core to their practice in a school setting. They all emphasized that since students' impairments may affect their academics, SLPs are expected to provide intervention that is academically based. For instance, SLP8 stated "...because I am their school SLP I think that is my primary goal...helping them succeed within the academic environment."

SLP1 emphasized how such responsibility underlies the SLP practice in a school setting: "In the schools it's the only thing you do. In the schools if you're not doing that then you are truly doing your students a disservice. If you don't address academic difficulties working as a school SLP you should chose a more medical based model."

It is important to note that providing academically based services can be a point of contention as highlighted by one of the SLPs' comments regarding how the role of the SLP in addressing academic difficulties has changed over the years: "More recently we are expected to address those academic needs in our field. I feel like we are becoming specialists in all areas which is hard because I'm expected to work on those areas" (SLP2). Her comment is congruent to the concerns highlighted in the literature, which emphasize how important it is for SLPs to know that they have different expertise, knowledge, and skill base than the classroom teachers (Ehren, 2000). SLPs should complement the teachers' work, and the underlying common ground should be the curriculum and academic standards, not the specific activities they do.

The SLPs not only acknowledged their responsibility to address academic difficulties, but they all reported addressing academic difficulties presented by students in their caseload. Eight out of the 10 SLPs stated they address academic difficulties by setting academic related goals based on the Grade Level Content Expectations (GLCEs, four SLPs) or the CCSSs (four SLPs). The SLPs in the study explained that they follow either the GLCEs or CCSSs and use those standards to write academic goals for their students. "My district focuses highly on the core standards so I use those and those are for each grade level...driven and geared towards specific levels...related to the curriculum," according to SLP8. Since the CCSSs are new to the districts the SLPs work in, they have had limited experience writing goals based on the CCSSs. "...In our district...right now we are using the GLCEs...it will be switching to the common core next

year..." stated an SLP. The integration of the CCSSs allows the SLP to make sure their goals are academically based. Two SLPs did not specify their source of information for writing academic-based goals.

The SLPs identified reading and writing as the most common academic difficulties addressed by them. Although all 10 SLPs reiterated the importance of addressing academic difficulties in their caseload, only five of them listed math as an academic subject they help their students with. When asked specifically if they address math, nine out of 10 SLPs responded they do address math academic difficulties.

The SLPs who address math difficulties do so in different ways. One SLP stated she uses the Boehm Test of Basic Concepts-3 (Boehm-3) to identify concepts the students struggle with. She said, "...it tests 50 different concept words like *first, second, third, beginning, middle, and end* and a lot of quantitative concepts." This assessment requires students to identify the picture which best exemplifies the concept from a field of three to test these basic concepts and allows the SLP to see what concepts the student struggles with without it being necessarily in the context of math. The use of this test can help guide the SLP's therapy in teaching the students about quantitative concepts that will be used throughout the math curriculum.

Another SLP stated that she does not address math that often but went on to explain a time she did. She said, "Not that often, but in one of the private schools some of the classroom teachers asked me to address that so what I would do is just the vocabulary part of it and review that to give them the knowledge and would hopefully carry over into their classroom." A few SLPs stated that they will work on the vocabulary used in math with their students. One SLP explained she works on the vocabulary and story problems. She said, "...most of it is with vocabulary or story problems and picking out the important details...a lot of times I'll read the

story problems for my auditory processing kids and then have them pick out the important details to work on receptive skills..."

Although SLPs know it is important to address academic difficulties, math is not always addressed. One reason stated for not addressing math is that they don't have enough time to explore it. For instance, SLP7 stated, "I wish I could do more for each student...but when you have six grades of math curriculum you can't keep up with it all." With smaller caseloads, SLPs may be able to provide more services targeting math achievement. Another reason mentioned was lack of training opportunities. One of the SLPs mentioned that she does "...not recall seeing any workshops targeting math academic achievement for students with speech and language impairments" and thinks the field of speech-language pathology should explore that aspect.

Theme C: Accountability of the SLP

SLPs play an important role in helping their students who have language impairments. Ultimately, they strive to help them become more successful in their academic studies. All 10 SLPs who were interviewed stated they thought they were effective to some degree ranging between moderately effective and very effective. Nine out of 10 SLPs hold themselves accountable and assess whether they are being effective in providing intervention by assessing whether or not the technique they are using is helping the student be successful. One common reason SLPs stated as something impacting their assessment of treatment effectiveness was that they do not have enough time.

