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Mathematics Academic Achievement of Students with Emotional and Behavioral Disorders

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Mathematics Academic Achievement of Students with Emotional and Behavioral Disorders

by

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Abstract

The aim of this secondary data analysis study was to examine the association between certain predictors and student's mathematics achievement on two tests of the Woodcock Johnson III Academic Knowledge subtests: Applied Problems and Calculations. Results indicated that students with a diagnosis of emotional and behavioral disorders (EBD) had academic deficits in mathematics, and these deficits became larger over time. Data pertaining to mathematics academic achievement from the first two waves of the National Longitudinal Transition Study 2 (N = 420) were examined. The variables investigated to further explore academic achievement scores were gender, race/ethnicity, student's school attended prior to the start of the study, and parent or guardian characteristics. Differences between gender and race/ethnicity are explained. Implications, limitations, and areas for future research are also presented.

Table of Contents

List of Figures

List of Tables

Chapter 1: Introduction

Statement of the Problem

Kauffman and Landrum (2012) estimate between 3% and 6% of school children have emotional and behavioral disorders (EBD). Mattison and Blader (2013) list classroom placement, socioeconomic status (SES), race/ethnicity, and gender as contributing factors affecting students' mathematics achievement. Students with EBD face additional challenges as teachers and schools are being held more accountable for academic achievement outcomes. All students must demonstrate achievement in core academic areas of mathematics, science, language arts, and history. Students with EBD typically score one to two grade levels lower than their non-disabled peers, and the achievement gap is growing (Cullinan, 2007; Trout, Nordness, Pierce, & Epstein, 2003). The present study examines the predictive potency of the following variables for mathematics achievement for students with EBD: academic placement, race/ethnicity, gender (male or female), parent/guardian characteristics, and socioeconomic status (SES).

Research Questions

This study was undertaken to address the following questions:

1. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and SES) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States?
2. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and SES) alone or in combination can be utilized to predict

mathematics achievement of students with EBD in the United States of a specific gender or race/ethnicity?

a) Are the predictors different if males and females are analyzed separately?
b) Are the predictors different for students who identify as White, African American, and Hispanic when analyzed separately?

Purpose and Rationale of Study

Legal reasons.

The rationale for conducting this study is four-pronged. The first reason is legal and is the most urgent and important as it requires policies to be potentially revisited. The United States Justice Department (USJD) filed a lawsuit against the state of Georgia for segregating students with disabilities, specifically students with EBD (USJD v. State of Georgia, 2016). This case was the first the federal government has brought against a state about students with disabilities. The lawsuit claimed that the Americans with Disabilities Act (ADA) is being violated in the Georgia Network for Educational and Therapeutic Support (GNETS) program because students with disabilities, specifically students with EBD, are segregated. This lawsuit is groundbreaking because it was "the first challenge to a state-run school system for segregating students with disabilities" (USJD v. State of Georgia, 2016, p. 1). The lawsuit alleged that GNETS students would be better served in general education settings with their peers rather than in separate settings. The lawsuit references Olmstead v. Lois Curtis (1999), which ruled that services must be made available to all people with disabilities, including those with behavior disabilities. The most appropriate integrated setting or Least Restrictive Environment (LRE) that meets student needs is what is required by the Individuals with Disabilities Education Act (IDEA) (USDOE, 2010a).

Currently, GNETS serves 4,600 students with disabilities in Georgia. Most students with EBD are served by the GNETS program. Pratt (2017) affirmed that Georgia has had a separate program to educate students with EBD for 50 years. Georgia has 24 GNETS programs that support local school systems in serving of students with EBD (Georgia Department of Education [GADOE], 2007). These services are for the most severe students diagnosed who would otherwise require residential, inpatient hospital placement, or more restrictive placement outside the local education setting. Students are directed to GNETS through the local Individualized Education Plan (IEP) process and provided services based on the severity of their behavior problems. Each referral must include documentation that a prior extension of LRE did not benefit the child educationally. GNETS is available to children 2 to 21 years of age. Families and specialists, including psychologists, educators, psychiatrists, social workers, and behavior specialists are required to participate in planning the child's services. GNETS classes are required to operate 180 days a year but can be extended up to 200 days. The maximum class size for high school is ten and eight for earlier grades.

Teacher use of evidence-based interventions (both behavioral and academic) are encouraged, and the curriculum is Georgia's Standards of Excellence (GADOE, 2007), the curriculum for all Georgia students. Miller (2017), when investigating the lawsuit filed by parents of students with disabilities, noted that the behaviors of the students in the GNETS program often became more problematic because the environment was outside the norm and appeared to be restrictive in comparison to other learning environments. In addition, no services are provided to help improve the behaviors. Teachers had little or no training related to teaching students with a diagnosis of EBD. A requirement of the GNETS program is that exit criteria are developed for each student when he or she enters the program. Pratt (2017) found when

interviewing over 100 parents with students in the GNETS program that they could do nothing to return their children to the local school environment once enrolled in GNETS. If students had issues at one GNETS program, they would send them to another program to better suit their needs. The parents felt that GNETS was the last stop because once in the program they realized their children would never meet the criteria to exit the program. Most students enter the GNETS program in late elementary or middle school, but they can be referred as early as age two. Students with EBD often miss school because of sickness, hospital confinements, and incarcerations (Weeden, Willis, Kottwitz, & Kamps, 2016).

The lawsuit contended that GNETS students were denied opportunities to interact with their non-disabled peers. Two-thirds of GNETS schools enroll only students with disabilities who are housed in facilities at a distance from most of their homes. Many children attend schools in buildings formerly used for segregated schools. The buildings are often in disrepair, and far away from the main school campuses. The education has been referred to as "paltry" with little grade content being taught and 67% of students are taught by educational software (Pratt, 2017). The school in the context of this investigator's experience is typical of GNETS schools, one that is separate from the general population (GADOE, 2007). In a county of 10,000 K-12 students, the students come from four feeder high schools. The school has a "learning village" of trailers with four classrooms and some auxiliary buildings. The trailers are in disrepair. The school is on the campus of a regular high school but removed from the main building. Compass students only visit the main building. The Compass Program was for students with EBD from four high schools in the county. Students were referred to the program by teachers of their self-contained middle school classrooms, and those referrals were based on their behavior in the classroom. If teachers had concerns that the students would not be successful in an inclusive environment, they

were referred to the Compass Program for their entire high school careers. In the past, these students were allowed in the gym and the lunchroom, but some were disruptive and thus all lost those privileges. They now eat in the classroom and any physical activity is limited to around the learning village.

Other GNETS schools are within the building housing the general population of students but often the students are still isolated from their non-disabled peers. The United States Justice Department (USJD) argues that settings such as the Compass Program fail to follow the ADA because of this segregation (2016). Another allegation of the lawsuit is that students in GNETS are given fewer opportunities to participate in extracurricular activities such as sports, art, and music (USJD, 2016). Access to academic and extracurricular activities by GNETS students is often more restricted than it is for their peers outside the program (Miller, 2017). The lawsuit alleges that educational services and supports for mental health and therapeutic activities are available to only a few students with disabilities in integrated educational settings. Pratt (2017) noted ironically that the absence of therapeutic benefits as referred to by the name and the results of a 2010 audit of GNET's could not determine whether there were any improvements in either academics or behaviors of those students in the program. The lawsuit argues that few students in GNETS are doing well in the general education setting and interacting with their non-disabled peers fully. These GNETS students are in a curriculum appropriate for their age levels and are taking part in many extracurricular activities. The USJD (2016) asserts that all students with disabilities, in particular those students with EBD, can be successful in the general education setting as well. The lawsuit notes that the ADA prohibits discrimination based on disability by public entities, including state and local governments. Students with disabilities need the most

integrated LRE, and the Justice Department argues GNETS is not fulfilling this need for students with EBD (USJD, 2016).

Kenworthy (2017) applauds the higher court ruling (Endrew F. v. Douglas County School District, 2017) that schools need to provide more than the minimum amount of education to students with disabilities. The IEP must help a student progress academically regardless of their disability or circumstances. Kenworthy (2017) references the lawsuit against GNETS. He states that for over five decades Georgia has had separate program for students diagnosed with EBD. The investigator's county has had several different programs for students with EBD (e.g., Employment Training Program, Compass Program). The separate programs fall short of the requirements for educating students with EBD. Students with EBD are educated in separate classrooms within a regular school.

Frick (2017) recommends changes for the GNETS program, including clarifying that GNETS is available as part of possible supports for a student with EBD within LRE and recommending that removal from general education should be a last resort and should depend on the severity and nature of a student's disability.

Policy Reasons.

