THE EFFECTS OF CORNELL NOTE-TAKING AND REVIEW STRATEGIES ON RECALL AND COMPREHENSION OF LECTURE CONTENT FOR MIDDLE SCHOOL STUDENTS WITH AND WITHOUT DISABILITIES

BY

Zulejka Baharev

A dissertation proposal submitted to

The Graduate School of Education

Rutgers, The State University of New Jersey

in partial fulfillment of the requirements

for the degree

Doctor of Education

Approved by

_____

Dr. Angela M. O'Donnell, Chair

_____

Dr. Judith Harrison, Committee

_____

Dr. Christopher Manente, Committee

New Brunswick, New Jersey

(October 2016)

ABSTRACT OF DISSERTATION

By Zulejka Baharev

At the start of the 21st century large scale educational initiatives reshaped the landscape of general education setting rigorous academic expectations to all students. Despite the legal efforts to improve K-12 education, an abundance of research indicates that students entering college often lack basic learning and study skills. For adolescents with learning disabilities, however, these challenges are even greater. While the number of students with learning disabilities who receive their education in the general education content-areas classes continues to grow, information lags behind as to how to effectively adapt instruction to support these students and improve their academic achievement.

In view of the research supporting the conjunctive use of note-taking and review, the current study involved instruction in note-taking using the Cornell method and review strategy with the use of summarization and question generation with sixty eighth grade students with and without disabilities from social studies classes in a public middle school. The current study focused on the evaluation and comparison of students with and without disabilities note-taking and review skills as well as comprehension of lecture content. Specifically, the research sought to answer the following questions: Would students' note-taking, and review skills improve as a result of strategy training? Would comprehension of the material improve with strategy intervention? What are the differences between students with and without disabilities in their note-taking and review strategies prior to and after intervention?

A nonrandomized pre-test-posttest design with experimental and intervention condition was employed to evaluate student performance. Strategy training and business-as-usual practice sessions were provided by the researcher. Data analysis comprised of students' quantity and quality of notes and comprehension of lecture content before and after strategy training.

The results of the current study suggest that successful strategy training should be time and mastery based in order ensure student success. The findings of the current study were inconclusive regarding the effectiveness of strategy training in note-taking and review on student performance. Lastly, differences between students with and without disabilities on note-taking, study, and test performance were mixed.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

Introduction

During the last two decades, general education underwent significant reform and transformation. First, with the passage of the No Child Left Behind of 2001 (P.L. 107-110), the federal government mandated that states and its schools implement new curriculum standards and testing policies and increased the demand for accountability in minimum basic skills (reading and mathematics), and improving student achievement for all children. A few years later, in 2010 the National Governors Association (NGA) released the Common Core State Standards (CCSS). The CCSS set rigorous expectations for all K-12 students in general education core academic subjects to guide instruction outlining what students need to know and learn to be prepared for college and the workplace. In order to meet the rigorous academic demands of the general education curriculum and achieve competency, students not only need to acquire academic skills and knowledge, but must also know how to learn. CCSS outlines minimum grade-level competency expectations in content areas too prepare students to college and career opportunities nationally as well as in a global economy (Haager & Vaughn, 2013). Certainly, most would agree that college and career readiness is an important long-term goal for most students.

However, a large body of research reports that students often experience challenges with many skills necessary to be successful in the college learning environment. More than fifty percent of college educators report that their students are underprepared and lack basic learning strategies (Jairam & Kiewra, 2010; Kiewra, 2002; Peverly, et al., 2003; van der Meer, 2012). Since lectures are the primary mode of teaching and learning in high school and college classes, efficient note-taking and study skills play an integral role in acquiring information and academic

success (Boyle & Weishaar, 2001; Butler et al., 2001; O'Donnell & Dansereau, 1993; Titsworth, 2004; Van Meter et al., 1994). Specifically, note-taking during lectures serves two purposes: it directs student attention and aids understanding (encoding) of lecture points and it serves to preserve (storage) lecture information for later study (Boyle & Weishaar, 2001; Di Vesta & Gray, 1972, Kiewra et al., 1991; Van Meter, Yokoi, & Pressley, 1994). In other words, taking notes during lectures promotes students' active participation and processing during lectures and the written notes of lecture materials facilitate later review and preparation for tests. Unfortunately, research has shown that many students utilize inefficient note-taking and study (review) strategies (Austin et al., 2004; Karpicke, Butler & Roediger, 2009; Kiewra, 2002; Suritsky & Hughes, 1991; Titsworth, 2004). Students record incomplete notes (Austin et al., 2004; Neef, McCord, & Ferreri, 2006; Titsworth & Kiewra, 2004), have difficulty discerning relevant and irrelevant information, employ shallow, inefficient learning strategies to review their notes, and are not good at evaluating their test preparation (Jairam & Kiewra, 2010; Karpicke, Butler, & Roediger, 2009). Note-taking and study skills present increased challenges for students with learning disabilities who often experience difficulties attaining academic competencies, employ inefficient learning strategies, and their note-taking performance lags behind their non-disabled peers' (Boyle, 2010a; Boyle & Forchelli, 20014; Hughes & Suritsky, 1994).

It is troubling that many educators erroneously believe that students acquire note-taking and study skills without any instruction, just by doing it. As a result, students are often left to their own devices to develop these skills (Kiewra, 2002; van der Meer, 2012). At the same time, research has shown that instruction in both the encoding and review functions of note-taking have shown promise in improving students' note-taking and study skills (Boyle, 2010b; Boyle &

Rivera, 2012; Boyle & Weishaar, 2001; Hamilton, Seibert, Gardner, Talbert-Johnson, 2000; Lazarus, 1991; Lazarus, 1993). While there is a growing body of literature on note-taking and review strategies of typical college students, research is lacking on note-taking and review strategies for students with and without disabilities at the middle school level.

Statement of the Problem

While research results have shown that many students demonstrate ineffective note-taking and study skills, research has also indicated that students who are taught to use note-taking and review strategies can improve and perform better on tests. Still many students and educators believe that students acquire these skills without explicit instruction, through a process of trial and error. Effective note-taking and review strategies need to be examined with students with and without disabilities to ensure their success in the postsecondary environment.

Purpose of the Study

The purpose of this research study is to contribute to the body of research on middle school students' (with and without disabilities) note-taking and study skills and the effectiveness of strategy training. The current study seeks to extend the research and explore middle school students' awareness and use of note-taking and study strategies. Second, the study examines the effects of note-taking plus review session strategy on students' comprehension. Lastly, the study is set out to compare the effects of note-taking interventions on students' performance with and without disabilities.

1. Will students' note-taking skills improve with strategy intervention?
2. Will students' review/study skills improve with strategy intervention?
3. Will student's comprehension of content area lecture material improve with the combined note-taking and review strategy instruction?
4. What are the differences between students with and without disabilities in their note-taking and review strategies prior to and after intervention?
5. What are the differences between students with and without disabilities in their performance on multiple choice tests?

Significance of the Study

The objective of this study is to gather meaningful information that has potential to improve students' note-taking and study skills in order to more effectively support them to become independent, autonomous, and successful learners. The findings and conclusions drawn from this study are intended to contribute knowledge in the field regarding effective note-taking and review process for potential improved achievement, as well as to offer information that may help inform future teaching practice in schools. It is anticipated that this study will contribute to literature in the field of note-taking and review and may be assist teachers as they instruct their students in the future.

CHAPTER II

Literature Review

The purpose of this review is to provide an overview of the importance of note-taking in processing, recording, and studying content area information more effectively and independently in core academic subjects. Current educational initiatives impose complex and rigorous academic standards to all students across the country with a focus on assessments, accountability, and preparing students for college and work success. Precisely, the most recent educational initiative, the development and adoption of the Common Core State Standards (CCSS) sets high expectations for what all K-12 students will learn in content areas to be prepared for college and career opportunities. Note-taking has shown to facilitate the organization, recall, and content area learning especially at the postsecondary level where lecture learning is the primary method of instruction. First, in order to better understand note-taking and its relationship to learning, the two major theories and cognitive functions of note-taking will be discussed. In particular, the encoding and external storage functions of note-taking and their effect on different cognitive processing will be highlighted. Next, the underlying cognitive processes and abilities influencing note-taking skills will be presented. Third, different ways for assessing note-taking skills will be offered. Then, students' note-taking skills and specific challenges of students with learning disabilities in regards to note-taking will be reviewed. Finally, the different approaches and strategies that have shown to be effective in improving students' note-taking and review skills will be described. These approaches will encompass teacher controlled adaptations, strategy instruction, and the use of technology.

Current Educational Context

The CCSS and College and Career Readiness

With the recent large scale-scale educational initiative, the development and adoption of the Common Core State Standards (CCSS) rigorous expectations were set for all K-12 students in core academic subjects. Although CCSS is not a federal educational initiative, it was adopted by forty-five states of the United States (U.S.). These national standards for elementary and secondary education were developed by a diverse group of key stakeholders comprised of parents, teachers, school administrators, and educational researchers. The creation of CCSS serves a twofold purpose. One is to outline minimum grade-level competency expectations for students and provide a framework for instruction that will lead to college and career readiness. In other words, the goal of the CCSS is to ensure that all students are taught basic skills and content that is aligned with higher-order thinking skills, so that students graduating from high school will be competitive in postsecondary and work environments, both nationally and worldwide. The other intention of the standards is to reduce variations in instructional expectations across districts and states. The CCSS provides a set of expectations for the shared goals that schools across the U.S. have for students at each grade level. By implementing uniformly high standards across the nation it is expected that all students graduating from high school will acquire the essential skills and knowledge in the content areas.

While the developments of these national standards shows promise to improve education, it is also controversial and raises concerns. One of the concerns is the potential erosion of state and district level educational decision-making autonomy. The developers of CCSS state that the standards do not serve as a national curriculum, rather they are designed to provide parents and teachers with a common understanding of the knowledge and skills students need to have in the

core content areas at each grade level. The CCSS establish a shared goal while allowing schools to maintain authority over their curriculum, instructional procedures, and materials. Another concern noted is the additional burden on teachers in determining how and what to teach to ensure all students acquire the knowledge and skills specified at each grade level. The language of the CCSS indicates that the rigorous expectations apply to all students and offers very little information as to how to support and accommodate students who struggle with academic skills or students with disabilities to achieve competency. Since students with learning disabilities (LD) are increasingly included both in general education instruction and state level assessments, the standards present implications for them and their teachers on how to facilitate access to the standards' content knowledge, and advanced critical thinking and reasoning skills (Ciullo, 2015; Haager & Vaughn, 2013; Singleton & Filce, 2015). While college and career readiness is an important long-term goal for students with LD, learning in the content areas remains more challenging for them than their typically developing peers. Despite the potential difficulties and apprehension, educational leaders are hopeful that the advantages that CCSS offer outweigh the concerns (Haager & Vaughn, 2013).

Using Writing to Facilitate Recall, Organization, Understanding, and Building of Knowledge

One of the important advantages of the CCSS is the emphasis on teaching students to become better writers and use different types of writing as tools to build and present knowledge across different content areas. Specifically, CCSS focuses on four applications of writing skills: (1) learning to write for multiple purposes; (2) producing and publishing organized text with the use of technology; (3) using writing to facilitate recall, organization, understanding, and building of knowledge from text; and (4) use writing tasks to facilitate content area learning.

Consequently, CCSS's vision for the role of writing is not only a skill that is limited to language arts and English, but also as a tool that interacts with reading, thinking, and content across disciplines to promote learning (Graham & Harris, 2013).

Note-Taking

Note-taking is a type of writing that can serve as a tool that promotes knowledge building and facilitates content area learning. Note-taking is an essential activity and study tool for students in schools that help them recall, organize, understand, and build knowledge in all different subject areas both from text and lectures. Starting in the elementary and middle school, students take notes during class discussions, scientific experiments, when reading literature or textbooks, or researching topics both at school and home (Boyle, 2010a). By high school and college years most of the material is presented in a lecture format. In secondary classrooms the most common teaching method (nearly fifty percent) is whole-class instruction using a lecture format. During lectures, students are required to listen, copy information, take notes, and follow the lecture (Boyle, 2012). Likewise, Titsworth & Kiewra (2004) reported in their study that nearly eighty-three percent of college and university faculty use the lecture format as their primary instructional method. The lecture method is favored because it offers a remarkably efficient way to convey enormous amount of information in a fairly short period of time to large classes (Butler et al., 2001; O'Donnell & Dansereau, 1993). Despite its effectiveness in communicating large amounts of information, the lecture method also has several limitations. Lecture listening tends to promote passive listening and imposes unreasonable demands on students' attention and memory (Butler et al., 2001; O'Donnell & Dansereau, 1993).

In order to overcome the difficulties that lecture listening places on students, they frequently engage in note-taking. Note-taking during lecture listening is a successful learning

strategy for two major reasons. First, the process of taking notes helps students remain attentive in class, processing and organizing the material, leading to better understanding and encoding information into memory. Second, note-taking helps students to collect and preserve information in written form for later review or study (Boyle & Weishaar, 2001; Titsworth, 2004; Van Meter et al., 1994). Since note-taking promotes active engagement, prioritization, organization, and preservation of information, it is evident why note-taking has long been linked to positive test performance (Bui et al., 2013). Students who take accurate notes during class lecture are more likely to perform better on subsequent tests (Hamilton et al., 2000). Therefore, note-taking is an important learning strategy available to students that helps them record information to gain content from class and demonstrate adequate recall of information to perform well on later tests (Boyle & Rivera, 2012; Hughes & Suritsky, 1994; Ruhl & Suritsky, 1995; Suritsky & Hughes, 1991; Titsworth, 2004; Ward-Lonergan et al., 1999).

It is not surprising that note-taking literature (Bui et al., 2013; Kim et al., 2009; Titsworth, 20004; Suritsky & Hughes, 1991; Van Meter et al., 1994) consistently reports that nearly all college students take notes in their classes. In their study, Van Meter et al. (1994) further investigated college students' understanding of note-taking and their beliefs about factors affecting note-taking. Results revealed that all students reported taking notes during lectures. However, their goals in taking notes, the content and structure of their notes, contextual factors affecting note-taking, and how notes are used after a lecture varied. In general, students identified doing well in their courses as the main goal of note-taking. Some of the subgoals of note-taking were directing attention during class, wanting to learn and organize lecture content, and constructing notes that can be used to complete homework and study for exams. When recording notes, students reported being selective in what information and how they code into

notes. Students stated that they focused on capturing information that might be important to know, such as information written on the board, definitions, main points, or content cited on the syllabus. The content of their notes was recorded either verbatim or paraphrased and typically organized into outlines or groups sometimes including markings or arrows to indicate connections. However, students' note taking styles and practices varied to accommodate the lecturer's style, the perceived demands and difficulty of the course, and students' prior content knowledge. After notes have been created, most students reported processing them in some way, while a few reported ignoring them. Students' post-class processing of notes included recopying of the material (without making changes to the content or structure), rewriting (including reorganizing, elaborating, or deleting information), or reviewing them with or without other resources (preparation for completing homework, guiding textbook reading, or studying for exams). College students' perceptions and reported practices may be beneficial in guiding note-taking theories and future research.

Since lectures and note-taking comprise major portions of high school and college classes becoming the primary means of learning, it becomes crucial for students to develop effective note-taking skills and review strategies by the time their college education. Furthermore, with CCSS's focus on college readiness it is imperative to help students with the acquisition of the critical skill of note-taking and independent study strategies. It is often erroneously assumed that students will learn how to take notes and learn just by doing it. Numerous studies, however, have indicated that it is far from reality (van der Meer, 2012). Note-taking and independent learning is a developmental process, preparing and explicitly teaching these skills to students before entering college is imperative in order to ensure their success. Kiewra (1988, p. 51) wrote, "autonomous learning is a developmental process whose nurturing should begin long before high

school or college." In order to effectively teach and foster the development of these skills one must have a thorough understanding of the different functions note-taking serves, the different cognitive processes that may impede or facilitate its functioning, and strategies that shown to improve note-taking and study skills.

Functions of Note-Taking

In an effort to clarify how note-taking facilities learning, researchers have identified two main functions of note-taking. Starting with Di Vesta and Gray's seminal analysis (1972), researchers have identified two distinct and fundamental functions: encoding and external storage (Boyle & Weishaar, 2001; Kiewra et al., 1991; Peverely, Marcelin, & Kern, 2014; Van Meter, Yokoi, & Pressley, 1994). Researchers propose that students benefit from the process of note-taking (encoding) and from the process of reviewing notes (external record or storage of lecture notes).

Encoding function. Encoding refers to the process of perceiving, recognizing, processing, and relating information to concepts already in memory so it can be remembered later. The encoding function of note-taking suggests that the process of recording notes promotes the encoding of lecture or text information. It has been established that more effective encoding facilitates learning and results in increased learning outcomes. Therefore, encoding is also termed as the process benefit of note-taking (Bui et al., 2013). The encoding function hypothesis states that the act of note-taking facilitates cognitive processes beneficial for memory and transfer (Einstein, 1985). Specifically, the learner is actively engaged in selecting, integrating, and transforming, lecture information into meaningful notes. Overall, the act of taking notes benefits the learner by activating attention, active cognitive processing, and facilitating the transfer of lecture content into long-term memory (Hughes & Suritsky, 1994; Suritsky &

Hughes, 1991). It is clear that note-taking is not just a recording technique; it has cognitive value as a way of meaning-making and understanding. The act of note-taking seems to facilitate a deeper process in terms of cognitive encoding when compared to passive lecture listening (van der Meer, 2012).

The encoding effect of note-taking is measured by comparing the performance of students who listen to a lecture but do not record notes with the performance of students who listen and record notes. Neither group is given the opportunity of reviewing their own or provided notes following the lecture (Kiewra et al., 1991; Kobayashi, 2005). According to the encoding function hypothesis, note-taking should involve cognitive mechanisms that result in generative processing and improved memory and transfer (Einstein, et al., 1985; Kiewra et al., 1991; Peper & Mayer, 1986). In comparison with simple lecture listening, note-taking may increase the individual's attention, more elaborate processing, and organization of lecture information. Based on this view, note-takers should have better learning outcomes than non-note-takers even when they are not allowed to review their notes. However, results of research on the encoding effects of note-taking have been mixed. While some studies found that note-taking improved performance, others found no effect, and some studies even suggested that note-taking hindered students' learning. It needs to be noted that note-taking interfered with encoding when the lecture was fast paced and had high information density. In this scenario, note-taking competes with attentional and memory resources necessary to process the material. Whereas, when information is presented at a more optimal rate note-taking often improved learning. Nevertheless, there is no general consensus on the effects on the encoding function of note-taking on memory and learning (Kiewra et al., 1991).

External storage function. The second function of note-taking is the external storage function. The external storage function suggests that the review of notes stored in a written form facilitates performance (Bui et al., 2013; Kiewra et al., 1994, Kiewra & Frank, 1988). Because of the benefit that comes from reviewing the notes, the external storage function is also referred to as the product benefit of note-taking. However, to benefit from review students must have sufficient notes to study. The external storage function is estimated by comparing the performance of students who record notes but are not allowed to review their notes with students who record their notes and are given the opportunity to review them. Research results have consistently provided evidence of the efficacy of the external storage function. While there are mixed results about the effectiveness of the encoding and storage functions there is a general agreement that both functions contribute to learning, but the external storage function seems to be the more important function (Kiewra et al., 1991). Moreover, when both functions of note-taking work in conjunction they provide the learner with a more powerful learning strategy than either function on its own (Bui et al., 2013; Chiu et al., 2013; Kiewra et al., 1991, Lazarus, 1991).

Note-Taking Theories

Over the years many different theories have been developed to provide a model to analyze the encoding and storage functions and account for the effects of note-taking. The two most prominent theories in cognitive psychology that account for note-taking differences are the information-processing and levels of processing theories. The information-processing model of memory suggests that a series of cognitive and behavioral responses influence the encoding, processing, and storage of information in long-term memory. First, the lecturer must gain the learner's attention. Next, the learner should respond by recording the information while

simultaneously differentiating between incoming relevant and irrelevant information and associating it with prior knowledge. Lastly, the learner must code the information in order to process it after the lecture and eventually transfer it long-term storage (Suritsky & Hughes, 1991).

The levels or depth of processing theory postulates that retention of information is influenced by the depth of cognitive processing of the stimulus. Depth of processing ranges from superficial processing of sensory features to deeper and more elaborate analysis of semantic features. Sensory processing involves seeing or hearing lecture content and recording it verbatim. Whereas semantic processing is a more elaborate representation of the information often combined with prior knowledge. Research has shown that information processed at the semantic level as compared to the sensory level results in superior recall and recognition over time (Suritsky & Hughes, 1991). The depth of processing is related to the qualitative view of note-taking and is also referred to as generative processing. The generative hypothesis is based on the idea that additional cognitive processes are involved and the learner is actively generating relationships among the parts of incoming new information and his/her prior knowledge occasioning greater learning and far transfer (Einstein et al., 1985; Kiewra et al., 1991; King, 1992; Peper & Mayer, 1986).

Over the decades many studies investigated the effects of generative processing (selecting, organizing, paraphrasing, summarizing, and questioning) pertaining to note-taking and review strategies and consistently found their effects superior compared to other superficial, non-generative (verbatim transcription, cutting and pasting) strategies individuals used. Recently, Mueller & Oppenheimer (2014) found that students who took notes on laptops performed worse on conceptual questions than students who took notes longhand. The authors postulated that

students who took notes by using a laptop were more inclined to take verbatim notes and this mindless transcription negatively affected conceptual understanding and performance on assessment. In contrast, longhand note takers were more likely to be engaged in more generative processing, selecting more important information, organizing, and summarizing the content that was included in their notes resulting in better test performance, especially conceptual understanding.

King (1992) trained college students to use generative review strategies (summarizing and self-questioning) to facilitate their learning from lecture. Results indicated that self-questioning and summarizing improved both initial encoding of lecture material and review of the lecture. Chiu, Wu, & Cheng (2013) extended King's research to elementary students and incorporated the use of technology in their shared electronic note-taking with questioning, summarizing, and note reading study. They also found that sixth grade students were able to apply and benefit from the use of these strategies. Students who were trained to use the generative strategies had notes that included more facts and concepts and achieved better grades on unit quizzes. Overall, research results uphold the hypothesis that students using generative strategies result in better outcomes for processing and studying material.

The information-processing and levels of processing theories can be organized under two different views: the quantitative view and qualitative view. The quantitative view or hypothesis proposes that note-taking mostly affects how much is encoded and learned. According to the quantitative theory, note-taking improves recall, because note-taking increases the individual's attention to the lecture material. Based on this assumption note-taking should lead to higher overall recall of all types of lecture information. Whereas, the qualitative hypothesis suggests that note-taking increases recall by affecting the processing of the note-taker and affects what is

learned (Einstein et al., 1985; Mayer, 1983). According to this view, note-taking alters the way students engage in lecture listening and the way they process information. The qualitative theory proposes that students who take notes employ processing such as relating ideas to one another and integrating new information into their existing knowledge base. Based on the qualitative view, note-taking should increase recall for the most salient concepts of the lecture.

In order to confirm or disconfirm the merits of the quantitative and qualitative view of encoding function of note-taking, Einstein and colleagues (1985) conducted an investigation. Twenty-four college students served as participants who were assigned to note-taking or listening-only conditions. After watching a video-taped lecture students were told to write down everything they remembered. Results indicated that the two groups did not differ significantly in the quantity of overall recall, but students in the note-taking condition recalled more high-importance propositions. Hence, results supported the qualitative theory of note-taking.

Factors Influencing Note-Taking

Note-taking is a cognitively demanding complex task which requires the seamless integration of several cognitive processes and skills (Kobayashi, 2005; Peverly, 2006; Piolat et al., 2005). During the first step of the note-taking process, the learner must direct and maintain his/her attention to the lecture information. Next, the learner has to hold, select, prioritize, organize, and integrate critical information from the lecture. Selection and prioritization involves discriminating between relevant and irrelevant information. The maintenance and processing of information (spoken language) has to be simultaneous and occur in an effective and efficient manner in working memory in order to prevent loss of information (Peverly et al., 2007; Ward-Lonergan et al., 1999). The processing of information requires that information is organized and integrated with knowledge from long-term storage. The last step is to quickly transcribe (via

writing or typing) the selected information while maintaining the continuity of the flow of the lecture (Peverly et al., 2007). Accordingly, the major cognitive processes that influence note-taking are: the ability to attend, verbal working memory, language comprehension, background knowledge, higher-order thinking skills, and transcription fluency. A break down in any of the processes and steps can result in inadequate notes. It is evident that students who have difficulty with maintaining and shifting attention, listening comprehension, working memory, and writing skills are likely to struggle with the task of note-taking and benefiting from the strategy.

Working memory. Since the temporary maintenance and simultaneous processing of information with the coordination of short-term and long-term memory functions plays a pivotal role in the note-taking process it is not surprising that working memory (WM) is one of the most frequently hypothesized abilities to underlie and influence note-taking skills. Piolat et al. (2005) describe note-taking as an activity that is strongly influenced by the central executive of WM in managing comprehension of the message, selection, and creation of a written product concurrently. In addition, working memory has been shown to contribute to individual differences in a variety of skills (e.g., writing) and abilities (e.g., verbal and reasoning) that are integral to academic success. However, there are contradictory research findings regarding the correlation between working memory and note-taking (Peverly et al., 2012). Bui and colleagues (2013) postulate that mixed results may be due to the different note-taking strategies that students utilize. Piolat et al. (2005) also support that the different personalized methods of students for taking notes (blank notes, linear notes) place different cognitive demands on WM. Makany, Kemp, & Dror's study (2009) also supported the idea that cognitive demands are influenced by the individual's actual technique used and their competence in utilizing it. On the other hand, Peverly at al. (2007, 2012) believe that mixed results may be due to the different

WM theories and measures used to evaluate them. Different working memory theories (Dehn, 2008) assume that individual differences are due to the structural differences in capacity (Daneman & Carpenter, 1980), the ability to attend (Kane & Engle, 2003), long term memory resources available (Cowan, 1988), or a combination of all (Baddeley, 1986).

Listening comprehension. Language comprehension is assumed to be another critical component of successful lecture note-taking. To learn from lectures students must comprehend the information presented. During class lectures students must be able to recognize and understand the speaker's spoken words, use semantic and syntactic cues to derive meaning in order to determine and select the main points before writing them down. Unfortunately, research on the relationship between language comprehension and note-taking is limited and significant associations between language comprehension and note-taking have not been demonstrated (Peverly et al., 2012, 2013, 2014).

Transcription fluency. Next, existing research suggests that transcription fluency, the rate of written word production is another factor influencing note-taking skills. Transcription encompasses the simplest writing skills of legible letter formation, spelling, grammar, to higher level writing skills such as planning and editing. Peverly (2006, 2013) states that the writer's transcription speed is related to the quantity and quality of his/her written composition. Automatic and fluent transcription skills free up space in working memory which can be used for the application of higher level cognitive skills (metacognition) resulting in longer and better organized written products (Peverly et al., 2007). Surveys of university students with LD about the self-evaluation of their note-taking abilities found that the majority of students had difficulties with note-taking. One of the most frequently reported difficulty was being able to keep up with the lecture and write fast enough. Additional difficulties noted were identifying

information instructors think is important to remember and making sense out of their notes after class (Suritsky & Hughes, 1994; Van Meter et al., 1994). In sum, transcription speed has been found positively and significantly related to quantity of notes, and higher quantities of note-taking were associated with higher achievement (Peverly, 2013).

Prior knowledge. It has been long established that prior knowledge, the knowledge base one brings to the learning situation has significant impact on being able to construct new information and deploying other cognitive processes and learning strategies effectively. In addition, it is possible that working-memory limitation may be mitigated by the amount of knowledge one brings to the learning context (Dehn, 2008; Kiewra, 1988). The amount and type of information already available in long-term memory may produce collateral improvement in working-memory, due to the relationship between long-term memory and working-memory. Well established structures in long-term memory facilitate automatic retrieval, thereby freeing up more cognitive resources in working memory (Dehn, 2008). Thus, prior knowledge may assist an individual's note taking in two ways. The information already available in long-term memory may free-up space in working memory lessening the cognitive load of the learner and allows other cognitive processes and strategies to actively facilitate knowledge construction and learning.