A few ways SLPs hold themselves accountable in providing effective therapy are by tracking daily progress and tracking monthly progress. Although SLPs track the progress on a daily and monthly basis, it was not specified whether the progress tracked is related to math. One SLP explained, "I keep a data log so every time I see a student I record." This particular SLP

uses her daily data log throughout the course of treatment and at every marking period goes through the log to make a synopsis. This allows her to see if the therapy she is providing is effective and whether or not she needs to change her therapy to better meet the students' needs.

Not only did the SLPs report keeping a daily log of data obtained in their therapy sessions, but half of the SLPs reported also doing progress monitoring on a monthly basis. SLP10 stated, "I do progress monitoring once a month...I'll document their progress." Monitoring the students' progress on a monthly basis holds the SLP accountable because they are constantly looking to see if their students are making progress. If their students are making progress, then their treatment is effective. In relation to progress monitoring, no SLP stated whether they specifically monitored math achievement related goals.

In addition to tracking progress through a daily data log and monthly progress reports, one SLP stated teacher reports help her assess how effective her intervention is. Teacher reports allow the SLP to see if her therapy is being carried over into the classroom. If there is carry over in strategies then the treatment is more effective. Since goals are academically based, teacher reports can be very helpful in holding the SLP accountable for the therapy provided.

Theme D: Factors Influencing Treatment Quality

Several factors came up throughout the interviews that related to the quality of intervention. The main factors mentioned affecting intervention were time, caseload size, and paperwork. The SLPs felt very strongly that these three factors influenced their treatment.

Not having enough time and caseload size were common concerns of the SLPs. Not having enough time was not only mentioned in relation to assessing intervention effectiveness, but also for influencing treatment quality. One SLP stated, "...my only major concern is that our caseloads are high and I think I could do more in-classroom type services if I had more time."

Another SLP had a similar response and said, "It would be nice to have more time to focus and less kids on your caseload."

Another aspect that was mentioned as being an important component to quality treatment is collaboration with the teachers starting at the beginning of the school year. At the beginning of the school year, one SLP explained she tells the teachers what students have which goals. SLP7 said, "At the beginning of the year...I try to give every teacher a heads up on the goals the students are working on for the year." This communication between the SLP and classroom teacher allow for a team approach and makes the teacher aware of what goals the students focus on in speech and language therapy. As highlighted in the literature, collaboration between teachers and SLPs seems to be key to guarantee high quality services and improved academic outcomes (ASHA, 2010).

Not only is communication important at the beginning of the school year, but the communication must happen throughout the school year. The SLPs stated they are constantly talking to teachers and other professionals such as resource room teachers in the school. One SLP stated:

I'm always meeting with teachers whether it's passing by in the hallways or meeting as a team. We try once a week or every other week as a special education team to discuss. I even meet with the reading specialist. When I bring things to teachers' attention, they are more aware.

Collaboration between the SLP and other professionals in the school leads to more effective intervention because the student is not always with the SLP. It is important for the SLP to communicate to the teacher what each student's goals are and the progress they are making towards the goals so the teacher is aware and can help address difficulties in the classroom,

especially when the SLP does not have an opportunity to implement a push-in service delivery model. If the teacher is aware of the students' deficits, they can help the student for additional time since the SLP has limited time with each student.

Four SLPs also mentioned that, in addition to working collaboratively with teachers and other professionals in the school, they work with the students' parents as well. The extent of parent collaboration mentioned in this study was related to homework assignments. Most SLPs reported they do not assign homework assignments unless the student requests homework. It was also noted that if the SLP knew the homework would be completed, they were more likely to assign homework assignments. It is important to note that none of the SLPs mentioned whether or not the homework assignments would target students' specific academic difficulties, and/or just general speech-language difficulties.

Chapter 5: Discussion

The findings of this study corroborate previous studies indicating a relationship between language impairments and academic difficulties, including math (Cirrin & Gillam, 2008; Ehren, 2000). The SLPs in the present study recognized such relationship in their caseload. Three major common language based areas were described by SLPs as important to the relationship between language and math: concepts, vocabulary, and problem solving. These findings were consistent with previous studies that found concepts, vocabulary, and problem solving to be language barriers of the math curriculum (Donlan et al., 2007; Morgan, 2005; Cowan et al., 2005, National Council of Teachers of Mathematics, 2000).

The SLPs' report of the math reliance on key concepts is congruent with studies suggesting that children with language impairments may be at risk for deficits in the acquisition of numerical concepts, which are key for learning math (Arvedson 2002; Cowan et al., 2005). Understanding key concepts affects students' academic achievement in all academic areas, especially math. This is compatible with a previous study that stated conceptual understanding is the central issue in mathematical development (Donlan et al., 2007).