The next part of the rationale for this study is policy. The county has had a separate high school program for students with EBD for many years. Before the Compass Program began in the county, there was the Employment Training Program (ETP) for students with EBD, which focused on work and life skills. This program began before the No Child Left Behind Act (NCLB, 2002) and in it students learned life skills, including doing laundry, cleaning, and balancing a checkbook, while they studied a typical academic curriculum for their grade. This program met the needs of most students, but not all. Some students had learning disabilities (LD)

that made it difficult for them to learn the regular academic curriculum. The percentages of students with LD in the GNETS program were similar to those in the research of Bender (1987) and Rourk and Fuerst (1991) that demonstrated between 24% to 52% of students with LD have clinically significant emotional, behavior, and social problems. These percentages were up to four times greater in children without LD (Schachter, Pless & Bruck, 1991). Likewise, studies of students with EBD have shown that between 38% and 75% had been diagnosed with a severe learning problem or LD (Duchnowski, Johnson, Hall, Kutash & Friedman, 1993).

NCLB was passed in 2001, the program changed, and all students were being held accountable to the new standards and testing that resulted from the education reform. At this time, the Compass Program was implemented for students with EBD in the local school system to meet their needs under NCLB. Under NCLB, all students were to be tested and were to pass state-mandated tests by the year 2014. When the current investigator arrived at the Compass Program campus four years ago, 75% of students in the program were placed in self-contained classrooms. They decided that a certified mathematics teacher would better meet the needs of the students. Students attended only electives on the main campus (art and physical education). The rest of their classes were on the Compass Program campus. At that time, students could also eat breakfast and lunch with their non-disabled peers. Some took part in extracurricular activities, such as homecoming, prom, and sports. Over the years, the program has become more self-contained because some students were struggling academically, sometimes due to their behavior issues, in the regular class settings. Now students can only eat breakfast with their non-disabled peers. They lost the privilege of eating lunch with them due to some of their inappropriate behaviors in the lunchroom. Some students are allowed to attend the technical high school if they have been successful outside of the GNETS setting. This means they have earned the right to

attend classes with their non-disabled peers because they had met their behavioral goals for a specified amount of time. This year all GNETS students moved to the main high school building and all other students with EBD were moved to another high school in the county. Both sets of students are in a self-contained classroom model and as behavioral goals are met, students can attend certain general education classes. Most of the classes are electives and a few can go to the College and Career Academy to complete their pathway to progress toward graduation, as opposed to completing their pathway at high school they are currently attending. Students have more opportunities to interact with their non-disabled peers and participate in electives and extracurricular activities. With the new configuration for students with EBD, the county is taking steps toward compliance with the ADA and to address the concerns of the lawsuit filed by the USJD (2016).

Professional Reasons.

The third motivation for the present study is related to the professional career of the investigator of this study, who at the time of the study, had taught mathematics for the past 17 years and, for the last 4 years, split time between teaching an alternative school program that was computer-based and teaching face-to-face high school mathematics classes in the Compass Program. Students spent much of their day completing their academic classes on the computer, using Programmed Logic for Automatic Teaching Operations (PLATO), a self-paced computer program, however, they were taught mathematics classes in a classroom setting. The administration wanted students to complete mathematics on the computer, but later decided it would be more beneficial for students if they were taught mathematics face to face by a certified, experienced mathematics teacher. Students also participated in vocational courses, such as horticulture or woodworking shop classes. Depending on their individualized education plan

(IEP) students could receive a special education diploma, a regular education diploma, or they could receive a college preparatory diploma if they fulfilled all the college preparatory requirements.

An informal observation, based on teaching students with EBD over the past four years is that they can do grade-level academic work, but struggle to pass unit assessments and Georgia's required End of Course (EOC) assessments, which count as 20% of their grade. When working in class, the students could complete the assignments, write down what they knew, and what they understood from the lesson, but when an assessment was given they often struggled to complete it successfully. The students with EBD are required meet the same Common Core Standards (National Governors Association, 2010) as their peers even though they struggle with certain behaviors, which qualify them for the Compass Program. Some of these behaviors include external ones such as aggression, and non-compliance and internal ones such as being withdrawn, anxious, and depressed. Students' inabilities to establish appropriate interpersonal relationships with peers and teachers, which is also one of the eligibility criteria qualifications for EBD, is one of the greatest barriers they face (USDOE, 2010a).

As a mathematics teacher, the current investigator wants students to reach their potential in their mathematics classes. Weeden, Willis, Kottwitz, and Kamps (2016) propose that students with EBD have fewer opportunities than their non-disabled peers to participate in classroom activities, form friendships with peers, and observe and be able to emulate appropriate classroom behavior. The current investigator has observed that most of the students have been mostly unsuccessful for their entire school careers and seem to be a low priority in the county and in Georgia as shown by the lack of progress toward academic and behavior improvements set forth by the GNETS program goals (Pratt, 2017).

Clarification of prior research findings.

The fourth reason is to clarify the prior research findings. When researching the predictor variables for the present study, the research results were mixed for most of the variables, as will be discussed later. For each (educational setting, gender, race/ethnicity, and socioeconomic status), there was research to support that the predictor did have an impact on mathematics academic achievement and there was also research that found that the predictor did not. For parent or guardian characteristics, the research was very limited, which indicates a gap in the literature and the need for more research to be completed in this area. This study will help clarify which predictors have an impact on mathematics academic achievement.

Conceptual Framework

The phenomenon to be analyzed is academic achievement of students with EBD based on certain predictor variables. Students with EBD struggle to achieve at their academic grade levels, and the research has noted many achievement gaps for students with EBD. Some research (Rice & Yen, 2010) states that the gender of students with EBD influenced achievement scores while other research (Kauffman & Landrum, 2012) found that classroom placement had an impact on achievement scores. The concept map organizes the different predictors into areas of their influence. The first area is the student characteristics, which include gender, race/ethnicity and whether they have a primary disability or diagnosis of EBD. Next, are the parent or guardian characteristics, which include the household income level, the mother/female guardian's education and employment status, and the father/male guardian's education and employment status. The last area of the concept map covers the academic setting, which for the current study included regular school, schools that only serve students with disabilities, and alternative school. To determine the relationship between the predictor variables and mathematics achievement, a

stepwise regression analysis was performed using academic achievement as the dependent variable and gender, race/ethnicity, academic placement, SES and parent or guardian characteristics as the independent variables (see Figure 1).