Learning strategies. Lastly, a considerable amount of research supports that the type of learning strategies employed by an individual have marked effects on quality of their learning. Learning strategies fall on a continuum of cognitive processing ranging from shallow to more generative processing. Note-taking research suggests that many students employ shallow ineffective note-taking and review strategies, especially students with disabilities. Fortunately, many research studies provided evidence that strategy training, teaching students how to take

notes and study can support metacognitive awareness for applying the strategy and result in improved learning.

Assessing Note-Taking Skills

Researchers have employed a variety of methods to assess note–taking skills with varying foci on the encoding or external storage functions of note-taking. One of the most often researched aspects of note-taking is the quantity and quality of notes taken by students as well as learning outcomes. Note quantity is often measured by the number of information units, idea units, T-units, cued and noncued lecture points, and total words. Quality of notes is evaluated by note accuracy, completeness, and organization, amount of relevant and irrelevant information.

Note quantity is an important measure, because there is a large corpus of research demonstrating the positive correlation between the quantity of students' notes and successful recall of information and increased test performance. Information units are frequently employed as a note-taking quantity measure. Information units were defined by Hughes & Suritsky (1994) as complete ideas or blocks of information, such as a sentence, sentence clause, or phrase. Information units are further classified as the percentage of total information units, cued information units, and noncued information units. Another way to assess student's note-quantity is by counting the number of T-units. T-units are similar to information units. More specifically, a T-unit is defined as a linguistic unit containing an independent clause and all associate subordinate clauses (Ward-Lonegran, 1999). Information or idea units can also be categorized as central ideas or details (O'Donnell & Dansereau, 1993).

Other measures to evaluate note-quantity and quality are cued lecture points, noncued lecture points, total lecture points, and total words recorded (Boyle, 2010b). A lecture point is defined as an idea or a block of information from the lecture, with a short clause or phrase. Cued

lecture points tend to be highly important ideas and details of a lecture and are usually introduced by the teacher with a cue drawing special emphasis to the information. Non-cued lecture points are the remaining ideas of the lecture content. Total lecture points are the sum of cued and non-cued lecture points of the lecture.

Finally, learning outcomes of note-taking, such as recall and comprehension of material are measured. To evaluate learning outcomes, researchers employ different types of tests, such as tests of immediate free-recall, delayed recall, multiple-choice tests, or problem-solving tests with or without review opportunities. Immediate free recall (IFR) usually involves asking students shortly after viewing a video-taped or live lecture to write down as many facts, vocabulary, and lecture ideas as they can within a specified short amount of time (e.g., five-minutes). Similar to IFR measures, when long-term free recall (LFR) measures are administered students are instructed to write down as much information as they can, but several days after the lecture (Boyle, 2010b). IFR and LFR tests assess information stated directly in the lecture, a mental representation derived directly from the lecture, which have not necessarily been elaborated by the students' knowledge and experiences. These tests are a measure of memory, but not necessarily understanding. Multiple choice or fill-in the blank comprehension tests typically range from ten to twenty items and the items may cover knowledge types from factual to conceptual based on Bloom's Taxonomy. Tests that require the students to make inferences and knowledge transfer are a better measure of understanding. Similarly, retention/comprehension tests can be administered immediately after the lecture or days, weeks, or months later to evaluate and compare performance. Delayed comprehension tests closely mirror real-life classroom assessments and may be the most authentic way to evaluate student learning.

While it is important to understand the different elements of note-taking assessments, it also needs to be noted that they are closely related and intertwined. In a study by Haynes, McCarley, and Williams (2015) the close relationship between note quantity, note quality, and students' test performance was demonstrated. Haynes, et al. hypothesized that allowing students more time to efficiently process the information is by manipulating the timing of note-taking during lecture presentation. The researchers speculated that taking notes after the lecture provides students with notes equally as well as well as students taking notes during lecture, resulting in similar retention of lecture information. In their study, college students were assigned to note-taking during lecture (NTD) or note-taking past lecture (NTP) conditions. The NTD group took notes during the lecture and students in the NTP condition listened to the lecture without taking notes, but were allowed to take notes following the lecture. Students' notes were analyzed for total word count, amount of relevant and irrelevant words, and were also administered an immediate retention quiz. Findings showed that participants in the NTD group wrote more notes. On the other hand, students in the NTP group could focus on the lecture, but would base their notes on delayed recall resulting in fewer words. Furthermore, when notes were evaluated for relevant and irrelevant word ratios, students in the NTD group recorded notes with significantly higher relevance ratio than the NTP group. These findings support previous research indicating that higher total word count reflects higher quality notes. In addition, high and low relevance ratios in students' notes had a positive relationship with performance on the retention quiz. Students with high relevance ratios performed better relative to those with lower relevance ratios.

The preferred method in research to present lectures and evaluate note-taking is by the use of video-taped lectures (Boyle, 2012; Boyle & Forchelli, 2014; Bui et al., 2013; Kiewra et

al., 1991; Peper & Mayer, 1978). Video-taped lectures offer several advantages with respect to research methodology. Video-taped lectures can control for extraneous variables between experimental and control conditions. Some of these variables include presentation rate, length, and lecturer style. Video-taped lectures are delivered at a rate ranging from 75 word per minute (WPM) to 150 WPM in reported studies (Hughes & Suritsky, 1994). While the use of video-taped lectures offers the best experimental control, it is contrived, and does not allow for the natural flow and interaction of a typical classroom setting.

Students' Note-Taking Skills

The vast majority of research investigating students' note-taking skills has been conducted with typical college students. Since note-taking is valued and prominent in colleges students should do it well. Research findings indicate that although students recognize the importance of note-taking most of them are poor note-takers (Titsworth, 2004). Almost all college students reported that they record lecture notes and believe that note-taking is an important activity to do well in their classes. However, existing research suggests that students' notes are usually incomplete and/or inaccurate. As noted by several studies, students record less than half of all lecture ideas (Austin et al., 2004; Suritsky & Hughes, 1991; Titsworth, 2004). Furthermore, students often struggle with discerning relevant information from irrelevant information causing them to record only twenty-forty percent of the important ideas presented during the lecture.

With the intention of gaining a better understanding of students' note-taking skills Einstein and colleagues (1985) investigated the processing differences between effective and less effective learners. Twenty-four college students' notes, recall (both immediate and delayed), were compared with and without review options. Median grade point average (GPA) was used

for classifying students as successful or less successful learners. Findings revealed that successful students differed from less successful students only in their recall of high-importance propositions. Successful students recalled more of the main ideas than did the less successful students. Based on this difference it is reasonable to assume that successful students may exercise more organizational processing of the material and engage in qualitatively different types of processing. These results support the notion of the encoding function of note-taking. The authors also found that review led to higher levels of recalls especially in delayed testing. Thus, the external storage function of note-taking also had pronounced effects on learning. More importantly, the significance of the external storage function increased with the one-week long delay.

While it is evident that the majority of typical college students have difficulty with recording accurate notes, students with learning disabilities (LD) are even more disadvantaged due to their deficits in nearly all essential component skills of note-taking. Students with LD often exhibit deficits in language skills, listening comprehension, attention, memory, and written expression skills, resulting in even lesser quality of notes and poor test performance. Hughes & Suritsky (1994) analyzed the notes of thirty university students with LD and thirty students without LD. Notes were analyzed in two ways: completeness and the use of abbreviations. Note completeness comprised the percentage of cued information units, noncued information units, and total information units recorded. The use of abbreviations consisted of the number of abbreviations and number of words abbreviated. Results showed that students with LD performed significantly lower on all variables. Namely, findings revealed that the notes of students with LD lacked in their quantity and quality of completeness.

Similarly, Boyle (2010) analyzed and compared the note-taking and comprehension skills of middle school students with and without LD. Participants were ninety students, forty-five of them with and without LD, respectively. Students viewed videotaped science lectures while recording notes and took a ten-question quiz. Results were compared on four measures: cued lecture points, non-cued lecture points, total lecture points, and total words recorded. In addition, relationship between students' notes and tests scores were evaluated. The study showed that students with LD performed more poorly on all four measures compared to their non-disabled peers. Hence, the study corroborated previous research findings that students with LD record fewer notes which results in lower test performance.

In another study, students who are deficient in their language skills (have been shown to have difficulty with processing spoken language in an effective and efficient manner) were compared in their verbal retellings of information presented during social studies lectures in adolescents with and without disabilities. Specifically, performance of students with learning disabilities (LD), language impairments (LI), and learning language disabilities (LLD) were compared in a study by Ward-Lonergan and colleagues (1999). They found that language processing difficulties of students with LLD manifested itself in fewer lecture component recall and retelling compared to students without LLD.

In a recent study by Boyle & Forchelli (2014), the differences in note-taking skills of middle school students with high achievement, average achievement, and learning disabilities were examined. Research findings revealed significant differences between the number of total lecture points (TLP) and cued lecture points (CLP) recorded according to achievement level. Students with high achievement recorded 52% of the total CLP, students with average achievement recorded on average 27% of CLP, and students with LD recorded only 15% of CLP

in their notes. The study confirmed results from previous research that there are considerable differences between notes of students with different ability levels.

Despite the well documented note-taking weaknesses of students and the importance of note-taking in promoting students' academic success, instruction in note-taking skills is seldom provided in schools. Although research has consistently shown that students are poor note-takers, many teachers assume that students know how to take notes (Meltzer, 2007) or just learn it by osmosis (van der Meer, 2012). Consequently, students are often left to their own devices to devise a method for recording lecture content (Hamilton et al., 2000).

Approaches to Compensate for or to Improve Students' Note-Taking Deficits

To help students compensate for their note-taking deficits and to help them acquire more efficient strategies to note-taking and studying, a number of approaches were developed and investigated over the years. Predominant among these are methods that change (a) the presentation of the lecture (b) how students take notes, and (c) how students review notes. Some of the approaches are accommodating in nature, while others promote active, independent, and autonomous study habits. To date, the majority of studies focused on the encoding function of note-taking and only a few investigated the external storage and review functions of note-taking. The different approaches present with various advantages and disadvantages.

Changes in Presentation of the Lecture

One of the approaches to improve students' note-taking involves the instructor modifying his/her method of presentation (Boyle & Weishaar, 2001; Peverly et al., 2014; Suritsky & Hughes, 1991). These modifications are related to the characteristics of the lecture and use of cues. Characteristics of the lecture encompass the rate of presentation, use of pauses, information density, and re-presenting the lecture. The use of lecture cues may include verbal or written cues

and can serve to direct attention, stress organizational structure, and assist processing information (Suritsky & Hughes, 1991).

Rate of presentation. Rate of presentation is a key characteristic of a lecture. The rate of presentation is crucial, because it may cause problems for students for two main reasons. One often reported problem is that students are unable to keep up and record (write or type) the information during a rapidly presented lecture. Another difficulty is identifying and processing information during the time constraints of a rapid presentation (Ruhl & Suritsky, 1995; Suritsky & Hughes, 1991). One way to slow down the rate of lecture is by employing the lecture pause procedure.

Pause procedure. Lecture pause procedure involves the teacher stopping periodically throughout the lecture at predetermined intervals. Typically, the interval schedule consists of a 10-15 minutes of lecture, followed by a 2-5 minute pause, repeated throughout the 45-50 minute class period. During these pauses students are provided with the opportunity to either review their notes, reflect on them, discuss them with a partner, or fill in missing information independently or with a partner. The lecture pause procedure has been found to be the most effective when students are taught and given specific tasks to complete based on their experience and ability during these pauses that stimulate and facilitate their learning (Stringfellow & Miller, 2005).

Ruhl & Suritsky (1995) investigated the effects of the pause procedure on completeness of notes and immediate free recall by thirty college students with LD. During the use of the pause procedure the instructor stopped for two minutes three times to permit student discussion of lecture content and updating of notes. Results indicated that the pause procedure had beneficial effects on both immediate recall and note completeness. In a recent study, Bachhel &

Thaman (2014) implemented the pause procedure as an active learning strategy with medical students. The authors were seeking to increase student engagement, understanding, and recall compared to traditional lecture format. 12-15 minute presentations were followed by a pause of 2-3 minutes, three times in a fifty-minute lecture. Pauses were strategically scheduled at appropriate time of the lecture. During the pauses students worked in pairs to discuss, compare, and rework their notes. A thirty-item multiple-choice quiz was administered fifteen days later to all participants. The experimental group students performed significantly better than the participants in the traditional lecture group. Furthermore, student feedback revealed that most of the students felt that the pause procedure helped them enhance the lecture recall, better understand concepts, and improve interaction with peers.

Research results suggest that the pause procedure is an effective and easy to implement approach that promotes student engagement, improves recall and comprehension. It is easy to implement, because it requires little planning, little modification to the traditional lecture, and very little extra class time. While this method may be beneficial to all students and easy to implement, general education teachers are often reluctant to modify their presentation modes. Often, general education teachers have to cover large amounts of information and they feel that slowing down would hinder their efforts of delivering course content (Boyle & Weishaar, 2001).

Questioning. Another method for slowing down the rate of presentation, providing feedback, and increasing student engagement and learning is incorporating questioning in the lecture. Research has consistently indicated positive effects and facilitated student learning when questioning was utilized as instructional method in lectures (Butler, Phillmann, & Smart, 2001; Campbell & Mayer, 2009; Gier & Kreiner, 2009; Stringfellow & Miller, 2005). Questioning is founded on the generative theory of learning. According to the generative theory of learning,

students learn better when they engage in appropriate cognitive processing during learning. Mayer (1996) identified selecting, organizing, and integrating as the most important cognitive processes that promote meaningful learning. When students are required to answer questions during a lecture they engage in these cognitive processes by increasing attending skills in anticipation of having to answer questions and after answering the questions they mentally organize and integrate the material with other knowledge.

There are several ways to effectively use questioning during lectures. One of the most commonly used is when the teacher asks a question, one of the students provides a response, and the teacher provides feedback. In this approach one student answers at a time, and he/she is reinforced by the teacher. As long as the rest of the students are attentive to the question, answer, and subsequent response they may also benefit from this method, that Albers and Greer (1991) termed as the three-term contingency. In order to ensure that all students participate and have an opportunity to respond and receive feedback the teacher may utilize choral responding, have students use response cards, response boards, or technology based systems (e.g., personal response system). Structured questioning may range from low-level to high-level questions during instruction to accommodate students in varying levels of the learning process (Stringfellow & Miller, 2005). Campbell & Mayer (2009) conducted a two-fold experiment to investigate the use of a questioning technique to see if it would improve student learning and engagement in college lectures. In a laboratory experiment students received a 25-slide Power Point lecture that included four inserted multiple-choice questions (questioning group) or four corresponding statements (control group). Students in the questioning group selected an answer and by using a personal response system (PRS) submitted their answers. The system tallied the votes and displayed a graph with the percentages of students voting for each answer. Lastly, the

instructor or a student would justify the answer and explain his or her reasoning in selecting the answer. At the end of the session students were administered a survey to find whether using clickers was useful or enjoyable and took a test measuring different aspects of learning; retention, near-transfer, and far-transfer. Consistent with the literature, students reported that they enjoyed the questioning process and found it helpful in understanding the material. In the first experiment the questioning group outperformed the control group on the retention test. Whereas, in the second experiment with a different group of students, the questioning group outperformed the control group on the transfer-test. While the results were mixed, the findings provide evidence that questioning and providing feedback during learning has a positive effect on learning.

Re-presenting the lecture. The evolution and expansion of computers and technology may provide educational advantages to lecture presentation and note-taking. Nowadays, it is easy to record lectures and make it available to students to listen to whenever and wherever they choose. Studies indicated when students were able to listen to lectures multiple times (videotaped lectures or podcasts) and take notes were able to record more notes (Kiewra et al., 1991; McKinney et al., 2009) and scored significantly higher on exams (McKinney et al., 2009). Kiewra and colleagues (1991) examined the effects of lecture repetition on recall and note-taking. In the first study, students were able to view a lecture one, two, or three times and took a recall test after each presentation without being able to review their notes. The number of presentations positively related to the amount of information recalled by the participants, confirming the quantitative hypothesis of repetition. The second study was identical, except all students were required to take cumulative notes, adding to their existing notes with a different color pen after each successive presentation. Results indicated that students shifted their attention

to different types of information after each presentation. Namely, during the first presentation students tended to focus on top-level information, and shifted their attention to the lower-level information on successive presentations of the lecture. These findings suggest that repetition allowed the students to adjust their strategy and focus on different aspects of the presentation during the successive presentations. These findings corroborated the notion that students are active learners who have control over the metacognitive strategies and supported the qualitative hypothesis that repetition enables students to reassess understanding and shift selective attention to lecture information. Overall, data suggest that students should review lectures more than once if the lectures have been recorded as it can increase total recall at each level of information, but especially important (top-level) information.

Using Lecture Cues

A substantial body of research has investigated the impact of lecture cues on students' note taking effectiveness and learning and shown that students' note-taking is positively influenced by the use of lecture cues. Lecture cues are signals that may take different forms and serve different purposes during lectures. Lectures cues are most often employed to increase students' awareness, to facilitate understanding of the material, indicate the importance of topics, signal the organization of the material, and ultimately improve learning and test performance (Titsworth, 2001; Titsworth, 2004). Lecture cues can be classified into two different forms: verbal/spoken and written. Verbal lecture cues are spoken words or phrases. Written lecture cues are words or phrases written on the blackboard or presented on a slide, or written handouts interspersed with empty spaces for students to take notes.

Verbal lecture cues. One of the research-based strategies to improve students' note-taking technique is the use of verbal lecture cues. Lecture cues take different forms (verbal or

written) and they also serve different purposes. Lecture cues are most often employed to stimulate students' interest, to indicate the importance of topics, and signal the organization of the material. Cues that immediately precede salient information and signal the importance of the material, are also known as emphasis cues. Emphasis cues are usually phrases such as, "It is important to…", "You should remember that…" Emphasis cues are used by teachers to indicate critical information in order to reduce the demands on students' selective attention and help them record and process key information (Boyle, 2012; Suritsky & Hughes, 1991). However, emphasis cues are not always words or phrases. The speaker's voice may signal importance suddenly becoming louder, softer or drawn out (Pauk, 2000). Another type of lecture cues, that facilitate note-taking and shown to help student learning are called organizational lecture cues. Organizational lecture cues make the organization of the material explicit and provide the student with a framework to organize lecture content. Organizational lecture cues are based on Mayer's SOI (selection, organization, and integration) model of learning (Mayer, 1996). According to the model, meaningful learning is dependent upon the individual's ability to select relevant information, organize it into a structure in working memory, and integrate it with prior knowledge from long-term memory. Several studies confirmed the effectiveness of organizational lecture cues (Titsworth, 2001; Titsworth & Kiewra, 2004). Organizational lectures cues are phrases such as, "The three types of muscle have significant differences." One of the reasons of improved learning may be that organizational cues provide students with natural "chunks" of information which allows more efficient use of short-term memory. Since organizational lecture cues identify the main and subordinate points of the lecture they also help students differentiate important lecture content from less important. Additionally, organizational lecture cues may assist students with developing a new schema which facilitates the storing

and/or retrieval of information from long-term memory (Boyle, 2012; Titsworth, 2004). Since one of the most important difficulties reported by students and supported by research findings is the difficulty of discerning relevant information from irrelevant information, the use of emphasis and organizational lecture cues and training students how to recognize these cues would allow students record more relevant information, retain more information, and increase academic performance.

During a lecture, teachers may use varying amount of verbal or written lecture cues. Titsworth and Kiewra (2004) compared the potential benefits and drawbacks of written and spoken lecture cues. They hypothesized that verbal lecture cues do not fare well against written lecture cues for several reasons. First, written lecture cues provide a permanent cue or framework to the student while spoken words are gone right after their presentation. Second, written cues and frameworks can provide the learner with the complete framework and organization of the lecture at once. Whereas, spoken lecture cues are presented one at a time, thus affording the learner only with portions of the entire presentation. Lastly, written frameworks prompt note-taking by providing specially selected spaces with specific written cues. Spoken cues may also prompt note-taking; however, verbal prompts are not associated with designated spaces for notes. While it appears that verbal lecture cues lack many of the advantages of written lecture cues, verbal lecture cues are extremely easy to deliver and incorporate them into any presentation.

Changes in Note-Taking - Providing Note-Taking Accommodations

Providing a complete set of notes or a note-taker. One of the frequently used methods is to provide students with the lecturer's notes or with a designated note-taker who would record the notes for them. Although it is an obvious and beneficial strategy for increasing the quantity of notes available to students to review, such method is accommodating in nature and has several

shortcomings. One of the major drawbacks is that it is controlled by the lecturer/teacher to provide the external learning aid (notes or a note-taker), so students continue to be dependent on teacher assistance. Another issue may be that instructors/teachers provide notes with various levels of length and detail. Furthermore, some instructors may be unable or unwilling to provide their notes to students for different reasons (Grabe, 2005). Also, when a note-taker is used, the note-taker may lack training resulting in inaccurate or incomplete notes. In addition, a note-taker may be absent or not always be available (Suritsky & Hughes, 1991). More importantly, providing copies or note-takers for students, limits the students' ability to actively engage in recording notes, process information, and to develop their own organizational framework. Consequently, students often assume a passive learning mode (Boyle & Weishaar, 2001; Suritsky & Hughes, 1991).

Written lecture cues and guided notes. Another research-based strategy to improve students' note-taking technique is the use of written lecture cues or guided notes. Written lecture cues are written handouts interspersed with empty spaces for students to take notes. These written handouts or frameworks are usually organized in guided notes, or matrix format (Titsworth & Kiewra, 2004).

Guided notes are skeleton outlines containing the main ideas and related concepts of the lecture. Guided notes are usually prepared by the teacher with the intention to guide the student through the lecture by providing standard cues and specific spaces to write key facts, vocabulary, relationships, and details (Hamilton et al., 2000; Lazarus, 1991; Lazarus, 1993; Stringfellow & Miller, 2005). Guided notes may have different forms, such as outline-type and cloze-type guided notes, and may be individualized depending on student ability. Outlines have a top-to-bottom structure, starting with the main topic or main points of the lecture with corresponding

spaces for students to record key ideas. Main topics are followed by subcategories with space under each topic for students to record additional details, vocabulary, or personal elaboration. Outline-type guided notes often list and organize information with the help of headings and subheadings with words or phrases, or Roman numerals and upper case letters (Boyle, 2012; Lazarus, 1993). Cloze-type guided notes use a cloze procedure in which information is missing from the notes. Missing information is indicated with a blank space for students to fill in during the lecture. Cloze-type guided notes have two forms: short-form guided notes and long-form guided notes. Short-form guided notes are missing one or two words that the student is required to fill in while long-form guided notes are missing more information in the form of key concepts and phrases (Lazarus, 1993). The use of guided notes may be beneficial for several reasons. First, it may prompt the note-taker to actively pay attention and fill-in missing information when required as opposed to being a passive observer. Second, the outline may serve as an advanced organizer activating prior knowledge of the note-taker and providing a road map. Lastly, as some of the information has already been recorded it may assist students with low transcription fluency.

Literature has consistently confirmed the beneficial effects of guided notes for students (Austin et al., 2004; Hamilton et al., 2000; Lazarus, 1991, 1993; Neef et al., 2006) through independent studies and meta-analysis. Larwin and Larwin (2013) conducted a meta-analysis on the impact of guided notes on post-secondary students' achievement examining both published and unpublished studies. After an extensive computerized literature search a total of 12 studies, comprising a total of 1,529 participants, met the criteria for inclusion. The overall mean effect measure was $d = 0.546$, a moderate effect size. The findings indicate that the use of guided notes can have a moderate impact on student achievement in post-secondary coursework.

Lazarus argued that secondary students with mild disabilities are increasingly included in general education content-area classes that require listening, reading, note-taking and study skills that are beyond their skill levels. To assist in the general education setting effective strategies are needed that compensate for their skill deficits. Since reviews of research on note-taking variables support the conjunctive use of note-taking and review Lazarus (1991, 1993) compared the effectiveness of guided notes and guided notes with review. Lazarus (1991) examined the effects of guided notes and guided notes with supervised review on the test scores of six high school students with learning disabilities and their thirteen classmates without disabilities in a general education science class. Findings showed that the use of guided notes resulted in improvement in test performance for all six students and their peers without disabilities. Although the students with LD showed significant improvement compared to pre-intervention performance, they still did not meet the criteria for mastery of curricular objectives and consistently earning passing grades. However, the addition of ten-minute supervised review facilitated comprehension and retention and produced academic gains for all six students with LD that paralleled the academic achievement of their typically developing classmates.

In her 1993 study, Lazarus compared the effects of personal note-taking, guided notes only, and guided-notes with in-class review on the test scores of five secondary students with mild disabilities. The five students attended integrated general education classes in their local high school. Students in the baseline condition were instructed to record notes independently. During guided-notes condition, students were provided with guided notes containing main ideas and key terms. Finally, guided notes with in-class review students were provided with ten minutes at the end of the class to review their notes independently. The three conditions were alternated in single-subject reversal design for all participants. Results showed that both

strategies improved student performance. It is important to note that the use of guided notes with in-class review proved to be a more effective strategy to increase students' test scores. Both studies corroborated existing research supporting the efficacy of the combined use of note-taking and review promoting academic achievement.

Similarly, Hamilton et al. (2000) investigated the effectiveness of guided notes on academic performance with seven adolescent male students in a medium-security juvenile detention center. Students were exposed to two conditions in the ABAB reversal sequence. In baseline, students were required to take their own notes without assistance while in the intervention condition they had to fill in the blanks on the teacher prepared guided notes. Accuracy of notes and daily quiz scores were used as dependent measures to determine intervention effectiveness. Results showed that guided notes provided participants with more accurate notes and with the exception of one, all participants improved their quiz performances. In addition, student questionnaires revealed that all except one student preferred using guided notes.

In another study, Austin and colleagues (2004) compared twenty-three undergraduates' notes after traditional lecture, lecture with slides, and lecture with slides plus guided notes. Three dependent variables were percentage of critical points, percentage of examples, and extra points recorded in students' notes. The results of the study revealed that for every dependent variable the guided notes lecture was significantly higher than each of the other formats. In other words, the guided notes lecture format helped students to produce the most accurate and complete notes. It is important, because note completeness and accuracy has been shown to positively correlate with test scores. The study, however, did not demonstrate that improved note-taking resulted in corresponding increase in student learning. To address this shortcoming and further extend the

research, Neef et al. (2006) compared guided notes and completed notes with respect to performance on delayed quizzes involving items that required different levels of understanding. Forty-six graduate students were given notes to use during lectures. Completed notes were identical to the Power Point slides the instructor used, whereas guided notes included blank spaces for writing key words or phrases shown in the lecture slides. Guided notes and completed notes were alternated across lectures using a multielement design. A five-point post-lecture quiz served as the dependent variable. Test questions were designed to range from lower knowledge-level to more complex items requiring application and analysis. Results did not reveal consistent differences between the two note formats on students' mean quiz scores. Although the two note formats seemed to produce similar results on factual type of questions, guided notes were associated with fewer errors on complex, analysis-level questions. Furthermore, students reported a clear preference for guided notes over personal note-taking and somewhat more students (59%) favored guided notes over completed notes. Overall, research results showed that providing guided notes for students is both effective and liked by students. However, a question remains whether guided notes contribute to more effective-note taking skills or an increase on students' reliance on the provision of structured notes.