Students need to have the vocabulary of math to be able to talk about mathematical concepts such as division, perimeters, or numerical difference, and without this knowledge progress may not be made (Morgan, 2005). SLPs who participated in this study highlighted the importance of vocabulary for learning, including math. Students with a language impairment might have difficulty understanding grade-level curriculum and a less diverse vocabulary than their peers. Since their vocabulary is not as developed, they struggle academically because the curriculum becomes more advanced as the grades increase.

SLPs who work in the public schools are legally bound to address speech and language needs that adversely affect a student's academic performance (ASHA n.d.-b). Participants of this study acknowledged such responsibility and described it as core to their practice in a school setting. They emphasized the need for intervention to be academically based, highlighting the need to target appropriate goals for curriculum-relevant therapy (Ehren, 2000), and indicating that therapy that is not curriculum based is not beneficial to students.

The SLPs stated they address academic difficulties by setting academic related goals. They cited both the GLCEs and the CCSSs as sources for writing their academic-based goals. By tailoring therapy goals to the CCSSs, SLPs can improve students' speech-language outcomes, and hopefully, their overall academic success (ASHA, n.d. -b). The CCSSs have goals under the category of language related directly to knowledge and ideas (concepts), vocabulary acquisition and use (vocabulary), and craft and structure (problem solving) (National Governors Association Center for Best Practices & Council of Chief State School Officers, 2010). These categories address the areas of math that were referenced by the SLPs in this study.

It is important to note that, although the SLPs seemed to be aware of the need to align goals to the CCSSs, not all of them were familiar with the common core. For instance, the SLPs who cited using the GLCEs as a source for writing academic based goals reported being unfamiliar with the CCSSs. They reported having limited experience writing goals based on the common cores, due to the fact that their district was still in the process of implementing them.

As described in the previous chapter, all SLPs interviewed in the study acknowledged an important relationship between students' language skills and their academic achievement in math. However, while reading and writing were identified by the SLPs as the most common academic difficulties they address, only half of the SLPs spontaneously listed math as an

academic subject they help their students with. When the SLPs were further probed, four additional SLPs stated they address math difficulties of the students on their caseload.

As presented in the previous chapter, the SLPs who address math difficulties seem to do so in different ways. The underlying thread seemed to be a focus on vocabulary and/or concepts. However, none of the SLPs mentioned the use of a specific procedure or evidence-based practice, as guiding their practice while addressing math difficulties that co-occur with language difficulties.

The SLPs identified different factors as limiting their intervention to math difficulties in the school setting, among which include, time, caseload size, and lack of training. Indeed, time and caseload size were also identified as affecting overall quality of service, not only to goals related to math. High caseloads have long been a source of concern among school-based SLPs (ASHA, 2004; ASHA, 2012). Given the need for academic-relevant intervention, school-based SLPs need to become familiar with curriculum and standards across grade levels. High caseloads reduce the availability of time for planning and implementing academic-relevant services (ASHA, n.d. -a).

High caseloads can also impact SLPs' ability to collaborate with teachers, as it can reduce the availability of time for collaboration necessary for transfer and generalization of strategies and skills. The SLPs in the present study cited collaboration as an important factor for quality intervention. All SLPs who were interviewed explained that the communication between the SLP, classroom teachers, support staff, and parents are going on constantly. It is important to communicate with the classroom teachers to see if skills that are addressed in speech and language therapy are carried over into the classroom. It is also important to collaborate with other support staff in the school and parents to provide the SLP with feedback, views about

instruction, and also to help brainstorm the student's strengths and weaknesses to assist in developing interventions that promote student's overall academic success.

Chapter 6: Conclusions

This study provides some insight to SLPs' perspectives on the relationship between language disorders and academic achievement, especially math, as well as their role in working with students with academic difficulties. The SLPs not only acknowledged their responsibility to address academic difficulties, but they all reported addressing academic difficulties presented by students in their caseload. In addition, all SLPs interviewed in the study acknowledged the important relationship between students' language skills and their academic achievement in math. However, while reading and writing were identified by the SLPs as the most common academic difficulties addressed by them, only half of the SLPs spontaneously listed math as an academic subject they help their students with.

Providing academic relevant services is not only mandatory for SLPs, but very important if one wants to improve students' overall academic success. The SLPs in this study emphasized the importance of aligning their therapy goals to the curriculum and GLCEs or CCSSs. As presented in the findings, the SLPs identified different factors as limiting their intervention to math difficulties in a school setting, among which, lack of training opportunities. A need for further training to better equip them to provide services for students on their caseload who are experiencing math difficulties was expressed. Development of workshops targeting math achievement for students with language difficulties should be explored by school districts to facilitate academically based interventions for those experiencing difficulties in math.