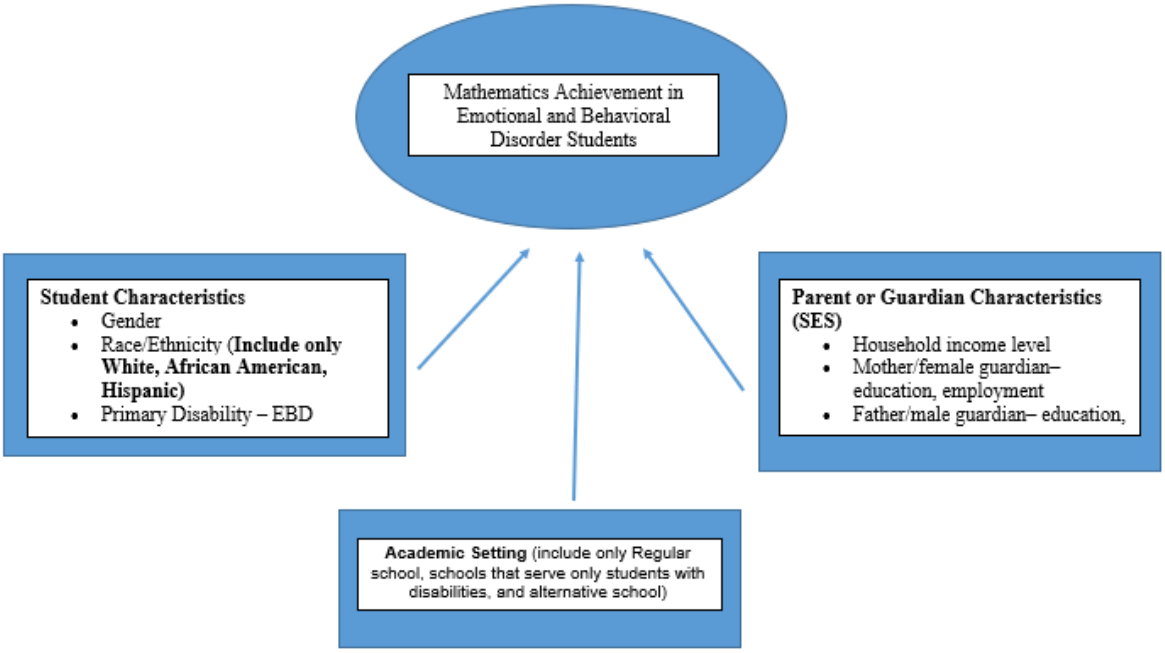


Figure 1. Concept Map

Relevant Terms

Academic Achievement	Refers to the National Longitudinal Transition Study 2 (NLTS2, 2000b) scores achieved on academic tests, a student's grade point average, and the successful completion of grade-level academic activities.
Achievement Gap	The unequal or inequitable distribution of educational benefits and results for different student groups (e.g., race/ethnicity, disability, gender). (Abbott, 2014)
Achievement Test	Measure students' knowledge and skills learned at school or their academic process in a certain time. Can be used to determine placement of a student or to evaluate how effective teachers and schools are. Measures how well a student learned what they were taught. (Abbott, 2014).
Accountability	Refers to a system of checks and balances to guarantee appropriate educational outcomes for students with disabilities. Educational accountability holds schools, teachers, and students accountable for their performance (Editorial Projects in Education Research Center, 2004).
Applied Problems subtest – Woodcock Johnson III	Measures a student's ability to analyze and solve math problems. Initial items require application of simple number concepts. Majority of items require a student to read the problem, recognize the mathematical procedures that must be followed, and perform the appropriate calculations (Woodcock & Johnson, 2001).
Calculations subtest-Woodcock Johnson III	Measures a student's ability to perform paper and pencil computations. Items range from writing numbers through numerical operations (addition, subtraction, multiplication, division), as well as, geometric, trigonometric, logarithmic, and calculus operations if appropriate (Woodcock & Johnson, 2001).
National Assessment of Educational Progress (NAEP)	Also known as "the Nation's Report Card, (NAEP) is the only nationally representative and continuing assessment of what United States students know and can do in various subject areas including mathematics. NAEP reports information for the entire nation and each geographic region of the country. Students are drawn from both public and nonpublic schools and reports results for student achievement for grades 4, 8, and 12 (National Center for Education Statistics, 2006).
Socioeconomic status (SES)	For the purpose of this study, SES is a measure based on household income levels, education level and work status of the parents/guardians.

Organization of Study

Chapter 1, the introductory chapter, includes the statement of the problem, research questions, the purpose and significance of the current study, a review of relevant terms, and a

description of the organization of the current study. Chapter 2 presents the review of literature relevant for the current study. It also includes the theoretical framework and summary and implications of the literature review. Chapter 3 presents a description of the research methodology, including information on the design, setting, overall and sample population, access to the controlled and restricted office site, and value of a specific methodology, instrumentation, and statistical analysis. It also addresses limitations and delimitations of the research and any ethical considerations. The analysis of data, results for the samples, and the interpretation of the results of the current study are provided in Chapter 4. Chapter 5 includes a summary of findings, conclusions, implications, and recommendations. Researcher comments are also included in Chapter 5, as well as the relationship of findings to previous literature and implications for future practice locally and nationally. References follow Chapter 5.

Chapter 2: Literature Review

Introduction

In this chapter, relevant theoretical models for educating students with special needs will be discussed, the history of education of students with special needs will be overviewed, and relevant research will be presented. The study investigated the relationship between mathematics achievement for students with EBD and a set of predictor variables. The current study examined whether effects differed based on race/ethnicity, socioeconomic status (SES), gender, parent or guardian characteristics, or academic placement or the extent that these predictors reflected upon mathematics student achievement.

Theoretical Framework

Several theorists have proposed models related to students with special needs. The most relevant will be discussed here: Social Model of Disability (Swain, French, & Cameron, 2003) and Vgotsky's (1993) Theory of Defectology.

Social model of disability.

Swain, French, and Cameron (2003) assert that disabled people want the same opportunities and chances in life as non-disabled people such as an education, a career, and meaningful relationships. Figure 2 shows some negative effects of discrimination based on a disability. They include but are not limited to

- segregated or poor education,
- isolation,
- labeling,

- lack of inclusion,
- access to information, and
- prejudiced attitudes (Disability Action in Islington, 2014).

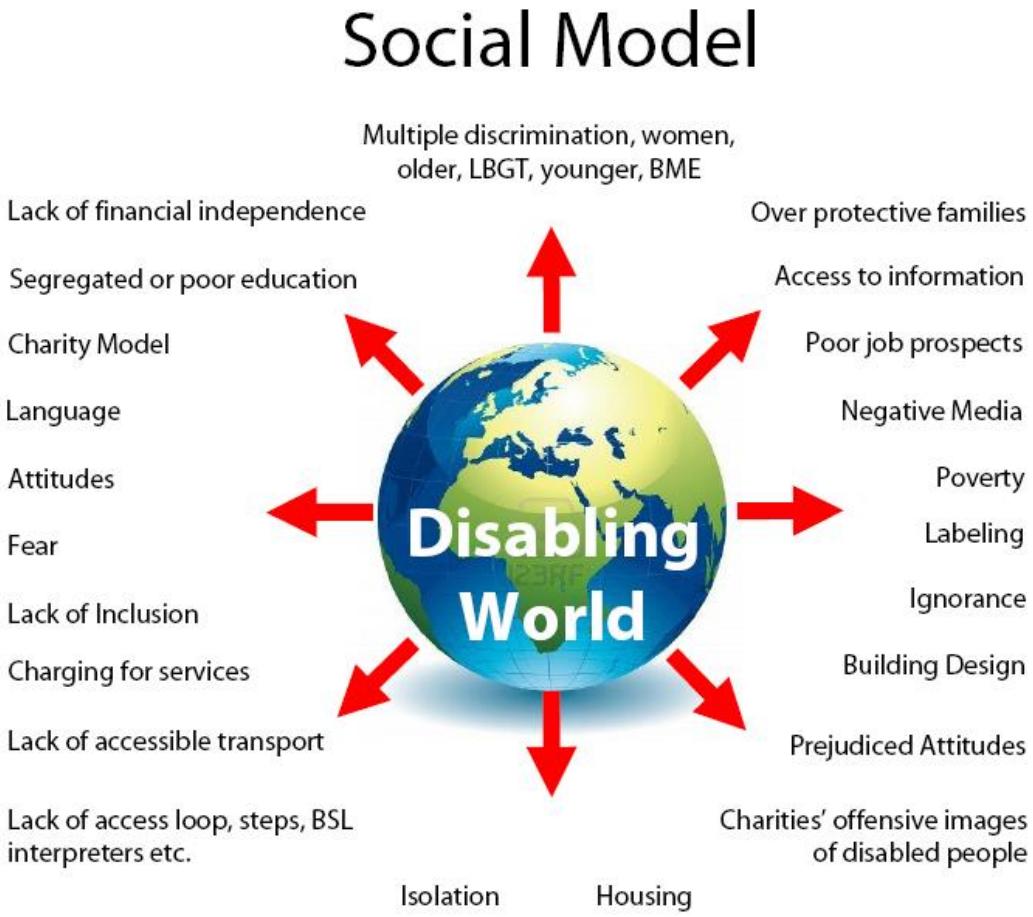


Figure 2. Social Model (Disability Action in Islington, 2014, p.1)

The Union of Physically Impaired against Segregation (UPIAS, 1976) based in the United Kingdom, produced a statement with the goal of identifying and removing the disabling aspects of society. This group began to fight for accessibility, to stop oppression, and protect the civil rights of disabled persons. Their goal was to reframe how society viewed disabled persons. This movement allowed a shift in the lives of disabled people from having limited choices and

allowed them to make more choices for themselves (UPIAS, 1976). They were able to participate in their family, personal, and social lives just as much as the non-disabled. Generally, they were no longer viewed as people with disabilities but as contributing members of society. Oliver (2004), a disabled academic himself, asserts that people with disabilities find society's perception of their disabilities as more of a challenge than the disability itself. This idea has become recognized as the Social Model of Disability. UPIAS agreed with Oliver (2004) that having a disability was a hardship, but they argued that general attitudes prevent individuals with disabilities from being fully functional in society (Finkerstein, 2004). Tugli, Clu, and Morwe (2014) advocated that people with disabilities are a very important part of society, and all have a role to play. These roles can be impeded by the barriers they face in society. The social model has offered effective and viable tools to help frame how people with disabilities are viewed.

The Social Model of Disability pertains to the current study, because it is about helping students with disabilities to have the same opportunities in schooling and for life. It is about being helpful and not hurtful and the potential for harm when students with disabilities are treated differently. Students with disabilities can be contributors to society; they just need to be given appropriate supports. They need to be given access to all activities and should not be excluded based on their disability. Their education should be integrated with and not segregated from other students. Labeling should be discouraged, and students should be able to participate in activities with others. Policies reflecting prejudiced attitudes toward students with disabilities should not be encouraged or allowed. This model is about inclusion and equality for students with disabilities and other disenfranchised groups.

Vygotsky's theory of defectology.

Vygotsky (1993) believed in looking at the whole person and mainstreaming people with disabilities into all aspects of everyday life. He argued a child with a "defect" was not less developed but just "differently" developed. A productive life is a goal for all. He argued that the focus and goals of education for these students can be more optimistic, oriented on the future, and conducted in settings that are focused on possibilities.

Disability is the difference between the individual's psychological structure and the cultural structure that disadvantages the disabled person living in that society (Vygotsky, 1993). What he termed *defectology* deals with characteristics of the human makeup that have typically been the topic of study in other areas such as abnormal psychology and special education. He argues that through a concerted effort by parents/guardians, teachers, policy makers and others involved in the education process, people with disabilities can be contributing members of society. Society has a role to play as well in the support of people with disabilities.