By contrast, the matrix format is non-linear and has a two-dimensional structure. In the matrix format, the topics are listed across the top while subcategories are listed down the left side and lecture details recorded within the intersecting cells. Kiewra et al. (1991) hypothesized that matrix notes are more helpful to students in building internal connections among lecture ideas or between lecture ideas and prior knowledge than linear notes for three reasons. Matrix notes, like linear notes, make superordinate-subordinate relationship explicit and connect it with topic and subtopic. Additionally, matrix notes also accent cross-topical relationships. Lastly, matrix notes

can be viewed on one page, while linear notes usually span over several pages. Viewing information on one page allows students to better synthesize ideas across topics. The results of the study supported the assumption that matrix notes were superior to conventional notes for recall, possibly because matrix notes were more complete and emphasized more of the internal connections. Similarly, almost twenty years later, Makany et al. (2009) researched whether leaners with non-linear (matrix) note-taking technique perform better than traditional note-takers on tests of comprehension, accuracy, and memory. The authors utilized technology, the SmartWisdom notebook program. The SmartWisdom methodology uses four concentric circles in the middle of the page to guide the note-taking process and provide structure for the different levels of information. Words are written on curved lines originating from the innermost circle. The lines branch into stems on all levels and the interconnected stems form an overall tree-like structure. The goal of the technique is to present information on a single sheet while preserving the hierarchical structure and real time flow of the presentation. The authors found that non-linear note-takers performed better than linear control group in tasks measuring comprehension. Thus, non-linear note-taking seemed to promote deeper understanding by recognizing interrelationships within information, making connections to prior knowledge, and integrating new information into existing knowledge structure more effectively.

Despite all the above noted benefits, the use of guided-notes and matrix-notes also has potential disadvantages. One disadvantage is that it may be time consuming for teachers to prepare adapted notes for students ahead of time in addition to all of their other responsibilities. Another potential disadvantage is that general education teachers may be unwilling to make adaptations to students in general education classes. Last but not least, with the use of guided notes students continue to rely on teacher assistance (Boyle, 2010).

Note-Taking Strategy Instruction

A more effective approach to improve student's note taking skills is to explicitly teach students note-taking strategies and techniques. A large body of research supports the powerful effects of learning strategy instruction on students' performance. Specifically, strategy instruction has shown to improve students' ability to select, encode, store, and retrieve information more effectively and efficiently. Learning strategies span a continuum of cognitive processing from simple rote strategies to more elaborate, higher level, generative strategies. Strategies stimulating the formation of internal connections of text ideas tend to improve near transfer performance, while strategies used for formulating external connections between text ideas and prior knowledge facilitate far-transfer performance (Kiewra, 1988). Even though there is a considerable amount of literature demonstrating the effectiveness of learning-strategy training, only a small body of literature is available in the area of note-taking.

Strategic note-taking. A research-based technique that promotes student engagement during note-taking and seeks to improve students' subsequent recall and comprehension of lecture material is strategic note-taking. Strategic note-taking was designed by Boyle (1996) to help students become more effective and independent note-takers. The strategy was originally developed for college students, but over the years it was adapted for use by high school students, and later further modified for use by middle school students with learning disabilities. Strategic note-taking is intending to help students focus their attention on important teacher cues and key vocabulary in the lecture, as well as to organize lecture content. The strategy is comprised of a series of steps, each step prompting the student to perform an action using the lecture content and the strategic note-taking paper. The use of the strategy requires explicit, direct teaching of the steps. The scripted lesson includes a brief description of the strategy and where it can be used,

instructor modeling, controlled/guided practice with corrective feedback, and independent practice to acclimate students to the pace of an actual lecture.

The strategic note-taking paper is based on Mayer's model of learning: selection, organization, and integration (Mayer, 1996). The first prompt on the SN paper is to ask students to identify the lecture topic and relate it to their existing background knowledge. Next, students are presented with the CUES mnemonic to follow. In the first step, students are to Cluster together three to six main points with details from the lecture. Next, students are prompted to summarize how the ideas are related to facilitate encoding of new information. During the second step, Use, students are prompted to pay attention and listen to teacher cues and record them. In the next step, Enter, students are required to list new vocabulary words and terms on their paper. During the Summarize step, students are to write words that would categorize three to six lecture points they have already listed. Lastly, students are required to write down five important lecture points from the lecture and describe the detail of each lecture point (Boyle, 2010b; Boyle, 2012).

Strategic note-taking holds strong promises for teaching students how to process, record, and study content area information more effectively and independently. Boyle and Weishaar (2001) examined the effects of strategic note-taking on the recall and comprehension of twenty-six high school students with mild disabilities. The strategy was more effective than conventional note-taking. Students in the strategic note-taking condition recorded more words in their notes, and scored higher on immediate free recall, long-term free recall, and comprehension measures.

Later, Boyle (2010a) extended the investigation of the effectiveness of strategic note taking to middle school students with learning disabilities. Forty students with LD in grade sixth through eighth were randomly assigned to two different conditions. Students in the experimental

group were trained to use the strategic note-taking strategy and paper while students in the control group were told to record notes as they typically do in class. Students' notes were analyzed for number of cued lecture points, non-cued lecture points, total lecture points and total words. Additionally, immediate free recall, long term free recall, a comprehension test, and a questionnaire were administered. Students who were taught the strategic note-taking strategy performed significantly better on all measures than student in the control group.

A potential drawback of the use of the strategic-note taking technique is the initial time investment to teach students the strategy. However, benefits seem to outweigh the drawbacks. Most importantly, the use of the strategic note-taking technique gives the tools to students to become independent learners. In addition, the use of the strategy lends itself to be easily generalized to multiple classroom settings, subject areas, and lecture styles.

Cornell note-taking. Although not as comprehensive and detailed as the strategic note-taking strategy and more frequently used to improve text reading, the Cornell note-taking method and Cornell template has many similarities. First, the underlying premise of the Cornell note-taking method is that cognitive strategies such as questioning, identifying main ideas, and summarizing will assist student to become more effective and independent note-takers, and to improve their academic performance. Second, just like the strategic note-taking, the Cornell note-taking method requires initial explicit instruction. Explicit instruction includes initial modeling by the teacher how to identify key words, generate questions, locate main ideas, and summarize. Teacher modeling is followed by guided practice, cooperative learning, and independent practice. Third, the Cornell method also has its own template for recording and organizing information. The Cornell template has three sections: keywords and questions in the left hand column, main ideas in the right hand column, and summary at the bottom section of the

page. Lastly, the Cornell-note taking method can be easily implemented in different subject areas (Donohoo, 2010, Minskoff & Allsopp, 2003; Pauk, 2000).

Although more and more studies emerged that assessed note-taking interventions for general education college students, unfortunately very few studies assessed the effectiveness of note-taking strategy instruction developed for school-age students with learning disabilities and attention deficit hyperactivity disorder (ADHD). Boyle and Rivera (2012) conducted a systematic review of research-bases note-taking interventions and their effectiveness for students ages 3-21 with LD and other mild disabilities during teacher-led lectures. A comprehensive search only yielded nine studies that matched all of the criteria. In general, the results revealed that students with LD and other high incidence disabilities who were taught note-taking techniques performed increased scores on tests and quizzes, and the quality and quantity of notes recorded with medium to large effect sizes on these measures. The review of research suggests that students with disabilities can benefit from learning note-taking strategies and they must start developing effective note-taking skills during middle and high school.

Changes in Review Strategies

The previously discussed accommodations and strategies were mostly focusing on the encoding function of note-taking. Although the importance of quantity and quality of notes for review cannot be underscored the type of review strategies students utilize are equally important. Although research findings are somewhat mixed, a large body of research supports that learning performance is higher when notes are reviewed than when they are not reviewed (Kiewra & Frank, 1988). The reason may be that during lecture learning and note-taking the information processing demands are so taxing on the learner that it is unlikely that many resources are available for generative processing of the information. Students have to divide their attention and

exert increased efforts to listen, hold and manipulate ideas, and engage in recording notes. Whereas, during the review phase of the learning students' information processing resources are free for generating relationship among ideas, prior knowledge and integration of information into existing knowledge. It is during review that student have time to conceptualize and remember. Consequently, reviewing notes contributes more to test performance than taking notes.

Research has consistently demonstrated that many high school and college students are not expert learners (Jairam & Kiewra, 2010; Karpicke, Butler, & Roediger, 2009; Kiewra, 2002; King, 1992). In other words, many high school and college students are inefficient learners; they often lack metacognitive awareness and employ weak and superficial strategies while studying. Students often report the use of ineffective methods of studying like taking verbatim notes, highlighting, studying facts independently, rereading, or recopying their notes and/or books. Fortunately, there is a growing body of research investigating the effectiveness of different review strategies looking to enhance learning from lectures and lecture notes. Research on review strategies examined a variety of strategies. Review strategies (a) improving notes students have for review through teacher accommodation or cooperative learning, (b) training student in the use of metacognitive and generative learning strategies, and (c) repeated retrieval and self-testing.

Improving notes for review. In order to benefit from review the learner must have sufficient and accurate notes to study. Unfortunately, note-taking literature has shown that students are often inadequate note-takers. Students' personal notes are frequently incomplete, including less than fifty percent of critical ideas and may contain errors. To compensate for this difficulty and assist students with having adequate and accurate notes for review teachers may provide their lecture notes to students. Teacher lecture notes can range in comprehensiveness.

Detailed notes are a complete, organized, and detailed summary of the lecture's content. Skeletal notes comprise of a list of headings, subheadings, and designated spaces for students to record details and elaborations. Kiewra & Frank (1988) set out to investigate the effects of review of three different types of notes on immediate and delayed factual performance and higher-order performance. The 118 college students watched a video-taped lecture, engaged in the corresponding review activity (personal, skeletal or detailed notes), returned their notes and completed the assessment. Five days later students were given their specific notes and were allowed to study them. After the twenty-five-minute review period students returned their notes and completed the test. Research results revealed no significant differences among the three different review conditions on the immediate test. However, performance on the delayed factual exam showed that students reviewing the detailed notes significantly outperformed groups who were in the other two review conditions. Result of the study show a positive correlation between the quantity of notes students have available for their review and later test performance.

Collaborative review. Available research of different review strategies examined collaborative learning techniques and the use of generative learning strategies. One of the collaborative techniques is scripted cooperation. In scripted cooperation student work together in pairs or small groups to build a shared understanding of text, problem, lecture information, or writing assigned to them. Incorporating cooperative review within the lecture format of instruction appears promising to improve note-quality, recall of information, and overall understanding (O'Donnell & Dansereau, 1993). O'Donnell & Danserau (2004) investigated whether cooperative interchange of information during lecture is more effective than individual review, and possible alternatives for arranging cooperative interchange of lecture information. The cooperative review strategy utilized scripted cooperation. In the context of lecture learning,

the use of scripted cooperation provides students with opportunities to engage in different cognitive processes to improve learning outcomes. The script is similar to a theater script in which students play specific roles during different stages of the learning experience. The specific roles in the script are: recaller and listener-facilitator. The script is developed for partners of two who are working together towards the common goal of mastering the target information (text or lecture). In order to master the information at first both partners read the text or listen to the lecture. Then the partner who is assigned the role of the recaller provides a verbal summary of all the information he or she can remember. The student acting as the listener-facilitator has the responsibility of detecting misunderstandings or identifying missing information in the summary. Next, both partners engage in a discussion to try to remember the information and move to the next portion of the text or presentation (Lambiotte, et al., 1987). This cooperative learning arrangement is most effective when both partners take an active role and alternate in their respective roles. To investigate whether cooperative interchange of information during lecture is more effective than individual review and possible alternatives for arranging cooperative interchange of lecture information 109 college students were assigned to three different conditions. In the individual review condition, students were told to take notes individually and that they would have the opportunity to review their notes at the end of the lecture. In the cooperative review condition, both students were informed to take notes and review lecture notes cooperatively at the end of the lecture using the cooperative script. In the cooperative noteshare condition, one member was directed to listen actively while his/her partner would take notes and share the task of learning the material at the end of the session. In the fourth, the unexpected cooperation group, students were directed to take notes individually and they would review their notes after the lecture. Members of this group were assigned to a partner after the lecture. Data

were evaluated by counting central ideas and details in notes and in free recall, respectively, as well number of words in students' notes. No differences were observed on recall measures even though there were differences in the encoding conditions. Recall performance, however, was influenced by the manipulation of review conditions. Cooperative review and unexpected review conditions significantly improved recall performance.

Generative learning strategies. Another review strategy is the use of generative learning strategies. Generative learning is consistent with constructivist views of learning in which students interact with the material, use their own knowledge and experience to build new relationships among the new ideas and their own knowledge in order to reconstruct the information in new and personally meaningful ways. Two commonly used learning strategies are summarizing and self-questioning. Summarization involves identifying the main idea of the text (spoken or written), and reducing the material substantially by using the learner's own words to construct novel sentences and relating new information with the learners' prior knowledge. While summarization is a powerful cognitive strategy, self-questioning may serve both cognitive and metacognitive functions in comprehension and learning. Self-questioning facilitates students' comprehension by prompting cognitive activities as focusing attention, organizing new materials, integrating new information with existing one. Since self-questioning provides the learners with a way to test themselves, to help the check how well there are comprehending what they are studying it is also considered a metacognitive strategy (King, 1992). Laidlaw, Skok, & McLaughlin (1993) examined the effects of combined text note-taking and self-questioning on exam performance in science with fifth and sixth grade students. Students were trained in note-taking, such as previewing text, looking at main and subheadings, pictures, italicized words, and recording relevant information in their note-books. After note-taking students learned the

importance and the process self-questioning. A baseline-1, note-taking and self-questioning-1, baseline-2, and note-taking and self-questiong-2 (ABAB) single-case design was used to evaluate the effects of the intervention. Results showed that note-taking and self-questioning improved students' accuracy on science quizzes. In addition, authors observed that students became noisy and excited to work in pairs to test each other on the notes during question-answer practice. Findings suggest that middle school students are able to acquire effective note-taking and self-questioning skills to improve school performance in the content area.

Several research studies found that students who employ self-questioning during reading show comprehension superior to students who used other strategies. To further extend the effectiveness of self-questioning, King (1991) investigated the effectiveness of self-questioning strategy, on high school students' lecture comprehension. Student received direct instruction in generating higher-order questions and were also provided with a set of generic question stems which they could use to guide them in asking questions. In addition, students were also provided with a brief explanation of metacognition. Results indicated that students who used the self-questioning strategy demonstrated significantly better comprehension of classroom lectures than did students in the discussion and independent review groups. Furthermore, on the ten-day maintenance test participants in the self-questioning strategy continued to show superior comprehension compared to the other groups. The study demonstrated that the self-questioning, as an instructional approach can be taught to high-school students, when teaching expository material commonly encountered at high schools. Furthermore, the study provided evidence that the questioning strategy can be successfully implemented in real high school classrooms.

In another study King (1992) focused on different approaches to reviewing notes by students. She compared the effects of self-questioning, summarization, and traditional review for

learning from lectures. All students took notes in their usual manner, but reviewed their notes in different ways. One group of college students was trained to generate questions (and answer) their questions, another group received training in writing summaries, and the third group simply reviewed their notes in their conventional manner. Although none of the students captured a large amount of lecture points presented, self-questionnaires and summarizers produced more complete notes than note-taking reviewers. On immediate posttesting of lecture comprehension, summarizers recalled more lecture content than self-questioners, and self-questioners outperformed note-reviewers. However, on the retention test administered a week later only the self-questioning strategy was superior to note-taking review. The reason for the superior enduring effect of self-questioning may be that the strategy promoted making both internal and external connections among lecture ideas while summarization focused more on internal connection only. Findings suggest that the use generative strategies appear to enhance lecture learning both during lecture (by improving initial encoding of the material) and after the lecture.

In a similar vein, Chiu and colleagues (2013) investigated the potential benefits of shared note-taking and cooperative review of notes. While their study also employs shared-note taking and cooperative review, they utilized computers to take notes instead of paper and pen and extended their study to younger students. Specifically, elementary school students' note-taking quality and achievement was examined with the application of different review strategies in shared electronic note-taking activities. Researchers opted to use electronic note-taking due to the widespread use of computer technology in schools and its perceived benefits and ease of typing organizing, and locating notes with the use of a computer. Even with the use of computers students often miss critical or misunderstand points of the lecture. One way to alleviate this problem is to have students work in pairs to share and compare their notes in order to supplement

missing information as well as practice and reinforce learning. Since self-questioning and summarizing have proven to be highly effective generative learning strategies with older students these strategies were also incorporated. Students were trained to use self-questioning (SQ), summarizing (SS), or were assigned to read their notes (SR). During class lecture, students took notes on the computer, shared their notes with their partners suing Google Docs, and engaged in their respective review strategy. Results indicated that the questioning and summarizing groups outperformed the reading group both on note-taking quality (percentage of facts and concepts recorded) and learning achievement (as measured by unit quizzes). These studies (Chiu et al., 2013; King, 1991, 1992) provide evidence that the more completely and actively information is processed it is better remembered over time.

Repeated retrieval. Learning is often viewed as the acquisition, encoding, and construction of new knowledge, while retrieval is considered a way to measure the learner's store of knowledge and assess learning. Retrieval processes can influence learning indirectly or directly. Indirect effects of retrieval refer to situations when retrieval enhances learning by another other mediating process. One example for indirect effects of retrieval on learning is when instructors ask the class questions which may motivate students to study more effectively improving processing as students encode the new information. On the other hand, engaging in the process of retrieval produces learning directly as individual reconstructs knowledge. Repeated retrieval, also known as the testing effect, has shown to enhance long-term memory more than repeated study (Karpicke & Grimaldi, 2012; Karpicke, Butler, & Roediger, 2009). However, available evidence from laboratory experiments and surveys of college students indicate that students are generally not aware of the positive effects of active retrieval for learning and the majority of students would repeatedly read their notes and only relatively few

would engage in self-testing or retrieval practice when studying (Karpicke, Butler, & Roediger, 2009). Butler (2010) demonstrated that retrieval practice was more effective in promoting both retention of specific responses and transfer of knowledge relative to repeated studying of the same information with college students. Agarwal, Bain, and Chamberlain (2012) extended laboratory research on the testing effect to authentic classroom and materials. In their applied research study at a middle school, students studied textbook chapter material (with teacher led instruction) and engaged in retrieval practice through quizzes administered on a clicker response system. Findings provide further proof that retrieval practice enhances long-term classroom learning compared to non-quizzed material. In addition, quizzes with feedback improved students' learning and metacognitive awareness. In summary, data support that review is the more important function of note-taking, but using review strategies that facilities the production of more complete notes and review strategies that promote generative processing of the information led to best test performance and learning outcomes. Although studies consistently support the beneficial effects of review during and/or after lecture learning, there is a paucity of research on review strategies to improve note-taking and lecture learning.

Technology

Technology can provide students with alternative pathways to access the curriculum, enhance learning outcomes, and demonstrate their knowledge across a wide range of academic areas (Marino, 2010). Specifically, the use of technology presents promising options for students to improve their note-taking skills, engagement, collaboration, and note-review. Technology should support the note-taker with any one or all components of note-taking: note creation, note management, and note use. First, technology should provide support for note creation, the task of recording the notes during a lecture or while taking notes from a source. The next stage is note

management, the editing and organizing of notes. Last is note use, using the notes to study for a test or as reference while working on an assignment (Kim, Turner, & Perez-Quinones, 2009). Despite the promising options technology seems to offer, it also presents with some potential disadvantages. The increased use of technology and certain electronic devices, may promote passive and superficial learning behaviors during lectures or even deter students from attending lectures. Caution must be exercised when selecting and integrating technology in the note-taking and review process.

Using computers to facilitate transcription and organization. Today, the ubiquitous presence and use of computers is everywhere in our lives. Hence, one of the technology options to assist note-taking is the use of personal computers (PCs), notebook computers, or tablet PCs. Computers may facilitate the note creation or note management stages of note-taking. Research has shown that proficient typists can type faster that they can handwrite. Since transcription speed is an important factor in note-taking the use of computers may increase students' speed to take lecture notes. Kim et al.'s (2009) study corroborated the importance of the rate and efficiency of data entry to the note-taker. In addition, Bui and colleagues (2013) conducted an experiment with a two-fold purpose to examine the use of computers and type of notes in the note-taking process on performance. First, they compared taking notes by hand with taking notes using a computer in terms of their effects on test performance. Second, they compared the effects of taking organized notes with the effects of attempting to transcribe a lecture. The eighty undergraduate participants were assigned to four different conditions. Students in the hand condition were provided a notepad and pen, while students in the computer condition were told to type their notes into a computer file using a word processor. In the third, organize condition, students were told to paraphrase and organize their notes as much as possible, while students in

the transcribe condition were encouraged to record as much verbatim information from the lecture as possible. Three dependent measures were used to evaluate the findings; note quantity, free recall, and performance on short answer questions. Note quantity was measured by the proportion of idea units from the lecture recorded in students' notes. Free recall was measured by the proportion of idea units recalled from the lecture. Short answer questions addressed details from the lecture. Results indicated that students in the computer condition who were instructed to try to transcribe the lecture took more notes and performed better both on the free recall and short answer tests than students in the hand condition. These findings support the notion that the use of computers may improve student's note-creation efficiency and test performance.

Interestingly, other researchers had contradictory findings. Mueller and Oppenheimer (2014) cautions that the use of laptops (and the internet) in class is controversial. Many professors report that the use of laptops often serves as a distraction. In particular, students using laptops are often not on task, it deters them from participating in class discussions, resulting in decreased academic learning. These findings suggest that laptop note-taking may be less effective than longhand note-taking for learning. Conversely, students tend to believe that laptop use is beneficial, despite that fact that it can be a distraction. For example, Kay and Lauricella (2014) surveyed college students about their use of laptops inside and outside of college classes. Specifically, the survey asked students about the perceived benefits and challenges of using laptops in class. Benefits of using laptops in class were active note taking, following Power Point presentation, using professor notes, online collaboration, and searching for academic resources. On the other hand, challenges included browsing the web for personal reasons, social networking, or playing games. Interestingly, benefits were reported thirty percent more often than challenges inside the classroom and equally often outside of the classroom. In their study,

Mueller and Oppenheimer investigated whether taking notes on a laptop versus writing long hand affects academic performance of college students. The authors speculated that using laptops may impair the encoding benefits of note-taking. In contrast, the ability to transcribe notes by using a computer might improve the external-storage function. To control for distractions, the laptops were disconnected from the Internet and could only be used for word processing. First, students were assigned and instructed to take notes in the laptop and longhand condition without an opportunity to review. On factual recall questions participants performed equally well across conditions, however, on conceptual-application questions longhand participants performed significantly better than laptop participants. The authors demonstrated that participants using laptops tended to produce lengthy verbatim transcriptions of the lecture content since most students are able to type faster that they can write. Although taking more notes resulted in more content (more complete record of external storage), the mindless transcription offset the benefit of increased content. These findings also support that effective note-taking with the use of selection, paraphrasing, and summarization of ideas is a generative process which results in deeper understanding and better performance on integrative and conceptual test questions. In contrast, verbatim note-taking is a shallower processing predicting poorer performance and impairs the quality of learning. Furthermore, in the next study when participants were allowed to study the notes they produced in their respective conditions, participants who took longhand notes still performed significantly better than the laptop participants. These findings suggest that longhand note-taking results in enhanced encoding compared to verbatim note-taking. Although having more notes is usually beneficial, with mindless transcription of content this benefit disappears. Therefore, teaching students to summarize and reframe the information in their own words should result in improved educational outcomes.

Students also use computers to create new notes, or supplement and organize their existing notes after lectures. When students construct their own study notes they tend to perform better than student who study instructor provided notes. In particular, when students use visual formats, such as matrices, graphic organizers, or concept maps encoding of information strengthens the individual's knowledge construction. With the use of computers students have two options when creating and filling out study templates. Student may choose to cut and paste or type in the selected information. Katayama, Shambaugh, and Doctor (2005) studied the difference between copying and pasting versus typed note-taking methods for constructing notes among undergraduate college students and their performance on retention and application tests. The first group of students typed their notes into the graphic template, while the second group used the mouse to cut and paste information into their notes. Results indicated that there were no significant differences on the fact test between the two groups, however the typed note-taking condition did better on the application test. The findings support the notion that the more students attend to constructing their notes, making encoding a more active process will likely increase their ability to retain and apply the information. Igo, Kiewra, & Bruning (2008) further investigated students' copy-and-paste behaviors during electronic note construction and its impact on their ability to learn. Findings revealed that the most important factor relating to the copy-and-paste process was the subsets of note-taking behaviors students brought to the task. Namely, the learner' selectivity as to what to paste and maintaining focus on the meaning of the information had the greatest influence on their ability to encode and learn the information.

Digital recording of the lecture to improve note-quantity and quality. Another new technology that may help students with the note-taking process is the Livescribe smart pen. The smart pen and the specially designed dot-paper was created by an MIT engineer and was

marketed for college students. The Bluetooth smartpen comes with an infrared camera that captures what is written and allows the notes to instantly appear on an electronic device (iPad or iPhone). Later, the writing, including pictures and diagrams can be easily converted into text or PDF files. In addition, the pen when used with an iPad or iPhone can record audio that the note-taker cannot capture while writing. To record the lecture, the note-taker may use the microphones of an iPad or iPhone and the software will synchronize the audio recording with the written notes. If students have incomplete notes they may replay the whole lecture or specific points of the lecture by tapping the paper in a specific section of the notes. This ability of the smartpen to move students through a review of their notes in a nonlinear fashion is a welcome and useful feature considering that most other recording technologies require a linear and cumbersome process. While the technology promises greater access to capturing lecture content and improved academic results, it also raises three major concerns. The first dilemma is whether technology would make students more passive about their learning. The second apprehension has been discussed earlier and relates to effective note-taking techniques. Is verbatim transcription and capturing a lecture word-for-word necessary and beneficial to the learning process? The last concern pertains to property and privacy rights of this information. The use of the smart pen enables students to capture a complete and accurate digital transcript of a semester long course. Most college and university policies have not clarified whether faculty and colleges own the intellectual property produced in the classroom. The law is also vague about students' right to privacy who participate in class discussions and their thoughts are captured and may be shared via e-mail, or posted on Facebook or Twitter (Hannon, 2008). In sum, smart pens will likely claim a place among the new note-taking technologies, but how much of its promise will actually be delivered are yet to be determined.

Utilizing Power Point to improve notes and increase student engagement during lecture. With the increasing presence of computers in schools and easy to use software electronic lectures, such as Power Point presentations are becoming widely used. Power Point lectures seem to offer many benefits over traditional lectures. Power Point slides allow teachers to present information in a new, more engaging, and dynamic ways to students. Electronic lectures also provide the teacher with quick and easy methods to share notes with students or create guided notes (Boyle, 2012). The use of Power Point slides, guided notes have shown to improve undergraduate students' ability to record more critical lecture points and examples in their notes (Austin, Lee, & Carr, 2004). Despite the above mentioned advantages, Gier and Kreiner (2009) cautions about potential disadvantages of Power Point lectures. One of the potential disadvantages is that interaction between teacher and students may decrease when Power Point slides are used. Decreased interaction between teacher and students may promote passive listening by students, does not allow for teaching higher order thinking, and diminishes feedback about student learning (Butler, Phillman, & Smart, 2001). Another potential disadvantage is that students may be under the false assumption that if they study the Power Point slides they will do well on assessments. Lastly, if electronic lectures are made available on line to students it may discourage course attendance, especially at the college level. Grabe (2005) investigated college students' voluntary use of on line lecture notes and whether the students use of notes is an alternative to class attendance. Data revealed that most students made use of the online notes. Specifically, about 82% of the students printed their notes and used the printed notes during lectures to support their own note-taking and comprehension of the lecture material. Moreover, students who used the online notes performed better on course exams than those who did not use online notes. In regards to attendance, about 30% of note users claimed that they

have used notes as a replacement for class attendance. Gier and Kreiner (2009) cautions that it is not the use of Power Point that determines its effectiveness, but how it is incorporated in the lecture by the instructor. As of today, research results vary in terms of the effects of Power Point lectures.