The SLPs who participated in this study also cited caseload size and lack of time as detrimental to their efforts to address academic difficulties, including math. As the SLPs need to become familiar with the CCSSs to align therapy goals to the cores, caseload size can become an even more pressing issue. Manageable caseload size is an important advocacy issue that needs to

be pursued in order to facilitate SLPs' ability to provide effective services and make the greatest impact on students' learning.

Results also indicated that SLPs in the present study who address math difficulties do so in different ways. These results seem to point to the lack of standard procedures in the field of speech-language pathology to address math difficulties among those with co-occurring language difficulties. Although a standard procedure might not be ideal or possible given the diversity of student clienteles and school dynamics, a general guideline could facilitate the service provision for those with math difficulties.

Limitations of the Study and Directions for Future Studies

While the findings of this study are partially generalizable to reflect school-based SLPs' perspectives regarding their service to children experiencing academic difficulties, qualitative studies, as defined by Bogdan and Biklen (1998), are not always generalizable in the truest sense of the word. The limited number of participants and the small geographical region are all limiting factors of this study. A similar, survey-based study performed on a larger group of SLPs representing a wider region would be beneficial in determining whether the findings highlighted in this study accurately reflect the perspectives of the majority of SLPs who work in school settings. In addition, future studies should focus on other school settings, including charter and private schools, as well cover a broader grade level range the SLPs provide services for. A survey-based study conducted in a variety of school settings would be beneficial in determining whether the findings highlighted in this study accurately reflect the perspectives of the majority of SLPs in school settings other than public elementary schools.

This study did not investigate potential differences in language therapy between grades at the elementary school level. Future studies should consider examining the differences in

curriculum and how school-based SLPs address co-occurring math difficulties in lower elementary grades versus upper elementary grades. Future research should also examine the differences in the types of training school-based SLPs receive and how that impacts their approach to working with students on academics, especially math. It should look at factors such as years of experience, types of training, and teacher certification to see if these factors impact whether or not and how school-based SLPs address math difficulties.

It is important to note that the present study did not consider the impact of specific language disorder types on math acquisition. Future research addressing specific language disorder types and math acquisition may be beneficial to provide SLPs with information for addressing specific math difficulties with students on their caseload. Future studies should also investigate whether SLPs use different service delivery models to address students' academic difficulties, especially math, and how effective those models are in promoting academic achievement. Such data may provide valuable information to school-based SLPs and improve service delivery models used for students with language disorders who have co-occurring math difficulties.

The SLPs in this study clearly indicated the importance of maintaining a constant communication with teachers as a way to assess the SLPs accountability related to academic achievement, as well as to provide comprehensive treatment for students in their caseload. Future studies should focus on investigating the dynamics underlying the trans-disciplinary approach through the perspectives of other professionals, especially teachers. A comparison of perspectives of different school professionals, including SLPs and teachers, may provide valuable information and improve intervention services in school settings for those with math difficulties and co-occurring language disorders.

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**Eastern Michigan University
College of Education
Review Committee on Student Research
Involving Human Subjects Committee Action**

Project Title: Language Therapy and Academic Achievement
in Mathematics: Speech-language Pathologists' Roles and
Perspectives

Principal Investigator (must be a faculty member): Dr. Ana Claudia Harten

Department: Special Education

Co-PI / Student Investigator: Rachel Richter

Approved []

Conditional Approval []

Disapproved []

Exempt []

Not exempt []

Reasons, if disapproved:

N/A

Comment:

Well set up human subjects proposal. Cleared to collect
data.

Signature for the Committee:
2013



Date: May 7,

* Please note that all Human Subjects Proposals need to be submitted well in advance of scheduled solicitation of potential participants and that **no data involving Human Subjects should be collected prior to approval.**

NOTE

1. Investigators are obligated to advise the review committee of any change in protocol that might bring into question the involvement of human subjects in a manner at variance with the considerations on which the prior approval was based.
2. Every 12 months from the date of this approval or at shorter intervals where specified by the committee, the investigator must submit the proposal to the committee for re-review.
3. Investigators are required to immediately suspend an inquiry if they observe an unanticipated negative change in the health or behavior of a subject that may be

attributable to the research, and shall report the circumstances promptly to the review committee for its further review and decision on continuation or termination of the project.