Vygotsky (1993) recommended social mediation with cultural tools. His approach is a theme of defectology and other areas of psychology. The nurture versus nature debate, which has continued into the 21st century, contrasts those who emphasized nature or biological factors in human development such as psychologist Piaget (1983) and those such as Vygotsky (1993) who examined nurture or cultural factors in human development and focused on differences and not deficits. Vygotsky considered himself a "defect." His feelings of inadequacy made it difficult to engage socially and the social stigma of having a disability led to feelings of inferiority. He asserted that the physical or mental difference was not the tragedy as much as the feelings of inadequacy and inferiority generated by them. This theory ties to the current study because

mainstreaming is addressed by this theory and in every case, it should at least be considered as a part of LRE.

Review of the Literature

Background on students with EBD.

History and diagnosis of emotional and behavioral disorders.

Abnormal behavior of people has been labeled with a variety of terms (Coleman, 1996). In the 1900s, terms such as "*mental illness*" and those referring to other adult conditions were too stigmatizing to apply to children. Around that same time, some still thought that people exhibiting odd, different, and strange behavior were possessed by evil spirits with exorcism being used to remove the evil spirits (Mercer, 2013).

Hippocrates (460-370 B.C.) was a Greek physician who was considered the father of medicine (Coleman, 1996). He believed an abnormal behavior was a physical illness and not a demonic possession and was due to heredity or a head injury accident. Although his understanding of the physiology of abnormal behavior was preliminary, his influence brought this perspective to the forefront, and it became an area of study for physicians (Yapijakis, 2009). In the Middle Ages (1100-1453), this physical or medical approach disappeared in the societies of most of Europe (Coleman, 1996), and more superstitious beliefs returned. Through the 15th and part of the 16th century, demonic possession was thought to be the cause of an abnormal state. By the middle of the 16th century, the mentally ill were deemed to be witches, and asylums were established. Often these institutions resembled jails, and patients were kept locked away in chains and shackles (Coleman, 1996).

In the late 19th century, less stigmatizing terms became more common for use with children including *emotional disturbance* and *behaviorally disordered*, which was used more

often within the special education community (Coleman 1996). The latter term held less stigma but did not acknowledge emotional problems.

French physician Philippe Pinel (1775-1826) was renowned for his humane and moral treatment of the patients in the asylums. He helped reform the care of those with abnormal behaviors from cruel and negligent to a more medically-centered approach. He also advocated the assistance of non-medical personnel with the treatment of the patients (Gerard, 1997).

Considered the father of American psychiatry, Benjamin Rush (1812) lobbied for no corporal punishment. He argued these individuals were sick and could not be held responsible for their behaviors. He lobbied for more humane treatment of those with abnormal behaviors. By the 19th century, the phrase *emotional and behavioral disorders* was firmly established. Physicians began to pay closer attention to patients' behaviors and began to recognize common symptoms of mental illness. Dix (1976) helped promote the start of mental hospitals, after he observed the patients' behaviors and recognized that more needed to be done for the mentally ill. His work spawned schools of psychiatric treatment. Young patients were educated in asylums and a more enlightened approach emerged including the use of education as a part of the treatment plan of the emotionally disturbed. Teaching strategies from this approach have become some of the cornerstones of the special education standards (Coleman, 1996). These cornerstones included assessment and instruction tailored to the individual: learning in sequential, structured activities; and multi-sensory approaches. Addressing anti-social and criminal behavior became the focus in the 20th century studies of the emotional disturbed.

Nicolas and Levine (2012) described the birth of psychometrics as a discipline in the later 1800s. French psychologists Alfred Binet and Théodore Simon (1905) contended that mental testing needed to be researched. Their rival Désiré-Magloire Bourneville argued children under

the care of psychiatrists should be removed from regular classrooms and receive their special education classes elsewhere. Nicolas and Levine (2012) contend that Binet wanted to keep his own children in school and to use psychologists to help with the process. His children were not disabled, but he observed them in their natural setting to get a sense of normal behaviors. He carried out home experiments on his two daughters and observed their behaviors over time. His background included working in hospitals with patients and writing many papers on hypnosis and hysteria. Binet and Simon developed the first working test of intelligence. Their scale and analysis helped to diagnose and potentially treat abnormal behavior. This scale was important because of a change in the law that mandated all healthy French children ages 6 to 13 to attend school. "Otherwise normal children sometimes need special help: they are *slow* (*arriéré*), but not *sick*" (Nicolas, Andrieu, Croziet, Sanitioso, & Burman, 2013, p.1).

The study of the domain of intelligence was carried forward by Lewis Terman and Lightner Witmer, and intelligence testing became an integral part of schooling in France (Nicolas et al., 2013). Binet believed an abnormal childhood would lead to a criminal adulthood and thus those children needed to be identified. The first metric of intelligence (Binet & Simon, 1905) included difficult items such as differentiating *debility* from *normality* and *idiocy* from *imbecility*. After Binet's death, Terman translated the Binet-Simon test into the Stanford-Binet test (Nicolas, 2013). He utilized some of its psychiatric content with the psychological content to ensure high functioning children were identified as well as low functioning children. The psychiatric content focused more on what was abnormal than normal to identify those students that needed extra assistance. From a psychology background, he focused on the normal mind rather than concentrating on the reasons for mental illness. It predicted school success and later became known as one of the earliest Intelligence Quotient (IQ) tests (Binet & Simon, 1905).

Cruickshank (1961) found a structured approach in the classroom for teaching students with EBD that worked well when dealing with those things that impede a child's inability to learn (e.g., volatility, inattentiveness, distractibility). Berkowitz and Rothman (1970) described a psychoanalytic approach to EBD instruction that was first utilized in the early 1960s. This aims to treat disorders by observing the interaction of the unconscious and conscious elements. Hobbs (1966) introduced Project Re-ED (Re-education of Emotionally Disturbed Children), which addressed the education of disturbed children in residential schools. The model is based on the student's relationships, including those with her or his surroundings. The model explained how the student behaved in the residential schools. Mental health services were provided that were effective and affordable as a way to be more supportive of the students. Hewett (1968) later advocated for a more behavioral approach. The classrooms were designed to deal with problems at each of the levels of interventions, classroom centers, and the curriculum. Emphasis was not placed on understanding those situational, environmental, and social determinants that influenced behavior.

Long, Morse, and Newman (1965) promoted the use of interrelated theories of the identification and education of students with EBD. Their theories of identification incorporated the child's inner and outer behaviors. Other relevant theories included inclusion into the mainstream (mainstream theory), preserving family and relationships (family systems theory), dealing with students with EBD in crisis (crisis theory) and intervention strategies (intervention theory).

Mainstream theory is inclusion of students with disabilities in the general education classroom (Dixon, 2005). Some teachers and administrators who practiced mainstreaming believed special needs students who struggled and could not function well in a general education

classroom needed to take classes in the special education environment. Cramer, Liston, Nevin and Thousand (2010) argued that inclusive settings improve interaction with non-disabled peers, and that mainstreaming students influences their academics in a positive way. Bowen (1974) described family systems theory as all family members playing an important role in how the family functions together as a whole. A change in the behavior of one family member influences the other family members. Crisis theory is a phenomenon that explained what happens when someone faces a problem to which they do not see a solution (Selig, 1976). Argyris (1970) described intervention theory as securing desired outcomes by intervening in a situation effectively. The interventions, he continued, should work on the internal influences and not the influence of external.

The theories address many of the facets of the life of a student that may influence his or her behavior. These theories can be used to evaluate the student in different environments and contexts to determine where the issues with behavior are more prominent. They can also be utilized to determine if a student does have an emotional and behavioral disorder or if the behaviors are being caused by influences that can be addressed and the student can operate as they had before the events or situations occurred.

Federal and state legislation regarding students with EBD.

Between 1970 and 2005, laws were passed protecting the rights of disabled students. These federal laws were a direct result of research developments in the field of special education. The cornerstone law for disabled students was the 1975 Education for All Handicapped Act (EHA), also referred to as Public Law (PL) 94-142. It ensured students with disabilities receive a Free Appropriate Public Education (FAPE; USDOE, 2010a), equivalent to that of their non-disabled peers (Zettel & Ballard, 1979). The purpose of PL 94-142 was to ensure that the

distinctive educational needs of disabled students are met so that they can reach their academic potential. EHA included over one million students who were excluded from the education system entirely and those who had limited access to the education system. The latter group included more than 50% of students with disabilities in the United States. Some other requirements of EHA were providing the services at no cost to the parents, development of an IEP for each student, parental participation and including students in their LRE to the extent possible. Education for All Handicapped Law Act Amendments (1983), also known as PL 98-199, was one of many revisions of EHA. This revision set standards for successful outcomes for students with EBD.