Researchers argue that students who actively generate information as opposed to being passive receivers of information are more likely learn the information. Therefore, researchers advocate for augmenting lectures with interactive exercises to facilitate student learning (Butler et al., 2001; Gier & Kreiner, 2009). Butler and colleagues (2001) developed and tested an in-class writing exercise to facilitate learning. Their in-class writing exercise is a combination of two learning exercises: minute papers and think-pair share. Minute papers are a classroom-assessment technique usually used at the beginning or end of a class period requiring students to provide brief written responses to short, general questions. Minute papers can also be used periodically throughout the lecture to provide a different learning activity and break for students. Think-pair share is a collaborative learning strategy, in which the teacher provokes students thinking with a question or prompt, students discuss the question in pairs, and then share their ideas with the class. The think-pair-share can also be used periodically during a lecture. They named the short in-class writing activity CARDS, because student wrote their responses on index cards. Participants were 125 college students. Research findings for student learning were moderate, providing evidence that CARDS improved test performance on one third of the questions tested. CARDS may have been effective improving test performance by providing additional practice opportunities to recall material and to receive immediate feedback. Additionally, the strategy motivated students to attend class, students found it engaging and believed that it helped them learn the materials.

Gier and Kreiner (2009) developed a similar active learning method to enhance the effectiveness of lectures, specifically Power Point-based lectures. In this method, the instructor poses questions to the class several times through the course of the class period. The questions are content-based-questions (CBQ) pertaining to the theories and concepts of the presentation. Students view and respond to the questions presented on the slides several times during the lecture. Researchers compared college students' performance who received Power Point presentations with CBQs with performance of students who participated in the traditional Power Point lectures. Results of the study confirmed the initial hypothesis that interactive learning methods can improve students' ability to recall lecture content.

In sum, technology holds promising benefits for supporting and improving students' note-taking ability. Electronic devices and computer software may be used both by the note-taker or lecturer to scaffold the personalized process of note-taking and note organization. It is crucial that technology is used in a manner that promotes students' engagement and more active processing of the information. While technology has a lot to offer it should make note-taking easier by accommodating the individual's note-taking abilities and be used in an integrated approach with instruction.

CHAPTER III

Methods

The purpose of this research study was to contribute to the body of research on middle school students' (with and without disabilities) note-taking and study skills and the effectiveness of strategy training to improve comprehension of content area material and academic success. First, the current study sought to extend the research and explore middle school students' quality and use of note-taking and study strategies. Second, the study examined the effects of note-taking plus review session strategy on students' lecture comprehension. Lastly, the study attempted to compare the effects of note-taking interventions on students' performance with and without disabilities.

1. Will students' note-taking skills improve with strategy intervention?
2. Will students' review/study skills improve with strategy intervention?
3. Will student's comprehension of content area lecture material improve with the combined note-taking and review strategy instruction?
4. What are the differences between students with and without disabilities in their note-taking and review strategies prior to and after intervention?

Site and Participants

Initial contact was made with the supervisor of special services and building principal to arrange access to the site. The contact letter explained the nature and purpose of the research and ensured confidentiality with a consent form. The supervisor and building principal provided a letter of approval to the Institutional Review Board to conduct the study at Wilson Middle School (a pseudonym). Afterwards, a meeting was arranged at the school with two eighth grade social studies teachers who expressed a desire to participate in the study with their classes. The

two social studies teachers were instrumental in developing the schedule, sending home and collecting the consent forms.

Wilson Middle School is located in Franklin (pseudonym) Township School District in suburban New Jersey near a large metropolitan area. Franklin Township is a comprehensive community public school district that serves students in Kindergarten through twelfth grade from the township. The district factor group (DFG) which represents the measure of a school district's relative socioeconomic status places Franklin School District with the "I" districts. (School districts are categorized into DFGs from lowest socioeconomic status to highest, the categories are A, B, CD, DE, FG, GH, I and J). The district's eleven schools have an enrollment of approximately 6,600 students. The district's eleven schools comprise seven elementary schools, three middle schools, and one high school. The schools are theme-based for grades K-8 and a comprehensive program is offered at the high school for grades 9-12. While each school has its own focus, every school follows a basic curriculum in the core subjects in accordance with the NJCCSSs.

Wilson Middle School is a magnet school serving a wide-range of students with diverse backgrounds. Specifically, the school is an inclusive STEM (science, technology, engineering, and technology) magnet school which is organized around the four STEM fields. Franklin Township children do not necessarily attend the school closest to their homes. The magnet schools provide flexibility of educational choice and balance of students from various economic zones. Wilson Middle School serves approximately 600 students grades six through eight and employs about 64 full time teachers. The racial makeup of the students is: White (42.6%), African-American (33.5%), Hispanic (12.6%). The middle school follows a block schedule (double periods) on a six-day cycle. Classes are approximately eighty minutes long and students attend the same subject area class every other day (A,C,E or B,D,F).

General education students and students with mild disabilities receiving resource center in-class support special education services were invited to participate in the study. Students were given information about the purpose of the study, assured about voluntary participation and withdrawal, and asked to sign an assent form if they wished to participate. General education students were the ones who participated in the general education program, did not receive special education services, and earned passing grades in their classes. Students with mild learning disabilities were defined as students who were found eligible for special education services by the district in accordance with state and federal guidelines. Students with mild disabilities had an Individualized Education Plan (IEP), and received the majority of their education in the general education classrooms with appropriate special education supports and services.

Study participants were sixty middle school students in grade eight. The sample comprised 7 students with disabilities and 53 students without disabilities. (One of the students with an IEP was absent during the post-test.) The participants, whose ages ranged from 13 to 14, were drawn from four different sections of social studies classes at the middle school. A total of 27 girls and 33 boys participated. The four eighth grade social studies classes comprised two resource center in-class support classes and two general education classes. The four class sections were taught by two male social studies teachers who used the same text book and followed the same district curriculum. The students' teachers did not participate in the training, but were in the classroom during instruction. Students from the classes who did not wish to participate in the study, worked on an alternate, quiet activity in the back of the room under the social studies teacher's guidance and supervision. Table 1 outlines the distribution of participants in the two control groups and two intervention sections, respectively.

Table 1 *Distribution of Participants*

	Number of Students	Male	Female	Students with IEPs
Control 1	14	6	8	0
Control 2	17	10	7	0
Total	31	16	15	
Intervention 1	18	11	7	6 (2F,4M)
Intervention 2	11	6	5	1 (1M)
Total	29	17	12	7

Materials

Materials included four videotaped lectures, computer, projector, sheets of 8.5 x10.5" lined paper, Cornell note-taking papers, summary and question stem cue cards, multiple-choice pre- and post- intervention comprehension tests, and student surveys.

Videotaped lectures. Four videotaped lectures were used, one for pre-test, two for training and practice, and one for the post-testing session. Videotaped lectures were selected and used because they offered advantages over using live lectures. The video lectures consisted of smaller segments and were approximately 20 minutes long. The video lecture simulated a typical social studies lecture similar to the one in which students participate in their general education classes. The instructor in the video presented information verbally, at times maps and photographs were displayed to illustrate the information, and the instructor wrote some of the key dates, names, locations, and information on the 'board'. The content of the lectures was drawn from social studies describing European history leading up to WWI and were titled Empires before World War I, Alliances Leading to World War I, Assassination of Franz Ferdinand, and the Great War Begins. The post-test lecture material addressed the end of the WWI, The Battle of Verdun, and WWI Eastern Front. The selection of the content of the lecture

was influenced by two main factors. One of the factors was the desire to control for student's prior knowledge to the most extent possible. The topic of European history after 1910 is not part of eighth grade social studies curriculum and the state and core curriculum content standards; therefore, students were expected to have minimal background knowledge pertaining to the topic. The second factor in the content selection pertained to the two social studies teachers' approval of the topic. High school and middle school teachers are content area specialist, who possess in depth knowledge of curriculum in their particular subject area. Thus, teachers at the high school and middle school level often view their roles as subject matter experts responsible for designing and delivering instruction to the whole class. In addition to their wish to control the delivery of the subject matter in their classrooms, the current educational context of high expectations and teacher accountability in regards to student achievement further decreased flexibility in the area of topic selection. Presently, teachers in New Jersey are evaluated on multiple measures, such as teacher practice and student achievement. Specifically, social studies teachers are required to set student growth objectives (SGOs), academic goals, for their students at the start of the year and are assessed on whether those objectives are met at the end of the year. Due to these reasons, the two social studies teachers did not feel comfortable with the idea of someone else teaching the content of their curriculum to the students in their classes. Consequently, the topic of WWI was negotiated as it would not be part of the 8th grade curriculum, but students could gain some exposure and background knowledge to promote their success in the high school social studies curriculum.

The lectures had a similar number of important main ideas and details and examples. The videotaped lectures were web-based and presented to students on a screen with audio. Detailed description of lecture materials and statistics appear in Table 2.

Table 2 *Descriptive Statistics for Lecture Materials*

Lecture Title	Time	Word Total	WPM	Main Idea	Detail/Example	TLP
			Pre-Test			
Empires Before WWI	7 mins and 36 seconds	1,306	-	-	-	-
Alliances Leading to WWI	4 minutes and 43 seconds	848	-	-	-	-
Assassination of F.F.	5 minutes and 33 seconds	839	-	-	-	-
The Great War Begins	6 minutes and 11 seconds	995	-	-	-	-
Total	24 minutes and 3 seconds	3,988	166	65	98	163
			Post-Test			
WWI Eastern Front	11 minutes and 46 seconds	1,593	-	-	-	-
Battles of Verdun & the Marne	6 minutes and 30 seconds	1,047	-	-	-	-
Total	18 minutes and 16 seconds	2,640	147	67	131	198

Cornell note-taking paper. The Cornell method is a well-established best practice to teach students to develop note-taking skills. The method was developed more than fifty years ago by Dr. Walter Pauk, Cornell University's reading and study center director and it remains one of the most effective note-taking approaches. With the Cornell method, the page is divided into three sections. The three sections can be easily drawn with a ruler and pen, or can be downloaded from the internet. One of the most important features of the Cornell system is the

cue column, a two and one-half inch margin at the left-hand side of the page. The cue column is for extracting main ideas, key points, or writing questions based on the notes. The six-inch note-taking column is for taking notes, recording the lecture as fully as possible in telegraphic sentences. A telegraphic sentence is a concise sentence containing five or less words, concentrating on central ideas and omitting additional verbiage not crucial for understanding the message. Telegraphic sentences are named after the compressed sentences commonly used in telegrams. By eliminating conjunction and unnecessary words the content is reduced to main ideas, sub-ideas, and important examples and details making it easy to write and read. The last section, two inches from the bottom is for writing a summary (Donohoo, 2010; Minskoff & Allsopp, 2003; Pauk, 2000). Appendix A illustrates the layout of the Cornell Note-Taking template.

Summary and question stem cue cards. Summary and question stem cue cards were modeled after those used in a study conducted by the King (1992) and Chiu et al. (2013). Summary cue cards (see Appendix B) served as prompts and memory aids to students for summarization rules. Following the steps of the summarization rules, the cards were intended to guide students to pull together and synthesize all the essential information in one paragraph. First, students had to identify the main topic of the lecture and create a sentence to reflect that topic by using their own words. Next, they were guided to identify key points, main ideas, and link them together into a summary. Question cue cards included generic content-free question stems that were designed to assist students in creating their own questions specific to the content of the lecture viewed (see Appendix C). Question stems were designed to assist students deeper processing of the lecture material by analyzing concepts, determining how concepts relate to

each other (internal connections), and relating new information to their own prior knowledge and experiences (external connections).

Multiple choice comprehension tests. Comprehension tests included 14 questions printed on 8.5 x 11 sheets (see Appendix E and F). Questions were printed with four answer choices for students to select and circle the option that best responds to the question. Test questions were designed to represent a range of increasing difficulty levels, including factual, knowledge level questions, comprehension, application, and analysis and synthesis of lecture content. Test questions were intended to assess students' retention of factual information as well as higher-order thinking requiring them to integrate lecture information. In addition, tests were constructed that the different question types were presented in a similar order on both the pre- and post-tests.

Procedures

Using a nonrandomized pretest-posttest control group design, the study groups were "intact" units (students remained in their classrooms with their classmates), each intact group was randomly assigned to one (experimental or control) treatment condition, and observations on the dependent variable were collected before and after the intervention administration. Specifically, students in Teacher 1 and Teacher 2's classes who were following the A, C, E schedule were designated as the experimental group (Cornell note-taking and summarization and question generation) and students attending Teacher 1 and Teacher 2's classes on days B, D, and F days were in the control condition (taking notes and studying them using their preferred method). All sessions were taught and facilitated by the Principal Investigator.

The experiment was conducted in three phases, over five 40-minute sessions during the second quarter of the school year. The first phase consisted of a pre-test (one session) for all

students. Then during the second phase of the experiment, training was provided in the respective strategies (three sessions) for participants in the intervention condition, and practice or business-as-usual for students in the control condition. Finally, the third phase entailed the posttest (one session) for all study participants.

Pre-test. To establish a baseline, during phase one, all students were pretested on their ability to take notes, review them, and comprehend the presented lectures. Students were asked to view the first videotaped lecture on the economic, social, and political context and events leading to World War I (Empires before WW I, Alliances Leading to WWI, Assassination of Franz Ferdinand, The Great War Begins) and then answer a 14-item multiple-choice test on its content. Pre-test sessions were completed in all four social studies classes the same way. The first two classes were pre-tested in the morning of Day A, while pre-test data was collected from the other two classes the following morning on Day B. All groups group were informed that they would be watching a videotaped lecture, they should take notes, review their notes after the lecture, and take a test on the lecture content. All students were given two 8.5 x 11.5" lined paper to use for note-taking. Students watched the approximately 25 minutes long video and took notes independently using their preferred method. At the end of the session, students had 10 minutes to review their notes. Most students re-read and/or explained their notes to a partner or worked independently, as it has been the established classroom review procedure or routine. Next, students' notes were collected and they completed the multiple-choice comprehension test. Lastly, students' tests were collected.

Training. Pretest sessions were followed by training provided to the intervention group and practice sessions without instruction for the control group. During the 40-minute training sessions, the researcher followed a scripted lesson and trained students how to take notes paying

attention to verbal and visual lecture cues, using the Cornell-note taking form, and how to review their notes by writing summaries and generating and answering questions in pairs. The strategy training followed the recommended steps of strategy instruction, describing the strategy, modeling, guided practice with corrective feedback, and independent practice (Minskoff & Allsopp, 2003; Kiewra, 2002; Schumaker, Denton, & Deshler, 1984).

The first training session focused on emphasizing the importance of effective note-taking and study skills, identifying lecture cues, the use of the Cornell-note taking method, and other note-taking skills (such as grouping and organizing information and using abbreviations and diagrams). First, the researcher provided a brief description of the new strategy of note-taking that detailed the nature of the strategy and the advantages of using it. To help students better understand the strategy the researcher used the four W's and an H to describe: What the strategy is, Why use it, When to use it, Where to use it, and How to use it (Call, 2000). This explanation, which was briefly reiterated during each training session, emphasized the value of the note-taking, note-review, and the value of applying one's metacognitive knowledge and continuously monitoring comprehension during learning. Students were informed that these particular strategies would benefit their note-taking quality, lecture comprehension, and academic achievement. Students were invited to participate in a discussion about the costs and benefits of mastering this new strategy and the advantages of using it compared to old note-taking habits. Providing this type of information to students has been shown to promote use of the trained strategy (Schumaker, Denton, & Deshler, 1984).

Next, the researcher modeled the techniques to the students by performing the task and providing explicit cognitive modeling to students by externalizing her thinking and decision making process through think-alouds. Modeling is a powerful instructional tool, most people

learn something better when they can observe someone else demonstrating it and having an opportunity to emulate those actions through imitation. Modeling emphasized the key elements of successful note-taking and review. These key elements of effective note-taking are identifying and recording main ideas, discerning between important and unimportant lecture points, recognizing lecture cues, recording important terms or vocabulary, paraphrasing, using abbreviations, and grouping and organizing lecture information in a clear and logical format. A large copy of the Cornell template was prepared in advance on chart paper and posted for all students to see. Students were given the STAR acronym (Set Up Paper, Take Notes, After Class, Review Notes), and an explanation how to use each section of the Cornell template. The lesson focused on modeling, the researcher played short segments of the videotaped lecture (The Schlieffen Plan and the First Battle of the Marne), used the Cornell note-taking to record information, and strategically stopped the video to explain her thinking. The researcher pointed out to students the lecture cues she used to identify key ideas, how she only wrote words and phrases, and grouped together ideas. Students were encouraged to ask questions and share their insights and follow along taking notes with the researcher. During the last segment of the video students were encouraged to attempt taking notes on their own and only compare their notes with the researcher's to evaluate their progress using the Cornell-method. At the end of the session students' notes were collected.

The second training session provided instruction in summarization and question generation. The researcher returned students' notes to allow them to summarize their notes and generate questions for review. Instruction followed the strategy instruction steps delineated in the previous section. After describing and modeling the strategy, the researcher assisted students in how to identify the main ideas or key points (e.g., identifying signal words in the lecture) based

on their notes and memory of the lecture. Next, students were taught to create a sentence using their own words to reflect that topic. The Summary Cue Card was introduced and given to students to assist them in the summarization process. Afterwards, students were instructed to work in pairs and identify other key ideas and subtopics from the lecture and write sentences that linked those ideas together. These sentences created the lecture summary. Summarization was intended to assist students to identify key points, organize and relate this information by developing connections among these ideas as well as between their own existing knowledge (Chiu et al., 2013; Kiewra, 2002; King, 1992). In other words, students were not only required to reduce the content into a concise summary, but to select the main idea and other key points, organizing them based on relationships, and put the information in their own words. These activities were intended to make summarization a truly generative process.

However, the researcher's informal observations suggested that students did not fully master the summarization process during the training session; hence, students' summaries most likely did not support generative learning. While students worked in pairs constructing their summaries, the researcher walked around to monitor progress and provide feedback to the dyads. Even with instruction, peer support, and the use of the Summary Cue Cards many students seemed to struggle with the summarization task. Some of the students had difficulty getting started and produced very brief, incomplete summaries, while others wrote lengthy descriptions of the lecture as a summary. Lastly, student pairs were asked to share their summaries with the class and the researcher in order to receive additional feedback and advice. Ideally, students would have benefited from additional instruction and practice opportunities in order to master the summarization process.

When all students had written their summaries, they were trained to use the question generation strategy by presenting a set of content free generic question stems. Question stems were used to scaffold students' processes in creating their own questions specific to the content of the lecture viewed. The use of question generation and self-questioning offers multiple benefits. Question generation and self-questioning fosters comprehension by facilitating the organization and integration of new information and the existing knowledge. Self-questioning also provides students with the opportunity to test themselves to assess their knowledge and understanding of the content. The researcher described the strategy how to generate questions by combining important information from the lecture to develop lower- and higher-level questions related to the lecture information. The importance of linking ideas from the lecture was explained and stressed. After the describing and discussion stage, the researcher modeled how to generate questions and answer the questions fully and accurately. Finally, students generated questions in pairs and answered each other's questions. The researcher circulated in the room monitoring students' responses and providing assistance. During this practice activity it was noted that students seemed to enjoy generating questions and testing one another, but most of them tended to create mainly low-level questions (who, what, where, when). Later review and analysis of the notes collected from the students also supported the observation that students were inclined to generate low-level questions. For the duration of the last training session students were reminded an encouraged to use the Question Stem Cue Card and the strategies they were taught to generate a variety of question types when reviewing notes and testing one another.

The third training session served as guided/independent practice for students to put to together and utilize all the strategies. Specifically, students were instructed to take notes using

the Cornell method and to write their summaries independently, but had the opportunity to read it to a partner and receive feedback or assistance, and to generate questions and test one another. During this period the researcher guided students through practice portions of the videotaped lecture scaffolding the learning process and providing corrective feedback. Through whole-group instruction, the researcher asked students to determine which keyword or phrases to select from the lecture and share their reasons for the selection. The major purpose of this stage was to provide students with opportunities to practice the new strategy to become successful and confident users of the skills. The researcher circulated and provided feedback to students about their performance, and as the students demonstrated success the scaffolds were gradually withdrawn. Lastly, students' notes were collected.

During the training phase, the control group also participated in three sessions, but without receiving any kind of explicit instruction in note-taking or study strategies. Students in this no intervention condition were instructed to watch the video and use their conventional note-taking to record notes and review their notes. Although students were not taught new techniques they were given the same amount of time and opportunities as the intervention group to watch videotaped lectures and practice taking notes on its content and study their notes with a peer.

Post-test. After viewing the final lecture (WWI Eastern Front, Battles of Verdun, Somme, and the Hindenburg Line), all groups in both conditions engaged in their respective strategies and then took a comprehension test on the lecture content. The tests contained 14 questions on different levels of difficulty. Test questions related to the content presented in the video-taped lecture. Tests questions were designed to assess students' retention of factual information and higher-order thinking requiring them to integrate information and elaborate on ideas. One group of questions were factual, knowledge-level questions that required the student

to recall the information that has been presented (e.g., What is the definition of …? Who…….? Where…? When did …? How many….?). The next group of questions were comprehension level questions that required stating an example of a concept, explaining a concept, describe, or compare ideas (What is the difference between …? What relationship exists between …?). . The next type of questions were be analysis-level questions that required knowledge, comprehension, and application (What are some factors that cause…? Why did the….?) Synthesis-level questions (How our lives would be different if….? What could be done to integrate …? How would you test ….? How would you combine …. to create a different ….? What changes would you make to revise …? What if…?) After all the students completed the post-test and turned them in to the principal investigator, they were thanked for their time, efforts, and participation.

Measures

Students' note-taking were analyzed on two different variables: number of lecture points (main points, details/examples) and total words written. Review and comprehension skills were assessed by using the 14-question multiple-choice test. The percent correct for each test were calculated. A correct response was scored if the student's answer matched the one found in the test key. A deviation from the answer in the answer key was scored as an error (incorrect). In addition, percentage correct were calculated for questions on different levels of difficulty. All measures were compared regarding performance for students in the control and intervention groups and students with and without disabilities.

Social Validity

Social validity is an important concept in research and has been an integral component of research studies. While interventions may produce results that are statistically significant, they could have no or very little applied value for individuals in their everyday life. Recipients of the

intervention must understand and approve the goals of the intervention, find the methods acceptable, and results achieved relevant and useful. Although the validity of these opinions has not been established, they can help researchers and practitioners improving and choosing interventions, as well as promoting buy-in (Cooper, Heron, & Heward, 2007, p. 238).

In order to gauge the acceptability and usefulness of the note-taking and review techniques, students in the intervention condition were asked to anonymously complete a questionnaire at the end of the last session. Students were asked to circle the number on a 5-point scale, ranging from strongly agree to strongly disagree designed to assess the value of the newly acquired note-taking and review strategies. Students were asked to indicate the extent to which each of the note-taking and review strategy helped the student (a) to follow the lecture, (b) to record information, (c) to study and review the material, (d) the value of the strategies to improve their test scores, and (e) the extent the type of method they preferred. (See Appendix D for the Student Survey.)

CHAPTER IV

RESULTS

Data analysis included different measures of pre- and post-test note-taking quantity as well as retention and comprehension of the lecture content for students in the control and intervention groups. Specifically, note-taking quantity measures comprised of total words written, the percent of total words written during lecture, percentage of main ideas and details/examples recorded, and performance on multiple-choice assessment in pre- and post-intervention sessions. Additionally, data was disaggregated by control and intervention conditions, broken down by gender, and the performance of students with IEPs was evaluated. Lastly, student questionnaire was analyzed to determine whether students judged the intervention acceptable, effective, and whether they would consider using it in the future.

Statistical data analysis was conducted by utilizing Excel and the Minitab 17 statistical software. First, statistical evaluation was used to evaluate the null hypothesis that the data followed the normal distribution. The normality of the data was evaluated using the Anderson-Darling (AD) test for normality. With the *p*-value set at 0.5 level, the findings indicated that all data groups followed the normal distribution with the exception of the Post-Intervention condition group's performance with respect to percentage of total words written (%TWW). However, the departure from the normal distribution was very little (*p*-value = 0.353). (See Table 3 for means and standard deviations.) Furthermore, by eliminating the two outliers, would bring the data to the normal distribution. Since the treatment and control groups are similar populations, comparison between the groups is justified and valid. (See Figure 1 for probability plots of percentages of total words written.)

Table 3 *Descriptive Statistics of Percentages of Total Words Written*

	Mean (%TWW)	SD	N	AD	p-value
Baseline Control	4.225	1.413	31	0.260	0.689
Baseline Intervention	4.805	1.803	29	0.225	0.802
Post-Intervention Control	5.691	1.760	28	0.300	0.558
Post-Intervention Intervention	5.860	2.347	26	0.392	0.353

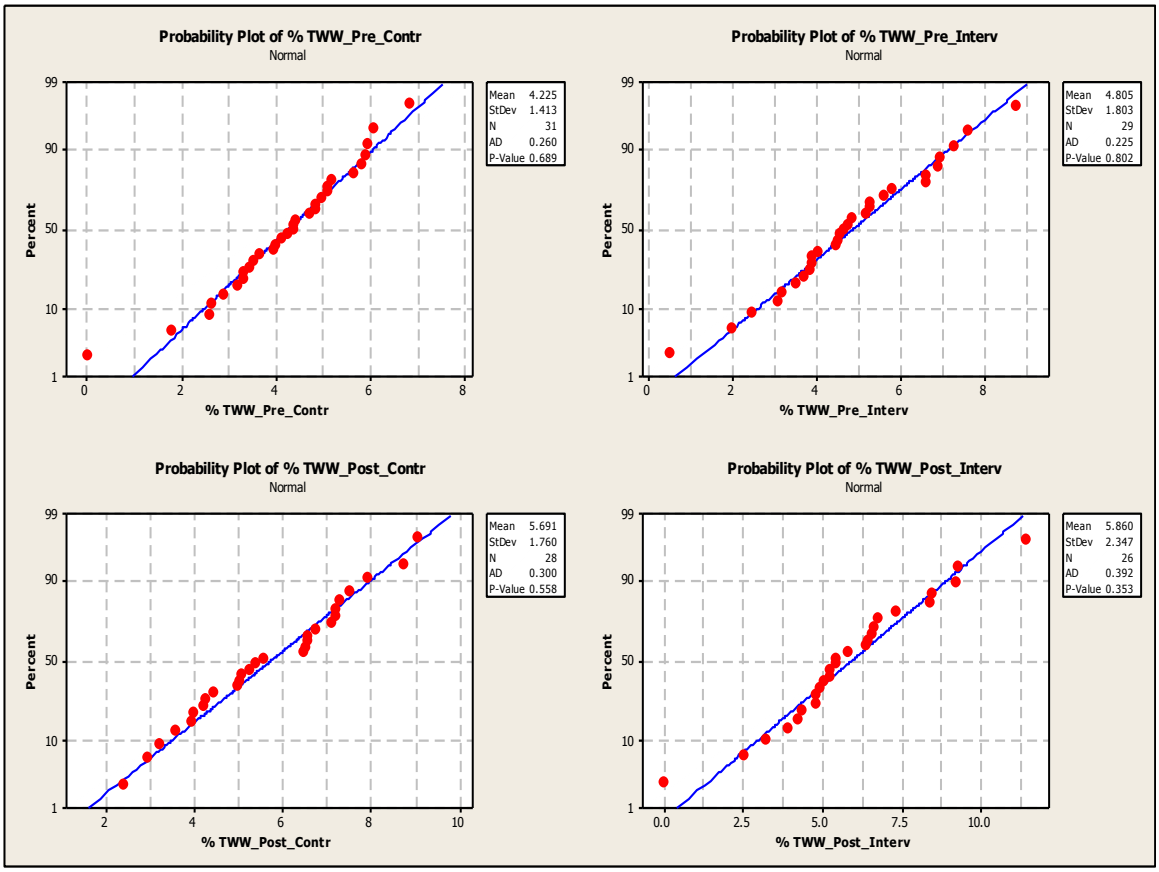

Figure 1. Probability plot of percentages of total words written.

