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Coteaching at an Elementary School Level in a Suburban Setting

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COLLEGE OF EDUCATION

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2016

Abstract

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CAS, SUNY Oswego, 2005

MS, Nazareth College, 1995

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Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Since leaders of a Central New York school implemented integrated cotaught (ICT) classrooms, no local investigation of ICT has taken place, leaving district administrators without empirical evidence of the value and effectiveness of the ICT services. The purpose of this study was to investigate the association between ICT services and student academic achievement in English language arts (ELA) and mathematics, as measured by the New York State ELA and mathematics assessments for 4th and 5th graders. Vygotsky's paradigm of cognitive development, which states that learners acquire knowledge through collaborative interactions with other students, guided this study because ICT classrooms emphasize social learning for students of all abilities. Research questions were used to determine the differences in ELA and mathematics performance between students with disabilities (SWD) in ICT and non-ICT classroom settings. An analysis of covariance compared math and ELA achievement of 4th and 5th grade classes from the 2008-2009 academic year (AY), 1 year prior to ICT implementation, to 4th and 5th grade classes from the 2009-2010 AY, 1 year after ICT implementation. With a census sample of 103 students, both 4th and 5th grade ICT classes scored significantly higher on the ELA than the non-ICT classes, $p = .011$ and $p = .001$, respectively. Also, both 4th and 5th grade ICT classes outperformed their non-ICT counterparts significantly in mathematics, $p < .001$ and $p < .001$, respectively. This study contributes to social change by informing administrators, teachers, and the educational community that the provision of special education services (ICT) in general education classrooms is associated with increased academic achievement for SWD.

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Dedication

I dedicate my study to my mother, Linda Lee Cook, and my grandmother, Frances Elizabeth DeWeaver.

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In order to finish a doctoral study, one must have a fabulous committee chair, which I had in Dr. Kathryn Swetnam. Her upbeat attitude, cajoling, prodding, encouragement, and investigative skills supported me during the ups and downs of the doctoral study process. Through Dr. Kate's unwavering support, I made it to the finish line.

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I also wish to thank Dr. Steven Wells, University Research Reviewer. Dr. Wells provided vital constructive criticism that required me to think deeper, so I could clearly articulate all aspects of my study to my intended audience. Without his questions, my research would have not reached the caliber it is today.

Finally, I would like to thank my family, friends, classmates, and colleagues who supported me throughout this journey. Their belief in my abilities kept me motivated to finish.

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Section 1: The Problem

Introduction

As public schools emerged in the United States, students with disabilities (SWD) were secluded from their peers. From the 1800s to the 1940s, children with disabilities were typically secluded at home, sent to day schools, or institutionalized (Osgood, 2008). When SWD attended public school, most were segregated into self-contained classrooms separate from their nonidentified peers. The focus of the special classes was centered on behavior, blindness, deafness, speech impairments, and chronic physical ailments. Watson (1938) led the charge in how to view children with disabilities differently and proposed that society should maximize the potential of every person, no matter his or her cognitive, physical, or behavioral level. Dobbs (1953) continued this theme by espousing that defects were not necessarily limitations, if society provided the right supports. Despite the new insights about disabilities, segregation remained the dominant educational setting for students with disabilities (Osgood, 2008).

Other than compulsory school attendance laws, federal and state governments had little to do with developing special education until the 1960s. In 1963, President John F. Kennedy and the U.S. Congress passed Public Law (PL 88-156), which addressed mental retardation, as well as PL-164, which provided funding for research and construction projects that related to special education and the disabled (Osgood, 2008). In 1965, the Elementary and Secondary Education Act was enacted by Congress, which culminated in PL 94-142, the Education for All Handicapped Children Act (EAHCA, 1975). This law established standards for a free, appropriate public education (FAPE) for all SWD in

order for states to receive federal funds (EAHCA, 1975). After the passage of these laws, the argument no longer centered on whether or not SWD should be included in public education settings, but rather focused on the amount of time SWD were in the general education classroom and special education service delivery (Osgood, 2008).

The EAHCA, PL 94-142 (EAHCA, 1975), was eventually renamed the Individuals with Disabilities Education Act (IDEA, 1997) and was revised to strengthen the integration of SWD in private and public schools. Congress approved the latest revision to IDEA, which evolved into the Individuals with Disabilities Education Improvement Act (IDEIA) in 2004, with final regulations published in 2006 and 2011. Each of the revisions placed an emphasis on educating SWD to the greatest extent possible within general education classrooms, which is considered the least restrictive environment (LRE) for most children. Furthermore, the adoption of the No Child Left Behind Act of 2001 (NCLB, 2002) required that all schoolchildren have access to the general curriculum and learn from highly qualified teachers.

To comply with federal laws, some schools began to implement coteaching as a means to meet the required mandates (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010; Kilanowski-Press, Foote, & Rinaldo, 2010; Kloo & Zigmond, 2008; Minarik & Lintner, 2011). Coteaching, as defined by New York State's Board of Regents, "means the provision of specially designed instruction and academic instruction provided to a group of students with disabilities and non-disabled students [by a special education teacher and general education teacher jointly]" (New York State Education

Department [NYS-ED], 2008, p. 2). However, limited research exists on the effectiveness of coteaching in increasing student achievement.

The intent of this quantitative study was to examine coteaching as a service delivery model. In Section 1, I define the problem regarding coteaching; provide a rationale based on evidence at the local and global levels; state the guiding research questions; and articulate what coteaching is, how it works, and the advantages and disadvantages of coteaching.

Definition of the Problem

In 2007, as a result of research-based instructional practices and the desire to service SWD within the general education classroom to the maximum extent possible, the New York State Board of Regents approved an amendment to 200.6 of the Regulations of the Commissioner of Education (NYS-ED, 2008). Prior to the amendment, resource room services (a pull-out model for service delivery) required a student with a disability to receive a minimum of 3 hours of service per week and to receive consultant teacher services (a push-in model for service delivery) a minimum of 2 hours per week. The amendment allowed both services to be combined, so that a student would receive a minimum of 3 hours a week total, which would result in more time in general education settings. Integrated coteaching services were not a part of the continuum of services that a SWD could receive. The amendment, which related to consultant teacher, resource, and integrated coteaching services, went into effect July 1, 2007. However, NYS-ED failed to provide guidance on the amendment until almost 1 year later, in April of 2008. By not operationalizing the means for how the amendment would be implemented in schools, the

staff was left with questions and was unsure of how to implement the models as described.

The memorandum from the state's coordinator for special education provided the definitions and related requirements pertaining to integrated coteaching, resource, and consultant teacher services. New York State's Board of Regents defined integrated coteaching services as "a general education teacher and a special education teacher jointly providing instruction to a class that includes both students with and students without disabilities to meet the diverse learning needs of all students in a class" (NYS-ED, 2008, p. 3). The memorandum also stated that integrated cotaught (ICT) classes must minimally include one special education teacher and one general education teacher and no more than 12 students with individual education programs (IEPs). Additional personnel, such as teaching assistants, if used, could not fulfill the role and responsibilities of the special education teacher in an ICT classroom. The ICT services could occur in one or more content areas.

From 2008 to 2009, as a result of this amendment and expressed concerns from general education and special education teachers, the Special Education Department at Cayuga Central School District (pseudonym), a school district situated in Central New York on the outskirts of a large city, convened a K-12 committee, consisting of administrators, special education teachers, and school psychologists, to examine special education services delivered to SWD, particularly at the elementary level (K-6). Special education teachers in the district provided a ratio of 15:1 student-to-teacher services to those students requiring support in ELA and/or mathematics, as well as those students

requiring resource and/or consultant services. This ratio refers to the number of SWD at any one time with the support of one special education teacher in a general education setting. As a result, special education teachers self-reported either under- or over-servicing students, causing general education teachers to report that they felt inadequately supported. Based on the conclusions of the committee, as related to the special education services provided in the district at the time, an ICT model was reviewed (ICT committee, personal communication, November 3, 2008). The committee decided to remove the 15:1 student-to-teacher services at Grades K-5 for the 2009-2010 academic year (AY) and implement ICT classrooms for those students who had required 15:1 student-to-teacher special education services. The ICT classes were not implemented for Grade 6 because the committee members did not feel students should be moved during their final year in elementary school. By not moving Grade 6, those students experienced fewer transitions in their educational career. The ICT classrooms were not offered at the middle school level. Most ICT classrooms consisted of one full-time general education teacher, one full-time special education teacher, and one full-time teaching assistant.

Since the implementation of the ICT classrooms at Cayuga Central School District (pseudonym), no quantitative data had been analyzed to explore the association that integrated coteaching services had on SWD's academic performance. The district's commitment to insuring a full-time teaching assistant, a full-time general education teacher, and a full-time special education teacher for each ICT classroom came under scrutiny. Although formal or informal transcripts do not exist to reflect this action within the district, the district administrators made a verbal commitment to continue to support a

staff-rich model, but required data to support its existence (Assistant Director of Special Education, personal communication, February 5, 2010). Conversations with the assistant superintendent for school improvement supported this observation (personal communication, July 23, 2012) and reflected the necessity of research to provide information for the district. The district collected data for all the New York State 3-8 assessments and Regents exams by subgroups, such as SWD, but did not disaggregate the data by classification area or type of special education service delivery (i.e., ICT). Therefore, the local educational problem was the absence of evaluation data for ICT classrooms, which left the district administrators without empirical evidence regarding the value and potential effectiveness of the ICT services that were perceived to improve the performance of SWD in the local district. Other researchers concluded that there was limited empirical evidence on the relationship between coteaching and student learning (Courey, Tappe, Siker, & LePage, 2012; Friend et al., 2010; Hang & Rabren, 2009; Kloo & Zigmond, 2008; McLeskey & Waldron, 2011; Murawski & Swanson, 2001; Pugach & Winn, 2011; Rytivaara & Kershner, 2012; Scruggs, Mastropieri, & McDuffie, 2007; Solis, Vaughn, Swanson, & Mcculley, 2012; Whittaker, 2012). Of the 72 articles reviewed for the Section 1 literature review, only 30 reported quantitative and/or qualitative data. Of those 30 studies, five were quantitative, 24 were qualitative, and one used a mixed methods approach. The majority of the researchers focused on describing the coteaching structures (Sileo & van Garderen, 2010), the techniques for developing and maintaining positive coteaching relationships (Conderman, 2011b; Lodato Wilson, 2008; McLeskey & Waldron, 2011; Murawski & Dieker, 2008; Pratt, 2014; Sileo, 2011;

VanGarderen, Stormont, & Goel, 2012), and the teacher and student perspectives of coteaching (Hang & Rabren, 2009; McDuffie, Landrum, & Gelman, 2008; Murawski & Hughes, 2009; Nichols, Dowdy, & Nichols, 2010; Rytivaara & Kershner, 2012; Shin, Lee, & McKenna, 2015; Solis et al., 2012; Strogilos & Stefanidis, 2015).

As demonstrated above, there is limited empirical evidence on coteaching and student learning. Without quantitative data, another perspective on coteaching is absent from the literature. The scarcity of empirical data does not allow for a definitive relationship between ICT and student academic achievement. This lack of data not only constitutes a gap in practice in the broader educational community, but also a gap in the local practice at Cayuga Central School District.

A study based on quantitative data was conducted to investigate the statistical differences between coteaching and student academic achievement in ELA and mathematics for SWD in Grade 4 and Grade 5 ICT classrooms in Cayuga Central School District's 10 elementary schools during the 2009-2010 AY. ELA and mathematics non-public student level data, with all identifying information removed except for tracking numbers, were collected and analyzed to investigate the association between implementation of the ICT model and student achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments.

Rationale

Evidence of the Problem at the Local Level

SWD who required support for ELA and/or mathematics within the general education classroom setting were provided special education services the assistance ratio

was 15:1 student-to-teacher (SWD: special education teacher). Through self-reports by general education and special education teachers, SWD were under- or over-serviced, and in response, the Cayuga Central School District administrators implemented three to four ICT classrooms per grade level (K-5, ICT Committee, personal communication, November 3, 2008). However, the district administrators had not collected quantitative or qualitative data to examine the effectiveness of integrated coteaching services concerning students' learning. To date, only anecdotal data from district personnel and conversations with staff members in the district were compiled. The anecdotal data came from personal communications between me and the principals and general education and special education teachers who had ICT classrooms, as well as from district office administrators who supported the implementation process during the 2009-2010 AY (S. Mere, personal communication, December 21, 2009; B. Woodcock, personal communication, December 7, 2009). Therefore, the local educational problem was the absence of evaluation data for ICT classrooms, which left the district administrators without formal evidence to support the value and potential effectiveness of the ICT services.

Due to economic constraints of school districts across New York State and the country, superintendents analyzed staff, programs, and courses. Cayuga Central School District's commitment to insuring a full-time teaching assistant, a full-time general education teacher, and a full-time special education teacher for each ICT classroom came under scrutiny. The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the

New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups.

Evidence of the Problem from the Professional Literature

The cornerstones of special education are FAPE (EAHCA, 1975) and LRE (IDEIA, 2004), as well as access to the general education curriculum, as defined by NCLB (2002). In order to uphold the spirit of each law, many school districts across the United States are implementing ICT classrooms (Leatherman, 2009; Pratt, 2014). An ICT classroom offers a special education service in a LRE, the general education classroom.

Despite the increase in ICT classrooms, little research on the effectiveness of coteaching exists. Kloo and Zigmond (2008) cited four studies, of which three were quantitative and limited in scope. Kloo and Zigmond demonstrated general overall academic gains and increased social interaction and acceptance. McDuffie et al. (2008) discussed the limited quantitative research available, but referred to qualitative studies that support potential benefits, such as increased instructional options and decreased discipline issues. Many researchers reiterated the lack of quantitative data to support coteaching's effectiveness to improve students' academic achievement (Friend & Reising, 1993; Friend et al., 2010; Hang & Rabren, 2009; Kilanowski-Press et al., 2010; Murawski & Hughes, 2009; Pugach &Winn, 2011; Saloviita & Takala, 2010; Sileo & van Garderen, 2010; van Garderen, Stormont, & Goel, 2012; Whittaker, 2012). Four meta-analyses/meta-syntheses were conducted between 1999 and 2007. The focus of these studies was coteaching and collaboration between general education and special education teachers (Murawski & Swanson, 2001; Scruggs et al. 2007; Weiss & Brigham,

2000; Welch, Brownell, & Sheridan, 1999). The results of these studies are incorporated into the literature review for Section 1.

The majority of scholars who conducted research on coteaching focused on qualitative data the feelings and perceptions of the participants. More quantitative research is required before coteaching can be presented as an evidence-based practice (McDuffie et al., 2008; Pugach & Winn, 2011; Whittaker, 2012). District administrators and teachers desire to better understand the local gap in practice regarding the performance of SWD in ELA and mathematics and implementation of the coteaching model to support SWD in these academic areas. Administrators have indicated the need for additional data regarding the effectiveness of ICT in meeting the academic needs of SWD in ELA and mathematics with the coteaching model (Assistant Director of Special Education, personal communication, February 5, 2010). Therefore, the purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups.

Definitions

The following operational definitions were used throughout the study:

Collaboration: The ability of professionals to cooperate to reach the same responsibilities and goals (Murawski & Hughes, 2009).

Coteaching: Two teachers delivering instruction to a mixed-ability group of students in one classroom setting (Cook & Friend, 1995).

Evidence-based: Research that has been conducted to determine the effectiveness of a program or intervention (Kilanowski-Press, 2011).

Inclusion: A philosophical approach to teaching where all students are served within a general education setting by providing appropriate educational programs, supports, and assistance (Hines, 2008; Murawski & Swanson, 2001).

Integrated Coteaching (ICT): "A general education teacher and a special education teacher jointly providing instruction to a class that includes both students with and students without disabilities to meet the diverse learning needs of all students in a class" (NYS-ED, 2008, p. 3). Cayuga Central School District not only subscribed to the NYS-ED definition, but also included a teaching assistant in the implementation of ICT classrooms.

Research-based: Research demonstrating a component of an intervention or program has a crucial impact on the development of a skill (Kilanowski-Press, 2011).

Significance

It is important to address this problem because there is no formative or summative data to establish the association between ICT services and student achievement in ELA and mathematics as measured by the New York State ELA and mathematics assessment for Grade 4 and Grade 5 in Cayuga Central School District. Research findings from other studies indicated an increase in academic achievement for SWD through their receipt of ICT services (McDuffie, Mastropieri & Scruggs, 2009; Murawski & Swanson, 2001; Nevin et al., 2008; Pickard, 2009; van Garderen, Stormont, & Goel, 2012). Despite the findings of these studies, researchers continued to state that there was limited empirical

evidence to definitively link ICT and student academic achievement (Friend & Reising, 1993; Friend et al., 2010; Hang & Rabren, 2009; Kilanowski-Press et al., 2010; Murawski & Hughes, 2009; Pugach &Winn, 2011; Saloviita & Takala, 2010; Sileo & van Garderen, 2010; van Garderen, Stormont, & Goel, 2012; Whittaker, 2012). Data on this problem, such as described in this study, could help local district administrators make decisions about the ICT model concerning material and human resources required to support the model.

Research Questions and Hypotheses

Cayuga Central School District implemented three to four ICT classrooms per grade level (K-5, 2009-2010, and K-6, 2010-2014) in order to provide adequate support to SWD within the general education classroom. The research questions of this study investigated the association between implementation of ICT classrooms and SWD's academic achievement in ELA and mathematics.

RQ1: What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?

$H_0$1: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 4 ELA assessment.

$H_1$1: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 4 ELA assessment.

RQ2: What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?

$H_0$2: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 4 mathematics assessment.

$H_1$2: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 4 mathematics assessment.

RQ3: What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the

2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

$H_0$3: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 5 ELA assessment.

$H_1$3: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 5 ELA assessment.

RQ4: What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

$H_0$4: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 5 mathematics assessment.

$H_1$4: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 5 mathematics assessment.