In 1990, EHA was amended under the name Individuals with Disabilities Education Act (IDEA). This change extended the definition of LRE. Behavioral Intervention Plans (BIP) and Functional Behavior Assessments (FBA) became required for students with EBD (Coleman, 1996). Criteria were established for removal of students with EBD from a school for disciplinary reasons to ensure they were not unduly denied access to an education. NCLB (2002) or PL 107-110 was introduced in 2001 to raise academic expectations for all students and was immediately met with heavy criticism. Opponents thought the testing mandates were unrealistic and very rigid. Specific services were mandated, but were not funded (Mathis, 2005). Darling-Hammond (2007) argued NCLB encouraged testing rather than investing, provided disincentives for improved learning, distracted schools from reform, narrowed the curriculum, and punished the neediest schools and students.

Congress reauthorized the IDEA in 2004. Section 300.8 of IDEA defined a child with a disability as a child evaluated under Section 300.304 of the law and found to have one of a list of disabilities that included serious emotional disturbance. Specifically, emotional disturbance was

defined as “a condition exhibiting one or more of the following characteristics over a long period of time and to a marked degree that adversely affects a child’s educational performance” (USDOE, n.d.):

- An inability to learn that cannot be explained by intellectual, sensory, or health factors;
- An inability to build or maintain satisfactory interpersonal relationships with peers, teachers;
- Inappropriate types of behavior or feelings under normal circumstances;
- A general pervasive mood of unhappiness or depression;
- A tendency to develop physical symptoms or fears associated with personal or school problems (p. 1).

Emotional disturbance includes schizophrenia. The term does not apply to children who are socially maladjusted unless it is determined that they have an emotional disturbance as well (USDOE, 2010a).

The Georgia Department of Education (GADOE, 2010a) defines an EBD disorder very similarly. The GADOE includes the first four bullets above, as well as one other characteristic: a consistent or chronic inappropriate type of behavior or feelings under normal conditions. Special education services are only necessary if the student has one or more of the above characteristics for a sufficient duration, frequency, and intensity that interferes significantly with their educational performance.

Process of diagnosis and usual interventions for students with EBD.

The diagnosis of a student to determine if they are EBD is an extended process that begins with documentation of modifications made in the regular classroom to help the student become successful and data on the student’s behavior following such interventions. The behavior

must persist over an extended period. The extended period is not defined by the guidelines. The behavior must be of sufficient intensity, duration or frequency to interfere with child's education, and must be documented. Kauffman and Landrum (2012) say that for a behavior to be chronic, it must be on-going and not resolve over time. Once a problem is identified, then the initial evaluation can begin. According to the Special Education Services and Support website of the Georgia Department of Education (GADOE, 2010b), evaluation is the first step in determining if a child with a disability is eligible for special education services. To start the evaluation, the parent must sign a consent form for evaluation. The purpose of the evaluation process in the state of Georgia, which is based on IDEA recommendations, is three-fold. The first step is to determine if the student has an IDEA-defined disability. The next step is to gather information on the needs of the student if he or she does have an IDEA-defined disability. The final step is to determine what an appropriate education is for the student.

Different categories are defined by IDEA, EBD being one of them. Having a disability does not make a student eligible for special education services. If students do not qualify for special education under IDEA, other education services such as Section 504, also known as Rehabilitation Act of 1973, are available (USDOE, 2010b) under FAPE. It extends additional rights to people with other disabilities.

The GADOE (2010b) provides for student referral for an evaluation in one of two ways. One path is when the parent requests the evaluation, which could also have been motivated by a doctor recommending to the parent an evaluation should be done. If the school agrees that an evaluation needs to be conducted, it is free of charge to the parent. Schools may also request an evaluation based on teacher recommendations, observations, or test results. For either path, the parent or guardian must give written permission for the evaluation. When providing parents

notice of the evaluation, the school must do so in writing and include the reason the school is requesting the evaluation or the reason the school does not recommend the evaluation. This communication includes a description of each of the processes, assessments, procedures to be utilized in proposing or denying the evaluation; a description of where parents can get information about IDEA's provisions. The communication must also include what other options the school considered and why those were not successful; and a description of any other factors that are relevant to the decision whether to evaluate the student for special education services. This information must be written in a manner so that laypersons can understand to ensure parents are fully informed. The GADOE must also provide guidelines for communicating the material orally or translating into another language if needed.

If a parent refuses to consent or does not respond to requests for consent, the school should carefully document all attempts to obtain consent and then can pursue evaluation using the guidelines in Section 300.300 (GADOE, 2010b). Teachers will continue to work with the student, while documenting interventions and corresponding results. IDEA (USDOE, 2010a) sets the time frame for testing at 60 days from receiving parental consent (less time if the state determines so in their guidelines). The evaluations should include health, hearing and vision, social and emotional status, general intelligence, academic performance, communication status, and motor abilities. The results of the evaluations are utilized to identify all special education services the child may need to be successful in school.

Review of student school records and other existing data is also a part of the evaluation and can include performance on state and district assessments, the student's classroom work, and information from parents (GADOE, 2010b). An assigned special education lead teacher in each school oversees this process for that school. If more information is needed, the school can extend

the evaluation. They may inform the parents that additional assessments can be completed if requested. The results of the evaluation will include the category of the disability or disabilities (if any), the student's present level of performance, whether special education services are needed, and whether any modifications are needed so the student may participate in the general curriculum. To ensure that the student is assessed fairly, the evaluation includes a variety of sources, valid and reliable research methods, and technically sound evaluations. The evaluation may require specific intelligence, reading or mathematics assessments (GADOE, 2010b).

GADOE (2010b) safeguards against discrimination in the process related to race or culture. The tests must be administered in the student's normal mode of communication (primary language, sign language, Braille) so that it yields accurate information about what the child can do and does not reflect limited English proficiency or other unrelated challenges. If the parent does not agree with the results, he or she can request an independent evaluator, and in some cases, the state will pay for the additional evaluation. If the independent evaluator concurs with the evaluation done by the school, then the parent is responsible for the cost of the additional evaluation. Once it is determined that the student has a disability and requires special education services, an IEP is written and evaluations are performed every three years or more often, if needed (GADOE, 2010b). Parental consent is required for re-evaluations as well. As with the original evaluation, the student will continue receiving special education services or will be removed from special education, based on what the IEP committee determines. This committee includes the special education lead teacher, special education teacher, regular education teacher, administrator, counselor, parent, child (when appropriate) and any other persons who have knowledge or special expertise related to the child.

Under Eligibility Determination and Categories of Eligibility, GADOE (2010a) also stipulates a student cannot be placed into special education under the EBD criteria if the primary factor for that determination is one of the following:

- Lack of appropriate instruction in reading, including the essential components of reading instruction;
- Lack of appropriate instruction in math;
- Lack of appropriate instruction in writing;
- Limited English proficiency;
- Visual, hearing or motor disability;
- Intellectual disabilities;
- Cultural factors;
- Environmental or economic disadvantage; or
- Atypical education history (multiple school attendance, lack of attendance, etc.) (p. 10).

Automatic referrals cannot be made for the following reasons:

- Children with social maladjustment unless it is determined that they are also children with EBD;
- A child whose values and/or behavior are in conflict with the school, home or community;
- A child who has been adjudicated through the courts or other involvement with correctional agencies;
- A child who has classroom behavior problems and social problems (e.g., delinquency and drug abuse);

- A child with a diagnosis of conduct disorder (p. 10).

Once a student is diagnosed as EBD, as defined by the GADOE (2010a), several options are available, depending on the needs of the student. The first is an inclusion class where the child is in a regular education classroom with nondisabled peers and a special education teacher or paraprofessional who can assist the student in the classroom. For those students with EBD for whom this option does not provide enough support, the next level of support is the resource room where students are pulled out to work on their general education classes with a special education teacher. This option helps them remain in general education classes and receive assistance where they struggle the most. The third option is the self-contained class where the student is removed from all mainstream classes and works on all their academic subjects with a special education teacher. The students in the self-contained class may be at different levels and working on different curricula. These classes are very structured to meet the needs of students (GADOE, 2010a). The most restrictive option is a school only serving students with disabilities. In the state of Georgia, GNETS is utilized for this third level of support (GADOE, 2007), but in some cases, based on the distance from the regular school setting, it is a school servicing only students with disabilities.

GADOE (2010b) categorizes the placement in GNETS as out-of-district when students go to a school specializing in specific learning or behavior needs. Students have the highest degree of structure, consistency, and routine but they are removed from their non-disabled peers and have no interaction with them. Also, this can be very costly to the school system. Duncan (2010) asserted if a school did not offer the program needed by the special education student, then the school could refer them to a school or institution that did provide the program. Because

the student's home district must provide for students under the Rehabilitation Act (1973), transportation would be provided and paid for by the home district.

Standards for teaching students with EBD.