Results of Students with IEPs

Although one of the main goals of the current study was to extend findings of previous research on note-taking skills of student with mild disabilities receiving services in general education content area classes, very few students with disabilities participated in the research study. Unfortunately, even after repeated attempts were made to reach out to parents, generate interest, and secure written consent for participation, most students with IEPs did not return the informed consent to participate in the study. Despite the fact that some of the students and their parents indicated that they wished to participate in the research and were interested in finding ways to improve their children's note-taking and study skills, they never returned signed consent form. Therefore, many students in the two resource in-class support classes did not participate in the study. The seven students with IEPs who participated in the study were assigned to the intervention condition. During baseline condition, all seven students recorded notes and completed the comprehension test. All students with IEPs received strategy instruction, but during the last session one of the students with IEP was absent. Due to the small number of students with disabilities participating in the study, no separate statistical analysis could be performed to compare differences between students with and without disabilities. Results of students with IEPs is presented as individuals compared to the mean of the control and intervention groups.

Baseline, Pre-Test Total Words Written (TWW) Results

Students' pre-test notes were analyzed for total number of words written during the lecture. Each word was counted as one unit, abbreviations were also counted as a unit, and dates were assigned a value for each component (day, month, year). A two-sample t-test was conducted to calculate means and standard deviations for the control and intervention groups.

The control and intervention groups were comparable on the total words written variable. The means and standard deviations for control group (M = 174.1, SD = 47.7) and the intervention group (M = 191.6, SD = 71.9) are listed in Table 4. No statistical differences were found between the groups, t-test of difference = 0 (vs not =): T-Value = -1.11 P-Value = 0.273 DF = 57. Both use Pooled StDev = 60.8022.

Table 4 *Two-Sample T-Test and Confidence Interval (CI): Pre-Test Notes TWW Control, TWW Intervention Means and Standard Deviations*

Group	N	M	St.Dev	SE Mean
Pre-Test Notes TWW Control	30	174.1	47.7	8.7
Pre-Test Notes TWW Intervention	29	191.6	71.9	13

95% CI for difference: (-49.2, 14.2)

While no statistically significant differences were found between the control (C) and intervention (I) groups in means and standard deviation, the intervention group which included students with IEPs, on average recorded slightly more words and showed a somewhat greater variability and dispersion (see Figure 2 and Figure 3). It needs to be noted that the lowest score (20 TWW) and the highest score (349 TWW) in the distribution belonged to two different students with IEPs.

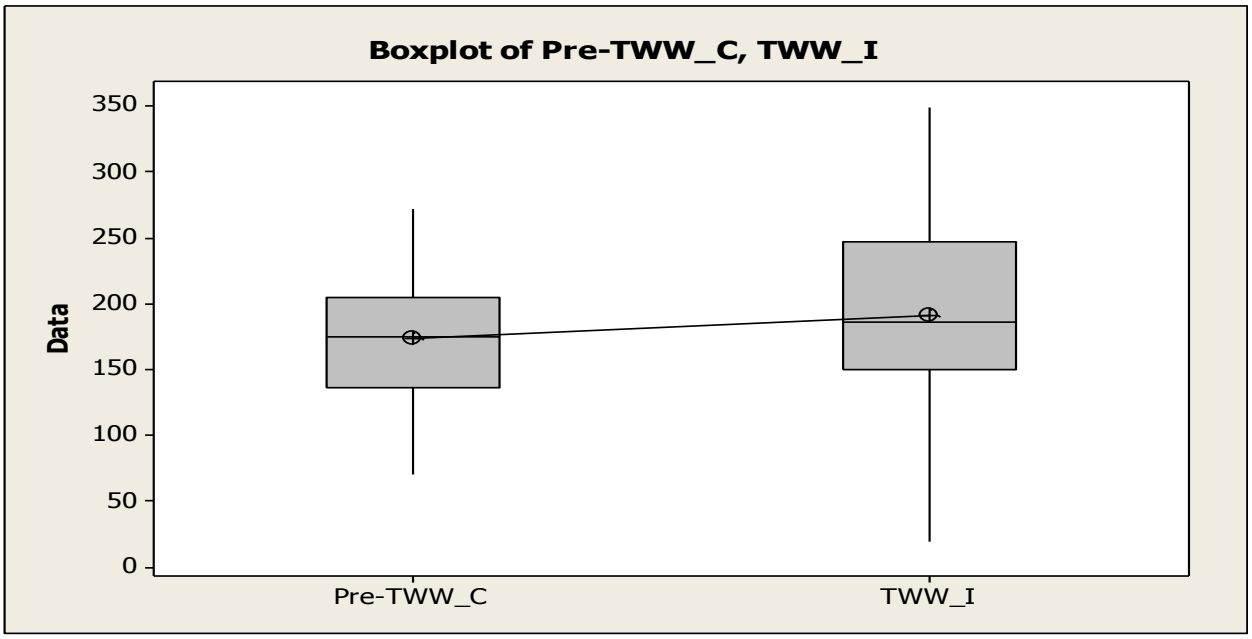

Figure 2. *Boxplot of pre-test (baseline) total words written (TWW) by students in control and intervention conditions.*

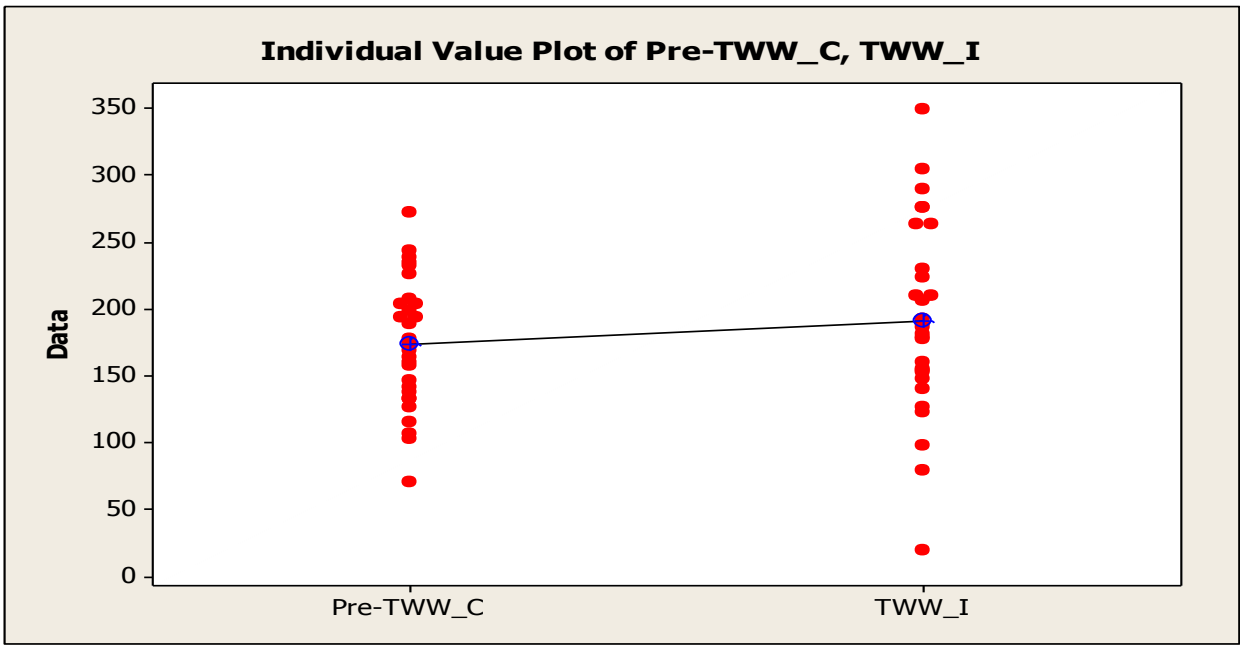

Figure 3. Individual value plot of pre-test (baseline) total words written (TWW) by students in control and intervention conditions.

Pre-Test TWW Results for Students with IEPs

In order to highlight differences between students in the two different conditions and disability status please refer to Table 5.

Table 5 *Pre-Test (Baseline) Results of Total Words Written for Students with IEPs*

Students with IEPs	Pre-Test Total Words Written	Z-Scores
Male 1	160	-0.44
Male 2	20	-2.39
Male 3	230	0.53
Male 4	349	2.19
Male 5	98	-1.30
Female 1	263	0.99
Female 2	152	-0.55
Mean of Control	174.1	
Mean of Intervention	191.6	

Pre-Test Percentage of Total Words Written by Gender

Total words written variable was also evaluated as the percent of total words written from all words spoken during the lecture. The percentage of total words written during the lecture was evaluated in both groups (control and intervention) and by gender. In the pre-test control group female students' performance was M = 4.654, SD = 1.635; while male students' performance was M = 3.822, SD = 1.069. Similarly, in the intervention group female student's performance was M = 5.086, SD = 1.903 and male students' M = 4.606, SD = 1.761. On average, male students recorded slightly less words and had smaller variability in their performance than female students in both groups. Table 6 and 7 show the information of means, standard deviation, minimum, median, and maximum disaggregated by gender in the control and intervention conditions. One female students in the control condition only turned in the first page of her notes; hence percentage of total words written could not be calculated for her and she is shown as an outlier in Figure 4. Two male students with IEPs in the intervention condition,

represented two extreme values on both ends of the distribution. (See Figure 5 for this information.)

Table 6 *Descriptive Statistics Pre-Percentage (%) of TWW Control Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	4.654	1.635	0.000	4.840	6.820
Male	3.822	1.069	1.780	3.837	5.667

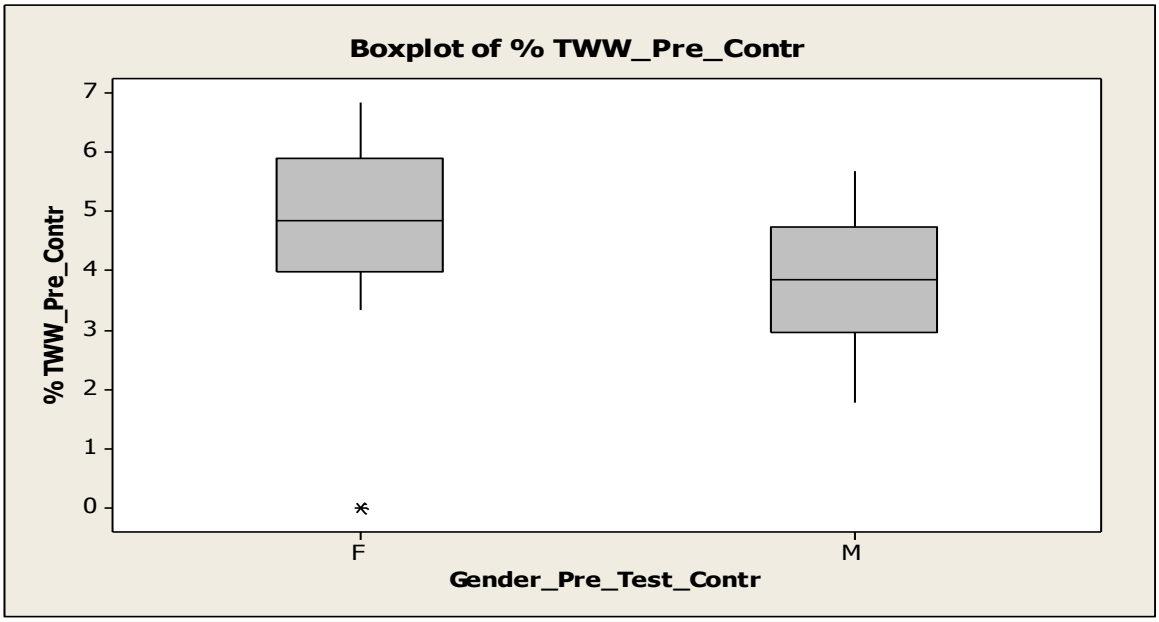

Figure 4. Boxplot of percentage of total words written in the control condition by gender.

Table 7 *Descriptive Statistics Pre-Percentage (%) of TWW Intervention Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	5.086	1.903	1.981	5.065	7.623
Male	4.606	1.761	0.502	4.664	8.751

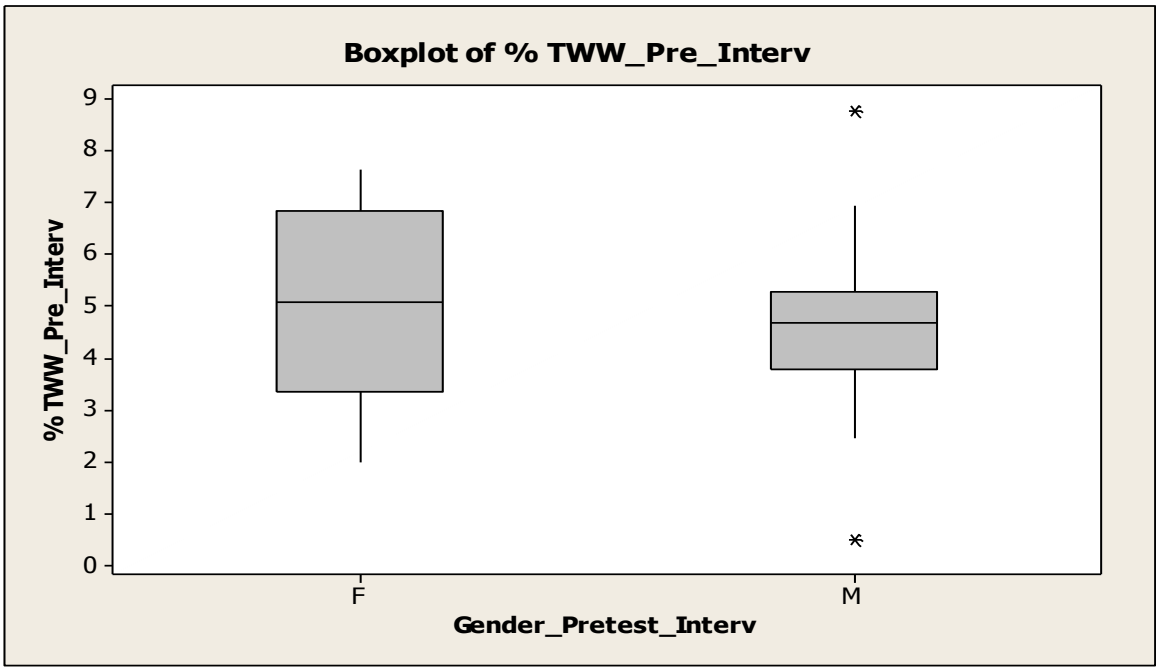

Figure 5. Boxplot of percentage of total words written in the intervention condition by gender.

Baseline Main Idea, Details, and Total Lecture Points Recorded

Students' notes were analyzed for the percentage of main ideas, details/examples and total lecture points recorded. A main idea was defined as a sentence or phrase deemed essential to understanding the lecture and information crucial for remembering on subsequent comprehension or classroom test. For example, "The assassination of Franz Ferdinand is one of the most famous events in all of world history and was the trigger for WWI.", or "By 1917 the Russian economy was falling apart." On the other hand, a detail or an example would be an idea unit providing additional information about the main idea or illustrating further illustrating it. For instance, "Franz Ferdinand was traveling in a car with his wife Sophie" or "there are food shortages and riots in Russia." It needs to be noted that in order to receive credit for a main idea or detail/example the information had to be accurate. For example, some students recorded the main idea that the "The Triple Entente was between the British Empire, Belgium, and Russia",

but they could not receive credit for this information as France and not Belgium was part of the triple agreement.

Students in the two different conditions demonstrated comparable performance on these variables. In particular, students in the control group recorded a mean percentage of TLP M = 18.16, main ideas M = 32.82, and details M = 8.44. At the same time, students in the intervention group recorded TLP M = 17.98, main idea M = 31.03, and detail M = 8.97. While the overall percentage of lecture points was very similar between the two groups, student in the intervention condition seemed to focus a little bit more on details and examples at the expense of recording main ideas. (Please refer to Table 8 and 9 for means, standard deviations, minimum, median, and maximum measures.) Table 10 illustrates the performance of students with IEPs compared to the mean performance of the control and intervention groups.

Table 8 *Descriptive Statistics for Baseline Condition of Control Group: Percent of Main Idea, Detail/Example, & Total Lecture Point (TLP)*

Variable	Mean	StDev	Minimum	Median	Maximum
Main Idea	32.82	7.48	15.38	33.08	46.15
Detail/Example	8.44	5.99	0.00	7.14	25.51
TLP	18.16	5.91	7.98	16.56	33.74

Table 9 *Descriptive Statistics for Baseline Condition of Intervention Group: Percent of Main Idea, Detail/Example, & Total Lecture Point (TLP)*

Variable	Mean	StDev	Minimum	Median	Maximum
Main Idea	31.03	8.99	6.15	32.31	43.08
Detail/Example	8.97	5.80	0.00	7.14	21.43
TLP	17.98	6.73	2.45	18.40	28.83

Table 10 *Descriptive Statistics for Baseline Condition of Students with IEPs: Percent of Main Idea, Detail/Example, & Total Lecture Point (TLP)*

Baseline	Main I. (%)	z-score	Details (%)	z-score	TLP (%)	z-score
Male 1	27.69	-0.37	4.08	-0.84	13.5	-0.67
Male2	6.15	-2.77	0	-1.55	2.45	-2.31
Male 3	36.92	0.66	4.08	-0.84	17.18	-0.12
Male 4	41.54	1.17	20.41	1.97	28.83	1.61
Male 5	21.54	-1.06	2.04	-1.19	9.82	-1.21
Female 1	36.92	0.66	15.31	1.09	23.93	0.88
Female 2	32.31	0.14	3.06	-1.02	14.72	-0.48
M of Control	32.82	-	8.44	-	18.16	-
M of Interv.	31.03	-	8.97	-	17.98	-

Results of Comprehension Pre-Test

After viewing the lecture, students were given ten minutes to review their notes with a partner, using their preferred method. A timer was set, and once the ten-minute review period was over, notes were collected and students were asked to complete a 14-question multiple-choice comprehension. Each correct answer was assigned a value of 1 and each incorrect answer a value of 0 with a continuum of 0-14 possible points. A two-sample t-test was performed to compare the means and standard deviations of the pre-comprehension test. Upon review of the results, the groups had no statistically significant differences. Control group (M = 10.3, SD = 1.85) and intervention group (M = 9.21, SD = 2.70) T-Test of difference = 0 (vs not =): T-Value = 1.39 P-Value = 0.171 DF = 58. Both use pooled standard deviation StDev = 2.3034

Again, while statistically significant differences did not exist between the means and standard deviations for the two groups, students in the intervention group demonstrated a slightly lower performance and greater variability in their test scores on the comprehension test (see Table 11 for means and standard deviations). The two outliers in the intervention group were two male students, one who did not have an IEP (with 2 correct answers) and one who had an IEP

(with 3 correct answers). Figures 6 and 7 also illustrate test performance and dispersion of scores of students in both conditions.

Table 11 *Two-Sample T-Test and CI: Multiple Choice Comprehension Pre-Test Control, Pre-Test Intervention Means and Standard Deviations*

Group	N	M	St.Dev	SE Mean
Pre-Test Control	31	10.03	1.85	0.33
Pre-Test Interv.	29	9.21	2.70	0.50

95% CI for difference: (-0.366, 2.017)

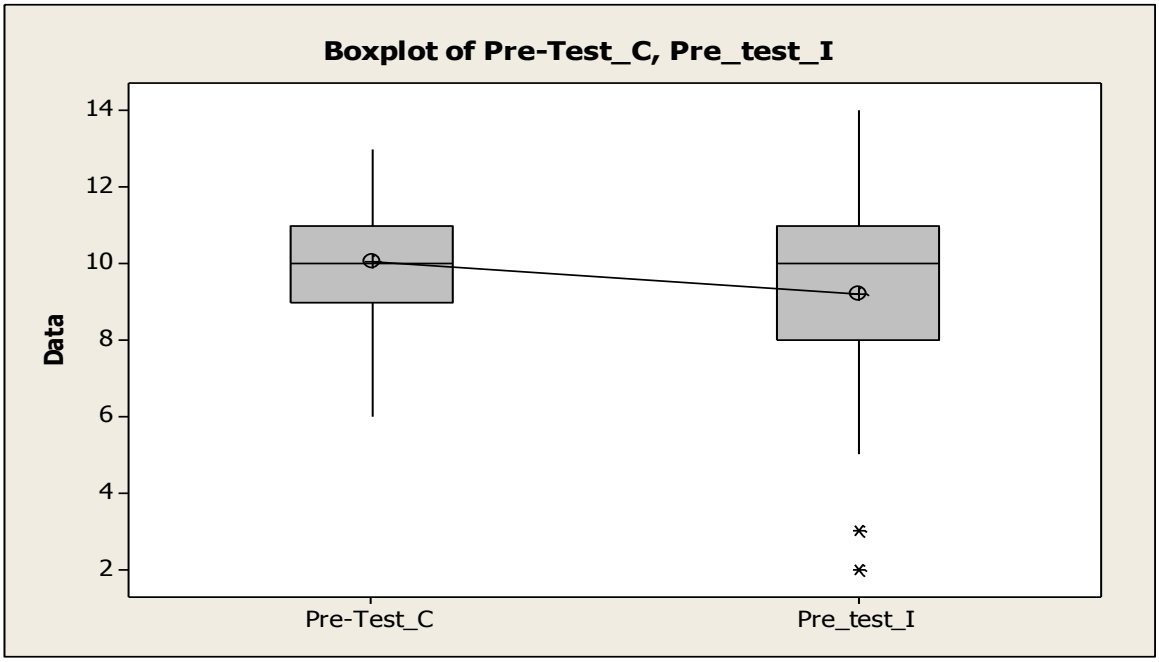

Figure 6. Boxplot of pre-test (baseline) condition performance of the control and intervention groups on the comprehension test.

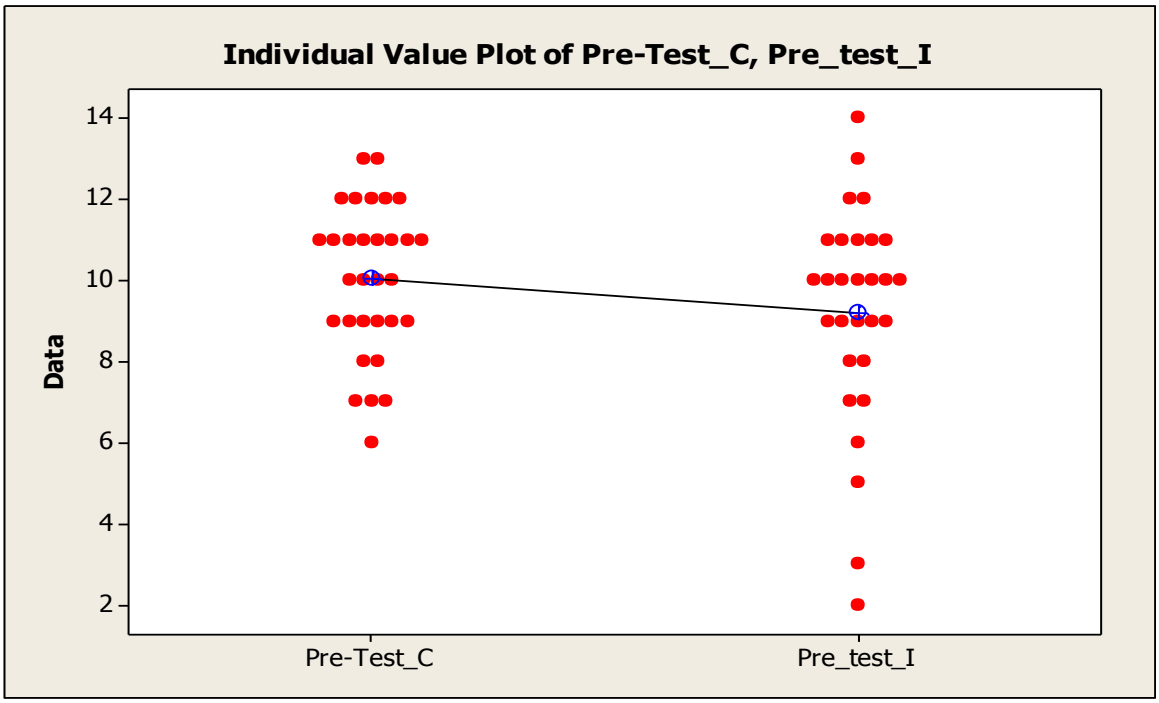

Figure 7. Individual value plot of pre-test (baseline) condition performance of the control and intervention groups on the comprehension test.

Results of Comprehension Pre-Test of students with IEPs

Performance of students with IEPs on the comprehension test varied widely. Results ranged from values more than two standard deviations below the mean (3 correct) to about one standard deviation below the mean (7 correct) and to the mean performance (9 and 10 correct answers out of 14). Specifically, student Male 2 had three correct answers out of the fourteen (z=-2.30), Male 4 and Male 5 had seven correct responses (z=-0.82), Female 2 obtained eight correct answers (z=-0.45), Male 3 nine correct (z=-0.08), and Male 1 ten correct (z=0.29). With the exception of one student, all students with IEPs performed below the mean on the comprehension pre-test. (Refer to Table 12 for pre-test comprehension scores and corresponding z-scores.)

Table 12 *Performance on Comprehension Test in Baseline Condition of Students with IEPs*

Students with IEPs	Pre-Test Performance	Z-Scores
Male 1	10	0.29
Male 2	3	-2.30
Male 3	9	-0.08
Male 4	7	-0.82
Male 5	7	-0.82
Female 1	10	0.29
Female 2	8	-0.45
Mean of Control	10.03	
Mean of Intervention	9.21	

Results of Comprehension Pre-Test by Gender

Comprehension pre-test performance was analyzed by gender. In the control group performance of female students had a M = 9.867, SD = 1.995, and male students M= 10.188, SD= 1.759. Correspondingly, in the intervention group female students had a M = 9.083, SD = 1.975 and male students' M = 9.294, SD = 3.177. (See Table 13 and 14 for descriptive statistics of comprehension pre-test performance by gender.) Overall, results were comparable in both groups. Both female and male students have just a marginally higher performance in the control condition, and much larger variability in performance of male students in the intervention group compared to the control group. Male students performed slightly better than female students in both conditions. The two outliers in the intervention group were a female student (with 5 correct answers) who did not have an IEP, while the male outlier (with 3 correct answers) was a student with an IEP. Figure 9 also illustrates the variability of student performance and the outliers.

Table 13 *Descriptive Statistics Pre-Comprehension Test Control Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	9.867	1.995	6.000	11.000	12.000
Male	10.188	1.759	7.000	10.000	13.000

Table 14 *Descriptive Statistics Pre-Comprehension Test Intervention Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	9.083	1.975	5.000	9.500	12.000
Male	9.294	3.177	2.000	10.000	14.000

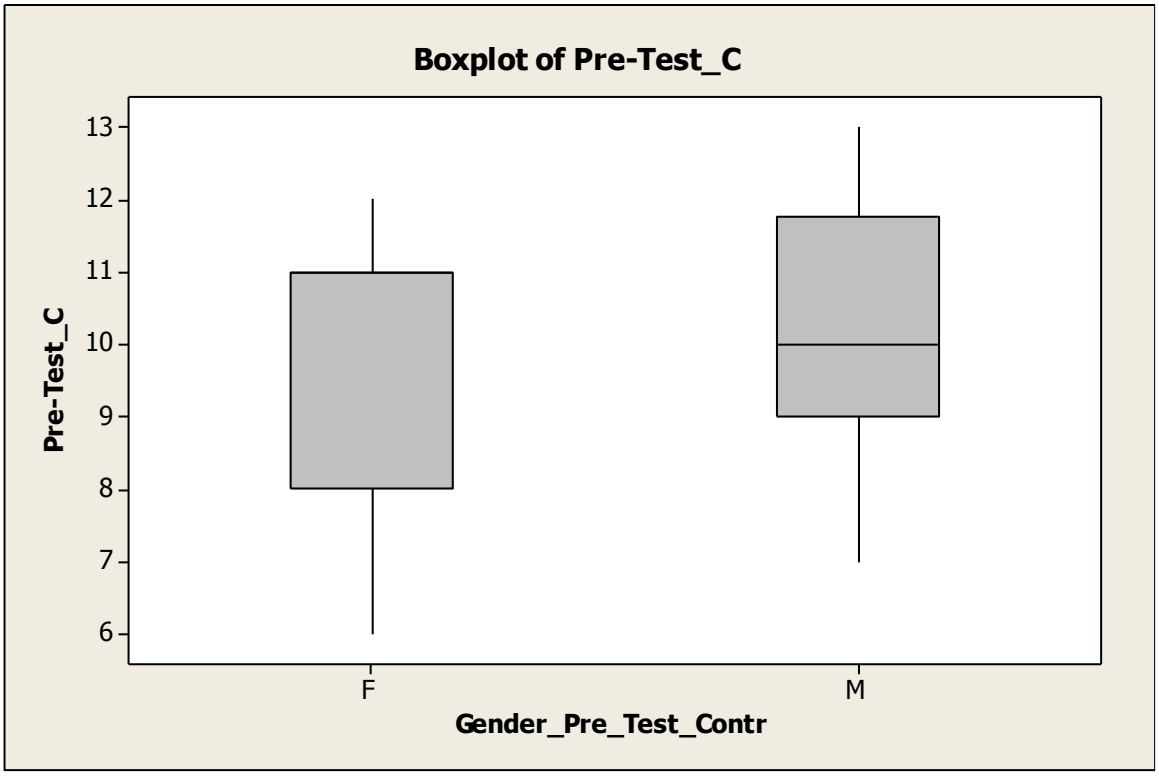

Figure 8. Boxplot of comprehension test performance in pre-test, baseline condition of the control group participants by gender.