My assumptions were that more individualized and explicit small group, direct instruction could occur in an ICT classroom with two teachers (general education and special education) than in a classroom with one teacher. The result is a fundamental shift from simply providing an opportunity to learn, to providing ingrained learning of content, skills, and strategies.

Review of the Literature

As special education evolved, so did the inclusion of SWD with their peers in the general education setting. The IDEA (1997) stated that SWD, to the maximum extent possible, have access to the general curriculum. The IDEIA (2004) stated that SWD should be instructed to the greatest extent possible within general education classrooms, which is considered the least restrictive environment (LRE) for most children. New York State offers a variety of special education services to meet the needs of SWD (NYS-ED, 2008); ICT services are one of those options. Integrated coteaching is the focus of the literature review for this study.

The literature search was conducted by using the following online databases: Academic Search Complete, Databases of Abstracts of Review of Effects, Directory of Open Access Journals, ERIC, Education Research Complete, Education: a SAGE full-

text database, Primary Search, ProQuest Central, PsycARTICLES, PsycINFO, SAGE Premier 2012, and Teacher Reference Center. The following keywords were used: *coteaching, cotaught, collaboration, inclusion, special education,* and *student academic achievement*. Peer-reviewed articles were located by reviewing the reference lists of located articles and books on coteaching. The majority of articles used were published within the last 5 years. Older articles were used to demonstrate the historical progression of coteaching.

Theoretical Framework

Social constructivism as a theoretical framework was established by Vygotsky and was expounded upon by Bruner and Bandura, among others. The three main features of social constructivism are the sociocultural context of learning, the social interaction occurring during development, and the participation of an active learner in his or her individual development (Mallory & New, 1994). Sociocultural context refers to the standards society follows in multiple settings in order to be a society. In the educational realm, this may include how and when to use instructional materials, such as guided reading books and pencils. Social interaction signifies how the conversations between peers and adults contribute to a person's understanding of a concept or skill. In order for concepts and skills to become internalized, a learner must actively engage in the learning process through social interactions (Vygotsky, 1978). Over time, intellectual functions, as represented by external activities, are discussed between people in a social setting and then become an innate, internalized part of an individual's psychological functioning (Vygotsky, 1978).

Social interactions are dependent on the development of a child's language skills. In the theory of cognitive development, Vygotsky (1978) postulated that a child's learning and development occurs simultaneously when a child's acquisition of language converges with the cultural and social factors that he or she encountered from the day of his or her birth. Vygotsky hypothesized that the convergence of a child's ability to define, describe, explain, and apply their knowledge was the most important event in a child's intellectual development. Language is the portal for social interaction between children and their world.

Children's attainment of knowledge is dependent on the supports and environment in which the learning occurs. Vygotsky (1978) espoused two main philosophies: the zone of proximal development (ZPD) and the more knowledgeable other (MKO). The MKO refers to an adult, peer, or computerized tutoring system that has more knowledge on a topic, product, or process than the learner (McLeod, 2007). The ZPD refers to the difference between what a child is able to do with assistance and what a child can do independently (Vygotsky, 1978). Children increasingly gain control of their learning through scaffolded guidance by adults and/or collaboration with peers. Prior theorists did not question how a student's potential with assistance might be more indicative of their mental development than what children can accomplish alone. As a result, slower learners tended to be segregated (Vygotsky, 1978), which is contrary to the principles of FAPE, LRE, and NCLB.

The ICT classrooms integrate learners of all abilities in the social learning process, as espoused by Vygotsky's (1978) paradigm of acquiring new information and

knowledge in a social context. The six coteaching models allow for free flowing discourse and scaffolded assistance to occur from child-to-child, adult-to-child, and adult-to-adult. The adults' understanding of educational pedagogy and of their students' development is a result of the social interactions among themselves, their colleagues, and their students. Using their knowledge, teachers create lessons, which allow multiple opportunities for students to socially interact with the adults and other children in the classroom to solidify their learning. Eventually, the MKO fades away and the learner gains direct control of their learning. By providing the scaffolded social interactions required to make meaning, students should demonstrate an increase in academic achievement.

The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. Vygotsky's (1978) social constructivist theory provided the basis for the study. The collaborative learning activities within the sociocultural context of an ICT classroom exemplify the significance Vygotsky attached to the learning students gain through the developmental socialization process. The results of the study, which are framed by Vygotsky's constructivist paradigm, demonstrate a positive association between the implementation of ICT classrooms and SWD's academic achievement on the NYS ELA and mathematics assessments for Grade 4 and Grade 5.

Inclusion

Coteaching is moored in the philosophy and principles of inclusion. Inclusion is defined in multiple ways in the literature (DeMatthews & Mawhinney, 2013; McMaster, 2012; Mukhopadhyay, 2013; Nichols & Sheffield, 2014). However, the crux of inclusion in regards to the impact coteaching has on SWD's academic achievement is the ability for schools to welcome and support all students in the community (Huberman, Navo, & Parrish, 2012; McMaster, 2012). By scaffolding and accommodating student needs, schools are better able to maintain a student's engagement in his/her learning, potentially increasing their knowledge base.

The guiding principles of inclusion are equality and social justice. These principles stem from the 1954 *Brown v. Board of Education* decision and the civil rights movement of the 1960s (Alquraini & Gut, 2012; Aron & Loprest, 2012). By focusing on the Equal Protection Clause of the 14th Amendment, where citizens should be afforded equal protection under the law, the Supreme Court justices stated students should be afforded access to an equal education. Segregation by race minimized students' access to a solid education, which decreased their likelihood of becoming productive members of society. This Supreme Court decision and the civil rights movement paved the way for the development of the Rehabilitation Act of 1973, Section 504. This federal law prohibits entities receiving federal funds, such as public schools, from discriminating against any individual with disabilities. Schools cannot exclude or deny eligible SWD access to programs and services (U.S. Department of Health and Human Services [USDHHS], 2006). Therefore, schools cannot deny students' access to FAPE, which was

established with the adoption of EAHCA in 1975. Mainstreaming was the terminology coined to describe the integration of SWD in schools. Typically, mainstreaming referred to SWD participating in self-contained special education classrooms and interacting with non-SWD peers in social situations, such as lunch and recess (Alquraini, 2013; Alquraini & Gut, 2012). As the IDEA (1990, 1997) and the IDEIA (2004) evolved, so did participation of SWD in general education settings. Inclusion became the leading terminology of integration of SWD. As a result, SWD are able to advocate for greater participation within the school setting (McMaster, 2012). Increased participation in the LRE allows for an increase in social interactions between and among SWD, peers, and adults (Vygotsky, 1978). As social interactions increase, a learner's receptive and expressive language development improves, which allows the learner to actively participate in his/her individual development more often (Vygotsky, 1978). Doyle and Giangreco (2013) also included least dangerous assumption (LDA), along with presumption of competence (POC), partial participation, and blending academic and functional curricula as guiding inclusive principles. The LDA and POC refer to the placement of SWD in the environment that would cause the least amount of harm to the student's learning, because an educator assumes a SWD has some ability to learn. Partial participation refers to the ability of everyone to participate to some degree in some activities. Blending refers to the balance educators need to create between academic demands and functional skills for SWD to live and operate independently in the real world. Coteaching embodies the spirit of these inclusive principles and laws by allowing

for FAPE and LRE to occur more consistently within general education settings in schools.

Laws may spell out the general necessities schools must implement, but they do not dictate the steps schools need to take to ensure inclusion; therefore, coteaching flourishes. By adopting a shared vision, establishing the role of school leadership, creating opportunities for collaboration within the school and within the community, addressing inclusion as a social issue more than a disability issue, focusing on individualized learning approaches, and attending to student voice (McMaster, 2012) allows inclusion to be realized in its entirety. By concentrating on these indicators, the following challenges to inclusion may be diverted: "(a) transfer of responsibility, (b) teacher preparedness, (c) service provision models, and (d) differentiation of curriculum" (McMaster, 2012, p. 17). These barriers to inclusion could also be countered with the implementation of other approaches, such as Response to Intervention (RtI) and School-wide Positive Behavior Interventions and Supports (SPBIS) (Aron & Loprest, 2012), along with restructuring school systems and roles and responsibilities of staff. As a result, increased participation by SWD in the LRE of the general education classroom may occur.

Coteaching

The foundation of coteaching began over 60 years ago. The development of coteaching began with the establishment of team teaching in the 1950s, where one team of teachers is responsible for one group of students (Friend & Reising, 1993). Current renditions of team teaching focus on interdisciplinary shared planning, with each teacher

providing instruction in his or her core content. In the 1980s, the regular education initiative (REI) proposed that SWD participate more in general education classrooms than self-contained classrooms (Minarik & Lintner, 2011). In response, special education teachers adopted team teaching as a way to mainstream SWD into general education settings. Team teaching was renamed cooperative teaching or coteaching as a way to separate it from team teaching used by general education teachers (Friend & Reising, 1993). The term collaborative teaching was used, as well.

Over the past four decades, the definition of coteaching has been refined to differentiate itself from other forms of interactive teaching. Friend and Reising (1993) stated,

> Coteaching in special education is an instructional delivery approach in which a classroom teacher and a special education teacher (or other special services professional) share responsibility for planning, delivering, and evaluating instruction for a group of students, some of whom have exceptional needs. (p. 1)

Cook and Friend (1995) revised the definition to "two or more professionals delivering substantive instruction to a diverse, or blended, group of students in a single physical space" (p. 2). Furthermore, Kloo and Zigmond (2008) and Fenty, McDuffie-Landrum, and Fisher (2012) referenced coteaching as a specific method of collaborative teaching. Cook and Friend's clarification of coteaching fostered servicing SWD in the LRE, the general education classroom. Learning within a general education classroom exemplifies the sociocultural context of Vygotsky's (1978) tenets of social constructivism theory.

Collaboration and inclusion are used interchangeably with coteaching, which leads to misunderstandings and negative perceptions (Friend et al., 2010). Collaboration is the ability of professionals to cooperate to reach the same responsibilities and goals (Fenty et al., 2012; Murawski & Hughes, 2009). Inclusion is a philosophical approach to teaching where all students are served within a general education setting by providing appropriate educational programs, supports, and assistance (Hines, 2008; Murawski & Swanson, 2001). In this study, I used New York State's Board of Regents' definition, in which coteaching is a service delivery model that represents the spirit of inclusion and collaboration (McMaster, 2012).

The Development of a Coteaching Model

In order for successful implementation of coteaching to occur, a systematic plan needs to be developed. Cook and Friend (1995) recommended establishing a planning structure, such as a task force, to decide how coteaching will be determined and introduced to the school community and the community at large. Subsequently, a description of the model needs to be developed. The task force should agree on specific goals and objectives. The criteria are then developed for determining which students are eligible. Specific responsibilities are established for each person involved in coteaching. An outline of the types of services offered during coteaching must be described. Lastly, evaluation strategies and measures need to be designed. Kloo and Zigmond (2008) reiterated the need for a plan, as well. Coteaching does not occur automatically or naturally when two teachers are placed together in one classroom. By having a specific rollout plan, all parties involved will understand the expectations for coteaching.

Components of Coteaching

In order to maximize the effectiveness of coteaching to impact student learning, co-partners must ensure the three components of coteaching have been addressed. In this study, co-partners are the special education teacher and general education teacher instructing students jointly in an ICT classroom (NYS-ED, 2008). The three components are co-planning, co-instructing, and co-assessing (Brown, Howerter, & Morgan, 2013; Conderman, 2011a; Murawski & Lochner, 2011; Stivers, 2008).

Co-planning. Co-planning is an essential component of coteaching. Access to common planning time by co-teachers has a positive effect on student learning (Mertens, Flowers, Anfara, & Caskey, 2010). During co-planning, both teachers actively contribute by offering ideas regarding instructional methods, coteaching models, program modifications, test accommodations, behavior adaptations, differentiation strategies, questions to check for understanding and promote higher level thinking, and student-specific needs pertinent to the lesson. Howard and Potts (2009) developed a checklist for co-teachers to use as they plan. Specifically, the checklist asks co-teachers if they accounted for standards, assessments, accommodations, modifications, instructional strategies, and logistics regarding materials, tests, roles in discipline and instruction, and seating arrangements (Howard & Potts, 2009; Shin, Lee, & McKenna, 2015). Other researchers have provided additional considerations co-teachers should consider during the co-planning stage (Lodato, 2008; Murawski, 2012). By thoughtfully reflecting on the needs of students before a lesson, co-teachers increase the likelihood of students gaining and maintaining learning.

Barriers exist for effective co-planning. A lack of co-planning time is often cited as the leading barrier to effective coteaching (Forbes & Billet, 2012; King-Sears & Bowman-Kruhm, 2011; Moin, Magiera, & Zigmond, 2009). Murawski (2012) provided 10 tips on how to use the planning time available more efficiently and effectively. The suggestions include establishing a regular time to plan, setting an agenda, determining roles and responsibilities, and using the what/how/who approach ("What needs to be taught in the lesson? How will the lesson be universally accessible for all students? Who may need additional consideration in order to access the lesson?") (Murawski, 2012, p. 12). Charles and Dickens (2012) recommended Web 2.0 technologies, such as meeting and document sites to address teachers' difficulties in meeting face-to-face to plan, discuss students, and reflect on their teaching practices and student learning. By implementing those suggestions, co-teachers may ease the time constraints they face.

Co-instructing. Co-instructing involves the delivery of instruction using the instructional methods and coteaching models decided upon during co-planning. The six coteaching models, which originally began as five approaches, have been described throughout the professional literature (Conderman, 2011b; Friend & Reising, 1993; Friend et al., 2010; Ploessl, Rock, Schoenfeld, & Blanks, 2010; Sileo & van Garderen, 2010; Whittaker, 2012). The descriptions define the role each co-teacher plays. The coteaching models include the following:

1. One teach, one observe. One teacher is observing the students, while the other is teaching to the whole class. The observer's focus could be on behavior, student engagement, teacher talk, and/or questioning levels.

2. Station teaching. Students are split into small groups that rotate to different instructional stations. The teachers provide direct instruction at two of those stations.
3. Parallel teaching. The students are separated into two groups. Both teachers are teaching the same content simultaneously.
4. Alternative teaching. While one teacher speaks with the entire group, a smaller group of students requiring pre-teaching or re-teaching of skills and/or strategies is occurring to the side.
5. Teaming. Both teachers present the lesson to the whole class at one time.
6. One teach, one assist. While one teacher is teaching a whole class lesson, the other teacher is roaming the class refocusing, redirecting, and assisting students as needed. The most common model used by co-partners is one teach, one assist (Fenty & McDuffie-Landrum, 2011; Murawski & Lochner, 2011).

By implementing the six coteaching models, along with research and evidence-based instructional practices, co-teachers may increase their ability to provide explicit direct instruction in smaller groups.

Co-assessing. During the co-assessing component, co-teachers reflect on what went well and what needed improvement in order to make adjustments for future lessons. The time is spent gathering and analyzing students' academic and behavioral data to determine if the students are learning. Based on the data gathered, future decisions can be made (Conderman, 2011a). Assessment decisions are made before, during, and after instruction to determine the appropriate formative and summative assessments to use

(Conderman & Hedlin, 2012). As a result, data-driven decision-making may lead to an increase in tailored instruction supportive of each student's needs.

Key Elements for Successful Coteaching

Before co-planning, co-instructing, and co-assessing can occur, common barriers encountered by schools and coteaching teams must be tackled. Administrative support is crucial, because administrators set the mission, vision, and climate of a school and/or district (Hall & Ryan, 2011). An administrator can support those entering a coteaching relationship by listening to educators, trusting educators, treating them fairly, and protecting them from outside pressures. These outside influences could possibly take the co-teacher's attention away from the focus on students (Hoppey & McLeskey, 2013). Furthermore, co-teachers will have access to shared planning time during the school day only if administration develops the building master schedule to include the time. The difficulty in finding common planning time is frequently mentioned in the professional literature (Gurgur & Uzuner, 2010; Nevin, Cramer, Voight, & Salazar, 2008; Nichols et al., 2010; Sailor, 2015; Saloviita & Takala, 2010; Scruggs et al., 2007).

The need for professional development regarding how to work as a team, the three components of coteaching, and the models of coteaching is another factor mentioned in the literature (Murawski & Hughes, 2009; Saloviita & Takala, 2010; Strogilos & Stefanidis, 2015). It is also important that both co-teachers have volunteered for the partnership (Hepner & Newman, 2010). Those teachers who chose to be co-teachers found more satisfaction with the partnership (Tannock, 2009). By addressing the common barriers, a cohesive coteaching partnership can evolve.

Requirements for Successful Coteaching Partnerships

Once coteaching partnerships have been established, ground rules need to be developed in order for the classroom to run smoothly and create a positive learning environment for students, as well as the adults in the classroom. Subjects for discussion may include educational philosophies, parity, roles and responsibilities, communication between co-teachers and families, confidentiality, classroom management, instructional and organizational routines and procedures, noise levels, grading, feedback, and pet peeves (Friend, 2008; Friend, 2012). Some of these topics are expounded on below.

Partnerships develop from effective communication skills. The success of coteaching rests on effective and ongoing communication (Brown, Howerter, & Morgan, 2013; Conderman, 2011a; Conderman, Johnston-Rodriguez, & Hartman, 2009; Cook & Friend, 1995; Ploessl et al., 2010; Pratt, 2014; Tannock, 2009). Through open communication, trust is established (Musanti & Pence, 2010). By addressing matters before, during, and after coteaching lessons, little issues do not have the opportunity to evolve into monumental concerns, which may create a rift in the partnership. Open communication can begin with each teacher's educational philosophies and instructional beliefs (Cook & Friend, 1995). Teachers with differing views may impact how lessons are planned and implemented, which may cause lower expectations for SWD, decreasing their potential for academic achievement.