In the late 1980s and early 1990s, many disciplines outlined teaching and curriculum standards. National Council of Teachers of Mathematics (NCTM, 1991) was one of the first to advocate opportunity for all students in mathematics. Everyone in society should have the opportunity to be mathematically literate. The Council for Exceptional Children (CEC, 2016b), is group that advocates for a quality education for all students with exceptionalities. They have a code of ethics for teaching special education students, and their Standards for Professional Practice suggest upholding the following principles:

- Maintain challenging expectations to help develop the highest possible learning outcomes.
- Promote meaningful and inclusive participation in school and communities.
- Maintain a high level of professional competence and integrity.
- Practice collegially with others.
- Develop relationships with families.
- Use evidence, instructional data, research, and professional knowledge to inform practice.
- Protect and support the physical and psychological safety.
- Neither engage in nor tolerate any practice that harms.
- Practice within professional ethics, standards and policies of CEC.
- Advocate for professional conditions and resources that will improve learning outcomes.

- Engage in the improvement of the profession through active participation in professional organizations.
- Participate in growth and dissemination of professional knowledge and skills.

In their Special Education Professional Ethical Principles, CEC (2016a) includes some relevant standards:

- Standard 1.7 states only use evidence-based proper behavior change practices.
- Standard 1.8 supports the use of behavior supports that are positive and conform to local policies with no use of corporal punishment.
- Standard 1.9 condemns the use of aversive techniques unless other methods have failed, and new techniques are approved by consult by the parents and others involved.
- Standard 1.10 does not condone corporal punishment for students with exceptionalities.
- Standard 1.11 requires a report of unprofessional or unethical practices to supervision.
- Standard 1.12 recommends special education for an individual to receive a proper education no matter the exceptionality (CEC, 2016a).

Related research on mathematics academic achievement of students with EBD.

Mattison and Blader (2013) described growing concern over the limited academic progress of students with EBD. Wagner and Cameto (2004) showed most interventions do not improve academic functioning of students with EBD, which was of concern in the special education community (Siperstein, Wiley & Forness, 2011). Wagner, Kutash, Duchnowski and Epstein (2005) utilized the NLTS2 data to compare students with and without disabilities and

found students with EBD had lower grade point averages across grade levels, higher levels of absenteeism, suspension, expulsions, and course failures. These particular students dropped out of high school at a much higher rate than their peers and were more likely to experience unemployment, drug and alcohol dependence, and involvement in the criminal justice system as adults. Greenbaum et al. (1996), in the National Adolescent and Child Treatment Study (NACTS) of 800 students with EBD, showed that 40% did not have a high school diploma or General Equivalency Diploma (GED), that 75% were below grade level in reading, and that an astonishing 97% were below grade level in mathematics. In a report titled *Statistical analysis report: Dropout rates in the United States*, the National Center for Statistics (2009) reported that 51.4% of all students with EBD drop out of high school, which was the highest percentage among all disability categories. Gonzalez and Cramer (2013) attribute truancy and poor academic success to this percentage being so high.

Mulcahy, Maccini, Wright and Miller (2014) maintain that, as a group, students with EBD experience higher rates of below grade level mathematics achievement, and these deficits increased as students got older. Trout et al. (2003), in their meta-analysis of research spanning from 1961 to 2000, found that (12 out of 13) or 92% of the studies stated that students with EBD had significant academic deficits in mathematics and that these deficits tended to increase in middle and high school. Lane et al. (2008) note that because of behaviors associated with students with EBD, more focus was placed on teaching basic skills mathematics, and that problem solving was not deemed as important to educators. This could be an explanation why achievement is not improving for students diagnosed with EBD. Mulcahy, Krezmien, and Maccini (2014) argue that instruction in a segregated model focuses more on behavior and less on academics, which may be a cause of academic deficits.

Anderson, Kutash, and Duchnowski (2001) found that students who have both EBD and academic deficits do not see their achievement improve as much as might be expected over time. Improvement would be expected because of interventions used to help students get back on track. More specifically, they found that students with EBD at their five-year follow-up after elementary school had not improved academically. When compared with students with LD who started out lower academically, students with EBD had fallen further behind than students with LD. Lane et al. (2008) confirmed that mathematics achievement deficits with students with EBD increased as students got older. Nelson, Benner, Lane and Smith (2004) found broad academic deficits and underachievement for students with EBD, including deficits in mathematics, reading, reading comprehension, vocabulary and written language. Kauffman (2001) compared students with EBD to those in other high-incidence disability groups and found that students with EBD had lower mathematics and reading scores, lower graduation rates, higher rates of grade retention, and higher rates of course failure. He also found students with EBD were less likely to continue their education beyond high school.

Kauffman (2001) argued that a reciprocal relationship between school failure and social failure exists. Social failure is not being able to get along with others, which impacts a person's ability to fit in in the school environment and many aspects of adult life. Wagner et al. (2005), in analyzing the NLTS2 data, found 75% of students with EBD failed one or more grades and more than half dropped out of high school, which was higher than the rate of the general education students. Students with EBD performed one to two grade levels below their expected grade level and have notably lower differences in achievement as compared to students without disabilities (Mattison, 2015; Trout et al., 2003).

Mattison and Blader (2013) conducted a study of students with EBD in a self-contained day school, the most intensive form of LRE. Their study included 196 students from 61 middle schools and 135 high schools and was conducted in New York City. The students in the program were placed in the day school because they had not responded well in general education classrooms. Their mean age was 15.2 (standard deviation of 2 years), and they were 73% male and identified as 67% Caucasian, 26% African American and 7% other race/ethnicity. Forty-five percent of students qualified for free or reduced lunch. Referrals were primarily for EBD (46%) but the students also were categorized as 32% other health impaired (OHI), 10% multiple exceptionalities, 8% LD, 5% autism, and 1% non-disabled. Over half the students did not have an EBD diagnosis, and some were diagnosed with multiple areas of disability. The day school included a support staff of content area teachers, a counselor, a psychiatrist, a substance abuse counselor, and a Positive Behavior Intervention System (PBIS) specialist. Mattison and Blader (2013) found the IQs of the students were average but the mean standard scores for achievement were lower, especially in mathematics. Their mean mathematics grade was between 70-79 (a "C" grade), and 14% were failing their mathematics classes. When looking at the reduced model for achievement in mathematics, the predictors that had the most impact were age (6%), verbal intelligence (24%), performance intelligence (14%), and Attention Deficit Hyperactive Disorder Index (ADHDI) (13%). Predictions in a reduced model for grade point average (GPA) included the following: age (4%), ADHDI (23%), and broad mathematics score (22%). They concluded poor academic progress seems to be more related to academic problems than behavior problems. Their implications included the recommendation that academic interventions be assigned to students with EBD along with the common EBD interventions.

In a meta-analysis of 26 studies, Riglin, Petrides, Frederickson, and Rice (2014) discovered that anxiety, depression, and other externalizing behaviors were associated with increased school failure. In a study of 352 secondary students, Joffe and Black (2012) found that students with low academic performance had much greater behavior, emotional, and social difficulties so other researchers need to study the effectiveness of EBD interventions. Ruhl and Berlinghoff (1992) noted that 33% to 81% of students with EBD have academic difficulties, which supports the evidence of a causal relationship between academic achievement and behavior problems.

Kremer, Flower, Huang, and Vaughn (2016) conducted a study with sample size of 2,028 students to predict academic achievement from behavior problems. The study using data from 1997 until 2007 during three waves of the Child Development Supplement (CDS) of the Panel Study of Income Dynamics (PSID). The PSID is a longitudinal survey that collected socioeconomic and demographic information from a nationwide sample of individuals and their families annually between 1968 and 1997 and then every two years thereafter. The CDS looked at each student's emotional well-being, cognitive and academic achievement, physical health and disability and social relationships between their peers and household members. Outcome variables included three subtests scores on the Woodcock-Johnson Revised (WJ-R) Tests of Achievement (Woodcock & Johnson, 1989). They found an inverse relationship between academic achievement and behavior problems that persists over time. The time interval is not defined but, given it is a longitudinal study, it is reasonable to expect it was months or years. External behaviors did not appear to affect the mathematics subtest score as much as the reading subtests score. Interventions should be designed for behavior and achievement before the cycle of academic failure begins for students, often starting in the elementary years.

Gonzalez and Cramer (2013) conducted a study in a large diverse district of 349,945 students from 45 high schools in four geographic regions in one urban school district. Their study included 573 African American and Hispanic 11th and 12th grade students with specific learning disabilities (SLD) or EBD. The students with EBD were ages 15 to 18 who were meeting graduation requirements for a standard diploma and being educated in an inclusive or self-contained setting. The academic history of the student was the only significant predictor of graduation among students with EBD. This research relates to the current study in many ways. The NLTS2 dataset, along with other data, was utilized to compare the achievement of students with and without disabilities. Gonzalez and Cramer (2013) found that students with EBD have deficits in their education, including mathematics, which is focus of the current study.

Research on educational setting and achievement.