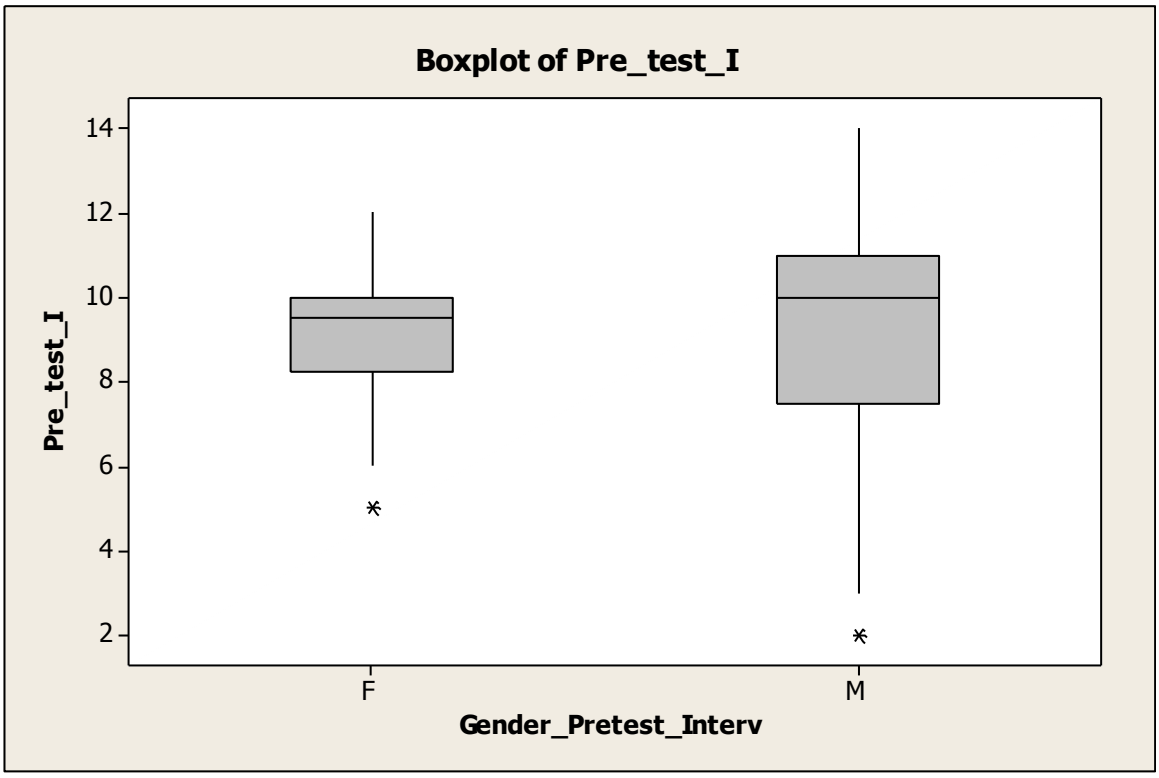

Figure 9. Boxplot of comprehension test performance in pre-test, baseline condition of the intervention group participants by gender.

Results of Comprehension Pre-Test by Question Types

Questions were grouped by different levels of difficulty. Level 1 Knowledge level questions were Questions 5, 6, 9, and 10. Level 2 Comprehension Level questions were 1, 2, 3, 4 and 11. Lastly, higher order Level 3 questions addressed analysis, synthesis and evaluation were 7, 8, 12, and 13.

Table 15 *Results of Comprehension Pre-Test by Question Types*

Question Type	Control % Correct	Intervention % Correct
Level 1	69.52%	66.33%
Level 2	75.57%	57.93%
Level 3	68.70%	70.63%

Results of Post-Intervention TWW

After the intervention sessions for students in the intervention condition, and practice without instruction in the control condition, students' notes were analyzed again for total words written using the same method and criteria as during pre-test phase. The performance of the two groups was nearly identical. A two-sample t-test was conducted to calculate means and standard deviations for the control and intervention groups. The control and intervention group were comparable on the total words written variable. The control group (M = 150.3, SD = 46.5) and the intervention group (M = 154.7, SD = 62.6). (See Table 16 for means and standard deviations).

Table 16 *Two-Sample T-Test and Confidence Interval (CI): Post-Test Notes TWW Control, TWW Intervention Means and Standard Deviations*

Group	N	M	St.Dev	SE Mean
Post-Test Notes TWW Control	28	150.3	46.5	8.8
Post-Test Notes TWW Intervention	26	154.7	62.6	12

Results of Post-Intervention TWW for Students with IEPs

Students with IEPs continued to represent the extreme values on both the low and high end of the distribution in regards to the number of total words written. Values ranged from almost 2.47 standard deviation below the mean to 2.35 standard deviation above the mean. In particular, one of the male students with an IEP did not take any notes (zero words written) whereas a different male student with an IEP has written the most words (302 words) in the entire research study during the post-intervention phase. (Please refer to Table 17 for distribution of total words written by students with IEPs.)

Table 17 *Post-Test Results of Total Words Written for Students with IEPs*

Students with IEPs	Total Words Written	TWW Z-Scores
Male 1	127	-0.44
Male 2	0	-2.47
Male 3	116	-0.62
Male 4	302	2.35
Male 5	absent	absent
Female 1	245	1.44
Female 2	112	-0.68
Mean of Control	150.3	
Mean of Intervention	154.7	

Results of Post-Intervention TWW by Gender

The percentage of total words written during the lecture was evaluated in both groups (control and intervention) and by gender after the practice/interventions sessions. In the control group female students' performance was M = 5.788, SD = 1.549; while male students' performance was M = 5.580, SD = 2.036. Similarly, in the intervention group female student's performance was M = 5.923, SD = 2.092 and male students' M = 5.813, SD = 2.590. On average, male students still recorded slightly less words than female students in both conditions. However, male students demonstrated larger variability in their performance in the post-intervention phase. (See Table 18 and 19 for this information.)

Table 18 *Descriptive Statistics Post Percentage (%) of TWW Control Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	5.788	1.549	3.598	5.379	8.750
Male	5.580	2.036	2.424	5.568	9.053

Table 19 *Descriptive Statistics Post Percentage (%) of TWW Intervention Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	5.923	2.092	2.538	6.477	9.280
Male	5.813	2.590	0.000	5.265	11.439

Post-Intervention Main Idea, Details, and Total Lecture Points Recorded

Students' notes were analyzed for the percentage of main ideas, details/examples and total lecture points recorded. Again, in order to receive credit for a main idea or detail/example the information had to be accurate. Students did record inaccurate information in post-intervention session as well. For example, some students recorded the main idea lecture point that the "Battle of Tannenberg was won by the Russians", but they could not receive credit for this information as the battle was won by the Germans and resulted in an almost complete destruction of the Russian army or when students recorded "Czar Nicholas took the throne in 1917" could not receive credit as Czar Nicholas II was overthrown and abdicated the throne at that time.

Students in the two different conditions demonstrated comparable performance on these variables. In particular, students in the control group recorded a mean percentage of TLP M = 15.878, main ideas M = 25.91, and details M = 6.870. At the same time, students in the intervention group recorded TLP M = 15.94, main idea M = 24.34, and detail M = 7.751. While the overall percentage of lecture points was very similar between the two groups, student in the intervention condition still seemed to focus a little bit more on details and examples on the expense of recording main ideas. (Please refer to Table 20 and 21 for means, standard deviations, minimum, median, and maximum measures.)

Table 20 *Descriptive Statistics for Post-Intervention Condition of Control Group: Percent of Main Idea, Detail/Example, & Total Lecture Point (TLP)*

Variable	Mean	StDev	Minimum	Median	Maximum
Main Idea	25.91	6.54	11.94	26.12	38.81
Detail/Example	6.870	2.849	1.527	6.870	12.214
TLP	15.878	4.232	6.627	16.566	23.494

Table 21 *Descriptive Statistics for Post-Intervention Condition of Intervention Group: Percent of Main Idea, Detail/Example, & Total Lecture Point (TLP)*

Variable	Mean	StDev	Minimum	Median	Maximum
Main Idea	24.34	8.59	0.00	25.37	34.33
Detail/Example	7.751	3.315	0.00	7.634	13.740
TLP	15.94	5.57	0.00	17.77	23.49

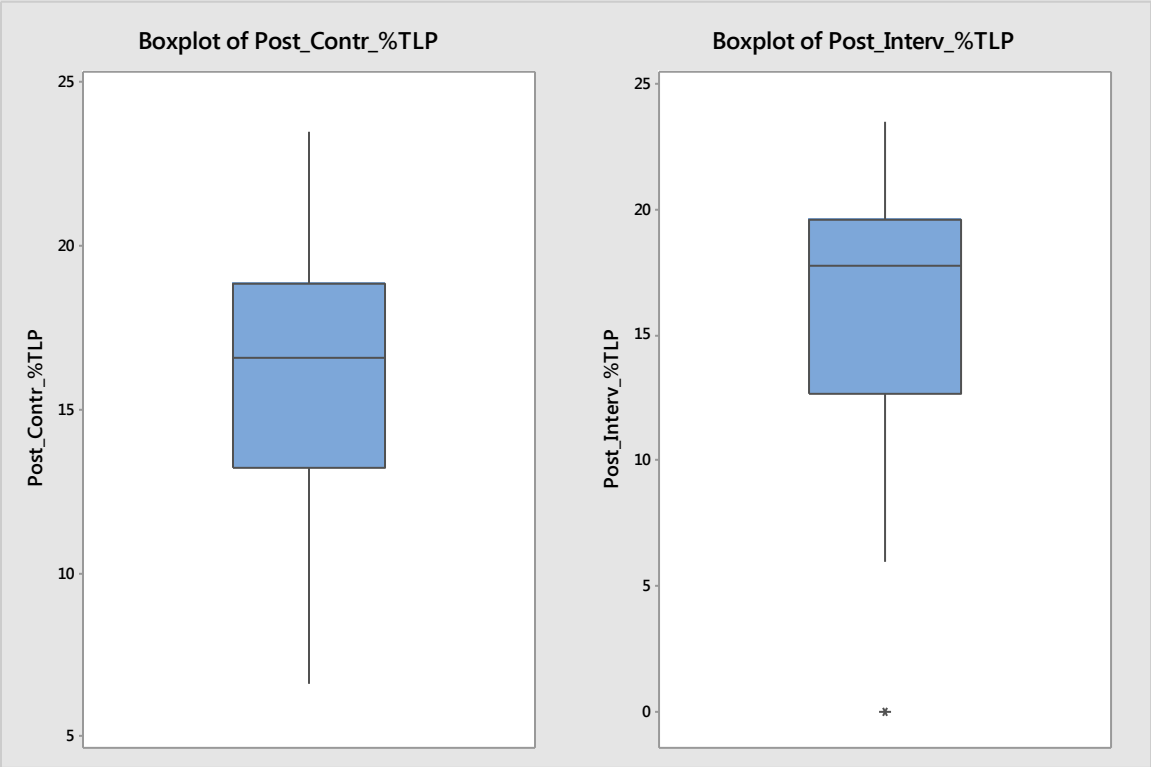

Figure 10. Boxplot of percentage of total lecture points written in post intervention condition by the control and intervention group participants.

Post-Intervention Main Idea, Details, and Total Lecture Points Recorded by Students with IEPs

Students with IEPs demonstrated varied skills and results when recording different types of lecture information. Again, the two male students (Male 2 and Male 4) recorded minimal or the most information on all measures), student Female 1 also recorded information one standard deviation above the mean, while the rest of the group's performance was close to the average performance. Refer to Table 22 for detailed information.

Table 22 *Descriptive Statistics for Post-Intervention Condition of Students with IEPs: Percent of Main Idea, Detail/Example, & Total Lecture Point (TLP)*

Post-Interv.	Main Idea	z-score	Details	z-score	TLP	z-score
Male 1	22.39	-0.28	4.58	-0.96	12.65	-0.59
Male 2	0	-2.83	0	-2.34	0	-2.86
Male 3	20.90	-0.40	4.58	-0.96	12.05	-0.69
Male 4	34.33	1.16	12.21	1.35	23.49	1.36
Male 5	absent	absent	absent	absent	absent	absent
Female 1	31.34	0.81	12.21	1.35	22.29	1.14
Female 2	19.40	-0.56	4.58	-0.96	11.45	-0.80
M of Control	25.91	-	6.87	-	15.87	-
M of Interv.	24.34	-	7.75	-	15.94	-

Results of Comprehension Post-Test

A two-sample t-test was performed to compare the means and standard deviations of the post comprehension test. Upon inspection of the results performance in the different groups was almost identical, the two groups had no statistically significant differences. Control group (M = 8.11, SD = 2.51) and intervention group (M = 8.58, SD = 1.92) T-Test of difference = 0 (vs not =): T-Value = -0.77 P-Value = 0.447 DF = 52. Both use pooled standard deviation StDev = 2.490. Refer to Table 23 for means and standard deviations.

The lowest outlier score, of four correct responses, belonged to a female student without an IEP in the intervention condition, as illustrated in Figure 11.

Table 23 *Two-Sample T-Test and CI: Multiple Choice Comprehension Post-Test Control, Post-Test Intervention Means and Standard Deviations*

Group	N	M	St.Dev	SE Mean
Post-Test Control	28	8.11	2.51	0.48
Post-Test Intervention	26	8.58	1.92	0.38

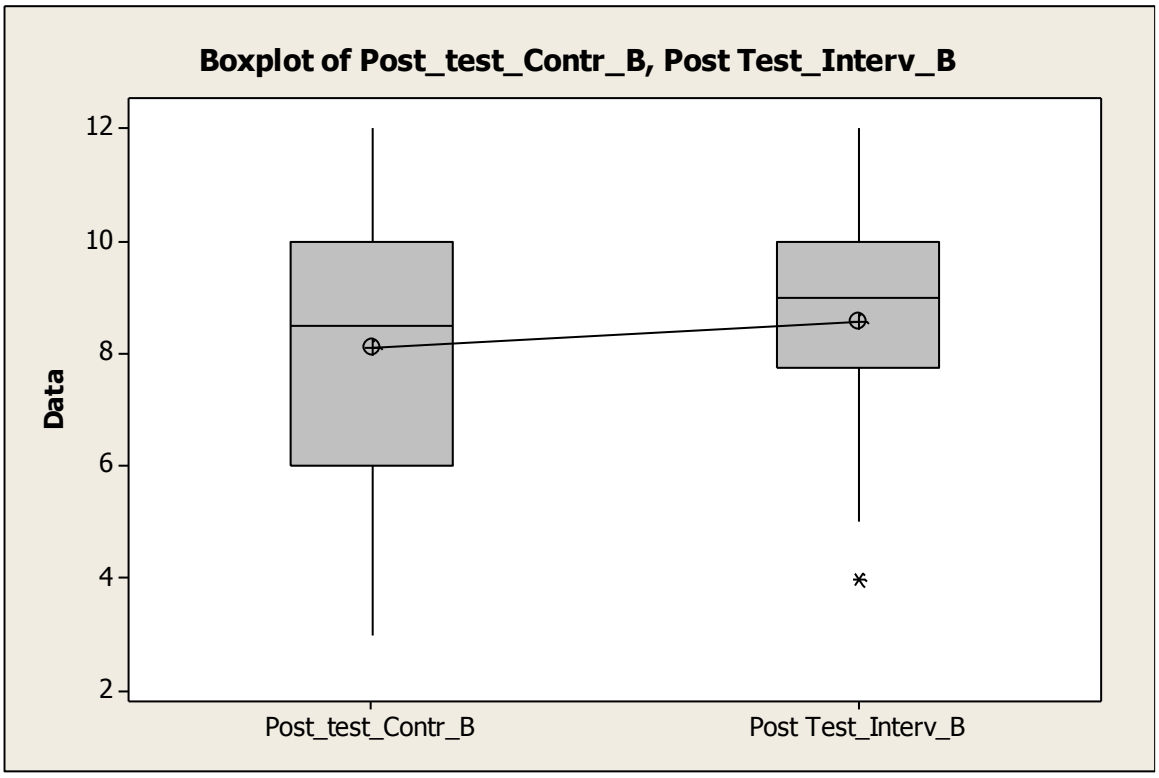

Figure 11. Boxplot of post-test comprehension results of students in the control and intervention condition.

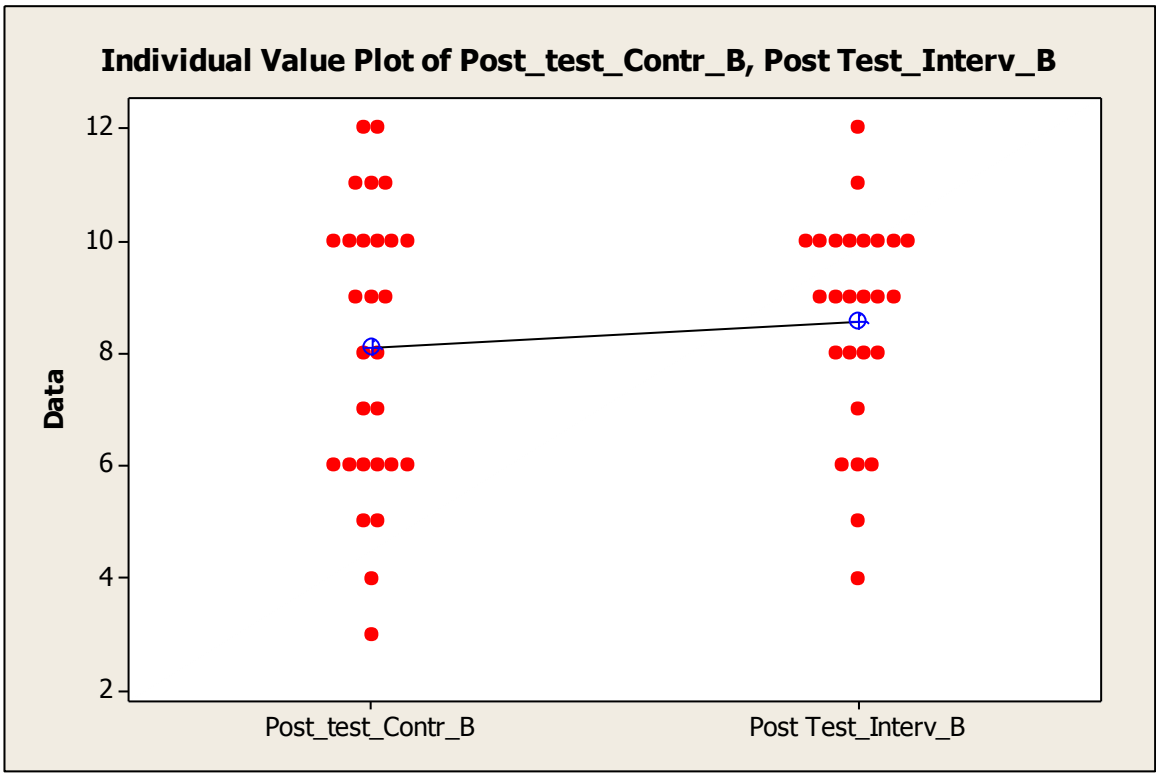

Figure 12. Individual value plot of post-test performance of control and intervention groups.

Results of Comprehension Post-Test for Students with IEPs

Out of the six students with IEPs who participated in the post-intervention comprehension test demonstrated a wide range of performance. Student Female 2 obtained a score of five (z=-1.86) Female 1 and Male 2 had a score of six (z=-1.34), while Male 1, 3, and 4 achieved a score of ten (z=0.74).

Table 24 *Results of Post-Intervention Comprehension Test Performance for Students with IEPs*

Students with IEPs	Post Comprehension Test	Z-Scores
Male 1	10	0.74
Male 2	6	-1.34
Male 3	10	0.74
Male 4	10	0.74
Male 5	absent	absent
Female 1	6	-1.34
Female 2	5	-1.86
Mean of Control	8.11	
Mean of Intervention	8.58	

Results of Comprehension Post-Test by Gender

Comprehension post-test performance was analyzed by gender. In the control group performance of female students had a M = 7.667, SD = 2.410, and male students M= 8.615, SD = 2.631. Compatibly, in the intervention group female students had a M = 7.818, SD = 2.228 and male students' M = 9.133, SD = 1.506. Results were comparable in both groups, male students having just a marginally higher performance.

Table 25 *Descriptive Statistics Post-Test Control Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	7.667	2.410	3.000	8.000	11.000
Male	8.615	2.631	5.000	10.000	12.000

Table 26 *Descriptive Statistics Post-Test Intervention Variable Gender*

	Mean	StDev	Minimum	Median	Maximum
Female	7.818	2.228	4.000	8.000	12.000
Male	9.133	1.506	6.000	10.000	11.000

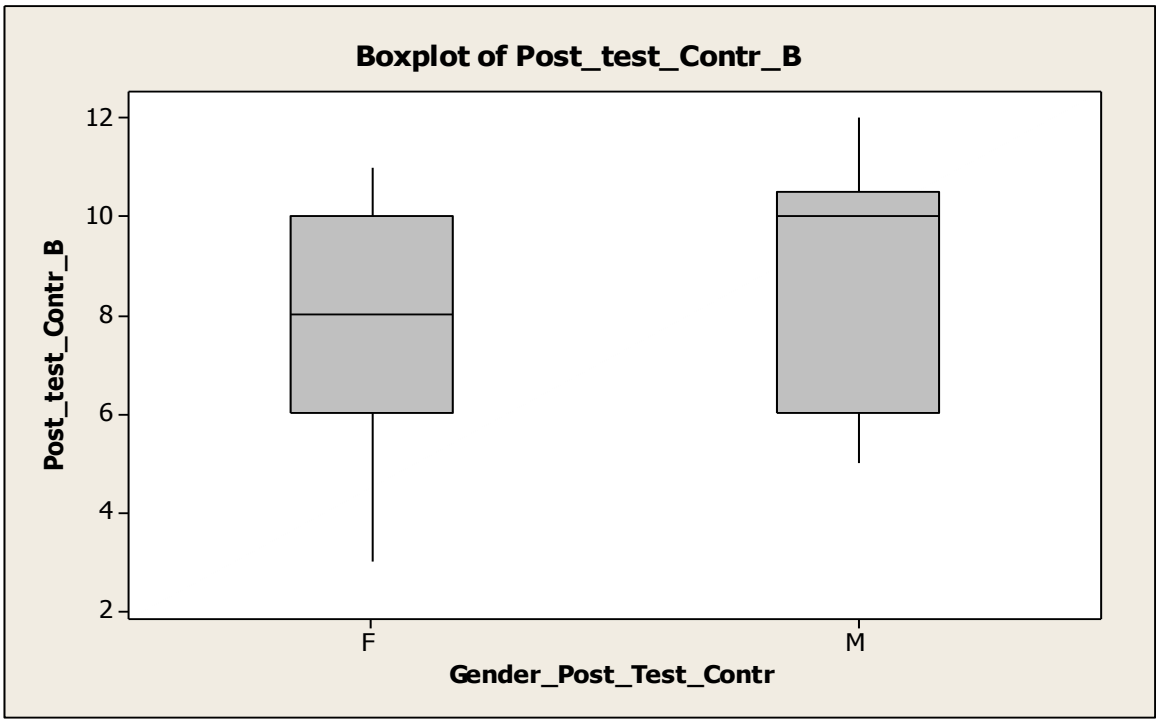

Figure 13. Boxplot of post-test performance in the control condition by gender.

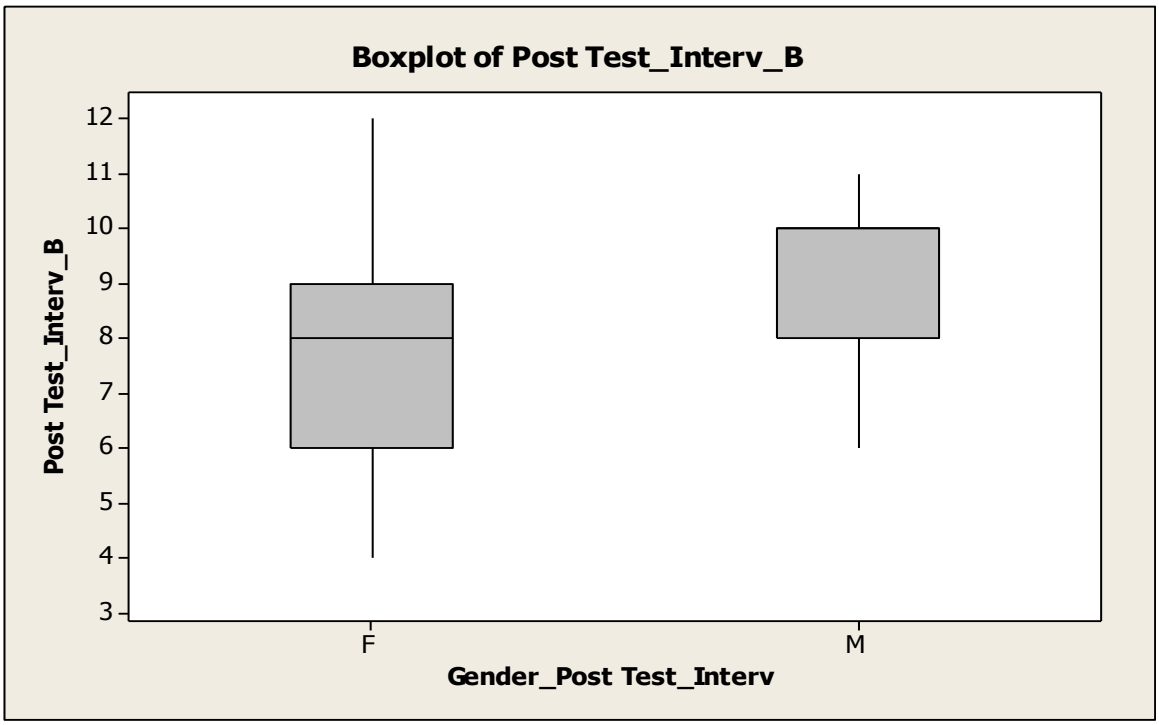

Figure 14. Boxplot of post-test performance in the intervention condition by gender.

Results of Comprehension Post-Test by Question Types

Table 27 *Results of Comprehension Post-Test by Question Types*

	Control	Intervention
Level 1	45.71 %	49.50 %
Level 2	63.35 %	61.90 %
Level 3	59.54 %	68. 25 %

Treatment Group Results

To determine the impact of the intervention, students completed a pretest and posttest.