Parity reflects equality in a partnership. Parity in a coteaching partnership may be established by placing both teachers' names on report cards and in all communication with families; both teachers have ownership of the classroom, and both teachers

participate in instruction (Sileo, 2011). When equality is created, the students and parents consider both teachers as their teachers. When parity does not exist, the special education teacher typically falls into the role of an assistant (Friend & Reising, 1993). Parity involves defining each teacher's role and responsibilities (Hines, 2008; Murawski & Lochner, 2011). By planning all aspects of the classroom from minute procedures, such as sharpening pencils and using the bathroom, to significant behavioral processes, which may include determining how to respond to students' inappropriate behaviors, students and adults have the same expectations. Responsibilities also include instructional planning and grading (Murawski & Dieker, 2008). Co-teachers should also address acceptable noise levels for instructional activities (Friend, 2008). Together, teachers can determine what noise levels look like and sound like for different types of events. Deciding how students and instructors will be situated within the six models of coteaching can control the impact of noise on learning. Hepner and Newman (2010) mentioned co-teachers need to discuss pet peeves. Partners need to share non-negotiables, which will allow them to feel comfortable teaching. Each instructor must honor their partner's wishes. Listening and honoring each other's beliefs, strengths, and concerns establishes parity.

Student and Teacher Benefits of Coteaching

Though the data regarding the effectiveness of coteaching are limited, researchers have suggested positive impacts for students and teachers' learning. Common themes in the research were (a) an increase in teaching techniques and use of differentiation (Baecher & Jewkes, 2014; Cramer, Liston, Nevin, & Thousand, 2010; Fenty &

McDuffie-Landrum, 2011; Friend & Reising, 1993; Gradwell & DiCamillo, 2013; Kloo & Zigmond, 2008); (b) an increase in student achievement (McDuffie, Mastropieri & Scruggs, 2009; Murawski & Swanson, 2001; Nevin et al., 2008; Pickard, 2009; van Garderen, Stormont, & Goel, 2012); (c) an increase in teachers' content and classroom management knowledge (Leatherman, 2009; Murawski & Hughes, 2009; Scruggs et al., 2007); (d) an increase in students' social skills due to positive peer models (Alquraini & Gut, 2012; Hepner & Newman, 2010; Scruggs et al., 2007); (e) receipt of support, accommodations, and modifications in the most LRE for the SWD learner (Courey, Tappe, Siker, & LePage, 2012; Kloo & Zigmond, 2008; McDuffie et al., 2008); (f) a decrease in student-teacher ratio (Kloo & Zigmond, 2008; McDuffie et al., 2008; Nichols et al., 2010); (g) a decrease in the stigma SWD might feel for receiving additional support (Kloo & Zigmond, 2008; Nichols et al., 2010); (h) an increase in students' self-confidence (Hang & Rabren, 2009; Nichols & Sheffield, 2014); (i) an increase in empathy by students without disabilities towards SWD (Pickard, 2009); and (j) an increase in immediate feedback to students (Jang, 2010). Hence, more research is required to verify the positive impact coteaching might have on a teacher's ability to instruct, which impacts a student's ability to learn and mature academically and socially.

Implications

From the literature review and anticipated findings, I saw the development of a white paper as one possible direction for the project. The white paper could report the results of the quantitative data analysis and describe recommendations for Cayuga Central School District regarding ICT classrooms. This information would be presented

to the superintendent of schools; the assistant superintendent for school improvement; and the executive directors of elementary education, secondary education, and special education. Another consideration was to evaluate ICT classrooms in my district, since I am using Cayuga Central School District for this study. However, the student-to-staff ratio was not the same. Also, the observations of ICT classrooms in this district indicate *one teach, one assist* is the prominent model being used. Friend and Reising (1993) stated, "What cannot be justified is a classroom that looks just like it did with one teacher except that now there are two teachers, one of whom is 'helping out' or acting as an instructional assistant" (p. 8). As a result, my analysis of current data and research may lead to a revised ICT model in my district if the model that is now being used by the district does not seem to support student learning. I also recommend further data analyses using quasi-experimental designs across subjects, diverse student populations, and grade levels implementing ICT classrooms, as well as longitudinal data analyses. Research involving multiple grade levels, subjects, and diverse student populations would increase the sample size and the possibility of generalizing the results. Also, I recommend investigating the association ICT classrooms might have with discipline referrals, attendance, suspensions, and dropout rates (Friend et al., 2010; Kilanowski-Press et al., 2010). As the volume of quantitative data regarding coteaching expands, an increased correlation between coteaching and student achievement may be determined thus, contributing to social change by supporting equality and social justice for SWD through the provision of special education services within the general education classroom.

Summary

Evidence of the effectiveness of coteaching remains elusive; despite the generally positive view students and teachers have of coteaching, (Whittaker, 2012). In order to understand the association between coteaching and academic achievement of students, further research needs to be conducted using quasi-experimental designs across subjects, diverse student populations, and grade levels. Data from other sources, such as curriculum-based measures, discipline referrals, attendance, suspensions, and dropout rates should be reviewed in addition to standardized assessments (Friend et al., 2010; Kilanowski-Press et al., 2010). The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups.

In Section 2, I address the quantitative methodology chosen for this study, including the sample selected, the data collection, and analysis process, as well as how participants were protected. In Section 3, I describe the project chosen based on the findings from the data. This paper concludes in Section 4 with a reflective analysis of what I learned from this study as a scholar-practitioner of research as well as the impact the project may have on creating social change.

Section 2: The Methodology

Introduction

The purpose of this quantitative study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. The majority of the researchers included in the literature review focused on qualitative data. Qualitative data often include the feelings and perceptions of the participants, while quantitative data emphasize the cause and effect relationship between variables. Therefore, continued evidence of the effectiveness of coteaching in relation to student achievement would be beneficial (Friend et al., 2010; Hang & Rabren, 2009; Kloo & Zigmond, 2008; McLeskey & Waldron, 2011; Murawski & Swanson, 2001; Pugach & Winn, 2011; Scruggs et al., 2007; Solis, Vaughn, Swanson, & Mcculley, 2012; Whittaker, 2012).

Section 2 provides information about the research design, the setting and sample, instrumentation and materials, and data collection. Assumptions, limitations, scope, and delimitations are examined. The measures taken to ensure protection of the participants in this study are discussed. Lastly, the data findings and analysis are presented.

Research Questions

1. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?

2. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?
3. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?
4. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

Research Design

A mixed methods approach, specifically an explanatory design, was considered, but not chosen due to the need for quantitative data, as identified through the review of literature (McDuffie & Scruggs, 2008). An interrupted, time series, quasi-experimental design was also considered, but it was not chosen because of the lack of consistent multiple pretest and posttest measures. The only reliable and valid measures of ELA and mathematics achievement available for the study were provided by the New York State ELA and mathematics assessments. The New York State assessments begin in Grade 3 and are only given once a year. As a result, the SWD who were included in ICT classrooms in Grade 4 during the 2009-2010 AY would have only one pretest measure:

the 2008-2009 Grade 3 New York State scores. Additionally, the SWD who were included in ICT classrooms in Grade 5 would have only two pretest measures, the 2007-2008 AY Grade 3 New York State scores and the 2008-2009 AY Grade 4 New York State scores. Creswell (2012) noted that a time series design requires the researcher to obtain multiple pretest measures. While the interrupted time series design would reduce selection as a threat to internal validity, it would increase the threat due to history. As noted by Creswell, "The effects of history are minimized by the short time intervals between measures and observations" (p. 315), which was not feasible in this study due to the restrictions of the New York State assessments.

The New York State assessments for ELA and mathematics measure different standards at different grade levels and are not vertically scaled, so scores cannot be compared from grade to grade (CTB/McGraw-Hill, 2010a, p. 1). In the analyses in this study, the covariates were scores on the prior grades' comparable New York State assessments. While the New York State scale scores cannot be compared from grade level to grade level, they do meet the test for use as a covariate. Creswell (2012) stated, "These variables [covariates] are any variables correlated with the dependent variable" (p. 298), which, in this study, was the scale score in the prior grade. Therefore, a quantitative study using comparison groups and analysis of covariance (ANCOVA) was conducted. For the purpose of this study, I analyzed the differences in academic scale score performance on New York State assessments in ELA and mathematics for SWD who were served in ICT classrooms and those that were not served in ICT classrooms.

Setting and Sample

A suburban school district located in central New York outside a large city provided the setting for this study. During the 2009-2010 AY, Cayuga Central School District had 10 elementary buildings, three middle schools, a ninth grade annex, and a high school building (Grades 10 to 12), serving approximately 7,500 students. The New York State Report Card for Cayuga Central School District (2009-2010) indicated that 31% of the total population was receiving free- or reduced-priced lunch, and 1% of the student population was identified as limited English proficient. The racial/ethnic origin of the student body consisted of 1% American Indian or Alaska Native, 8% Black or African American, 2% Hispanic or Latino, 4% Asian or Native Hawaiian/Other Pacific Islander, 84% White or Caucasian, and 1% multiracial.

The target population chosen from this setting for the analyses SWD who required an ICT fourth or fifth grade classroom during the 2009-2010 AY, as well as SWD who were in fourth or fifth grade during the 2008-2009 AY and would have been served in ICT classrooms if those classrooms had been available. Students who participated in an ICT classroom required full day support for academic and/or behavioral challenges. Additional SWD in Grades 4 and 5 were not included in the target population because they required only resource and/or related services, such as occupational, physical, and speech therapies. All students who were in the 2009-2010 AY target population and who had the necessary test score data were included in the ICT sample, and all students who were in the 2008-2009 AY target population and who had the necessary test score data were included in the non-ICT sample.

The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5 by comparing the scale scores of non-ICT and ICT groups. Additionally, I examined ICT as a service delivery model for SWD as a means to comply with federal laws regarding special education and NCLB (Friend et al., 2010; Kilanowski-Press et al., 2010; Kloo & Zigmond, 2008; Minarik & Lintner, 2011). In order to address the objectives above, the specific sample size needed to be determined.

Due to the limited number of students who met the inclusion criteria, random sampling of the target population was not possible. Therefore, the census method, in which all individuals who met the criteria were included, was used for this study (Lodico, Spaulding, & Voegtle, 2010, p. 146). This nonprobability sampling strategy (Creswell, 2012; Lodico et al., 2010) was chosen because historical data collected from the 2008-2009 and 2009-2010 academic years needed to specifically match the criteria established for determining if a SWD was placed in a non-ICT or ICT group. Of the census sample (n = 111), 72 were male and 39 were female. Their racial/ethnic origin consisted of White/Caucasian (n = 86), Asian (n = 2), Black/African American (n = 21), and Hispanic/Latino (n = 2). After correcting for students who repeated a grade level and/or had only one scale score, the following ICT, non-ICT, and covariate group sizes were determined: (a) ELA non-ICT for Grade 3 2007-2008 and Grade 4 2008-2009 (n = 18), (b) ELA ICT for Grade 3 2008-2009 and Grade 4 2009-2010 (n = 20), (c) ELA non-ICT for Grade 3 2008-2009 and Grade 4 2009-2010 (n = 20), (d) Math non-ICT for Grade 3

2007-2008 and Grade 4 2008-2009 (n = 18), (e) Math ICT for Grade 3 2008-2009 and Grade 4 2009-2010 (n = 20), (f) Math non-ICT for Grade 3 2008-2009 and Grade 4 2009-2010 (n = 20), (g) ELA non-ICT for Grade 4 2007-2008 and Grade 5 2008-2009 (n = 15), (h) ELA ICT for Grade 4 2008-2009 and Grade 5 2009-2010 (n = 12), (i) ELA non-ICT for Grade 4 2008-2009 and Grade 5 2009-2010 (n = 18), (j) Math non-ICT for Grade 4 2007-2008 and Grade 5 2008-2009 (n = 15), (k) Math ICT for Grade 4 2008-2009 and Grade 5 2009-2010 (n = 12), and (l) Math non-ICT for Grade 4 2008-2009 and Grade 5 2009-2010 (n = 18). The group sizes ranged from 12 to 20. The smallest group had only 12 participants because three students had not received a score due to test administration errors.

The sample size calculator powered by Raosoft (2015) was used to determine the recommended sample sizes for this study. The recommended sample size from a power analysis with a 5% margin of error, a 95% confidence level, a 50% response distribution, and a population size of 12 is 12 participants (Raosoft, 2015). The recommended sample size from a power analysis with a 5% margin of error, a 95% confidence level, a 50% response distribution, and a population size of 15 is 15 participants (Raosoft, 2015). The recommended sample size from a power analysis with a 5% margin of error, a 95% confidence level, a 50% response distribution, and a population size of 18 is 18 participants (Raosoft, 2015). The recommended sample size from a power analysis with a 5% margin of error, a 95% confidence level, a 50% response distribution, and a population size of 20 is 20 participants (Raosoft, 2015). Each of these corresponds with the group sizes determined above.

Instrumentation and Materials

The New York State Testing Program (NYSTP) for Grades 3 through 8 focuses on assessing the skills, processes, and concepts students in New York should learn. Though the NYSTP offers criterion-referenced assessments in ELA, science, and mathematics, I focused on the ELA and mathematics assessments administered to Grade 4 and Grade 5 during the 2008-2009 and 2009-2010 school years. Both general education and special education teachers tend to have a solid knowledge base and well-developed skills and techniques to instruct reading and writing (Zwerger & Greninger, 2012). As a result, the benefit of having a general education teacher paired with a special education teacher may not have an effect on ELA scores. However, special education teachers do not typically have a background in mathematics instruction because they are strategy generalists and are not required to obtain specific certification in content (NCLB, 2002). Thus having a general education teacher in an ICT classroom may have more of a differential effect for mathematics than ELA.

Grades 3 through 8 ELA tests are used to assess student progress towards three learning standards: "S1 information and understanding, S2 literary response and expression, and S3 critical analysis and evaluation" (CTB/McGraw-Hill, 2010a, p. 5). The Grades 3 through 8 mathematics tests are used to assess student progress towards the content standards, which include statistics, probability, measurement, geometry, algebra, and number sense and operations (CTB/McGraw-Hill, 2010b). Each assessment created for the NYSTP goes through an extensive development process. As a result, CTB/McGraw-Hill (2010a, 2010b) wrote a technical report containing "information

about OP [operational] test development and content, item and test statistics, validity and reliability, differential item functioning studies, test administration and scoring, scaling, and student performance" (p. 1). Reviewing each multiple choice and constructed response item, as well as independently studying alignment between the New York State curriculum and the New York State assessments via Norman Webb's method, established content validity. Construct validity was determined through internal consistency and minimizing bias. Reliability coefficients for ELA per Cronbach's alpha ranged from .83 to .88 (CTB/McGraw-Hill, 2010a). Reliability coefficients for mathematics per Cronbach's alpha ranged from .88 to .94, and the Feldt-Raju scores were .89 to .95 (CTB/McGraw-Hill, 2010b).

The ELA and mathematics assessments are timed paper and pencil tests administered over 2 to 3 days, depending on the grade level. The number of multiple choice and constructed response items included vary per grade level. Copies of all the 2010 NYSTP assessments for ELA and mathematics can be found on the New York State Department of Education (2013) website.

Because New York was a "truth-in-testing" state, all tests were released to the public; therefore, no grade level test was the same from 1999 to 2010. However, the State of New York employed test-equating procedures to allow scale scores for each grade level to be compared across years (NYS-ED, 2005). Scores are not vertically scaled inhibiting score comparison from grade to grade (CTB/McGraw-Hill, 2010a, p. 1).

The 2010 OP tests were equated so that the scale scores from the 2009 and 2010 administrations can be directly compared. That is, a scale score in a given grade

level and content area represents the same ability level (comparable knowledge and skills) in 2009 and 2010 (CTB/McGraw-Hill, 2010a, p. 88).

The data used to measure each variable in the study are found in the data analysis and summary of results sections located in Section 2.

Data Collection and Analysis

Non-public student data with all identifiable information removed, except for a tracking number, were gathered from Cayuga Central School District's student information system. The data obtained showed covariate information from 2007-2008 AY and 2008-2009 AY and dependent variable scores from 2008-2009 AY, the year before the implementation of ICT classrooms, and 2009-2010 AY, the first year of implementation of ICT classrooms. I used pairwise deletion, so that a student was included in the analysis only if that student had scores at both test administrations (covariate and dependent). Statistical analyses were performed with the Statistical Package for the Social Sciences Statistics (SPSS 21.0.0.0) Desktop. Experiment-wise error was controlled through use of the Bonferroni procedure (Green & Salkind, 2011).

I used an ANCOVA because I conducted a group comparison involving only one independent categorical variable and two continuous dependent variables, each with one covariate (Creswell, 2012). As stated by Lodico, Spaulding, and Voegtle (2010), categorical variables represent discretely separate groups or categories, so my independent variable (ICT services) was categorical, specifically, a nominal scale of measurement. Grade 3 and 4 scores from the 2007-2008 and 2008-2009 school years were the coordinating covariates. The separate groups included students in Grades 4 and

5 during the 2008-2009 AY before the implementation of ICT classrooms and students in Grades 4 and 5 following one year of implementing ICT classrooms during the 2009-2010 AY. The assessment scores were on an interval continuum, so the dependent variables (New York State ELA and mathematics scale scores) are considered continuous scale data. I used the scale scores of the individual students for the analysis. The coordinating covariates were the Grade 3 and 4 scores from the 2007-2008 and 2008-2009 school years. According to Green and Salkind (2011, p. 164), a normal distribution is an underlying assumption for a one-way ANCOVA. I expected the dependent variables to be normally distributed, because the New York State Report Card (2009-2010) for Cayuga Central School District showed a bell curve distribution across the four proficiency levels (1 to 4) (NYSED, 2014). I confirmed the assumption by conducting the Shapiro-Wilk test. Therefore, the ANCOVA was an appropriate test of the differences between 2009 Grade 4 scale scores for SWD and 2010 Grade 4 scale scores for SWD, and of the differences between 2009 Grade 5 scale scores for SWD and 2010 Grade 5 scale scores for SWD.