In the Social Model of Disability (Swain et al., 2003), participating in a segregated and poor education is a barrier that some disabled persons, including those students with EBD, must overcome. Isolation is also a factor that must be overcome. Depending on the education setting in which students receive their education, the setting itself may be segregated and a barrier to an appropriate education. Educational setting is also addressed in Vgotsky's theory of defectology in that he advocated for mainstreaming, or inclusion, for students with disabilities, including those students diagnosed with EBD. Lane et al. (2008) noted that academic achievement may be a function of the setting in which the student is educated. In theory, self-contained classrooms are better equipped with the services and resources the students require, but some research suggests otherwise. Singer, Butler, Palfrey, and Walker (1986) found that smaller classes and paraprofessional support have the most impact on academic achievement, while Meadows, Neel, Scott, and Parker (1994) argued that modified curriculum and varied instructional strategies are

as impactful as the smaller classes and paraprofessional support. Kauffman and Wong (1991) believe that effective classroom management has the most impact on academic achievement. Wagner and Cameto (2004) discovered that students with EBD tend to attend multiple schools in their schooling career because of placement changes for either IEP or disciplinary purposes, and these disruptions affect their academic achievement, in part because of their lack of access to one consistent educational model. The academic progress of students being moved from school to school frequently cannot be gauged accurately because students are not in one place long enough for an intervention to have effect. Students with EBD had poorer outcomes than any other group of students with disabilities and the general population; they had the lowest grades of all disability groups. Mulcahy et al. (2014) argue that teacher attention in a segregated model focuses less on academics, and more on behavior, which may be the cause of academic deficits. Trout et al. (2003) found academic functioning of students with EBD reveals academic underachievement across all age categories and educational settings in all content areas.

Gonzalez and Cramer (2013) emphasized that students with EBD are often placed in self-contained settings because of the negative perceptions of their behaviors, and these placements often lead to low teacher expectations. Hehir (2005) stated that special education students, especially those with EBD, must deal not only with their disabilities but also with disadvantages from typically being placed in more restrictive settings and being removed from the general school population to receive services. He contends this indicates a failure of the school and community to see them as contributing members. Hehir recommends that schools address the academic needs of students with EBD in the inclusive classroom settings by familiarizing general education teachers with the accommodations and adaptive support students with EBD

need to be successful. He also stresses that this initiative must be supported by the administration and the special education leaders in the school.

Reid, Gonzalez, Nordness, Trout, and Epstein (2004) conducted a meta-analysis of studies on the placements of students with EBD. Their meta-analysis found that students with EBD continued to exhibit increasing academic delays over time, and moderate to large differences in achievement existed for students with EBD when compared with students without disabilities. Lane et al. (2008) reviewed the academic profiles of students in self-contained classrooms and self-contained schools and found both groups of students had broad academic deficits, but the students in self-contained schools had higher deficits than those in self-contained classrooms. Students with EBD made limited academic progress in both reading and mathematics skills in both programs, which may be due to less emphasis on academic instruction relative to the emphasis on behavior intervention and social skills intervention. Reid et al. (2004) hypothesize this result may also be due to other compounding variables such as hyperactivity and externalizing or internalizing behaviors. Externalizing behaviors included aggression and disruption while internalizing behaviors included social withdrawal and depression. Gagnon and Bottge (2006) show high numbers of students with EBD are taught in alternative education programs including some programs that are far removed from the student's home school because of discipline, behavior problems, or chronic absences. The United States Department of Education (2009), in the Executive Summary of the Race to the Top Program, reported that 42% of students with EBD are taught outside the general education classroom 21% of the day and 15% of students with EBD are taught in segregated schools.

Gonzalez and Cramer (2013) found that students with EBD in inclusion classes had a more successful academic history when compared to students with EBD in self-contained

classes. Those students who participate in inclusion classes were typically those with less severe EBD and those who had met the behavior goals and shown they were able to participate in inclusion classes. They were able to attend classes and were not considered to be a disruption of the other students' education. Students with more severe behaviors were considered too disruptive to other students and were served in self-contained classes. Only 6% of students in the sample who were educated in self-contained classes had a successful academic history. Gonzalez and Cramer (2013) also found 93% of students with EBD placed in inclusion classes were passing their classes compared to 72% of students in self-contained classes. They found a significant association between inclusion setting and successful behavior. For example, 79% of students with EBD in self-contained classes were suspended compared to only 22% of students with EBD placed in inclusion classes. Rea, McLaughlin, Walker, and Thomas (2002) affirmed that the inclusive setting increases academic performance as well as pro-social behaviors. Cramer et al. (2010) maintain that students' opportunities improved in an inclusive setting because students could interact with their non-disabled peers and feel a part of the school community. Gonzalez and Cramer (2013) contend that, because students with EBD had better academic grades in the inclusive setting, students should be exposed to the inclusive setting more frequently and for longer periods of time.

Research on academic setting and achievement is relevant to the current study because of the lawsuit against GNETS and Georgia by the USJD (2016). The USJD alleges segregation and violation of the ADA in Georgia. Because of this, students are not given the same opportunities as they would have in a regular education setting and many of their deficits come from focusing more on behavior modification than on academic interventions. The current study could

contribute to research base on what education setting is most appropriate for students diagnosed with EBD.

Research on gender and academic achievement.

Callahan (1994) found in an empirical study that males account for approximately 85% of students with EBD, and the cause of such a disparity needs to be explored further. In other research, the USDOE (2009) noted females account for approximately 20% of students diagnosed with EBD, but little is known about gender differences in academic achievement. Wilkins and Ma (2002) do not identify gender differences in mathematics achievement scores in their study of regular education 7th grade students as they continued through the 12th grade. With the limited information available (i.e., sample size too small), Nelson et al. (2004) noted that both males and females with EBD have comparable achievement deficits. When compared with their peers, males and females have large deficits in their academics. Reid et al. (2004) found in their meta-analysis study of adolescents diagnosed with EBD that they were disproportionately male, behaviorally disruptive, non-compliant, verbally abusive and aggressive. The meta-analysis had less conclusive results when observing student's demographics, specifically race/ethnicity and gender. This could be that the demographics were not included or that when analyzed, they did not provide more information. or the information could not be analyzed. Reid et al. believed these characteristics impaired the students' abilities to succeed in school and society.

Callahan (1994) asserts more males are identified as EBD because of physiological (brain function, cognition, maturity and development levels, aggression, and hormones) and environmental (education and home experience) issues. Rice and Yen (2010) conducted a study using the Special Education Elementary Longitudinal Study (SEELS) data and noted no

statistically significant gender differences in academic achievement. This study began in 1999 and continued for six years. They found that males performed better on applied problem subtests as compared to females. This finding was based on comparisons and was not deemed significant. Kremer et al. (2016) maintain the achievement gap between males and females does exist. Their study addressed students with behavior problems based on their internalizing and externalizing behaviors. Weaver-Hightower (2003) emphasized that in the regular education setting, males outperform females in mathematics and science. In literacy achievement, Ready, Logerfo, Burkman, and Lee (2005) report females outperform males, which they suggested may be due to females coming to school more prepared than males. Classroom behavior may play a role in the gender differences (Weaver-Hightower, 2003). He asserts males have higher retention rates, and Gregory, Skiba, and Noguera (2010) cite more suspensions and expulsions for males than females. Coutinho and Oswald (2005) posit having more suspensions and expulsions may be attributed to overrepresentation of males in special education categories such as EBD.

Kremer et al. (2016) noted that males, aged 3 and older, scored significantly higher than females on the Applied Problems mathematics test (AP subtest), while females scored significantly higher than males on the Passage Comprehension test (PC subtest) that focuses on a child's reading ability. This finding affirms prior research (e.g., Ansary et al., 2012) on academic achievement of males and females. Males score for externalizing behavior subscale (PSC-17) was also higher than the females, and no significant differences existed in the internalizing behavior subscale score of males and females. Trout et al. (2003) also found few studies assessing academic achievement across gender. Mattison and Blader's (2013) study of 196 students with EBD included 76% males. In their reduced regression model to predict academic functioning, gender did not have a significant impact.

Ansary et al. (2012) discovered significantly lower grade point averages (GPAs) for 6th grade males than females in their study of 6th through 8th graders with EBD. These GPAs for males decreased over time. Snyder and Dillow (2012) found females outperforming males from the early elementary years to the high school years of school while analyzing all students, including students in general education and those with disabilities. In a meta-analysis with a focus on gender-specific analyses, Riglin et al. (2014) found lower anxiety was more closely related to higher school grades for females more than males for students with EBD.

Research on gender and achievement relates to the current study because the NLTS2 dataset provides a large enough sample to determine whether these research results also apply to students with EBD. In practice, differences are noticed between male and female students when it comes to their achievement. As this literature review has shown, research findings have been mixed on gender differences in academic achievement in research in general education and in students with EBD, so the current study looked for gender differences and, when appropriate, compared predictors for males and females to see if there was a difference in academic achievement.

Research in race/ethnicity and academic achievement.