One-way analysis of variance (ANOVA) was performed to compare the means of the pretest scores. To evaluate the impact of the intervention on student's note-taking and comprehension, repeated measures ANOVA examining the change between the pretest and posttest scores for the dependent measures. An alpha level of 0.5 was used for all statistical tests.

Table 28 *Analysis of Variance*

	DF	Adj SS	Adj MS	F-Value	P-Value
Pre-Test Cont	1	3.752	3.752	0.56	0.462
Control Group Gender	1	3.164	3.164	0.47	0.499
Pre-Test Int.	1	27.747	27.747	11.72	0.002
Int. Group Gender	1	9.601	9.601	4.06	0.056

Survey Results

Students completed a five-item post-survey of their attitudes regarding the new note-taking strategy. Specifically, statements were designed to evaluate the students' perception of the effectiveness of the Cornell method in assisting them to take better notes, understand and remember information, its potential future use by the student, and the extent students preferred their own note-taking strategy versus the Cornell method. The survey was comprised of five statements with a 5-point Likert-type scale rating from 1 (strongly disagree) to 5 (strongly agree). Items were the following: (1) The Cornell-note taking form was helpful to take better notes, (2) summarization helped me better remember information, (3) generating and answering questions helped me better understand and remember information, (4) I will use the strategies I learned, and (5) I prefer my new strategies over my own note-taking and study methods. All 26 students (11 females and 15 male) in the intervention condition who were present during the last session completed the survey.

The survey indicated that students' ratings were in the upper range for all of the items (range for all items = 3.5 to 3.8). The item with the highest rating was statement number four, "I will use the strategies I learned." (3.8). It was closely followed by statements number one and number three, "The Cornell note taking was helpful to take better notes." (3.7), and "Generating and answering questions helped me better understand and remember information" (3.7). Lastly, statements number two and number five, "Summarization helped me better understand and remember information" and "I prefer my new strategies over my own note-taking and study methods", both received a rating of 3.5.

Overall, male and female students rated the statements similarly. However, in depth comparison of ratings of responses between male and female students did show some

differences. Generally, male students' ratings were slightly higher on most items with one exception. Statement three, "Generating and answering questions helped me better understand and remember information" was rated somewhat higher by female students than males.

Table 29 *Survey Results of Students Attitudes Regrading the New Note-Taking Strategy*

	SD (1)	D (2)	N (3)	A (4)	SA (5)	Average
Statement 1	0	4	5	13	4	3.7
Percent	0.0	15.4	19.2	50.0	15.4	
Female	0	3	4	3	1	3.2
Male	0	1	1	10	3	4.0
Statement 2	1	0	13	8	4	3.5
Percent	3.8	0.0	50.0	30.8	15.4	
Female	1	0	5	3	2	3.5
Male	0	0	8	5	2	3.6
Statement 3	0	5	6	8	7	3.7
Percent	0.0	19.2	23.1	30.8	26.9	
Female	0	2	1	5	3	3.8
Male	0	3	5	3	4	3.5
Statement 4	0	1	7	13	5	3.8
Percent	0.0	3.8	26.9	50.0	19.2	
Female	0	1	4	5	1	3.5
Male	0	0	3	8	4	4.1
Statement 5	1	5	6	9	5	3.5
Percent	3.8	19.2	23.1	34.6	19.2	
Female	1	3	3	4	0	2.9
Male	0	2	3	5	5	3.9

CHAPTER V

Discussion

The purpose of the current study was to extend the body of research on middle school students' (with and without disabilities) note-taking and study skills and the impact of strategy training on those skills. First, the current study sought to extend the research and explore middle school students' note-taking and study strategies. Second, the study examined the effects of note-taking plus review session strategy on students' comprehension. Lastly, the study was set out to compare the effects of note-taking interventions on students' performance with and without disabilities.

First Question

The first research question sought to answer the question whether students who use the Cornell note-taking method would record more notes overall. Results revealed a wide variation among the 8th grade students who participated in the study in the amount of words recorded during the video lecture. Pre-intervention, baseline findings were congruent with previous studies noting that students were poor note-takers. For example, Titsworth (2004) reported that students typically recorded only 20-40% of the important ideas presented during a lecture as noted in different studies. More importantly, this numbers tend to be even lower for middle school students and students with disabilities (Boyle, 2010). During the base-line session students' performance ranged from 0% (20 words) to 8.75% (349 words) of the total words spoken during the lecture (3988). The mean number of words recorded was 174.1 (18.16% of total lecture points) and 191.6 (17.98% of total lecture points) for students in the control and intervention conditions, respectively. Despite that fact that students in the intervention condition recorded more words, they had less lecture points in their notes. The contradiction appeared to be

the result of taking verbatim notes and writing down unnecessary words that were not essential for understanding and preserving the meaning of the lecture. Additionally, many students recorded lecture points that were incorrect and could not receive credit for that information.

During base-line, the intervention group participants had a slightly higher mean score for TWW and showed larger variance in their performance (control SD = 47.7 and intervention SD = 71.9). It is important to note that during the base-line session the control group comprised of all general education students, whereas the intervention group included seven students with IEPs. Both the highest (z = 2.19) and the lowest number (z = -2.39) of TWW recorded belonged to two different students with IEPs. Therefore, it is reasonable to assume that the higher variance in the intervention groups' performance could be at least partially attributed to the fact that students with disabilities tend to represent exceptional performance (both high and low) on both ends of the continuum.

Since the two conditions included almost equal amount of male and female students it allowed to perform some gender comparisons. (Control condition comprised of 15 female and 16 male students, whereas the intervention condition 12 female and 17 male students.) Minor gender differences emerged on the number or percentage of total words recoded between male and female students. Female students recorded 4.65% and 5.086% while male students only recorded 3.822% and 4.606% of the total words in the control and intervention conditions. Female students were more copious note-takers than male students in both conditions. Overall, middle school students in this study matched previous research findings demonstrating that students record incomplete and inaccurate notes of lecture information.

While many studies (Boyle & Rivera, 2012; Titsworth, 2004; Titsworth & Kiewra, 2008) suggested that students who took more and accurate notes are more likely to perform better on

subsequent test, it did not seem to be true in this study. In the baseline condition, intervention group participants recorded slightly more words, but demonstrated weaker performance on the comprehension test. These findings could be attributed to a number of different reasons. One of the reasons could be, as noted in the literature (Van Meter, Yokoi, Pressley, 1994), when information is new and highly unfamiliar to the learner, it may be more beneficial to listen to the speaker, as opposed to attempting to record as much information as possible. Attending to large amount of new information and attempting to simultaneously transcribe it may place a huge burden on different cognitive resources and results in less efficient processing. Another potential explanation may be, as it was discovered in the analysis, students in the intervention group logged more details and examples and less main ideas than the control group participants. While they recorded more words, they tended to record less important or irrelevant information, instead of key main ideas. Being able to discern important information from irrelevant information or details in a lecture has been named as a difficulty for students in many research studies (Hughes & Suritsky, 1994; Ruhl & Suritsky, 1995). Deep level processing involves being able to extract maximum meaning, main ideas and principles rather than conceptually unsupported specifics (Lahtinen, Lonka, & Lindblom-Ylanne, 1997).

Another very small change was noted in the information recorded pertaining to the percentage of main ideas and details/examples. Specifically, in baseline condition both groups recorded about the same percentage of total lecture points. However, the make-up of total lecture points with regards to the proportion of main ideas and details/examples was different in the two groups. Students in the control group recorded more main ideas and less details/examples when compared to the intervention group participants. In the post-intervention session, the intervention group participants managed to lessen the difference in this area.

Finally, it is possible that students who wrote less words may have performed more mental transformation of the information. The review of students' notes revealed that some students documented lecture information verbatim. Nongenerative, verbatim recording of information limits the opportunities for analyzing and synthesizing information and excludes transformation of ideas (Chiu, Wu, & Cheng, 2013; Mueller & Oppenheimer, 2014). Consequently, it leads to weaker comprehension and long-term retention of the material. At the same time, other students seemed to process and transform the information into more condensed phrases using their own words. Thus, demonstrating more interaction and deeper, generative processing of the material, which usually results in better comprehension and recall.

Post-intervention results indicated that students participating in the note-taking instruction, on average still recorded just a little bit more words during lecture (control M = 150.3 and intervention M = 154.7), but their performance was much closer to the control group's performance post-intervention, albeit not statistically significant. In other words, the total words written became almost identical for both groups and the variance in performance was maintained in the control group, but decreased in the intervention group's performance (control SD = 46.5 and control SD = 62.6). Hence, note-taking instruction did not result in an increase of number of words recorded, but appeared to bring the performance closer to the performance of general education students' performance in the control condition and minimized the wide variation among students in the intervention condition.

Since various note-taking studies (Boyle, Rivera, 2012; Lazarus, 1991; Titsworth, 2004) suggest that the amount of information recorded and its availability for later review leads to better learning and test performance, it was expected that performance of students in the note-taking intervention group would even further decline compared to the control group. On the

contrary, students receiving the note-taking intervention managed to slightly improve their performance on the comprehension test when compared to the control group as it will be discussed in the following paragraph.

Second Question

The second question sought to answer whether students who received instruction in the use of the Cornell note-taking would perform better on a comprehension test than the control group who practiced their preferred note-taking and study methods. Pre-intervention, baseline comprehension test results were comparable for both groups. Mean scores were 10.03 (71.64%) in the control condition and 9.21 (65.78%) in the intervention condition. While there is no statistical difference between the two groups, the intervention group's performance was somewhat lower. In a school setting this small difference would be represented by a mean grade for the control group as a C- and a D average for the intervention group.

Small gender differences were apparent on the comprehension pre-test performance as well. Male students slightly outperformed female students in both conditions. (Control condition female M= 9.867 male M= 10.188 and intervention condition female M= 9.083 and male M= 9.294.) Even though female students took more notes than male students, their performance slightly lagged behind.

Following strategy training and practice sessions, the post-intervention comprehension test mean scores were nearly identical for the two groups. The control condition, had a mean score of 8.11 (57.92%) while the intervention group obtained a mean score of 8.58 (61.28%) with no statistically significant difference between the performances of students in the two conditions. However, the results have a small social implication. Namely, the control group mean grade would have been an F and the control group mean a D- in a school setting. While

none of these grades are desirable, it has social significance, as one would mean failing the assessment, while the other would be considered a passing grade.

Gender differences on test performance were maintained following practice and strategy training session. Just like in the base-line sessions male students outperformed female students in both conditions. (Control condition female M= 7.667 Male M= 8.615 and intervention condition female M=7.818 and male M= 9.133.) Although the difference is marginal, male students in the strategy training seemed to have a larger improvement than male students in the practice condition.

Since test performance declined in both groups after practice in one group and strategy training in the other group, it is possible that the post-test had a higher difficulty level, students lost interest in the activity, or the amount of instruction was not sufficient to master the strategy. Thus, neither repeated practice sessions nor the intervention sessions resulted in improvement as measured by the multiple-choice comprehension test.

A decline in test performance in both conditions may be the result of lack of student motivation. Lack of motivation could be the result of the selected content or the lack of incentives to engage in the demanding task of note-taking and acquisition of a new study strategy. Frequently, students lack interest and motivation to learn about the history and past events as they do not always recognize its relevance to their lives. WWI in particular, may seem distant and irrelevant to students. Furthermore, WWI is sad and complex web of events characterized by unprecedented slaughter, carnage, and destruction that lay the groundwork for WWII. The use of a more engaging or pertinent content could have possibly increased student interest and engagement in the learning activity resulting in better comprehension scores and test performance.

Learning novel and unfamiliar content and employing a newly introduced strategy at the same time is a rather difficult task requiring an enormous amount of effort from students. Note-taking by itself requires a significant amount of attention and effort from the listener and when combined with the concurrent use of a new study strategy it may have prompted students to give up and led to a lack of motivation to engage in listening, note-taking, and learning. In order to increase student motivation, it would have been beneficial to communicate to each student individually his or her pre-test performance comprehension score along with a review of his or her performance in the social studies class. Students who did not perform adequately could receive an explanation using specific examples how this type of performance could prevent success in school and reaching their personal goals in life. By establishing a connection between effective strategy use and academic success students may set goals. To assist students in monitoring their progress with strategy use and towards goal attainment, students may chart the accuracy of their strategy use, comprehension probes, and grades in the content area class. The systematic progress monitoring could assist the teacher to provide more targeted and/or additional instruction to those students who need it.

Analysis of test results by question type revealed that decline in test performance was especially large on knowledge level questions in both groups. Interestingly, performance on comprehension level questions had different results. Performance of control group participants sharply declined (75% to 63%) while intervention group participants made a small improvement (57% to 61%). Lastly, performance on level 3 questions indicated that control group participants' performance fell (68% to 59%) whereas intervention group participants nearly maintained their achievement (70% to 68%). These findings suggest that the Cornell note-taking method may not improve simple recall of factual information, but facilitates the comprehension, analysis and

synthesis of material by prompting students to make internal and external connections among ideas when summarizing and generating questions.

Although the intervention did not result in a statistically significant improvement in comprehension scores for the intervention group, two observations need to be noted. One of them is that the control group had a higher mean score on the pre- comprehension-test and smaller variation among the scores compared to the intervention group, while on the post-test the opposite was witnessed. On the post-comprehension test, the intervention group slightly outperformed the control group and had smaller variability in the test scores when compared to the control group. The findings show that the difference is not statistically significant; therefore, the difference is likely due to chance.

Nonetheless, the small difference also provides a glimmer of hope that the Cornell note-taking and review strategy training may be beneficial for students if taught for a sufficient period of time allowing students to master the strategy. In addition, the decrease in variability of performance suggests that strategy instruction may be more beneficial for students with weak note-taking and study skills than for students with typical or high-achievement. Kobayashi (2005) speculated based in his research findings that for less skilled learners note-taking may facilitate deeper understanding and retention of the material. King (1991) had similar findings when high achieving, academically competent did not benefit from the introduction of a learning strategy. In particular, students who perform at the lower end, far from students with average performance, strategy training may help those students closing the achievement gap. The individual breakdown of the pre- and post-test results of students with IEPs seem to support this notion. While the mean performance from pre-test to post-test declined in both conditions, performance of students with IEPs on the post-intervention comprehension test greatly varied.

Out of the six students, two students demonstrated a drop in performance, one maintained the same score, while three of them showed improvement. Due to the small number, heterogonous composition of students with mild disabilities, and brief training period in the current study a definitive conclusion cannot be made about the effectiveness of the strategy training for this particular group.

Training observations, students' notes and post-test results support the assumption that three training session to acquire the Cornell-note taking method is not sufficient at the middle school level. Identifying lecture cues, discerning important information, writing accurate, succinct summaries, generating both low and higher-level questions about lecture content would require more in-depth instruction, extended practice opportunities, and individualized feedback.

Although being able to summarize and synthesize information has been proven to be paramount in learning, review of students' notes indicated that most students seemed to struggle with the task of summarizing lecture information. In addition, feedback from the student questionnaire pertaining to statement number two, "summarization helped me better remember information," received the lowest rating suggesting that students themselves recognized that they had difficulty with selecting main ideas, important supporting details, and condensing it into a cohesive summary. While it seemed reasonable to assume that by eighth grade students would have acquired and mastered the task of summarization in their English language arts and content area classes, it was not the case. Although one of the sessions was dedicated to teaching summarization (and question generation) with the modeling, guided and independent practice, and with the use of summary cue cards, it proved to be insufficient to most students. Based on these findings, it would be crucial to teach the strategy in smaller, more defined steps, closely monitor progress, provide teacher and peer prompting and scaffolding, and gradually withdraw

assistance until mastery is achieved. If summarization skills are taught to mastery, it is more likely that students could apply the strategy successfully independently (Ciullo, 2015). A three-step comprehension strategy, such as Get the Gist, may be a viable option to teach how to write a brief summary. Get the Gist is one of the components of the Collaborative Strategic Reading (CSR), content area reading comprehension intervention developed by Klingner and Vaughn to elementary and middle school students (Hoover, 2013) and highly similar to the Paraphrasing Strategy, a reading comprehension and study strategy designed by Schumaker, Denton, & Deshler (1984) for high school and college students. The three steps are: (1) identify the most important who are what in a section of text, (2) identify two or three details about who or what, and (3) paraphrase and put the information into a main idea sentence (Ciullo, 2015). Another hallmark of strategy training is that instruction should be criterion-based rather than time-based. Unfortunately, the current study had strict time limitations set forth by the school district and students were only given one forty-minute time period to practice summarization. Ideally, students should be afforded with the time and support needed to master the strategy.

Third Question

The fourth research question sought to answer what were the differences between students with and without disabilities in their note-taking skills and performance on comprehension test prior to and after strategy instruction in note-taking and review. As mentioned earlier, regrettably only seven students with IEPs participated in the research study, making it impossible to perform statistical analyses and comparison of performance between students with and without disabilities. Although statistical analyses could not be performed, data were examined in terms of the different note-taking and test performance variables. Furthermore, no information could be obtained pertaining to the students' disability category, report card

grades, performance on state tests, cognitive functioning and academic achievement levels on individual psycho-educational assessments. The lack of individual information made it difficult to draw conclusions.

The most striking observation was that the seven students' performance represented the entire continuum among all study participants. Wide variance in note-taking performance was especially evident in the number of words recorded during lecture. Remarkably, one of the male students (Male 4) managed to capture the most amount of words (349 in baseline and 302 in post intervention) while another student (Male 2) recorded the least amount of words (TWW), both during baseline and post-intervention conditions (20 and 0, respectively). The total words recorded by the other five students with IEPs were closer to the mean, ranging from significantly below to slightly above the mean. The limited amount of strategy instruction did not seem to reduce these differences for students with IEPs. The same students still recorded an extraordinary amount of words or nothing at all, similar to their baseline condition performance. As mentioned previously, teaching new strategies to mastery and providing ample practice and feedback would be needed to change students' note-taking and study habits.

Performance on the baseline comprehension test showed a somewhat different pattern. Even though the number of notes students with disabilities recorded showed much great variation than notes of students without disabilities, the test performance of students with disabilities seemed to be more even, closer to the mean performance. Specifically, student (Male 2), had one of the lowest scores (3 out of 14 correct), while the rest of the students with IEPs performed slightly below or close to the mean (earning 7, 8, 9, or 10 correct responses out of 14). It needs to be stressed that comprehension test performance even for the highest performing student with disabilities only reached or exceeded a little bit the control group's mean score (M =

10.03). It is important to note that many students without IEPs demonstrated lower performance on the comprehension test than students with disabilities.

Post-intervention comprehension test results showed some promise for students with disabilities. As it has been noted, post-test result mean scores declined both for control group and intervention group participants. Despite the overall decline, few of the students with IEPs managed to maintain or even improve their test performance. Three of the six students with IEPs achieved a score well above the mean, and the other three students' scores were close to the mean. Moreover, the lowest scores on the post-intervention comprehension test were obtained by general education students in the control group (not receiving note-taking and review strategy instruction).

Finally, the results from the Student Questionnaire indicated that in general, students had a favorable view of the intervention. The survey indicated that students' ratings were in the upper range for all of the items. Items with the highest ratings were: (4) I will use the strategies I learned, (1) the Cornell note taking was helpful to take better notes and (3) generating and answering questions helped me better understand and remember information, followed by (2) summarization helped me better understand and remember information and (5) I prefer my new strategies over my own note-taking and study methods. Overall, male students seemed to have a slightly more view of the intervention, especially in the area of being open to and preferring the new strategies over their own note-taking and study methods (Statement 5).

Since survey results were mostly positive regarding the strategy, it suggests that students are likely to be willing to commit and participate in a longer, more thorough instruction to learn the strategy and improve their note-taking and study skills.

Limitations and Future Research

Existing research has demonstrated that note-taking is a critical learning strategy. Note-taking helps students recall, organize, understand, and build knowledge in all different subject areas both from text and lectures. Although much progress has been made in note-taking research several unanswered questions remain.

The current study was a small endeavor to fill a gap in the research literature and empirically investigate middle school students' with and without disabilities note-taking skills and the effectiveness of strategy training to improve those skills and comprehension of content area material. As a result, the findings must be considered in relation to the study's limitations. First, the study had a narrow time frame due the school's other instructional and legal obligations. The limited amount of time afforded to teach strategies did not appear to allow students to fully master the different component skills involved in the strategy. To eliminate this limitation, future studies could be structured to provide students with the adequate time and support needed to master the critical skills or summarization, question generation, and self-testing to be able to evaluate effects of strategy training more accurately.

Additionally, the study had a narrow focus with a small sample size of students all in eighth grade in a suburban magnet school. Moreover, only a few students in the study had a documented disability, receiving special education services. It is unknown whether the results of the intervention would be similar in urban or rural schools, with students in other grade levels, and students with different types of mild disabilities in inclusive settings. Therefore, additional studies are needed to better understand the full scope of the effects Cornell-note taking combined with review to other learning environments and with various middle school students.

The quasi-experimental, nonrandomized design of the current study presented additional limitations. A true experimental design would have increased the internal and external validity of the study; however, it was not possible to implement because of two reasons. First, a quasi-experimental, non-randomized design was selected because it is typical of the majority of research conducted in applied educational settings. Secondly, keeping the classrooms and students intact within the class and school was aligned with the expectation and culture of the school. Future research may attempt random assignments of students to different treatment conditions.

Another potential limitation of the study was the selection and topic of the lecture content. While the topic of WWI was helpful in regards to controlling for student's prior knowledge it also presented additional difficulty for students to acquire new and unfamiliar information and a new strategy simultaneously. Frequently, students lack interest and motivation to learn about the history and past events as they do not always recognize its relevance to their lives. WWI in particular, may seem distant and irrelevant to students. Furthermore, WWI is not an uplifting and exciting topic that would make most individual to wish they could hear more about the unprecedented slaughter, carnage, and destruction that characterized that time period.

Note-taking by itself requires a significant amount of attention and effort from the listener and when combined with the concurrent use of a new study strategy it may have prompted students to give up and led to a lack of motivation to engage in listening, note-taking and learning. Future studies could explore examining students' note taking skills when providing training with the use of familiar and more engaging content to increase student motivation and buy-in to the learning activity. In addition, future investigations may minimize lack of student motivation introducing and employing some type of incentive or external motivator, such as

establishing a connection between strategy use and success in the content area classes (improved grades) and personal goal setting.

The difficulty level of the lecture material and comprehension test could not be determined and did not allow for accurate evaluation of pre- and pot-test results for students. While considerable effort was made to ensure that lecture material and test questions would have the equivalent difficulty level the attempt may or may not have been successful. Lecture material was selected from the same company, had the same speaker, presented on a similar topic, and was similar in length. Pre- and post-tests had the same amount of questions, the same type of questions (why, which factor, what, where, what if...) and were presented in the same order. Future research could minimize this limitation by conducting field-based testing on the video lectures and corresponding comprehension tests prior to the actual research to make certain that they present with very similar difficulty for a particular age group.

Furthermore, it is still not clear how different cognitive processes and skills influence and predict note-taking. It would be important to further investigate students' various abilities (verbal, memory) and skills (letter formation, spelling, typing) and their relationships to note-taking. A better understanding of these relationships could help to design more effective and individually tailored strategies to enhance students' note-taking skills. Second, future research should explore the more nuanced differences among the different learners and students with and without disabilities. To determine exactly what constitutes an effective note-taking strategy may vary across students who differ in various skills and abilities. Individual differences interact with note-taking strategies and their effectiveness. Understanding the differences would allow educators to guide students towards strategies that rely on cognitive abilities that they are stronger in, or toward strategies that depend less on the abilities that they are weaker in (Bui et

al., 2013). Third, since most of the studies were conducted in contrived lecture settings with videotaped lectures it would be important to examine different aspects lecture delivery, note-taking, and review in the natural classroom setting. It would be interesting to examine what type of lecture cues teachers use (verbal/written) in their classes and what are their effects on students' notes. Also, many of the studies were successful in teaching students different techniques during the experiment to improve note-taking and subsequent recall; yet, it cannot be determined whether the students would transfer and generalize the use of these techniques to different settings. Furthermore, the majority of the studies used immediate recall and comprehension tests. However, in schools, assessments are scheduled and taken often after several weeks of the lecture. It would be important to examine the effectiveness of different note-taking and review strategies over a longer period of time. In addition, research has consistently shown the positive effects of review on long-term recall. However, it is still unclear what the best types of review strategies are, and what is the recommended length and timing for review. Lastly, more studies are needed to understand how technology, electronic note-taking systems effect learning. Specifically, how do the different electronic devices (computers, tablets, smart pens, note-taking applications) change and support the task of note-taking.

REFERENCES

Austin, J. L., Lee, M., & Carr, J. P. (2004). The effects of guided notes on undergraduate students' recording of lecture content. *Journal of Instructional Psychology, 31*(4), 314-320.

Bachhell, R., & Thaman, R. G. (2014). Effective use of pause procedure to enhance student engagement and learning. *Journal of Clinical and Diagnostic Research, 8*(8), 1-3.

Baddeley, A. D. (1986). *Working memory*. New York: Oxford University Press.

Boyle, J. R. (2010a). Note-taking skills of middle school students with and without learning disabilities. *Journal of Learning Disabilities, 43*(6), 530-540.

Boyle, J. R. (2010b). Strategic note-taking for middle-school students with learning disabilities in science classes. *Learning Disability Quarterly, 33,* 93-109.

Boyle, J. R. (2012). Note-taking and secondary students with learning disabilities: Challenges and solutions. *Learning Disabilities Research & Practice, 27*(2), 90-101.

Boyle, J. R., & Forchelli, G. A. (2014). Differences in the note-taking skills of students with high achievement, average achievement, and learning disabilities. *Learning and Individual Differences, 35,* 9-14.

Boyle, J. R., & Rivera, T. Z. (2012). Note-taking techniques for students with disabilities: A systematic review of the research. *Learning Disability Quarterly, 35*(3), 131-143.

Boyle, J. R., & Weishaar, M. (2001). The effects of strategic note-taking on recall and comprehension of lecture information for high school students with learning disabilities. *Learning Disabilities Research & Practice, 16*(3), 133-141.

Bui, D. C., Myerson, J., & Hale, S. (2013). Note-taking with computers: Exploring alternative strategies for improved recall. *Journal of Educational Psychology, 105*(2), 299-309.

Bulgren, J. A., Graner, P. S., & Deshler, D. D. (2013). Literacy challenges and opportunities for students with leraning disabilities in social studies and history. *Learning Disability Research & Practice, 28,* 17-27.

Butler, A., Phillman, K-B., & Smart, L. (2001). Active learning within a lecture: Assessing the impact of short, in-class writing exercises. *Teaching of Psychology, 28*(4), 257-259.

Call, P. (2000). Reflective-questioning: A strategy to review notes. *Journal of Adolescent & Adult Literacy, 43*(5), 487-488.

Campbell, J., & Mayer, R. E. (2009). Questioning as an instructional method: Does it affect learning from lectures? *Applied Cognitive Psychology, 23,* 747-759.

Chiu, C-H., Wu, C-Y., & Cheng, H-W. (2013). Integrating reviewing strategies into shared electronic note-taking: Questioning, summarizing and note reading. *Computers & Education, 67,* 229-238.

Ciullo, S. (2015). Improving access to elementary school social studies instruction: Strategies to support students with learning disabilities. *Teaching Exceptional Children, 48*(2), 102-109.

Ciullo, S., Falcomata, T., & Vaughn, S. (2015). Teaching social studies to upper elementary students with learning disabilities: Graphic organizers and explicit instruction. *Learning Disability Quarterly, 38*(1), 15-26.

Cooper, J. O., Heron, T. E., & Heward, W.L. (2007). *Applied behavior analysis*. Upper Saddle River, NJ: Pearson Education Inc.

Cowan, N. (1988). Evolving conceptions of memory storage, selective attention, and their mutual constraints within the human information-processing system. *Psychological Bulletin, 104*(20), 163-191.

Daneman, M., & Carpenter, P. C. (1980). Individual differences in working memory and reading. *Journal of Verbal Learning and Verbal Behavior, 19*(4), 450-466.