Assumptions

This study was based on the assumption that all ICT teachers participated in a 2-day coteaching training with two outside consultants in June of 2009 and a half-day training in August, which included teaching assistants assigned to those classrooms. It was assumed that all coteaching teams had a common planning time and that all teams were using the six coteaching models throughout their lessons over the course of the school year. Furthermore, it was assumed that the majority of teams participated in

professional development six times throughout the school year geared toward coteaching teams. I assumed that all data had been verified at the district, regional, and state levels. In New York State, all data collected are verified three times before the state reports on a district's performance.

According to Green and Salkind (2011), four assumptions underlie a one-way ANCOVA. First, the dependent variable is normally distributed in the population; second, the variances of the dependent variable are equal; third, the scores on the dependent variable are independent of each other; and fourth, the covariate is linearly related to the dependent variable. After consulting Laerd Statistics (2014), I tested these assumptions in SPSS. First, a linear relationship between the covariates and dependent variables was determined as assessed by a visual inspection of the scatterplot associated with each research question (see Appendices B, C, D, and E). Second, homogeneity of regression slopes existed as the interaction term was not statistically significant; Grade 4 ELA $F(1,34) = .763$, $p = .389$, Grade 4 mathematics $F(1,34) = .133$, $p = .718$, Grade 5 ELA $F(1,23) = .018$, $p = .894$, and Grade 5 mathematics $F(1,26) = .488$, $p = .491$. Third, the scale scores were normally distributed as assessed by Shapiro-Wilk's test ($p > .05$). Fourth, Levene's Test of Equality of Error Variances ($p > .05$) validated the assumption of homoscedasticity; the variance of the residuals is equal for all predicted values. Lastly, there were no outliers in the data, as assessed by no cases with standardized residuals greater than 3 standard deviations.

Limitations

This quantitative study had potential limitations. First, the selection of the sample was not random due to the small number of students who met the inclusion criteria and because the students could not be randomly assigned to an ICT classroom. Also, the comparison samples, 2008-2009 4th graders and 2009-2010 4th graders, and 2008-2009 5th and 2009-2010 5th graders, were independent. The study could not use a repeated measures analysis, although that would have produced stronger results. The use of a covariate removed some of the potential effect of initial differences between the groups. Despite the similar demographics for both groups and similar findings from the ANCOVA, the results must be treated with caution due to the small sample size.

Second, history may pose a threat to internal validity because the students were served in 2 different years. Additionally, unknown outside influences, such as immigration, may have influenced the results. Furthermore, student mobility within the district and between districts may have affected the results. I curtailed this factor by including only those students who took the New York State ELA and mathematics tests in 2009 and 2010 while in the Cayuga Central School District. Another limitation may be maturation. Students develop and change over the course of a school year (Creswell, 2012). Lastly, the findings are not generalizable outside the current setting, because the evaluation is applicable only to the local school district included in the study. Further research would be necessary to allow generalization.

Scope and Delimitations

In this study, I focused on one school district located outside a large city in Central New York State servicing approximately 7,500 students during the 2009-2010 AY. The sample size was limited to SWD in Grades 4 and 5 (2009-2010) who participated in an ICT classroom and who had taken the New York State ELA and mathematics assessments the year before ICT implementation in the 2008-2009 school year. The sample did not include third grade SWD because the NYSTP does not begin until Grade 3; therefore, there was no covariate available for use in analyzing Grade 3 SWD's achievement. Grade 6 was not included because there were no sixth grade ICT classes that school year (2009-2010), as the K-12 committee for Cayuga Central School District did not feel students should be moved their last year in elementary school. The results of the study do not apply to SWD who only received resource and/or related services.

Protection of Participants

The National Institute of Health (NIH) and the Institutional Review Board (IRB) for Walden University set guidelines that researchers must follow in order to protect participants from harm and ensure confidentiality. Because non-public student-level data with all identifying information removed, except for a tracking number, were used and no direct interactions with students or teachers occurred, I did not need to obtain informed consent from students and parents. However, I did need to obtain permission from the superintendent of schools or designee for the Cayuga Central School District. The data use agreement outlined how the data were culled from the student information system for

the district and included how student identities were kept confidential. In addition, I obtained permission from the IRB for Walden University. My NIH certification number was 819993.

Data Analysis Results

I collected de-identified archival data from Cayuga Central School District's student information system. The district's director of data management collected and provided the data in an Excel spreadsheet for my use. I averaged mean scale scores for each grade level and subject area by entering each student's individual score into SPSS for analysis. I conducted an ANCOVA to compare the ICT and non-ICT groups' scale scores using SPSS. (Green & Salkind, 2011).

The 2010 NYSTP uses a scale score for ELA and mathematics for Grades 3 through 8.

> A scale score is a quantification of ability as measured by the Grades 3 through 8 ELA tests at each grade level. The scale scores were comparable within each grade level, but not across grades because the Grades 3 through 8 ELA tests were not on a vertical scale. The test scores were reported at the individual level and can be aggregated. (CTB/McGraw-Hill, 2010a, p. 1)

An identical statement appears in the mathematics technical report for the 2010 NYSTP. The ELA scale scores for Grades 4 and 5 ranged from 430 to 775 and 495 to 795, respectively (CTB/McGraw-Hill, 2010a). The mathematics scale scores for Grades 4 and 5 ranged from 485 to 800 and 495 to 780, respectively (CTB/McGraw-Hill, 2010b). The raw data for the ELA and mathematics scale scores can be secured upon request.

Research Questions and Hypotheses

The research questions for the study were: (a) What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?; (b) What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?; (c) What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?; and (d) What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes? I used narratives and tables to address each null hypothesis and non-directional alternative hypothesis (Creswell, 2012).

Hypothesis 1. $H_0$1: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 4 ELA assessment.

$H_1$1: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 4 ELA assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the Grade 4 New York State ELA assessment (see Table 1). After adjusting the mean scale scores, I found a statistically significant difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the ELA scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, with the ICT group scoring higher, $F(1,33) = 4954.91$, $p = .011$, partial $\eta^2 = .181$. Furthermore, a Levene's test of equality of error variances ($p = .675$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 1

Results of the ANCOVA for Grade 4 New York State ELA

	Grade 4		
	Adj. Mean	F	*p*
ICT	643.500	7.294	.011
Non-ICT	615.444	8.973	.005

Hypothesis 2. $H_0$2: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 4 mathematics assessment.

$H_1$2: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 4 mathematics assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the Grade 4 New York State mathematics assessment (see Table 2). After adjusting the mean scale scores, I found a statistically significant difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the mathematics scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, with the ICT group receiving higher scores, $F(1,33) = 14600.81$, $p = .000$, partial $\eta^2 = .568$. Furthermore, a Levene's test of equality of error variances ($p = .679$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 2

Results of the ANCOVA for Grade 4 New York State Mathematics

	Grade 4		
	Adj. Mean	F	*P*
ICT	655.213	43.339	.000
Non-ICT	639.120	6.007	.020

Hypothesis 3. $H_0$3: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 5 ELA assessment.

$H_1$3: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 5 ELA assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the Grade 5 New York State ELA assessment (see Table 3). After adjusting the mean scale scores, I found a statistically significant difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the ELA scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, with the

ICT group scoring higher, $F(1,24) = 2015.81$, $p = .001$, partial $\eta^2 = .356$. Furthermore, a Levene's test of equality of error variances ($p = .536$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 3

Results of the ANCOVA for Grade 5 New York State ELA

	Grade 5		
	Adj. Mean	*F*	*P*
ICT	637.221	13.270	.001
Non-ICT	635.221	.164	.689

Hypothesis 4. $H_0$4: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 5 mathematics assessment.

$H_1$4: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 5 mathematics assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the

Grade 5 New York State mathematics assessment (see Table 4). After adjusting the mean scale scores, I found a statistically significant difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the mathematics scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, with the ICT group scoring higher, $F(1,27) = 5335.65$, $p = .000$, partial $\eta^2 = .467$. Furthermore, a Levene's test of equality of error variances ($p = .447$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 4

Results of the ANCOVA for Grade 5 New York State Mathematics

	Grade 5		
	Adj. Mean	*F*	*P*
ICT	641.946	23.677	.000
Non-ICT	639.120	.157	.695

Discussion of Findings

The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. Following data collection, a summary of the data analysis results in relation to acceptance or rejection of each null hypothesis and non-directional alternative hypothesis (Creswell, 2012) was presented. The findings, as they correspond to the research questions, are discussed in the following sections.

Research Questions 1 and 3

The first and third research questions asked if a significant difference existed between the ELA scale scores of non-ICT SWD and the ELA scale scores of ICT SWD as measured by the New York State Grade 4 and Grade 5 ELA assessments. The ANCOVA indicated that the ELA scale scores of SWD who received ICT special education services were statistically higher those of the non-ICT group. These results appear consistent with other researchers' findings when coteaching was the primary delivery model for learning (McDuffie et al., 2008; Murawski & Swanson, 2001). I concluded that participation in a full-day ICT classroom might have been a contributing factor to SWD's academic success as measured by the NYS Grade 4 and Grade 5 ELA assessments.

Research Questions 2 and 4

The second and fourth research questions asked if a significant difference existed between the mathematics scale scores of non-ICT SWD and the mathematics scale scores of ICT SWD as measured by the New York State Grade 4 and Grade 5 mathematics assessments. The ANCOVA indicated that the mathematics scale scores of SWD who received ICT special education services were statistically higher those of the non-ICT group. These results appear consistent with other researchers' findings when coteaching was the primary delivery model for learning (Nevin et al., 2008; Pickard, 2009). I concluded that participation in a full-day ICT classroom might have been a contributing factor to SWD's academic success as measured by the NYS Grade and Grade 5 mathematics assessment.

Assumptions

I assumed the student achievement in ELA and mathematics noted above occurred due to the implementation of the six coteaching models by the two teachers (general education and special education) and one teaching assistant. Depending on the needs of the SWD, a few of the ICT classrooms had more than one teaching assistant. I also assumed the ICT teachers co-planned on a daily basis. These regular conversations allowed teachers to use more teaching techniques, such as differentiation, individualization, and small group explicit direct instruction, which led to smaller student-to-teacher ratios and more immediate feedback. Furthermore, the ICT model permitted general education and special education teachers to design daily lesson plans collaboratively, which in turn provided a consistent opportunity for the instructors to administer accommodations and modifications to SWD. Interaction among the participants reflected Vygotsky's (1978) constructivist framework that meaningful conversations can lead to increased knowledge for teachers, teaching assistants, and students. The results of this study indicate that a possible shift from simply providing an opportunity to learn, to providing ingrained learning of content, skills, and strategies occurred; thus, increasing student academic achievement in ELA and mathematics for Grades 4 and 5.

Final Thoughts

A statistically significant difference was found between the scale scores of ICT SWD's achievement on the New York State ELA and mathematics assessments for Grades 4 and 5 and non-ICT SWD's achievement on the New York State ELA and

mathematics assessments for Grades 4 and 5. The findings from this study are not able to causally relate the higher scores to the ICT classroom; however, the cotaught support in these classrooms could have been a factor to the success of SWD. I recommend the school district continue to support ICT classrooms with full-time general education teachers, full-time special education teachers, and full-time teaching assistants. The staffing configuration appeared to allow for differentiated lessons and flexible groups, which permitted students to receive individualized specialized instruction. Additionally, the district should consider continuing the yearly professional development that allows coteaching partnerships to bond. The staffing and professional development allowed teams to fully implement the three components of coteaching (co-planning, co-instructing, and co-assessing), which resulted in an increase in student achievement for SWD in Grades 4 and 5. In order to maintain increased student achievement, a white paper outlining the results of this study was crafted and shared with stakeholders.

In the white paper, I outlined the problem at the local level, presented the results of the study, stated conclusions, and made recommendations to the district regarding coteaching at the elementary level. Future evaluations of ICT at the elementary level are outlined for district administration to consider. It is recommended that implementation of ICT at the middle and high school levels for ELA and mathematics be explored, as well.

Conclusion

A quantitative study met the necessary requirements to gather data to examine the association between coteaching and student achievement, specifically to determine if a statistically significant difference was found between the scale scores of ICT SWD's

achievement on the New York State ELA and mathematics assessments for Grades 4 and 5 and non-ICT SWD's achievement on the New York State ELA and mathematics assessments for Grades 4 and 5. The results of the ANCOVAs demonstrated statistically significant differences in scale scores regarding SWD's academic achievement in ICT classrooms.

In Section 3, I describe the resultant project, a white paper. I integrated the quantitative findings into a white paper that was shared with the superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District. The white paper includes the quantitative data, which highlight the results of the research questions for this quantitative study.

Section 3: The Project

Introduction

The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. Cayuga Central School District had not conducted quantitative analyses since the inception of ICT classrooms during the 2009-2010 AY. The study was guided by these research questions.

Research Questions

1. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?
2. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?
3. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

4. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

The results of this study determined the ELA and mathematics scale scores of SWD who received ICT services were statistically higher than those of the non-ICT group.

A white paper (Appendix A) was the most appropriate project by which to share the findings of the study with Cayuga Central School District administration. In this section, I discuss the project's goals and rationale, as well as a review of the literature regarding white papers and the critical aspects supporting ICT. Finally, I conclude with an implementation timeline along with implications for social change.

Description and Goal of the Project

The mission of the white paper was to apprise the superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District about the findings of the study. The results demonstrated that the implementation of ICT, as a delivery model of special education services, had a significant difference on SWD's academic achievement in the areas of ELA and mathematics. The findings from this study also revealed positive academic achievement for SWD when the staffing for ICT classrooms consisted of a full-time teaching assistant, a full-time special education teacher, and a full-time general education teacher. Additionally, a consistent level of professional development was

offered to coteaching teams. In addition to the results of the study, the white paper was formatted to highlight the problem at the local and national levels through a review of the scholarly literature, to state conclusions based upon the results obtained and assumptions held, and to make recommendations to the district regarding coteaching at the elementary level. The clear and concise nature of a white paper provided the optimum format by which I could share the results and recommendations of the study.

Rationale

No quantitative data had been collected since the inception of ICT classrooms during the 2009-2010 AY. The findings from the study presented in the white paper provided the data that had been lacking. Due to the quantity of tables generated during the data analysis portion of the study, I required a project genre that allowed the data to be represented in a precise manner. The white paper provided a succinct summary of the results of the study, which demonstrated a statistically significant difference between the scale scores of the ICT and non-ICT groups. Through the white paper, I was able to provide district administration with pertinent information for consideration when discussing the future staffing needs of coteaching classrooms, as well as the provision of related professional development.

Review of the Literature

The literature review focused on the project study, a white paper, regarding the association participation in ICT classrooms had on SWD's academic achievement on the New York State Grade 4 and Grade 5 ELA and mathematics assessments. The literature search was conducted using Walden University's online databases: Academic Search

Complete, Database of Abstracts of Reviews of Effects, Education Research Complete, ERIC, Primary Search, PsycARTICLES, PsycINFO, Teacher Reference Center. The Boolean phrases used were *coteaching, co-taught*, *staff, staffing, staff to teacher ratio, paraprofessionals, personnel, teaching assistants, teacher aides, special education, academic achievement, student academic achievement, collaboration, white papers,* and *professional development*. Google Internet search was also used to locate any peer-reviewed articles specifically connected to white papers.

The White Paper

A white paper is a written report. The goal of the report is to inform an intended audience about a specific problem and persuade the audience to consider a specific solution for the problem using results and logic (Graham, 2010; Kemp, 2005; Mattern, 2013). I used the white paper to share that the results of the ANCOVA (four out of four), which demonstrated positive academic achievement for SWD in ICT classrooms.

In order to create a cohesive white paper, I followed a specific outline, as identified by Kemp (2005).

- Establish goals and audience. The goals of the white paper were to inform the audience – superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District – of the local problem, present the results of the study, state conclusions based upon the results obtained and

assumptions held, and make recommendations to the district regarding coteaching at the elementary level (Kemp, 2005; Walsh, 2014).

- Form a plan for creation and sharing of the white paper. During this phase, I decided to provide a print document to each audience member backed by a PowerPoint presentation that focused on the highlights of the white paper. Along with the researchers in the peer-reviewed articles, I was considered a subject matter expert. Members of my doctoral study committee served as reviewers of the white paper (Kemp, 2005).
- Review information and data. I reviewed my information and data from Sections 1 and 2 to determine relationships.
- Organize data. I organized the information and data into a storyboard to show the benefits of coteaching, how coteaching enables the benefits to occur, the problems associated with coteaching, and how coteaching can be a solution for increasing students' academic achievement (Kemp, 2005; Sakamuro, Stolley, & Hyde, 2015).
- Design layout. I designed the layout of the white paper so the audience could read the information and data with ease.
- Determine major concepts. I stated the major concepts with short narratives and bulleted lists and provided visual representations as appropriate (Kemp, 2005; Mattern, 2013).
- Review. I sent my white paper to my reviewers to review content and style (Kemp, 2005).

- Publish. I published my word document for distribution (Kemp, 2005).

By following these steps, I was able to include all pertinent data relevant to this study.

Revisiting Coteaching

The purpose of a white paper is to inform a specific audience in a concise manner about a problem, relevant data, and possible solutions. The local educational problem of this study was the absence of evaluation data for ICT classrooms, which left the district administrators without evidence regarding the value and potential effectiveness of the ICT services that were perceived to have a positive impact on the performance of SWD in the local district. The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5 by comparing the scale scores of non-ICT and ICT groups. Four out of four quantitative analyses conducted affirmed the positive statistical significant difference ICT had on SWD's academic achievement. The findings are in alignment with previous studies discussed in Section 1. Additional recent quantitative studies demonstrate how SWD participating in inclusive settings met or exceeded state proficiency standards in reading and mathematics (Hoppey & McLeskey, 2013; Roden, Borgemenke, & Holt, 2013). Bronson and Dentith (2014) found that after participating in coteaching, particularly a partner-teaching model, kindergarten students demonstrated above average reading scores, as compared to their peers who had not been exposed to coteaching. Using comparative analysis, the findings from Tremblay's (2013) research showed positive results in reading and writing for those students who had participated in a cotaught

classroom as compared to those students who had not participated in a cotaught classroom. Math results were also positive, but not significantly different. Learners appeared to construct knowledge through participation in cotaught setting (Vygotsky, 1978). However, Aliakbari and Nejad (2014) found no significant impact with grammar for SWD participating in a coteaching situation, and DeMatthews and Mawhinney (2013) observed a decrease or flat line in standardized test scores in one district they studied. Perhaps the latter was a result of the district focusing on compliance issues rather than classroom instruction.

In addition to the elementary quantitative findings noted above, quantitative findings from several secondary studies show the positive impact coteaching and/or collaboration has on student achievement. The effect of ICT services on SWD's academic performance on state assessment tests is supported by current research (Ashton, 2014; DiCamillo & Gradwell, 2012; Mirza & Iqbal, 2014). As evidence-based research continues to show the affirmative influence coteaching has on student academic achievement, especially in the areas of ELA and mathematics, the support for ICT classrooms across various grade levels increases.

Teaching Assistants

Through the white paper, I shared the findings of my study and presented several factors that may have contributed to the results. One of the factors was the presence of a teaching assistant in each ICT classroom. Unlike other research reviewed, the ICT classrooms included in the current study had, minimally, one teaching assistant assigned to each classroom full time. Depending on the needs of the SWD, a few of the ICT

classrooms had more than one teaching assistant. The additional support may have contributed to the positive student academic achievement results, as measured by the Grades 4 and 5 New York State ELA and mathematics assessments. However, as with coteaching, limited empirical evidence relating to student academic achievement and teaching assistants exists (Alborz, Pearson, Farrell, & Howes, 2009; Blatchford et al., 2011; Webster, Blatchford, & Russell, 2013; Alborz, Howes, & Pearson, 2010). Further research is needed to determine what impact teaching assistants and/or support staff has on students' academic achievement.

New York State Education Department (NYS-ED) (2015a) defined teaching assistants as support staff that "provide instructional support to students under the supervision of a certified or licensed teacher" (NYS-ED, 2015a , para. 1a), as compared to teacher aides, who provide "non-instructional support under the direction of a designee by local school districts" (NYS-ED, 2015a , para. 1b). Teaching assistants must hold certification (Level I, Level II, Level III, Pre-Professional, Temporary, Continuing); whereas, teacher aides are not certified, but are employed according to New York State Civil Service laws (NYS-ED, 2015a). Level I certification requires a prospective candidate to possess a high school diploma or pass the General Educational Development (GED) test along with the New York State Teacher Certification Exam – Assessment of Teaching Assistant Skills. Candidates must take workshops focused on topics, such as child abuse and bullying. Prospective teaching assistants must also have fingerprint clearance (NYS-ED, 2015b). In order to receive Level II certification, potential candidates need an additional 9 hours of college course work, with one year experience

as a New York State licensed teaching assistant (NYS-ED, 2015b). Level III requires 18 hours of college course work, and confirmation of U.S. citizenship or immigration and naturalization service permanent residence. A pre-professional candidate must have all the requirements for Levels I, II, and III completed, as well as be enrolled in a New York State registered teacher preparation program.

In addition to defining teaching assistants and teacher aides' roles and establishing certification requirements, NYS-ED (2015a) provides guidance on the types of duties a school district may assign; however, local bargaining units ultimately determine the specific responsibilities both groups will fulfill within the district. Teaching assistants may assist students with instructional projects and classwork, as well as provide feedback to the classroom teacher regarding student learning and behavior (NYS-ED, 2015a). By contrast, teacher aides may manage records, audio-visual materials, and computer or laboratory equipment (NYS-ED, 2015a). The NYS-ED's clear delineation of the role of a teaching assistant and teacher aide exceeds the descriptions noted in other research (Blatchford et al., 2011; Farrell et al., 2010). In Blatchford et al.'s (2011) study, the title of teaching assistant also included "classroom assistant, higher level teaching assistant, learning support assistant, and nursery nurse" (p. 443), as long as the position covered similar duties. Farrell et al. (2010) relegated support staff to three categories: technical and specialist staff, pupil welfare, and teaching assistant equivalent (e.g., language assistant, paraprofessional, teaching assistant, nursery nurse, learning support assistant, and classroom assistant). The majority of the studies in Farrell et al.'s review focused on classroom assistant. The inconsistency of who is considered a teaching

assistant and questions of how teaching assistants are trained and deployed in these studies may affect findings.

Teaching assistants may have a positive impact on SWD's academic achievement. Farrell et al. (2010) found that in eight out of nine studies, the use of teaching assistants increased student academic achievement when a targeted intervention was provided to primary students struggling with literacy and language, but less so with numeracy. One cause of this finding could be the abundance of research-based practices for literacy (Kilanowski-Press, 2011, Slide 32). Another cause could be the social interactions between a more knowledgeable other (MKO), in this case the teaching assistants, and students, where the MKO scaffolds support in order to engage students in individual learning (Vygotsky, 1978). Three of the studies demonstrated teaching assistants appeared to be as effective as teachers and therapists; however, one of the teaching assistants had a psychology degree with experience working with children, and four other teaching assistants were certified teachers. This level of competence parallels the requirements by NYS-ED (2015b). Four other studies noted no impact when the support was general in nature (Farrell et al., 2010). Those studies did not target specific groups of students to monitor, and the nature of the teaching assistant support was not defined.

Although the quantitative data regarding the impact of teaching assistants within the classroom was mixed, qualitative studies revealed teachers' perceptions were positive. With teaching assistants in the classroom, teachers felt the additional support increased students' attention, learning outcomes, and teacher effectiveness by freeing up

their time, so they could focus more on the students (Farrell et al., 2010). The increase in social interactions between teachers and students allowed for collaborative dialogue, which may contribute to greater understanding/performance on behalf of the students (McLeod, 2014; Vygotsky, 1978). Farrell et al. concluded that properly trained teaching assistants who provide specific literacy and language interventions can have a positive impact on student's academic achievement. Alborz et al. (2009) came to a similar supposition. Consistent training of teaching assistants is a necessary element in increasing the effect of student academic achievement.

Four out of four quantitative analyses conducted for the current study demonstrated statistically significant differences between the scale scores of ICT and non-ICT students, with the ICT group scoring higher. I assumed the addition of teaching assistants contributed to the results. Blatchford et al.'s (2011) study showed a significant effect between level of teaching assistant support and positive approaches to learning, such as decreased distractibility, increased confidence, and ability to follow directions. On the other hand, academic progress appeared to be thwarted by teaching assistant support. The data revealed more teaching assistant support equated to less academic progress. Students who are assigned teaching assistant support may become less independent, which could have contributed to the results Blatchford et al. obtained, as well as my own results. Caution must be taken in assigning teaching assistant support.

Just as student learning may increase through social interactions, so may adult learning. The research presented corresponds to Cayuga Central School District's establishment of certain guidelines and professional development when ICT classrooms

utilize a full-time teaching assistant. Teaching assistants attend one half-day training session over the summer to meet with their co-teachers. The purpose of the meeting is to determine the roles and responsibilities of each member of the coteaching team, as well as establish collaborative working relationships (Vygotsky, 1978). During the school year, the teams meet on a daily or weekly basis to share information. Teaching assistants are also afforded after school training sessions aligned with interventions and initiatives offered by the district. The social interactions and resulting conversations reflect a constructivist framework by which learning can occur (Vygotsky, 1978). Through these means, teaching assistants are consistently trained and given specific roles within the classroom.

Professional Development

Consistent, cohesive professional development may lead to improved student achievement. As with coteaching and the use of teaching assistants in classrooms, little research exists linking professional development with student outcomes (Garet, Porter, Desimone, Birman, & Yoon. 2001; Kretlow & Bartholomew, 2010; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Shaha & Ellsworth, 2013). However, the provision of professional development, a factor I discussed in the white paper, may be another reason why implementation of ICT as a special education service delivery model for SWD in ELA and mathematics had a significant difference on the ICT group's scale scores versus the non-ICT group's scale score performance, as measured by the New York State Grade 4 and Grade 5 ELA and mathematics assessments.

Form. When creating and presenting constructive professional development, specific preparations need to be completed. The components consist of form, duration, collective participation, focus, active learning/inquiry based, and coherence (Garet et al., 2001; Penuel et al., 2007; Wang, 2013). Form refers to traditional methods, such as workshops, institutes, courses, and conferences (Nishimura, 2014) or reform methods, such as study groups, mentoring, and coaching (Garet et al., 2001; Kretlow & Bartholomew, 2010; Kretlow, Cooke, & Wood, 2012; Penuel et al., 2007). The form of professional development may impact a teacher's ability to learn content, skills, and strategies, which could have bearing on student learning and achievement.

Duration. Another component to learning new strategies and techniques for the classroom is the period of time professional development is offered. Professional development sustained over time provides opportunities for in-depth discussions and the ability to try new practices and receive feedback (Pancsofar & Petroff, 2013). Weekly professional development provided with fidelity appears to have the most significant impact on teacher learning (Martin, 2010; Mundy, Howe, Kupczynski, 2014; Schrum & Levin, 2013). Professional development could be provided on a weekly basis by offering sessions before or after school, during the day through release time, on Saturdays, or online (Martin, 2010). The time to process new information permits teachers the opportunity to take their learning from recall to analysis and application.

Collective participation. Professional learning communities and collaboration exemplify collegial team work (Abilock, Harada, & Fontichiaro, 2013; Wang, 2013), which is intertwined with Vygotsky's (1978) constructivist framework. Vygotsky's

theory and the research are linked through teachers' social interactions in solving a problem (Owen, 2014), which in the context of this study is coteaching and the association ICT classrooms have on SWD's academic achievement. Social dialogue increases clarification and cognitive development (Vygotsky, 1978). The more engaged teachers are in professional development, the more focused they become on research and evidence-based teaching strategies (Shaha & Ellsworth, 2013). Shaha and Ellsworth's (2013) results showed schools that were more engaged in professional development outperformed lower engaged schools (increase in reading and math scores, lower dropout rates, increase in college attendance, lower discipline issues, and higher teacher retention).

Focus. When the emphasis of professional development is content-specific, positive student progress is possible. As teachers learn specific math content versus general pedagogy, an increase in students' math achievement is observed (Garet et al, 2001; Blank & de las Alas 2010). Shymansky, Wang, Annetta, Yore, and Everett (2010) reported a positive connection between teachers' professional development hours, which focused on science content and student's achievement on science assessments. As teachers become more confident with content, they tend to be more open to trying different teaching strategies (Penuel et al., 2007).

Active learning/inquiry-oriented. Social interactions, such as meaningful discussion, planning, practice, observing and being observed, providing and receiving feedback, or reviewing student work enhance and promote a teacher's individual growth. These social interactions allow a MKO to scaffold support in order for a teacher to

develop along their personal ZPD (Vygotsky, 1978). By engaging in active learning, especially through observations and immediate feedback, teachers provide a positive impact on student achievement (Gregory, Allen, Mikami, Hafen, & Pianta, 2014; Yost & Vogel, 2007). The time to reflect on their learning helped teachers focus more on student needs (Yost & Vogel, 2014). By placing the focus on the needs of students, teachers align curriculum, instruction, and assessment to scaffold student learning in order to meet state standards.

Coherence. Professional development should be connected with personal and professional goals for teachers and students and aligned with standards and assessments. The results suggest sustained, consistent professional development embedded within the daily lives of teachers and focused on specific academic content and goals can lead to increased teacher efficacy (Garet et al., 2001; Martin et al., 2010; Penuel et al., 2007; Schrum & Levin, 2013). Penuel et al. (2007) also saw a significant correlation between type of professional development activity, time span, coherence, and changes in teacher knowledge and practice. As teachers' knowledge and skills improve, so should students' knowledge.

In preparation for the implementation of ICT classrooms, Cayuga Central School District arranged for professional development opportunities for co-teachers and/or ICT teams. Co-teachers attended a 2-day workshop entitled "Introduction to Coteaching" in June of 2009. The focus for the workshop was New York State guidelines for coteaching, team self-analysis, coteaching approaches, roles and responsibilities, purposeful planning, coteaching agreement, and reflection. In August of 2009, ICT teams attended a half-day

workshop with me as facilitator. An hour was spent reviewing New York State guidelines for coteaching. The next 2 hours focused on determining the roles and responsibilities of each member of the coteaching team and to begin planning initial lessons. I followed up the training by visiting each classroom in the fall and winter. The fall visits were informal observations, while the winter visits included sit down meetings with each team. Co-teachers were allotted three half-days for planning. I also facilitated six 1-hour ICT meetings after school throughout the year. The topics included horizontal and vertical discussions about how coteaching was progressing, differentiated instruction, and classroom management. Mandatory participation was required for most sessions. Subsequent years included one to two team workshop days, as well as three half-days for planning. Based on the research summarized above, I surmised Cayuga Central School District's professional development practices regarding coteaching provided ongoing, content-specific, and collaborative opportunities, which led to effective coteaching and, ultimately, student achievement (four out of four quantitative analyses).

Project Description

Based on the findings from the study, the resultant project is a white paper. The white paper will be presented to the superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District. The purpose is to present the results of the study and to persuade the group to continue the current staffing for ICT classrooms in order to maintain SWD's academic achievement in the areas of ELA and mathematics. In

this section, I describe the needed resources, existing supports, and potential barriers I may use and/or face as I share the white paper and accompanying recommendations. Additionally, I outline the timetable for implementation, along with the roles and responsibilities other stakeholders and I may have.

Potential Resources and Barriers

The most important resource for this project is the actual white paper. A clear and concise document outlining the project will provide quantitative data highlighting the results of the study and recommendations for consideration by the district. A PowerPoint presentation will be created to visually represent the contents of the white paper. Having electronic and print copies of both documents will allow for easier dissemination to the intended audience.

The superintendent, assistant superintendent, and executive directors are another vital resource in disseminating the findings of the study. By following the timeline established, the findings could be publicized to other administrators, teachers, and stakeholders in a timely manner.

The greatest existing support for the study and resulting project, the white paper, originated with Cayuga Central School District's assistant superintendent for school improvement. The assistant superintendent for school improvement reviewed the initial proposal and submitted the letter of permission, as well as the signed data use agreement. Arrangements were also made for the director of data management to provide the data set I analyzed.

By completing the study, I accomplished five things. First, I demonstrated a significant difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes. Second, my research revealed a significant difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes. Third, a significant difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes existed. Fourth, I found a significant difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes. Fifth, this study provided possible reasons as to why there was a statistically significant difference between ICT and non-ICT SWD's academic achievement (scale scores) in ELA and mathematics. Two of those possible reasons were the current staffing ratios for ICT classrooms and the provision of professional development. The greatest barrier to both would be the continued availability of funding. One way to address the cost of staffing would be to complete program evaluations of all special education services to determine the effect on SWD's academic achievement. If the overall results demonstrate

ICT has a greater positive impact on SWD's performance than other special education services, the district could repurpose existing staff roles and responsibilities to meet the needs of students. The cost of providing professional development could also be another barrier for Cayuga Central School District. However, the district could build in-house expertise, so funds would not need to be expended on out-of-district conferences or consultants. Educational grants are also available to educators for adding instructional materials and knowledge to their repertoire.

Proposal for Implementation and Timetable

Upon completion of Walden's requirements, my goal is to share the white paper in person with the superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District before the end of the current school year. My vision is to work with the team to share the findings and recommendations by presenting the white paper at administrative team meetings during the summer because the administrators are 12-month employees. The presentation of the white paper would allow administrators time to discuss the information and determine the next steps for the district. I would also recommend a presentation to the board of education during the summer, so there is a public record of the information before the white paper is posted on the district's website. Lastly, I would request presenting the information at faculty meetings at the beginning of the school year. The findings would affirm the positive actions taken on the part of co-teachers, which may help set the stage for a successful mindset as the school year begins.

Roles and Responsibilities of Stakeholders

In my role as researcher, I am a vital stakeholder in distributing the information of this project study. Initially, I gathered and analyzed the literature and data regarding the association between ICT and SWD's academic scale score performance in ELA and mathematics, as measured by the NYS Grade 4 and Grade 5 ELA and mathematics assessments. Once data collection and analysis were completed, I was responsible for creating a clear and concise white paper outlining the findings of the study and resulting recommendations for the district. Lastly, I am responsible for disseminating the white paper.

Cayuga Central School District officials are important stakeholders for this project. The assistant superintendent for school improvement provided permission and signed the data use agreement. The director of data management provided the data sets for analysis. The assistant superintendent will arrange the opportunity for me to present the white paper to the administrative team. Collaboration with the administrators is needed to determine how best to disseminate the white paper to other stakeholders in the district and community. Administration will also need to determine if they will proceed with a program evaluation of special education services and what protocols will be used.

Project Evaluation Plan

In order to gauge the impact of the white paper, an evaluation needs to be conducted. Goal-based, outcome-based, formative, and summative evaluations were considered. A goal-based evaluation compares a program's performance against specific measurable objectives (Youker, 2013). An outcome-based evaluation helps to establish

clear outcomes, to measure those outcomes, and clarify the individuals or groups for which the project's benefits are intended (New York State Library, 2014). A formative evaluation provides immediate feedback on the current workings of a program or student's performance, which is used to make adjustments to improve efforts in real time (Brookhart, Moss, & Long, 2008; Cornelius, 2013; Nan, 2003; Nolen, 2011; Sadler, 1989). A summative evaluation assesses the final product or learning (Cornelius, 2013; Hoover & Abrams, 2013; Northern Illinois University, 2014). Based on the information gathered, I chose to use a formative evaluation, as well as a summative evaluation, to assess the white paper.