Deshler, D. D., Lenz, K. B., Bulgren, J., Schumaker, J. B., Davis, B., Grossen, B., & Marquis, J. (2004). Adolescents with disabilities in high school setting: Student characteristics and setting dynamics. *Learning Disabilities: A Contemporary Journal, 2*(2), 30-48.

Di Vesta, F. & Gray, S. G. (1972). Listening and note taking. *Journal of Educational Psychology, 63*(1), 8-14.

Di Vesta, F. & Gray, S.G. (1973). Listening and note taking: Immediate and delayed recall as functions of variations in thematic continuity, note taking and length of listening-review intervals. *Journal of Educational Psychology, 64*(3), 278-287.

Donohoo, J. (2010). Learning how to learn: Cornell notes as an example. *Journal of Adolescent & Adult Literacy, 54*(3), 224-227.

Gier, V. S., & Kreiner, D. S. (2009). Incorporating active learning with PowerPoint-based lectures using content-based questions. *Teaching of Psychology, 36*(2), 134-139.

Haager, D., & Vaughn, S. (2013). Common core state standards and students with learning disabilities: Introduction to the special issue. *Learning Disabilities Research & Practice, 28*(1), 1-4.

Hamilton, S. L., Seibert, M. A., Gardner, R., & Talbert-Johnson, C. (2000). Using guided notes to improve the academic achievement of incarcerated adolescents with learning problems. *Remedial and Special Education, 21*(3), 133-170.

Hannon, C. (2008). Paper-based computing. *Educause Quarterly, 31*(4), 15-16.

Haynes, J. M., McCarley, N. G., & Williams, J. L. (2015). An analysis of notes taken during and after a lecture presentation. *North American Journal of Psychology, 17*(1), 175-186.

Hoover, J. J. (2013). *Linking assessment to instruction in multi-tiered models: A teacher's guide to selecting reading, writing, and mathematics interventions*. Upper Saddle River NJ: Pearson Education Inc.

Hughes, C. A., & Suritsky, S. K. (1994). Note-taking skills of university students with and without learning disabilities. *Journal of Learning Disabilities, 27*(1), 20-24.

Igo, B. I., Kiewra, K. A., & Brunig, R. (2008). Individual differences and intervention flaws: A sequential explanatory study of college students' copy-and-paste note taking. *Journal of Mixed Methods Research, 2*(2), 149-168.

Jairam, D., & Kiewra, K. A. (2010). Helping students soar to success on computers: An investigation of the SOAR study method for computer-based learning. *Journal of Educational Psychology, 102*(3), 601-614.

Kane, M. J., & Engle, R. W. (2003). Working memory capacity and the control of attention: The contributions of goal neglect, response competition, and task set to Stroop interference. *Journal of Experimental Psychology: General, 132*(1), 47-70.

Karpicke, J. D., Butler, A. C., & Roediger, H. L. (2009). Metacognitive strategies in student learning: Do students practice retrieval when they study on their own? *Memory, 17*(4), 471-479.

Karpicke, J. D., & Grimaldi, P. J. (2012). Retrieval-based learning: A perspective for enhancing meaningful learning. *Educational Psychology Review, 24,* 401-418.

Katayama, A. D., & Robinson, D. H. (2000). Getting students 'partially' involved in note-taking using graphic organizers. *Journal of Experimental Education, 68*(2), 119-134.

Katayama, A. D., Shambaugh, N. R., & Doctor, T. (2005). Promoting knowledge transfer with electronic note taking. *Computers in Teaching*, 32(2), 129-131.

Kay, R. H., & Lauricella, S. (2014). Investigating the benefits and challenges of using laptop computers in higher education classrooms. *Canadian Journal of Learning and Technology, 40*(2), 1-24.

Kiewra, K. A. (1988). Cognitive aspects of autonomous note taking: Control processes, learning strategies, and prior knowledge. *Educational Psychologist, 23*(1), 39-56.

Kiewra, K. A. (2002). How classroom teachers can help students learn and teach them how to learn. *Theory into Practice, 41*(2), 71-80.

Kiewra, K. A., Dubois, N. F., Christian, D., McShane, A., Meyerhoffer, M., & Roskelley, D. (1991). Note-taking functions and techniques. *Journal of Educational Psychology, 83*(2), 240-245.

Kiewra, K. A. & Frank, B. M. (1988). Encoding and external-storage effects of personal lecture notes, skeletal notes, and detailed notes for field-independent and field- dependent learners. *Journal of Educational Research, 81*(3), 143- 148.

Kiewra, K. A., Mayer, R. E., Christensen, M., Kim, S., & Risch, N. (1991). Effects of repetition on recall and note-taking: Strategies for learning from lectures. *Journal of Educational Psychology, 83*(1), 120-123.

King, A. (1992). Comparison of self-questioning, summarizing, and notetaking-review as strategies for learning from lectures. *American Educational Research Journal, 29*(2), 303-323.

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

Kobayashi, K. (2005). What limits encoding effect of note-taking? A meta-analytic examination. *Contemporary Educational Psychology, 30*, 242-262.

Laidlaw, E. N., Skok, R. L., & McLaughlin, T. F. (1993). The effects of notetaking and self-questioning on quiz performance. *Science Education, 77*(1), 75-82.

Lambiotte, J. G., Dansereau, D., F., O'Donnell, A. M., Young, M. D., Skaggs, L. P., Hall, R., H., & Rocklin, T.R. (1987). Manipulating cooperative scripts for teaching and learning. *Journal of Educational Psychology, 79*(4), 424-430.

Lahtinen, V., Lonka, K., & Lindblom-Ylanne, S. (1997). Spontaneous study strategies and the quality of knowledge construction. *British Journal of Educational Psychology, 67,* 13-24.

Larwin, K. H., & Larwin, D. A. (2013). The impact of guided notes on post-secondary student achievement: A meta-analysis. *International Journal of Teaching and Learning in Higher Education, 25*(1), 47-58.

Lazarus, B. D. (1993). Guided notes: Effects with secondary and postsecondary students with mild disabilities. *Education & Treatment of Children, 16*(3), 272-289.

Lazarus, B. D. (1991). Guided notes, review, and achievement of secondary students with learning disabilities in mainstream content courses. *Education & Treatment of Children, 14*(2), 112-116.

Makany, T., Kemp, J., & Dror, I. E. (2009). Optimising the use of note-taking as an external cognitive aid for increasing learning. *British Journal of Educational Technology, 40*(4), 619-635.

Marino, M. T. (2010). Defining a technology research agenda for elementary and secondary students with learning and other high-incidence disabilities in inclusive science classrooms. *Journal of Special Education Technology, 25*(1), 1-27.

Mayer, R. E. (1983). Can you repeat that? Qualitative effects of repetition and advance organizers on learning from science prose. *Journal of Educational Psychology, 75*(1), 40-49.

Mayer, R. E. (1996). Learning strategies for making sense out of expository text: The SOI model for guiding three cognitive processes in knowledge construction. *Educational Psychology Review, 8*(4), 357-371.

McKinney, D., Dyck, J. L., & Luber, E. S. (2009). iTunes University and the classroom: Can podcasts replace professors? *Computers & Education, 52*, 617-623.

Minskoff, E., & Allsopp, D. (2003). *Academic success strategies for adolescents with learning disabilities & ADHD.* Baltimore, MD: Paul H. Brookes Publishing Co.

Mueller, P. A., & Oppenheimer, D. M. (2014). The pen is mightier than the keyboard: Advantages of longhand over laptop note taking. *Psychological Science, 25*(6), 1159-1168.

Neef, N. A., McCord, B. E., & Ferreri, S. J. (2006). The effects of guided notes versus completed notes during lectures on college students' quiz performance. *Journal of Applied Behavior Analysis, 39*(1), 123-130.

O'Donnell, A. & Dansereau, D. F. (1993). Learning from lectures: Effects of cooperative review. *Journal of Experimental Education, 61*(2), 116-125.

Pauk, W. (2000). *Essential study strategies.* Clearwater, FL: H & H Publishing Company, Inc.

Peper, R. J. & Mayer, R. E. (1986). Generative effects of note-taking during science lectures. *Journal of Educational Psychology, 78*(1), 34-38.

Peverly, S.T. (2006). The importance of handwriting speed in adult writing. *Developmental Neuropsychology, 29*(1), 197-216.

Peverly, S. T., Marcelin, G. E., & Kern, M. B. (2014). Tailoring interventions for students with difficulties in lecture note-taking. In J. T. Mascolo, D. P. Flanagan, & V. C. Alfonso (Eds.), *Essential of planning, selecting, and tailoring interventions for unique learners*. New York: John Wiley & Sons, Inc.

Peverly, S.T., Ramaswamy, V., Brown, C., Sumowski, J., Alidoost, M., & Garner, J. (2007). What predicts skill in lecture note taking? *Journal of Educational Psychology, 99*(1), 167-180.

Peverly, S. T., Vekaria, P. C., Reddington, L. A., Sumowski, J. F., Johnson, K. R., & Ramsay, C. M. (2013). The relationship of handwriting speed, working memory, language comprehension and outlines to lecture note-taking and test-taking among college students. *Applied Cognitive Psychology, 27,* 115-126.

Piolat, A., Olive, T., Kellogg, R. T. (2005). Cognitive effort during note taking. *Applied Cognitive Psychology, 19,* 291-312.

Risch N. L., & Kiewra. K. A. (1990). Content and form variations in note taking: Effects among junior high school students. *Journal of Educational Research, 83*(6), 355-357.

Ruhl, K. L. & Suritsky, S. (1995). The pause procedure and/or an outline: Effect on immediate free recall and lecture notes taken by college students with learning disabilities. *Learning Disability Quarterly, 18,* 2-11.

Schumaker, J. B., Denton, P. H., Deshler, D. D. (1984). *Learning strategies curriculum: The paraphrasing strategy*. Lawrence, KS: The University of Kansas.

Singleton, S. M., & Filce, H. G. (2015). Graphic organizers for secondary students with learning disabilities. *Teaching Exceptional Children, 48*(2), 110-117.

Stringfellow, J. L., & Miller, S. P. (2005). Enhancing student performance in secondary classrooms while providing access to the general education curriculum using lecture format. *Teaching Exceptional Children Plus, 1*(6), 2-16.

Suritsky, S. K. & Hughes, C. A. (1991). Benefits of notetaking: Implications for secondary and postsecondary students with learning disabilities. *Learning Disability Quarterly, 14*, 7-18.

Titsworth, S. B. & Kiewra, K. A. (2004). Spoken organizational lecture cues and student notetaking as facilitators of student learning. *Contemporary Educational Psychology, 29,* 447-461.

Titsworth, S. B. (2001). The effects of teacher immediacy, use of organizational lecture cues, and students' notetaking on cognitive learning. *Communication Education, 50*(4), 283-297.

van der Meer, J. (2012). Students' note-taking challenges in the twenty-first century: Considerations for teachers and academic staff developers. *Teaching in Higher Education, 17*(1), 13-23.

Van Meter, P., Yokoi, L., & Pressley, M. (1994). College students' theory of note-taking derived from their perceptions of note-taking. *Journal of Educational Psychology, 86*(3), 323-338.

Ward-Lonergan, J. M., Liles, B. Z., & Anderson, A. M. (1999). Verbal retelling abilities in adolescents with and without language-learning disabilities for social studies lectures. *Journal of learning Disabilities, 32*(3), 213-223.

Weinstein, C.-E., Schulte, A., and Palmer, D. (1987). *Learning and Study Strategies Inventory (LASSI).* Clearwater, FL: H. & H Publishing Company Inc.

Appendices

Appendix A: Cornell Notes Template

Appendix B: Summary Cue Card

Appendix C: Question Stem Cue Card

Appendix D: Student Survey

Appendix: E: Pre-Test

Appendix F: Post-Test

Appendix G: Parental Informed Consent

Appendix H: Student Assent Form

APPENDICES

Appendix A

Cornell Notes Template

Cornell Notes Lecture, reading/chapter/novel/article during class, power point, movies (if need to collect info.) **Topic:**_____ _____	**Name:** _____ **Class:** _____ **Period:** _____ **Date:** _____
Essential Question:	
Questions/Main Ideas:	**Notes:**
Summary:	

Appendix B

Summary Cue Card

Identify the topic of the lecture. -----→	Turn the topic into a sentence.
Identify one main idea/subtopic. -----→	Turn it into a sentence.
Identify another main idea/subtopic. →	Turn it into a sentence.
Combine the sentences into a summary.	

Appendix C

Question-Stem Cue Card

What is the main idea of …?
Explain why … (Explain how…)
How would you use… to….?
What is a new example of …?
What do you think causes…?
What do you think would happen if…?
What is the difference between…and…?
How are… and … alike/similar?
How does … affect…?
What are the strengths and weaknesses of …? What are the advantages and disadvantages of …?
What is the best … and why?
How is …related to …that we studied earlier?
What do I (you) still not understand about …?

Appendix D

Student Survey

Note-taking & review: Tell me what you think!

5 = I strongly agree 4 = I agree 3 = I feel neutral 2 = I disagree 1 = I strongly disagree

	5 I strongly agree	4 I agree	3 I feel neutral	2 I disagree	1 I strongly disagree
The Cornell-note taking form was helpful to take better notes.					
Summarization helped me better remember information.					
Generating and answering questions helped me better understand and remember information.					
I will use the strategies I learned.					
I prefer my new strategies over my own note-taking and study methods.					

Appendix E

Pre-Test

1. Which of the following is ***not*** true about the major empires leading up to World War I?

    a. The empires of Europe contained people of many ethnicities and religions.
    b. The major powers were in a race to build their empires which added to their wealth and prestige.
    c. Germany was a new "empire" and was eager to expand beyond its current holdings in Africa and the Pacific.
    d. Most of the empires were unified by their common language and religions.

2. Why were European nations motivated to build empires?

    a. To increase their power and influence.
    b. To access and control other people's resources.
    c. To spread their ideology and ethnic beliefs.
    d. All of the above.

3. What relationship existed between Germany and Austria-Hungary?

    a. They became allies as a result of the 1892 Franco-Russian Military Convention where they agreed to provide military assistance both ways in the event of attack.
    b. They were part of The Triple Alliance, a military alliance among Germany, Austria–Hungary, and Italy. Each member promised mutual support in the event of an attack by any other great power.
    c. They were part of the Triple Entente, an understanding linking Germany, Austria-Hungary, and Serbia together.
    d. They were part of the Austro-Hungarian Empire.

4. Which of the following is ***true*** about the European alliances in years before World War I?

    a. Great Britain had an alliance with Austria-Hungary.
    b. Russia had an alliance with the Ottoman Empire.
    c. France was allied with Russia.
    d. Germany was allied with Great Britain.

5. Where was Franz Ferdinand and his wife Sophie assassinated?

    a. Sarajevo, Bosnia
    b. Vienna, Austria-Hungary
    c. Zagreb, Croatia
    d. London, Britain

6. Who was Gavrilo Princip?

a. A Croatian military leader
b. A Bosnian Serb who assassinated Franz Ferdinand
c. The archduke of Austria-Hungary
d. The king of Serbia

7. How were the Serbians, Croatians, and Bosnians alike?

a. They were all linguistically connected (spoke a similar language).
b. They were all ethnically connected.
c. They were all linguistically *and* ethnically connected.
d. They all lived in the country of Yugoslavia.

8. What was the most famous trigger for World War I?

a. The creation of unified Yugoslavia
b. The Prussian War
c. The act of annexing Bosnia-Herzegovina to Austria
d. The assassination of Franz Ferdinand

9. What is the definition of 'ultimatum'?

a. A final list of demands, expressing serious consequences, a breakdown of relations, or a threat of war if the terms are not accepted.
b. A public declaration of military attack.
c. A military tactic used to obtain information by visual observation about the activities of the enemy.
d. A formal agreement between two or more countries in reference to peace, alliance, or other international affairs.

10. When did Austria declare war on Serbia, starting World War I?

a. November 11, 1918
b. August 4, 1914
c. July 28, 1914
d. August 2, 1914

11. Why did Britain declare war on Germany?

a. Because Germany invaded Great Britain, so the British had to protect themselves

b. Because Germany invaded neutral Belgium before moving towards France and Britain was obliged to defend Belgium by a treaty of 1839.
c. Because Britain disliked Germany
d. Because Britain wanted to increase the size of the British Empire

12. What were some of the major factors that caused World War I?

a. Increased militarization (arms race), the desire to build empires and national wealth, the alliance system, nationalism
b. Increased militarization (arms race), the desire to build empires and national wealth, the Treaty of Versailles, nationalism
c. Increased militarization (arms race), the desire to build empires and national wealth, the alliance system, socialism
d. The need to use nuclear weapons, the desire to build empires and national wealth, the alliance system, nationalism

13. Which of these events or facts provides the best justification for blaming Germany for World War I?

a. The annexation of Bosnia
b. Hitler's increasing power and Nazi propaganda
c. The speed and aggression with which the Germans engaged the French and Russians shortly after Austria's declaration of war
d. The Zimmerman Telegram

14. What if the empires did not have alliances and treaties prior to World War I?

a. Austria-Hungary and Germany would have been able to unite to form an even larger empire.
b. World War I would have been fought among the countries over a longer period of time.
c. The Ottoman Empire would still be able to rule the Balkans.
d. The war likely would have remained more regional and isolated.

Appendix F

Post-Test

1. Which is ***not*** true of the dynamics of World War I in early 1918 (January and February)?

    a. Russia was looking to capture as much territory as possible before an armistice was signed with the Central Powers.
    b. The Allies were eager for American troops to arrive in significant numbers before Germany had a chance to redeploy troops from the Eastern Front.
    c. It was unclear whether the Allies or Central Powers would win the War.
    d. Bolshevik Russia had taken itself out of the war and was in negotiations with the Central Powers over the Treaty of Brest-Litovsk.

2. Why were the Russians pushed out of Russian Poland in 1915, even though they had a large army?

    a. They had bad communication lines
    b. They had bad technical supplies
    c. The Russian industry was unable to keep up with the demands of the war
    d. All of the above

3. Why did Germany decide to move behind the Hindenburg line after losing on the eastern and western fronts in 1916?

    a. It allowed Germany not to lose too much ground, while holding a smaller front on the western front
    b. To avoid heavy artillery fights
    c. It allowed Germany to avoid trench warfare
    d. It helped moving the troops to the eastern front to fight with Russia

4. Which of the following is ***true*** about the outcome of Russia's peace negotiations?

    a. Russia gained territory
    b. Russia lost territory
    c. Russia neither gained nor lost territory
    d. Russian soldiers would have to serve in the German army on the western front

5. At what river in France were both Germany's initial drive in the Fall of 1914 and its Spring Offensive in 1918 halted?

    a. the Marne
    b. the Seine
    c. Verdun
    d. the Somme

6. Who was Nicholas II?

    a. The king of Prussia
    b. The tsar of Russia
    c. The leader of the Russian interim government
    d. A communist, Bolshevik leader

7. How was the battle of Verdun and the battle of the Somme alike?

    a. They both resulted in a million casualties and loss of human life
    b. They both resulted in major movements of the front
    c. They both resulted in large gain of territory
    d. They both used tanks at the first time

8. What was the significance of the Treaty of Brest-Litovsk?

    a. It promised that Germany would no longer utilize U-boats.
    b. It guaranteed the delivery of food and supplies to soldiers in isolated areas.
    c. It awarded areas of the Middle East to the Allied forces.
    d. It ended Russian participation in World War I.

9. What is the definition of ‘decimate’?

    a. To achieve full victory
    b. To kill or destroy a great number or proportion of something
    c. To lose a large amount of land as a result of a treaty
    d. Quick movement of an army at a front

10. Which country joined the war on the side of the Allied powers (Triple Entente) in 1916?

    a. Romania

b. U.S.
c. Serbia
d. Turkey

11. What were the factors that led to the Russian Revolution?

a. The Romanov dynasty no longer wanted to rule, the country needed a new government
b. The Russians wanted to win independence from Germany
c. The Russian people wanted a new and better tsar
d. Russia had failing economy, food shortages, riots, army demoralized due to constant defeats in the war

12. How did Russia's withdrawal affect the Allied forces?

a. Allied troops were soon to be outnumbered by the Germans
b. With Russia out of the picture, peace negotiations would become easier
c. Without Russian help, Serbia fell to Austria-Hungary
d. France withdrew from Alsace-Lorraine

13. Which best describes fighting on the Eastern and Western Fronts during World War I?

a. They were both characterized by trench warfare that gave the advantage to the defense
b. The Western Front was a defensive stalemate from 1914-1918 while the Eastern Front was much more fluid
c. The Western Front was much longer than the Eastern Front which made trench warfare impractical
d. The Western Front was won quickly which allowed for a longer, protracted conflict on the Eastern Front

14. Based on the information what you know what judgement can you make about WWI?

a. The war was a global conflict, resulting in enormous material and human cost, and had no clear winners
b. The war was a large European conflict with the Allied Forces as clear winners
c. The war was a trench warfare where troops spent their time in the trenches
d. Since the war was a stalemate war it did not result in many casualties and deaths

Appendix G

Parental Informed Consent

PARENTAL INFORMED CONSENT

Your child is invited to participate in a research study that is being conducted by Zulejka Baharev, who is a doctoral student in the Department of Educational Psychology at Rutgers University. The purpose of this research is to determine the effects of note-taking and review strategy instruction on comprehension of lecture information in the content area class for middle school students with and without disabilities.

Approximately sixty subjects will participate in the study, and each individual's participation will last approximately four-five 40-minute sessions.

The study procedures will include the following. First, students will be pretested on their ability to take notes, review material, and recall and comprehend the content area lecture material. Specifically, students will be asked to listen to a videotaped lecture on a social studies or science topic, take notes, and review their notes using their conventional methods. Next, students will be asked to answer a 10-15 item multiple-choice test (assessing factual knowledge, comprehension, and application). Pretest session will be followed by training provided to the intervention group and practice sessions without instruction for the control group. During the 40-minute training sessions, the researcher will follow a scripted lesson and train students how to take notes using lecture cues and the Cornell note-taking form, and review their notes by writing summaries and generating and answering questions in small cooperative groups. Lastly, all students will engage in their respective strategies viewing a lecture and then take a post-test.

This research is confidential. Confidential means that the research records will include some information about your child and this information will be stored in such a manner that some linkage between your child's identity and the response in the research exists. Some of the information collected about your child includes age, grade, gender, general or special education status. Please note that we will keep this information confidential by limiting individuals' access to the research data and keeping it in a secure location**.** Data will be stored in a locked cabinet and/or restricted-access password protected computer.

The research team and the Institutional Review Board at Rutgers University are the only parties that will be allowed to see the data, except as may be required by law. If a report of this study is published, or the results are presented at a professional conference, only group results will be stated. All study data will be kept for three years. All the student data from this study will be destroyed on or before October 1, 2018.

There are no foreseeable risks to participation in this study.

You have been told that the benefits of taking part in this study may be: improvements in your child's ability to take better notes and employ more effective study strategies. However, your child may receive no direct benefit from taking part in this study. Your child's teacher will also be taught to continue the intervention after I finished collecting data. Participation in this study will offer an opportunity to share findings and may produce valuable data regarding the development of students note-taking and study skills.

Participation in this study is voluntary. You may choose for your child not to participate, and you may withdraw your child from participating at any time during the study activities without any penalty to your child. In addition, your child may choose not to answer any questions with which your child is not comfortable.

If you or your child have any questions about the study or study procedures, you/your child may contact myself at 908-642-6747 or zbaharev@scarletmail.rutgers.edu or you can contact my faculty advisor, Dr. Angela O'Donnell at the Department of Educational Psychology, Graduate School of Education, Rutgers, the State University of New Jersey, 10 Seminary Place, New Brunswick, NJ 08901, angela.odonnell@gse.rutgers.edu, 848-932-0830.

If you/your child have any questions about your rights as a research subject, you may contact the Institutional Review Board (a committee that reviews research studies in order to protect those who participate). Please contact an IRB Administrator at the Rutgers University, Arts and Sciences IRB:

Institutional Review Board
Rutgers University, the State University of New Jersey

Liberty Plaza / Suite 3200

335 George Street, 3rd Floor

New Brunswick, NJ 08901

Phone: 732-235-9806
Email: humansubjects@orsp.rutgers.edu

Your child will also be asked if they wish to participate in this study. You will be given a copy of this consent form for your records.

Sign below if you agree to allow your child to participate in this research study:

Name of Child (Print) _____

Name of Parent/Legal Guardian (Print) _____

Parent/Legal Guardian's Signature _____ Date _____

Principal Investigator Signature _____ Date _____

Appendix H

Student Assent Form

ASSENT FOR PARTICIPATION IN RESEARCH ACTIVITIES

Investigator: Zulejka Baharev

Rutgers University

Study Title: **The effects of Cornell note-taking and review strategies (summary & question-generation) on recall and comprehension of lecture content for middle school students with and without disabilities.**

This assent form may contain words that you do not understand. Your teacher or I will read it to you as you read along. Please ask the researcher or your parent or teacher to explain any words or information that you do not clearly understand before signing this document.

1. **Zulejka Baharev is inviting you to take part in her research study. Why is this study being done?**

The purpose of this study is to see if middle school students' note-taking and lecture comprehension skills improve when they use the Cornell note-taking method and review strategies (summary & question-generation). I expect about 60 middle school students to be part of this study.

2. **What will happen:**

First, all students will be asked to view a videotaped social studies lecture and use their preferred note-taking method to take lecture notes, review their notes, and complete a short multiple-choice comprehension test. Next, some students will be asked to use the Cornell-note-taking method and review strategies (summary & question generation). If you use the Cornell note-taking and review strategies, you will use the Cornell notes template to record notes of videotaped lectures and summary and question generation cue cards to review your notes. Each session is about 40 minutes long and each videotaped lecture is about 20-25 minutes in length. I want to know how you record notes when using the Cornell note-taking template and use review strategies. You will be given breaks during each session if needed. *Lastly, all students will engage in their respective strategies viewing a lecture and then take a post-test.* With your permission indicated below, you can begin the note-taking and review sessions. Your parent(s) will also need to give their permission.

3. **What does it cost and how much does it pay?**

There is no cost and you will not be paid to participate in this study.

4. **There are very few risks in taking part in this research, but the following things could happen:**

Nothing bad would happen. I will give you breaks during each session to minimize any discomfort that you may have.

5. **Are there any benefits that you or others will get out of being in this study?**

All research must have some potential benefit either directly to those that take part in it or potentially to others through the knowledge gained. The only direct benefit to you is that you may learn how to take better notes and effectively review them. The knowledge gained through this study may allow me to develop more effective programs to assist students who need help taking notes and studying them.

It is completely up to you! Both you and your parents have to agree to allow you to take part in this study. If you chose to not take part in this study, I will honor that choice. No one will get angry or upset with you if you do not want to do this. If you agree to take part in it then you change your mind later, that's OK to. It is always your choice!

6. **CONFIDENTIALITY: I will do everything I can to protect the confidentiality of your records.** If I write professional articles about this research, they will never say your name or anything that could give away who you are. I will do a good job at keeping all our records secret by following rules made for researchers.

7. **Do you have any questions?** If you have any questions or worries regarding this study, or if any problems come up, you may call the principal investigator Zulejka Baharev at 908-642-6747 or e-mail me at zbaharev@scarletmail.rutgers.edu

If you have any questions about your rights as a research subject, please contact an IRB Administrator at the Rutgers University, Arts and Sciences IRB.

Institutional Review Board

Rutgers University, the State University of New Jersey

Liberty Plaza / Suite 3200

335 George Street, 3rd Floor

New Brunswick, NJ 08901

Phone: 732-235-9806

E-mail: humansubjects@orsp.rutgers.edu

Your parent or guardian will also be asked if they wish for you to participate in this study. You will be given a copy of this form for your records.

Please sign below if you assent (that means to agree) to participate in this study.

_____ _____

Signature Date

Name (Please print):_____

Investigator's Signature: _____ Date: _____