Justification

I chose to combine a formative evaluation with a summative evaluation because the former informs and impacts the latter. My presentation of the white paper, which includes a summary of the local problem, the results of the study, conclusions based on the results obtained and assumptions held, and recommendations to the district regarding coteaching at the elementary level, served as the formative evaluation portion because continuous immediate feedback of the stakeholders' learning in regards to the study's findings was obtained through the discourse. Answering questions and clarifying items throughout the presentation of the white paper afforded me the opportunity to solidify the stakeholders' understanding of the content, which may increase their willingness to follow up on the suggestions made. The summative evaluation of the white paper is incomplete until the stakeholders decide what actions the district will take regarding the future of coteaching, with the goal of adopting all recommendations.

Overall Evaluation Goals

Two project evaluation goals exist. The first goal is to succinctly state the findings of the study in a clear and precise manner. The second goal focuses on continuation of current staffing levels for ICT classrooms and professional development focused on coteaching through support offered by the superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District. The first goal will be accomplished when the feedback through the formative evaluation process is received with a positive reception. The second goal will be achieved when, through the summative evaluation, plans are made to implement all suggestions presented. By securing these responses, I would consider the presentation of the white paper a success.

Project Implications

Local Community

The least restrictive environment (LRE) (IDEA, 2004) is one of the cornerstones of special education. At the local level, placement of SWD within an ICT classroom allows SWD to receive special education services within a LRE, the general education classroom. The findings presented in the white paper reveal an association may exist between ICT classrooms and student achievement on the New York State ELA and mathematics assessments for Grades 4 and 5. Thus, positive social change could be achieved by further implementation of ICT classrooms with the current staffing levels

and professional development resulting in more SWD participating in general education settings for at least 80% or more of their day.

Far-Reaching

The study's findings expand the limited quantitative research that currently exists on the effectiveness of coteaching in increasing student achievement. As a result, the gap in creating generalizations to a multitude of academic environments and grade levels is closing. Increasing SWD participation in general education settings, as well as increasing their ability to graduate high school and become contributing members of society, may instigate social change beyond the district.

Conclusion

The section described the resultant project, a white paper, to be shared with the superintendent of schools, the assistant superintendent for school improvement, the executive director of elementary education, the executive director of secondary education, and the executive director of special education for Cayuga Central School District. The best way to disseminate the results of this research was by means of a white paper, which highlights the possible influence ICT had on SWD and answers the research questions for this quantitative study. The research questions focused on the significant difference the implementation of ICT classrooms had on SWD's academic achievement in ELA and mathematics and how ICT affected the performance of SWD in ELA and mathematics, as measured by the New York State Grade 4 and Grade 5 mathematics assessments. In Section 4, I reflect on the strengths and limitations of the project, discuss

the potential impact the project may have on social changes, and suggest future research. I also address my growth as a scholar, practitioner, and project developer

Section 4: Reflections and Conclusions

Introduction

This research project focused on the association between ICT as a service delivery model of special education on SWD's academic performance in ELA and mathematics, as measured by the New York State Grades 4 and 5 ELA and mathematics assessments. Vygotsky's (1978) social constructivist theory provided the foundation for the project study. The ICT classroom provided the sociocultural context of learning for SWD, while the literature reviews, data analysis, project development, and virtual discussions with fellow scholarly colleagues supported the context of my learning. In an ICT classroom, SWD have opportunities to socially interact with peers and adults, who are often the MKO (Vygotsky, 1978). The interactions allow SWD to use their language to clarify their understanding of concepts, which increases their knowledge, as evidenced in four out four data analyses.

Further exploration and reflection on the doctoral journey as a scholar-practitioner is described in this section. I discuss the strengths and limitations of the study and conclude with the potential impact the project study may have on social change and make suggestions for future research.

Project Strengths

The most notable outcome of this project study was the significant difference noted between the scale scores of ICT SWD and the scale scores of non-ICT SWD, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5. Four out of four analyses demonstrated the ICT SWD scoring higher scale

scores than the non-ICT SWD. The statistics represented in this study support the limited quantitative data regarding the influence coteaching may have on SWD's academic achievement (McDuffie, Mastropieri & Scruggs, 2009; Murawski & Swanson, 2001; Nevin et al., 2008; Pickard, 2009; van Garderen, Stormont, & Goel, 2012).

The findings of this study show that current staffing (one full-time general education teacher, one full-time special education teacher, and one full-time teaching assistant) in ICT classrooms may contribute to SWD's scale score performance. The data present a justification for the level of staffing others may consider extensive in an age of economic constraints. Additionally, the results support consistent yearly professional development with ICT teams for the continuous refinement of best teaching practices.

A final strength of the study was the development of the white paper. The resulting document summarized in a concise manner the problem at the local level, presented the results of the study, stated conclusions, and made recommendations to the district regarding coteaching at the elementary level. Recommendations based on the white paper include the district's ability to share the positive findings, support for the continuation of current staffing, and encouragement of professional development for coteaching teams. The white paper may also be relevant to other districts that are reviewing the efficacy of coteaching.

Recommendations for Remediation of Limitations

The current project study was limited to the significant difference between the scale scores of ICT and non-ICT SWD's in ELA and mathematics, as measured by the Grades 4 and 5 New York State ELA and mathematics assessments for the 2009-2010

AY. To broaden the scope and sample size of this study, I would recommend (a) using all non-public data from the 2009-2010 AY to the current school year for all ICT classrooms across K-6; (b) using another assessment, such as AIMSweb or the Developmental Reading Assessment, which would provide multiple data points; and (c) analyzing the academic achievement of non-SWD who participated in an ICT classroom. The resulting longitudinal data would allow the district to decipher trends and patterns in relation to ICT classrooms and students' academic achievement.

Due to the precise nature of a white paper, the presentation may appear impersonal. I recommend future research include interviews or surveys of teachers, teaching assistants, and students who had participated in an ICT classroom in order to obtain anecdotal comments about their personal experiences in an ICT classroom. By adding the participants' thoughts and feelings, the data are not just numbers on a page. The audience would be able to envision the real impact ICT had on the participants.

Scholarship

Scholarship is my ability to delve into content and apply the knowledge learned (Tomlinson, 2014). My doctoral journey began with the coursework required by Walden University. The assignments and tasks broadened my knowledge of quantitative and qualitative research, as well as the appropriate methodologies to apply to both. The foundational information garnered laid the groundwork for my project study.

As I delved into my research, I became adept at utilizing the databases provided by Walden Library. Focusing on Boolean phrases and peer-reviewed articles associated with my topic and subsequent findings, I was able to obtain current primary sources that

provided qualitative and quantitative data to support the need for the initial research. Additionally, I learned to interpret and evaluate the information presented in the peer-reviewed articles to determine validity and relevance to the research for this study. As the process continued, I received continuous support, feedback, and direction from my doctoral committee. Their guidance led to new understandings and of the iterative process of scholarly writing. With each recursive step, I clarified the purpose for this study, articulated the findings from other studies, analyzed evidence, explained the relevance of the evidence, and concluded with connections between and among researchers and the overall study. During the analysis, I used SPSS to complete the ANCOVAs. The multiple layers of my study demanded considerable thought and reflection during the analysis stage of the study. As a novice scholar, I learned to perform second and third analyses of the data of my research. Through conversations with other researchers and scholars I gained knowledge to perform tests to assess assumptions that further solidified the analysis of my data. My findings resulted in a white paper. I had not previously been familiar with this type of project study. The knowledge I gained throughout the process has been applied to other professional projects I have completed in my profession.

Project Development and Evaluation

The findings from this study supported the development of a white paper. Because of the straightforwardness of content, a white paper can instigate social change in a direct and positive manner. Through the white paper, I was able to condense the quantity of tables generated during the data analysis portion of the study into a succinct

summary of the results of the study, which demonstrated a statistically significant difference between the scale scores of the ICT and non-ICT groups. By reducing the amount of information presented throughout the study, I was able to provide district administration with pertinent information for consideration when discussing the future staffing needs of coteaching classrooms, as well as the provision of related professional development.

The development of the white paper was one-dimensional compared to the development of the study. The essence of white papers is the reduction of ideas, thoughts, and comments down to the main points, specific supporting details, and relevance to the discussion. Whereas with the research study, I needed to persevere in analyzing the literature and data to draw accurate inferences based on the information presented. By breaking information into smaller units of study in the white paper, educators can absorb, think, and analyze, which leads to richer, fuller conversations and increased opportunities for implementation leading to potential positive change for SWD's academic achievement.

Leadership and Change

Through the research process and the white paper, I feel I have refined my leadership skills. My level of questioning has evolved. I ask more in-depth questions to understand the bigger picture of a situation. Through multiple perspectives, I have a greater understanding of how to best support SWD's academic, social, emotional, and physical well-being in an educational setting. By looking at all aspects of a situation, I am able to provide clearer responses with adequate support for my thoughts and decisions.

The process of working on my doctorate allowed me to model continuous learning for teachers and other administrative colleagues. I exemplified the fact that learning never stops, and by applying new knowledge, better strategies and processes can be put in place for the benefit of students. For example, the findings from this study supported full day ICT classrooms, which helped me facilitate the development of two additional Kindergarten classrooms during the 2013-2014 school year, and two more ICT classrooms were implemented the following year.

Analysis of Self as Scholar

As someone who has always enjoyed learning, I relished acquiring more knowledge in order to complete research on a particular topic in education. My coursework was challenging, but doable. The content explored allowed me to dig deeper into concepts I had briefly been exposed to during my master's and certificate of advanced study programs. The in-depth analysis of qualitative and quantitative research made me question why educators were not incorporating the same research process at the high school level.

While writing my prospectus, I challenged myself to internalize the elements of the rubric into my study. My scholarly writing and critical thinking skills improved as I delved deeper into the writing process. As I culled information and data from the peer-reviewed articles, I was able to see the unifying themes. I was able to state the main idea, provide evidence, and conclude my point. The struggle at times revolved around the analysis of the evidence. In particular, stating the relevance in my own words. At times, I would overthink matters, which made the process more difficult than it really was. The

doctoral writing process made me more proficient in stating my main points with supporting evidence and explaining the connections and relevance to student achievement.

Because I had two groups with two separate covariates, I sought support regarding inputting data into SPSS. Consulting with scholarly experts helped me to complete tests for assumptions associated with ANCOVA. By seeking out these resources, I deepened my understanding of the data analysis component of quantitative research as a beginning researcher and scholar.

Analysis of Self as Practitioner

As a scholar-practitioner, I researched literature to inform my practice. The act of analyzing research has transferred to an inquiry stance in my educational career. I ponder more about the research and/or evidence provided. The scholarly literature and findings of this study provided me with the data I needed to explain whether an association may exist between ICT SWD's and non-ICT SWD's scale scores from the NYS Grade 4 and Grade 5 ELA and mathematics assessments. I was able to show that students who were taught in ICT classrooms scored higher on the NYS ELA and mathematics assessments than students in non-ICT classrooms in this local setting.

In my administrative role, I focus on utilizing the information I gain as a scholar and applying the knowledge for practical functions on the job site. I clarify my purpose (mission and vision) and develop a plan based on peer-reviewed research and data. Shared decision-making choices are based on data instead of personal statements that are unsubstantiated with qualitative and/or quantitative data. This approach helped me

facilitate the Response to Intervention District Design Team. In the future, I will apply the process to the development of curriculum, instruction, and assessment for my district.

Analysis of Self as Project Developer

As I commenced writing Sections 1 and 2, I realized the project's originations needed to come from the data findings not my personal agenda. At that point, I became concerned, because the findings from my study did not warrant an evaluation report, curriculum plan, or professional development, all of which I had experience in. I did not have prior involvement or knowledge about preparing policy recommendations in the form of a white paper. I was unable to locate peer-reviewed articles specifically related to white papers. Therefore, I sought other sources, such as dissertations, that would provide information about white papers. The clear and concise nature of a white paper provided the optimum format by which I could share the results and recommendations of the study. Through the white paper, I was able to provide district administration with pertinent information for consideration when discussing the future staffing needs of coteaching classrooms, as well as the provision of related professional development.

Critical thinking, planning, and organizational skills learned through my doctoral journey are applicable to my future career plans. I will use the skills learned to map out a plan for curriculum, instruction, and assessment of students, where all items are connected in order to achieve the highest level of academic success for students.

The Project's Potential Impact on Social Change

The LRE (IDEA, 2004) is one of the cornerstones of special education. At the local level, placement of SWD within an ICT classroom allows SWD to receive special

education services within a LRE, the general education classroom. The findings presented in the white paper revealed a statistically significant difference between non-ICT and ICT SWD's student achievement (scale scores) on the New York State ELA and mathematics assessments for Grades 4 and 5. An implication for social change could be further implementation of ICT classrooms with the current staffing levels and professional development, which would result in more SWD participating in general education settings for at least 80% or more of their day.

The study's findings expand the limited research that currently exists on the effectiveness of coteaching in increasing student achievement. As a result, the gap in creating generalizations to a multitude of academic environments and grade levels is closing. Increasing SWD's participation in general education settings, as well as increasing their ability to graduate high school, will help to create positive social change in the local school environment and assist these individuals to become contributing members of society.

Implications, Applications, and Directions for Future Research

The findings of the study have empirical implications. The data support and expand the limited empirical evidence located in current literature regarding coteaching at the elementary level. With the information from this study, school districts are able to defend coteaching as a way to meet the requirements of IDEIA and NCLB in the LRE, the general education classroom. Districts may consider applying the staffing configuration (one full-time general education teacher, one full-time special education teacher, and one full-time teaching assistant) of the ICT classrooms included in this study

to see if similar results can be obtained. Adoption of the professional development process as a stand-alone option or in conjunction with the staffing configuration to increase co-teachers' understanding of ICT services and their efficacy in providing those services may be another consideration for districts.

Recommendations for future research includes further data analyses using quasi-experimental designs across diverse student populations, subjects, and grade levels implementing ICT classrooms, as well as longitudinal data analyses. Research involving multiple grade levels, subjects, and diverse student populations would increase the sample size and the possibility of generalizing the results. In addition, I recommend investigating the significant difference ICT classrooms might have on discipline referrals, attendance, suspensions, and dropout rates (Friend et al., 2010; Kilanowski-Press et al., 2010). Student engagement tends to increase as instruction improves, which tends to decrease discipline issues, absences, and dropout rates. Therefore, students are more apt to stay in school and become college and career ready.

Conclusion

Cayuga Central School District had not conducted quantitative analyses since the inception of ICT classrooms during the 2009-2010 AY. The purpose of this study was to investigate the association between ICT services and student academic achievement in ELA and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. The study was guided by Vygotsky's social constructivist theory and the following research questions: (a) What is the difference between the ELA scale scores of

SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?; (b) What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?; (c) What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?; and (d) What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

The findings of this study indicated a statistically significant difference on ICT SWD's academic achievement (scale scores) in ELA and mathematics, as measured by the New York State Grades 4 and 5 ELA and mathematics assessments was found, with non-ICT students scoring lower. These differences in student performance may be indicative of ICT classrooms being a highly viable option for teaching the SWD population in the LRE of the general education classroom. A possible social change outcome of this study may be continued research regarding the impact coteaching has at other grade levels, as well as on discipline, attendance, and dropout rates.

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Appendix A: The White Paper

Co-Teaching at the Elementary School Level in a Suburban Setting

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Table of Contents

Introduction

To comply with federal laws, some schools began to implement coteaching as a means to meet the required mandates of Individuals with Disabilities Education Improvement Act (IDEIA) and No Child Left Behind (NCLB) Act of 2001 NCLB (Friend, Cook, Hurley-Chamberlain, & Shamberger, 2010; Kilanowski-Press, Foote, & Rinaldo, 2010; Kloo & Zigmond, 2008; Minarik & Lintner, 2011). Coteaching, as defined by New York State's Board of Regents, "means the provision of specially designed instruction and academic instruction provided to a group of students with disabilities and non-disabled students [by a special education teacher and general education teacher jointly]" (New York State Education Department [NYS-ED], 2008, p. 2). However, limited research exists on the effectiveness of coteaching in increasing student achievement. The intent of this quantitative study was to examine the effectiveness of coteaching as a service delivery model.

Limited research exists on the effectiveness of coteaching in increasing student achievement.

Problem

From 2008 to 2009, as a result of an amendment to 200.6 of the Regulations of the Commissioner of Education (NYS-ED, 2008) and expressed concerns from general education and special education teachers, the Special Education Department at Cayuga Central School District (pseudonym), a school district situated in Central New York on the outskirts of a large city, convened a K-12 committee, consisting of administrators, special education teachers, and school psychologists, to examine special

Limited empirical research regarding coteaching exists at the

education services delivered to students with disabilities (SWD), particularly at the elementary level (K-6). Special education teachers in the district provided a ratio of 15:1 student-to-teacher services to those students requiring support in English language arts (ELA) and/or mathematics, as well as those students requiring resource and/or consultant services. This ratio refers to the number of SWD at any one time with the support of one special education teacher within a general education setting. As a result, special education teachers self-reported either under- or over-servicing students, causing general education teachers to report that they felt inadequately supported. Based on the conclusions of the committee, as related to the special education services provided in the district at the time, an integrated coteaching (ICT) model was reviewed (ICT committee, personal communication, November 3, 2008). The committee decided to remove the 15:1 student-to-teacher services at Grades K-5 for the 2009-2010 academic year (AY) and implement ICT classrooms for those students who had required 15:1 student-to-teacher special education services. The ICT classes were not implemented for Grade 6, because the committee members did not feel students should be moved during their final year in elementary school. By not making this change, the sixth graders experienced fewer transitions in their educational career. Also, ICT classrooms were not offered at the middle school level. Most ICT classrooms consisted of one full-time special education teacher, one full-time general education teacher, and one full-time teaching assistant.

Cayuga Central School District administrators had concerns about providing adequate support to SWD within the general education classrooms via a ratio of 15:1 student-to-teacher special education services to those students requiring support in

English language arts and/or mathematics. Through self-reports by general education and special education teachers, SWD were under- or over-serviced, and in response, the district administrators implemented three to four ICT classrooms per grade level (K-6) (ICT Committee, personal communication, November 3, 2008). However, the district administrators had not collected quantitative or qualitative data to examine the effectiveness of integrated coteaching services concerning students' learning. To date, only anecdotal data from district personnel and conversations with staff members in the district were compiled. The anecdotal data came from personal communications between me and the principals and general education and special education teachers who had ICT classrooms, as well as from district office administrators who supported the implementation process during the 2009-2010 AY (S. Mere, personal communication, December 21, 2009; B. Woodcock, personal communication, December 7, 2009). Therefore, the local educational problem was the absence of evaluation data for ICT classrooms, which left the district administrators without empirical evidence regarding the value and potential effectiveness of the ICT services that were perceived to have a positive impact on the performance of SWD in the local district.

Due to economic constraints of school districts across New York State and the country, superintendents analyze staff, programs, and courses. Cayuga Central School District's commitment to insuring a full-time teaching assistant, a full-time general education teacher, and a full-time special education teacher for each ICT classroom came under scrutiny. Although formal or informal transcripts do not exist to reflect this action within the district, the district administrators wished to continue to support a staff-rich

model, but needed data to support its existence. A staff-rich model included using a full-time teaching assistant, a full-time general education teacher, and a full-time special education teacher for each ICT classroom in the district (Assistant Director of Special Education, personal communication, February 5, 2010). Therefore, the purpose of this study was to investigate the association between ICT services and student academic achievement in English Language Arts (ELA) and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. Other researchers concluded that limited empirical evidence exists on the relationship between coteaching and student learning (Friend et al., 2010; Hang & Rabren, 2009; Kloo & Zigmond, 2008; Murawski & Swanson, 2001; Pugach & Winn, 2011; Scruggs, Mastropieri, & McDuffie, 2007; Whittaker, 2012)

Research Questions

Cayuga Central School District implemented three to four ICT classrooms per grade level (K-5, 2009-2010 and K-6, 2010-2014) in order to provide adequate support to SWD within the general education classroom. The research questions of this study concerned the association between implementation of ICT classrooms and SWD's academic achievement in ELA and mathematics.

Research Questions

1. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in

the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?

2. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?
3. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?
4. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

What Does the Research Say About Coteaching?

The foundation of coteaching began over 60 years ago. The development of coteaching began with the establishment of team teaching in the 1950s, where one team of teachers is responsible for one group of students (Friend & Reising, 1993). Current renditions of team teaching focus on interdisciplinary shared planning, with each teacher providing instruction in his or her core content. In the 1980s, the regular education initiative (REI) proposed SWD participate more in general education classrooms than self-contained classrooms (Minarik & Lintner, 2011). In response, special education

teachers adopted team teaching as a way to mainstream SWD into general education settings. Team teaching was renamed cooperative teaching or coteaching as a way to separate it from team teaching used by general education teachers (Friend & Reising, 1993). The term collaborative teaching was used, as well.

Over the past four decades, the definition of coteaching has been refined to differentiate itself from other forms of interactive teaching. Friend and Reising (1993) stated,

> Coteaching in special education is an instructional delivery approach in which a classroom teacher and a special education teacher (or other special services professional) share responsibility for planning, delivering, and evaluating instruction for a group of students, some of whom have exceptional needs. (p. 1)

Cook and Friend (1995) revised the definition to "two or more professionals delivering substantive instruction to a diverse, or blended, group of students in a single physical space" (p. 2). Furthermore, Kloo and Zigmond (2008) and Fenty, McDuffie-Landrum, and Fisher (2012) referenced coteaching as a specific form of collaborative teaching. Cook and Friend's clarification of coteaching helped establish a special education service delivery model that fostered servicing SWD in the least restrictive environment (LRE), the general education classroom. Learning within a general education classroom exemplifies the sociocultural context of Vygotsky's (1978) tenets of social constructivism theory.

Components of Coteaching

In order to maximize the effectiveness of coteaching to impact student learning, co-partners must ensure the three components of coteaching have been addressed. In this study, co-partners are the general education teacher and the special education teacher working together in an ICT classroom (NYS-ED, 2008). The three components are co-planning, co-instructing, and co-assessing (Brown, Howerter, & Morgan, 2013; Conderman, 2011; Murawski & Lochner, 2011; Stivers, 2008). A lack of co-planning time is often cited as the leading barrier to effective coteaching (Forbes & Billet, 2012; Moin, Magiera, & Zigmond, 2009). The six coteaching models are (a) one teach, one observe; (b); (c) parallel teaching; (d) alternative teaching; (e) teaming; and (f) one teach, one assist. For co-assessing, the time is spent gathering and analyzing students' academic and behavioral data to determine if the students are learning. As a result, data-driven decision-making may lead to an increase in tailored instruction supportive of each student's needs.

Key Elements of Successful Coteaching

Before co-planning, co-instructing, and co-assessing can occur, common barriers encountered by schools and coteaching teams must be tackled. Essential elements to address barriers to effective coteaching are:

- Administrative support
- Shared planning time
- Provision of professional development

Requirements for Successful Coteaching Partnerships

Once coteaching partnerships have been created, parameters need to be established, which include the following:

- Ground rules
- Effective communication skills
- Parity

Benefits of Coteaching

Though the data regarding the effectiveness of coteaching are limited, researchers have suggested positive impacts for students' and teachers' learning. Common themes in the research are:

- An increase in teaching techniques and use of differentiation (Baecher & Jewkes, 2014; Cramer, Liston, Nevin, & Thousand, 2010; Fenty & McDuffie-Landrum, 2011; Friend & Reising, 1993; Gradwell & DiCamillo, 2013; Kloo & Zigmond, 2008)
- An increase in student achievement (McDuffie, Mastropieri & Scruggs, 2009; Murawski & Swanson, 2001; Nevin, Cramer, Voight, & Salazar, 2008; Pickard, 2009)
- An increase in teachers' content and classroom management knowledge (Leatherman, 2009; Murawski & Hughes, 2009; Rytivaara & Kershner, 2012; Scruggs et al., 2007)
- An increase in students' social skills due to positive peer models (Alquraini & Gut, 2012; Hepner & Newman, 2010; Scruggs et al., 2007)

- Receipt of support, accommodations, and modifications in the most LRE for the SWD learner (Courey, Tappe, Siker, & LePage, 2012; Kloo & Zigmond, 2008; McDuffie, Landrum, & Gelman, 2008)
- A decrease in student-teacher ratio (Kloo & Zigmond, 2008; McDuffie et al., 2008; Nichols, Dowdy, & Nichols, 2010)
- A decrease in the stigma SWD might feel for receiving additional support (Kloo & Zigmond, 2008; Nichols et al., 2010)
- An increase in students' self-confidence (Hang & Rabren, 2009; Nichols & Sheffield, 2014)
- An increase in empathy by students without disabilities towards SWD (Pickard, 2009)
- An increase in immediate feedback to students (Jang, 2010)

Research Design

The New York State assessments for ELA and mathematics measure different standards at different grade levels and are not vertically scaled, so scores cannot be compared from grade to grade (CTB/McGraw-Hill, 2010, p. 1). In the analysis for this study, the covariates were scores on the prior grades' comparable New York State assessments. While the New York State scale scores cannot be compared from grade level to grade level, they do meet the test for use as a covariate. Creswell (2012) stated, "These variables [covariates] are any variables correlated with the dependent variable" (p. 298), which in this study was the scale score in the prior grade. Therefore, a quantitative study using comparison groups and analysis of covariance (ANCOVA) was

conducted. For the purpose of this study, I analyzed the differences in academic performance on New York State assessments in ELA and mathematics for SWD who were served in ICT classrooms and those that were not served in ICT classrooms for Grades 4 and 5.

Data Collection and Data Analysis Results

I collected de-identified archival data from Cayuga Central School District's student information system. The district's director of data management collected and provided the data in an Excel spreadsheet for my use. I conducted an ANCOVA to compare the ICT and non-ICT groups' scale scores using SPSS.

The 2010 NYSTP uses a scale score for ELA and mathematics for Grades 3 through 8.

> A scale score is a quantification of ability as measured by the Grades 3 through 8 ELA tests at each grade level. The scale scores were comparable within each grade level, but not across grades because the Grades 3 through 8 ELA tests were not on a vertical scale. The test scores were reported at the individual level and can be aggregated. (CTB/McGraw-Hill, 2010a, p. 1)

An identical statement appears in the mathematics technical report for the 2010 NYSTP. The ELA scale scores for Grades 4 and 5 ranged from 430 to 775 and 495 to 795, respectively (CTB/McGraw-Hill, 2010a). The mathematics scale scores for Grades 4 and 5 ranged from 485 to 800 and 495 to 780, respectively (CTB/McGraw-Hill, 2010b). The raw data for the ELA and mathematics scale scores can be secured upon request.

Research Questions and Hypotheses

The research questions for the study were: (a) What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?; (b) What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?; (c) What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?; and (d) What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes? I used narratives and tables to address each null hypothesis and non-directional alternative hypothesis (Creswell, 2012).

Hypothesis 1. $H_0$1: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 4 ELA assessment.

$H_1$1: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 4 ELA assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the Grade 4 New York State ELA assessment (see Table 1). After adjusting the mean scale scores, I found a statistically significant difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the ELA scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, with the ICT group scoring higher, $F(1,33) = 4954.91$, $p = .011$, partial $\eta^2 = .181$. Furthermore, a Levene's test of equality of error variances ($p = .675$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 1

Results of the ANCOVA for Grade 4 New York State English Language Arts

	Grade 4		
	Adj. Mean	F	*p*
ICT	643.500	7.294	.011
Non-ICT	615.444	8.973	.005

Hypothesis 2. $H_0$2: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 4 mathematics assessment.

$H_1$2: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 4 mathematics assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the Grade 4 New York State mathematics assessment (see Table 2). After adjusting the mean scale scores, I found a statistically significant difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the mathematics scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, with the ICT group receiving higher scores, $F(1,33) = 14600.81$, $p = .000$, partial $\eta^2 = .568$. Furthermore, a Levene's test of equality of error variances ($p = .679$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 2

Results of the ANCOVA for Grade 4 New York State Mathematics

	Grade 4		
	Adj. Mean	F	*P*
ICT	655.213	43.339	.000
Non-ICT	639.120	6.007	.020

Hypothesis 3. $H_0$3: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 5 ELA assessment.

$H_1$3: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in ELA, as measured by the New York State Grade 5 ELA assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the Grade 5 New York State ELA assessment (see Table 3). After adjusting the mean scale scores, I found a statistically significant difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the ELA scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, with the

ICT group scoring higher, $F(1,24) = 2015.81$, $p = .001$, partial $\eta^2 = .356$. Furthermore, a Levene's test of equality of error variances ($p = .536$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 3

Results of the ANCOVA for Grade 5 New York State English Language Arts

	Grade 5		
	Adj. Mean	*F*	*P*
ICT	637.221	13.270	.001
Non-ICT	635.221	.164	.689

Hypothesis 4. $H_0$4: There is no significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 5 mathematics assessment.

$H_1$4: There is a significant difference between the scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes on academic achievement in mathematics, as measured by the New York State Grade 5 mathematics assessment.

An ANCOVA was conducted to determine if a significant difference existed between the scale scores of non-ICT SWD and the scale scores of ICT SWD on the

Grade 5 New York State mathematics assessment (see Table 4). After adjusting the mean scale scores, I found a statistically significant difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the mathematics scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, with the ICT group scoring higher, $F(1,27) = 5335.65$, $p = .000$, partial $\eta^2 = .467$. Furthermore, a Levene's test of equality of error variances ($p = .447$) was greater than .05, which signifies the error variance of the dependent variable is equal across all groups (Laerd, 2014); therefore, I rejected the null hypothesis.

Table 4

Results of the ANCOVA for Grade 5 New York State Mathematics

	Grade 5		
	Adj. Mean	*F*	*P*
ICT	641.946	23.677	.000
Non-ICT	639.120	.157	.695

Discussion of Findings

The purpose of this study was to investigate the association between ICT services and student academic achievement in English Language Arts (ELA) and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. Following data collection, a summary of the data analysis results in relation to acceptance or rejection of each null hypothesis and non-directional alternative hypothesis (Creswell, 2012) was presented. The findings, as correlated to the research questions, are discussed in the following sections.

Research Questions 1 and 3

The first and third research questions asked if a significant difference existed between the ELA scale scores of non-ICT SWD and the ELA scale scores of ICT SWD as measured by the New York State Grade 4 and Grade 5 ELA assessments. The ANCOVA determined the ELA scale scores of SWD who received ICT special education services were statistically higher those of the non-ICT group. These results appear consistent with other researchers' findings when coteaching was the primary delivery model for learning (McDuffie et al., 2008; Murawski & Swanson, 2001). I concluded that participation in a full day ICT classroom may have been a contributing factor to SWD's academic success as measured by the NYS Grade and Grade 5 ELA assessments

Research Questions 2 and 4

The second and fourth research questions asked if a significant difference existed between the mathematics scale scores of non-ICT SWD and the mathematics scale scores of ICT SWD as measured by the New York State Grade 4 and Grade 5 mathematics assessments. The ANCOVA determined the mathematics scale scores of SWD who received ICT special education services were statistically higher those of the non-ICT group. These results appear consistent with other researchers' findings when coteaching was the primary delivery model for learning (Nevin et al., 2008; Pickard, 2009). I concluded that participation in a full day ICT classroom might have been a contributing factor to SWD's academic success as measured by the NYS Grade and Grade 5 mathematics assessments

Recommendations

There are several purposes of this white paper. The first is to inform the administrators and stakeholders of Cayuga Central School District about the findings of the quantitative data revealed in this study regarding the association between ICT classrooms and SWD's academic achievement in ELA and mathematics. Data from this study provided evidence a statistical difference between the scale scores of ICT SWD and non-ICT SWD's scale scores was found. As a result, I have included three recommendations based on the findings of this study, which are: (a) the ongoing environment provided by ICT classrooms, (b) continuing the use of teaching assistants, and (c) offering professional development focused on integrated coteaching.

Recommendation 1: Continue ICT

All four quantitative analyses conducted showed a statistical difference between the ICT and non-ICT SWD's scale scores. The findings are in alignment with previous studies. Additional recent quantitative studies demonstrated how SWD participating in inclusive settings met or exceeded state proficiency standards in reading and mathematics (Hoppey & McLeskey, 2013; Roden, Bogemenke, & Holt, 2013). Bronson and Dentith (2014) found that after participating in coteaching, particularly a partner-teaching model, kindergarten students demonstrated above average reading scores, as compared to their peers who had not been exposed to coteaching. Using comparative analysis, the findings from Tremblay's (2013) research showed positive results in reading and writing for those students who had participated in a co-taught classroom as compared to those students

who had not participated in a co-taught classroom. Math results were also positive, but not significantly different. Learners appeared to construct knowledge through participation in co-taught setting (Vygotsky, 1978).

In addition to the elementary quantitative findings, quantitative findings from several secondary studies show the positive impact coteaching and/or collaboration has on student achievement. The effect of ICT services on SWD's academic performance on state assessment tests is supported by current research (Ashton, 2014; DiCamillo & Gradwell, 2012; Mirza & Iqbal, 2014). As evidence-based research continues to show the affirmative influence coteaching has on student academic achievement, especially in the areas of ELA and mathematics, the existing support for ICT classrooms across various grade levels increases.

As demonstrated by the findings of this study and other peer-reviewed literature, the district needs to continue the use of ICT classrooms not only at the elementary level, but also the secondary level, as well. ICT classrooms appear to be a factor contributing to SWD's academic achievement; and ICT classrooms support the provision of special education services within the general education classroom.

Recommendation 2: Utilize Teaching Assistants

Unlike other research reviewed, the ICT classrooms included in the current study had, minimally, one teaching assistant assigned to each classroom full time. Depending on the needs of the SWD, a few of the ICT classrooms had more than one teaching assistant. The additional support may have contributed to the positive student academic

achievement results, as measured by the Grades 4 and 5 New York State ELA and mathematics assessments, which suggests the current model needs to remain constant.

Teaching assistants may have a positive impact on SWD's academic achievement. Farrell, Alborz, Howes, and Peterson (2010) found that in eight out of nine studies, the use of teaching assistants increased student academic achievement when a targeted intervention was provided to primary students struggling with literacy and language, but less so with numeracy. One cause of this finding could be the abundance of research-based practices for literacy (Kilanowski-Press, 2011, Slide 32). Another cause could be the social interactions between a more knowledgeable other (MKO), in this case the teaching assistants, and students, where the MKO scaffolded support in order to engage students in individual learning (Vygotsky, 1978).

Qualitative studies revealed teachers' positive perceptions regarding the impact of teaching assistants. With teaching assistants in the classroom, teachers felt the additional support increased students' attention, learning outcomes, and teacher effectiveness by freeing up their time, so they could focus more on the students (Farrell et al., 2010). The increase in social interactions between teachers and students allowed for collaborative dialogue, which may have contributed to greater understanding/performance on behalf of the students (McLeod, 2007; Vygotsky, 1978). Farrell et al. concluded that properly trained teaching assistants who provide specific literacy and language interventions can have a positive impact on student's academic achievement. Alborz, Pearson, Farrell, and Howes (2009) came to a similar supposition.

Consistent training of teaching assistants is a necessary element in increasing the effect of student academic achievement.

Four out four quantitative analyses conducted showed a statistical difference between the ICT and non-ICT SWD's scale scores. I assumed the addition of teaching assistants contributed to the results. Blatchford et al.'s (2011) study showed a significant effect between level of teaching assistant support and positive approaches to learning, such as decreased distractibility, increased confidence, and ability to follow directions. On the other hand, academic progress appeared to be thwarted by teaching assistant support. Blatchford et al.'s data revealed more teaching assistant support equated to less academic progress. Students who are assigned teaching assistant support may become less independent, which could have contributed to the results Blatchford et al. obtained, as well as my own results. Caution must be taken in assigning teaching assistant support.

As supported by the findings of this study and other research conducted on the use of teaching assistants, the district needs to continue providing teaching assistants in ICT classrooms. The provision of teaching assistants within ICT classrooms appears to support SWD's academic achievement and support the provision of special education services within the general education classroom, as long as specific parameters are established. Teaching assistants in the ICT classrooms will support SWD to continue developing thinking skills and becoming independent learners.

Recommendation 3: Continue Professional Development

Consistent, cohesive professional development may lead to improved student achievement. As with coteaching and the use of teaching assistants in classrooms, little

research exists linking professional development with student outcomes (Garet, Porter, Desimone, Birman, & Yoon. 2001; Kretlow & Bartholomew, 2010; Penuel, Fishman, Yamaguchi, & Gallagher, 2007; Shaha & Ellsworth, 2013). However, the provision of professional development may be another reason why implementation of ICT as a special education service delivery model for SWD in ELA and mathematics had a positive impact on the ICT group's versus the non-ICT group's performance, as measured by the New York State Grade 4 and Grade 5 ELA and mathematics assessments.

In preparation for the implementation of ICT classrooms, Cayuga Central School District arranged for professional development opportunities for co-teachers and/or ICT teams. Coteachers attended a 2-day workshop entitled "Introduction to Coteaching" in June of 2009. The focus for the workshop was New York State guidelines for coteaching, team self-analysis, coteaching approaches, roles and responsibilities, purposeful planning, coteaching agreement, and reflection. In August of 2009, ICT teams attended a half-day workshop with me as facilitator. An hour was spent reviewing New York State guidelines for coteaching. The next 2 hours focused on determining the roles and responsibilities of the members of the coteaching team and to begin planning initial lessons. I followed up the training by visiting each classroom in the fall and winter. The fall visits were informal observations, while the winter visits included sit down meetings with each team. Coteachers were allotted three half-days for planning. I also facilitated six 1-hour ICT meetings after school throughout the year. The topics included horizontal and vertical discussions about how coteaching was progressing, differentiated instruction, and classroom management. Mandatory participation was required for most sessions.

Subsequent years included one to two team workshop days, as well as three half-days for planning. Based on the research summarized in this white paper, I concluded that Cayuga Central School District's professional development practices regarding coteaching provided ongoing, content-specific, and collaborative opportunities, which led to effective coteaching and, ultimately, was a contributing factor to improved student achievement for students serviced in ICT classrooms compared to non-ICT students (four out of four quantitative analyses).

As the research findings from this study suggest, ongoing, specific professional development increases teachers and teaching assistants' knowledge, and consequently, their skill level in the classroom increases. Therefore, the district needs to continue providing professional development to ICT teams, including teaching assistants, in order to support SWD's academic achievement and support the provision of special education services within the general education classroom.

Conclusion

Cayuga Central School District had not conducted quantitative analyses since the inception of ICT classrooms during the 2009-2010 AY. The purpose of this study was to investigate the association between ICT services and student academic achievement in English Language Arts (ELA) and mathematics, as measured by the New York State ELA and mathematics assessments for Grade 4 and Grade 5, by comparing the scale scores of non-ICT and ICT groups. The study was guided by Vygotsky's social constructivist theory and the following research questions:

1. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?
2. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 4 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 4 class with ICT implementation, while controlling for the Grade 3 scores of each of these classes?
3. What is the difference between the ELA scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?
4. What is the difference between the mathematics scale scores of SWD in the 2008-2009 AY Grade 5 class with no ICT implementation and the scale scores of SWD in the 2009-2010 AY Grade 5 class with ICT implementation, while controlling for the Grade 4 scores of each of these classes?

The findings of this study indicated a positive association between ICT and SWD's academic achievement in ELA and mathematics, as measured by the New York State Grades 4 and 5 ELA and mathematics assessments. The findings from this study are not able to causally relate the higher scores to the ICT classroom; however, the co-taught support in these classrooms could have been a factor to the success of SWD. As a result of this research study, recommendations are (a) continuation of ICT classrooms, (b)

continuation of teaching assistants in ICT classrooms, and (c) continuation of consistent professional development focused on the development of coteaching partnerships. These recommendations allow the district to uphold the cornerstones of special education, free appropriate education (FAPE) (Education for All Handicapped Children, 1975) and LRE (IDEIA, 2004), as well as access to the general education curriculum, as defined by NCLB (2002), by offering a special education service in a LRE, the general education classroom. Furthermore, ICT is moored in the philosophy and principles of inclusion. The crux of inclusion in regards to the impact ICT has on SWD's academic achievement is the ability for schools to welcome and support all students in the community (Huberman, Navo, & Parrish, 2012; McMaster, 2012). By scaffolding and accommodating student needs, schools are better able to maintain a student's engagement in his/her learning, potentially increasing their knowledge base.

The guiding principles of inclusion and social change are equality and social justice. These principles stem from the 1954 *Brown v. Board of Education* decision and the civil rights movement of the 1960s (Alquraini & Gut, 2012; Aron & Loprest, 2012). By focusing on the Equal Protection Clause of the 14th Amendment, which states citizens are afforded equal protection under the law, the Supreme Court justices declared that all students should have access to an equal education. Segregation by race minimized students' access to a solid education, which decreased their likelihood of becoming productive members of society. This Supreme Court decision and the civil rights movement paved the way for the development of the Rehabilitation Act of 1973, Section 504. This federal law prohibits entities receiving federal funds, such as public schools,

from discriminating against any individuals with disabilities. Schools cannot exclude or deny eligible SWD access to programs and services (U.S. Department of Health and Human Services [USDHHS], 2006). Therefore, schools cannot deny students' access to FAPE, which was established with the adoption of EAHCA in 1975.

As the IDEA (1990, 1997) and the IDEIA (2004) evolved, so did participation of SWD in general education settings. Increased participation in an ICT classroom allows for an increase in social interactions between and among SWD, peers, and adults (Vygotsky, 1978). As social interactions increase, a learner's receptive and expressive language development improves, which allows the learner to actively participate in his/her individual development more often (Vygotsky, 1978). The lasting positive social change is increased academic achievement for SWD while in an educational setting, and ultimately, SWD's ability to live and operate independently in the real world.

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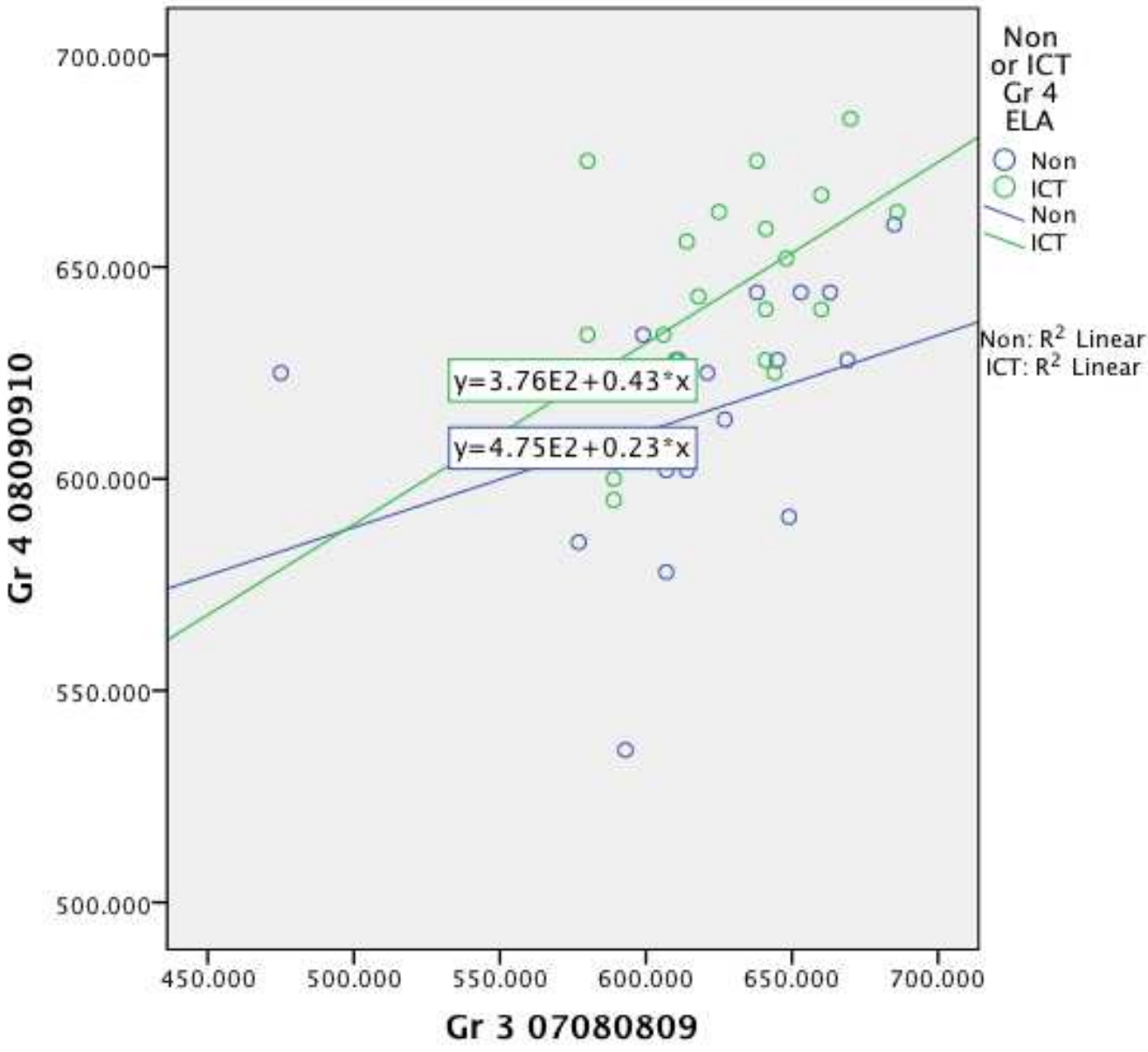
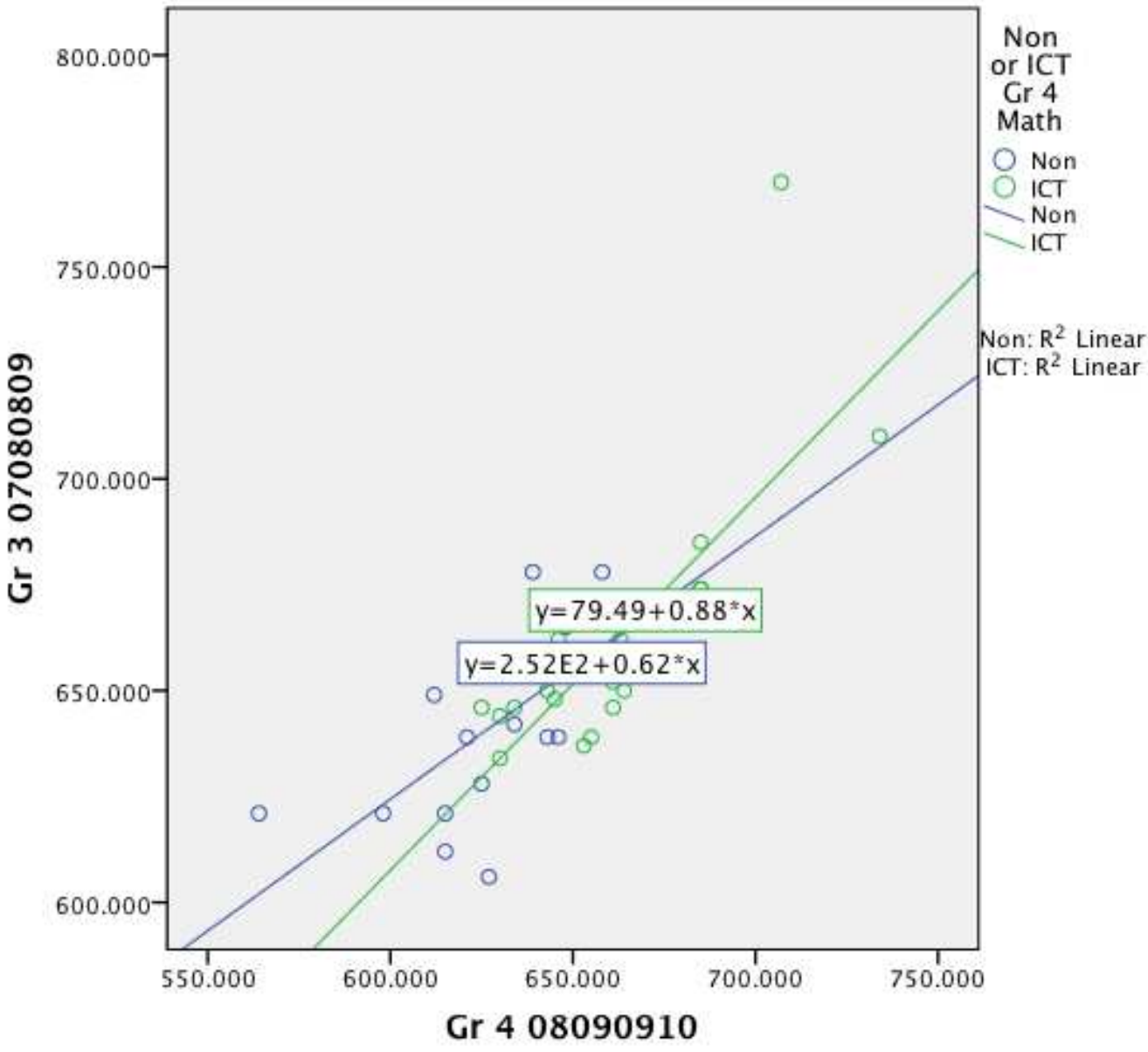
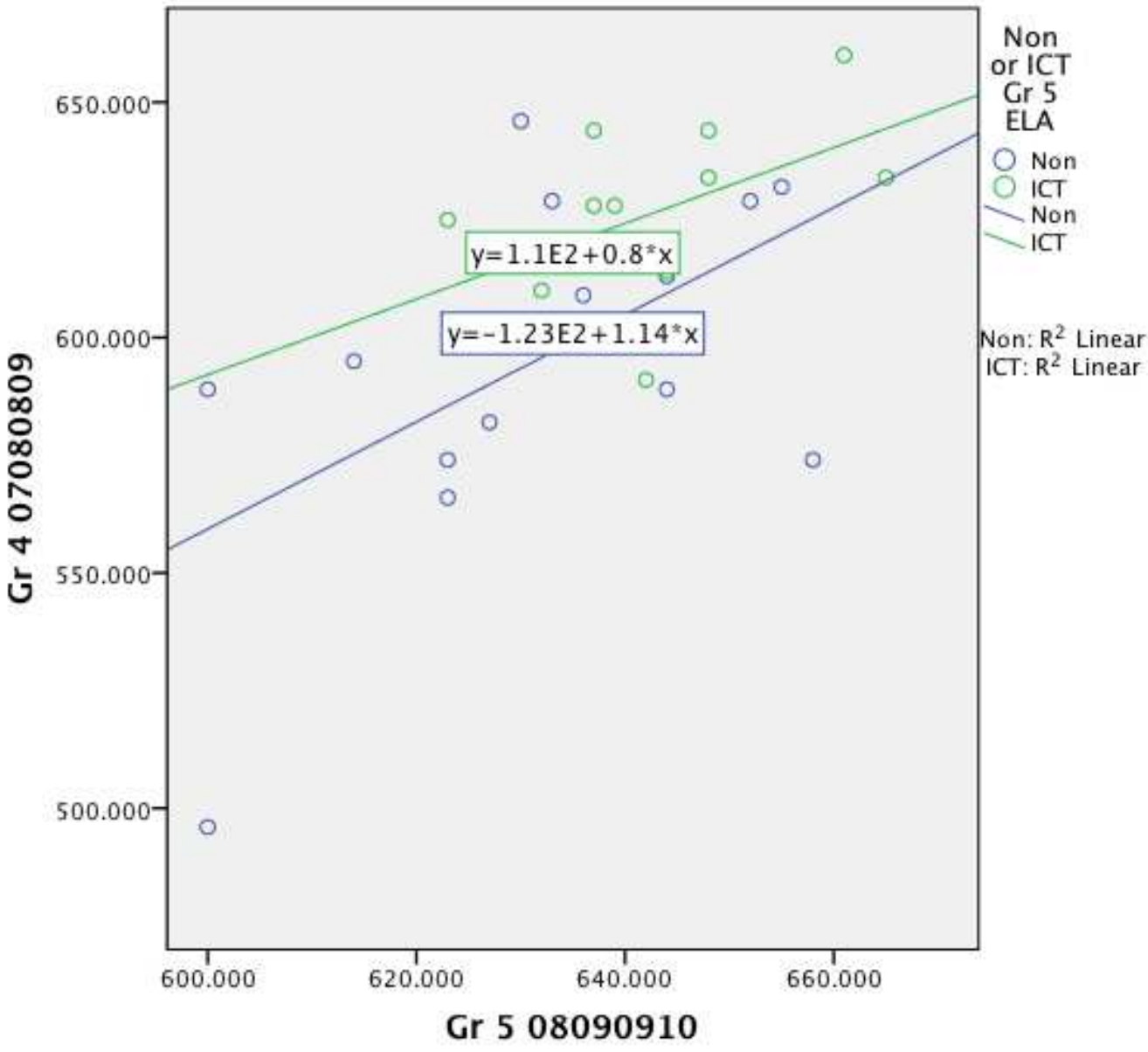
Appendix B: Assumption of Linearity for Grade 4 ELA



Appendix C: Assumption of Linearity for Grade 4 Mathematics



Appendix D: Assumption of Linearity for Grade 5 ELA



Appendix E: Assumption of Linearity for Grade 5 Mathematics