Blanchett (2006) notes that a disproportionate number of African American students are placed in high incidence special education categories such as EBD. Lehr and McComas (2015) confirm that an inordinate number of African American students are placed in EBD, and this disparity needs to be researched further. Meece and Kurtz-Costes (2001) argued that achievement differences among racial/ethnic groups are well documented and may also occur in the EBD student population, even though there is less research specifically on students with EBD. Ladson-Billings (2006) contends the achievement gap continues between African

American and White students, despite the efforts of NCLB to close the gap. Some of this effect can be attributed to the higher exclusion rates of African American students than White students in the form of suspensions and expulsions (Goodkind, Wallace, & Wallace, 2008). Wright, Morgan, Coyne, Beaver, and Barnes (2014) argue that, although some researchers (e.g., Blad, 2015) claim discrimination in the suspension rate disparity, suspension rates are based on previous behavior problems and not race. Gregory et al. (2010) contend differences in disciplinary actions contribute to the achievement gap because when students are removed from the classroom setting, they have fewer opportunities to learn. This may lead to the dropout rate of African American students being higher than that of White students (Chapman, Laird, Ifill, & KewalRamani, 2010). As with males as a subgroup, African American students are overrepresented in special education in categories such as EBD (Hosp & Reschly, 2004).

A recent study of students age 3-17 with EBD, Kremer et al. (2016) found African American students scored significantly lower than White students on the WJ-R in all three areas, although African American students maintained higher scores on the Externalizing Behavior subscale. Gonzalez and Cramer (2013) found the African American graduation rate was higher than the Hispanic graduation rate, but not at a statistically significant level. Trout et al. (2003) argue that few studies assess academic achievement across race/ethnicity for those students with EBD. Mattison and Blader (2013) studied 196 students: 66.8% White, 26% African American, and 7.2% other. In their reduced regression model utilized to predict academic functioning, race/ethnicity did not have a significant impact. On average, the results from the National Assessment of Educational Progress (NAEP) shows Hispanic and African American students score significantly lower than White students in mathematics and science (USDOE, 2000). These differences continue throughout the 4th, 8th, and 12th grades, the grades in which the NAEP is

given. These group differences in academic skills exist from the beginning of kindergarten (Morgan, Farkas, & Wu, 2009; West, Flanagan, & Reaney, 2000) and have been associated with internalizing (fear and social withdrawal) and externalizing behaviors (bullying, vandalism, and arson) later in the student's schooling.

Research on race/ethnicity and achievement, much like gender, relates to the current study because the NLTS2 and analyses of the data can add to the literature. As with gender, there are disproportionate numbers of minorities in special education, including EBD, another topic for further research. In practice, differences are noticed between different students of race/ethnicity when it comes to their achievement. There are mixed results in studies of race/ethnicity differences in academic achievement for students in general education as well as those students with EBD, so the current study looked for race/ethnicity differences and, when appropriate, compared predictors for White, African American and Hispanic students to see if there was a difference.

Research on socioeconomic status and academic achievement.

In the Social Model of Disability (Swain et al., 2003), socioeconomic status falls under the category of poverty. Poverty is a barrier that some disabled persons, including those students with EBD, must overcome. Dixon-Floyd and Johnson (1997) noted that individuals with different SES levels have well-documented academic performance differences in general, and they hypothesize this could be true for students with EBD. Mattison and Blader (2013) found 44.9% of students with EBD qualified for free or reduced lunch, an indicator of SES. In their reduced regression model to predict GPA and Woodcock Johnson III (WJ-III, 2001) achievement in broad mathematics (e.g., Calculations and Applied Problems), eligibility for free or reduced lunch as a predictor variable had no significant impact. The Broad mathematics

assessment (Woodcock et al., 2001) is a combination of calculation, mathematical fluency, and applied problem solving (Woodcock, McGrew & Mather, 2001). Trout et al. (2003) claimed of the 70 datasets analyzed in their review of literature, only 34% reported SES as one of the descriptive predictive components of the students with EBD, which makes it difficult to discover the impact of SES as a predictor if the dataset does not gather the necessary information.

Wiley, Siperstein, Bountress, Forness and Brigham (2008) completed a study of 140 K-6 students in 36 elementary schools to examine the relationship between SES and academic characteristics of students with EBD. The Massachusetts Department of Education (MDOE, 2010) reported that 68% of students were receiving free or reduced lunch, and, on the mathematics section of the Massachusetts Comprehensive Assessment System (MCAS), findings indicated significantly lower scores across school income levels as compared to their non-EBD peers. On both of the WJ-III mathematics subtests (Calculations and Applied Problems), Wiley et al. (2008) determined SES contributed significantly to the scores, and prior academic performance did not have an impact on the scores. SES was determined by the median annual income of the town where the schools were located and the percentage of students receiving free and reduced lunch.

In their study of students with EBD, Wiley et al. (2008) compared higher-income SES schools (schools with 20% or fewer students eligible for free or reduced lunch), and lower income schools (schools with 70% or more children eligible for free or reduced lunch). In their study, 39 students attended the 15 higher income schools. Of the sample, only 15% of the students were eligible for free or reduced lunch. Those students had average scores on the range of tests, and the sample included fewer students with EBD proportionally compared to the lower SES schools. Ten schools and 64 students made up the lower income schools category. Of those,

92% of the students were eligible for free or reduced lunch. They scored on the low range on the tests, and the sample included more students with EBD proportionally when compared to the high-income schools. Coutinho and Oswald (2005) found that lower income schools normally serve a higher percentage of students with EBD. Costello, Compton, Keeler and Angold (2003) also found more students with EBD with lower SES than with higher SES in their population sample and found that lower SES students tend to exhibit more EBD behaviors. A 20-point average difference on the tests existed between those schools identified as low-income, and those schools identified as high-income schools. High income schools scored higher on the tests than the low-income schools. Higher school income predicted higher WJ-III scores in every regression model. Regression analysis of school income as a predictor of academic achievement showed a strong relationship for students with EBD. Twenty-five percent of the variance in the Calculations subtest was attributed to school income level while 29% of the variance in Applied Problems subtest test was attributed to SES level (Wiley et al., 2008).

Ansary et al. (2012) proposed the explanation that high-income students were protected from long-term effects of their EBD. These include, but are not limited to, getting in trouble for acting out and bullying. High-income students typically have access to more resources, so they would get treatment sooner and help to restore some normalcy in their lives. Low-income students may not have the resources to allow them to overcome effects of their behaviors. Wigfield, Eccles, Schiefele, Roeser and Davis-Kean (2006) suggest that lower income students underachieve because of the quality of schools in their neighborhoods, lack of resources for both advanced and remedial classes, safety problems, and the lack of trained teachers. In the Great Smoky Mountains Study (Costello et al., 2003), when families moved out of poverty because of

the new economic opportunities the casinos provided, behavioral symptoms of their youth decreased over time, and their overall behavior improved.

The research on SES relates to the current study because the current study analyzed secure data from NLTS2 that can address differences in SES levels in predicting academic achievement far better than studies that use free and reduced lunch percentages as predictors of SES. Household income reported by the parent/guardian is a more accurate indicator of SES than free and reduced lunch status.

Research in parent/guardian characteristics and academic achievement.

In the Social Model of Disability (Swain et al., 2003), parent/guardian characteristics fall under the category of poverty. Since a parent/guardian's work status and education status can play a role in overall quality of life, students with EBD may experience poverty, a barrier that they and their families must overcome. Klebanov, Brooks-Gunn and Duncan (1994) argue that the literature on academic achievement shows that parent education is an important predictor. Most of the literature (e.g., Jimerson, Egeland, & Teo, 1999) on parent's education finds a positive, direct correlation on academic achievement. Several studies (e.g., Haveman & Wolfe, 1995; Pleck, 2010) examine the impact of parents' education on the academic success of their children. Pipere and Mirena (2017) found in a survey of 9th graders that parent education was one of the top factors in academic achievement in adolescents.

Little research is available about parent/guardian's work status as a predictor of academic achievement. Most of the research is tied to SES and does not specify whether the parents/guardians are working full time, working part time, or not working, which is another gap in this research that needs to be addressed. The research on parent/guardian characteristics is

relevant to the current study because NLTS2 data is available. Education attainment or lacking thereof, can have long term effects on future generations.

Summary of Literature Review

In conclusion, concern about the lack of academic achievement for students with EBD is growing. The studies reviewed provide evidence for achievement gaps regarding gender, race/ethnicity, academic placement, SES, and parent/guardian characteristics. The current study will investigate the relationship between mathematics achievement for students with EBD and the set of predictor models discussed. A better understanding of the relationships between the predictors and mathematics achievement of students with EBD will inform the development and implementation of more effective interventions and policies.

Chapter 3: Methodology

This chapter include the research questions, the rationale for the methodology, and the research design, including the setting, the overall and sample populations for the analysis. The chapter also describes the data collection process, instrumentation, the statistical analysis procedures applied, the validity of interpretation, limitations, and ethical considerations of the present study.

Research Questions

This study was undertaken to address the following questions:

1. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and SES) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States?
2. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and SES) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States of a specific gender or race/ethnicity?
    a) Are the predictors different if males and females are analyzed separately?
    b) Are the predictors different for students who identify as White, African American, and Hispanic when analyzed separately?

National Longitudinal Transition Study 2 (NLTS2)

The NLTS2 (2000a) was funded by the United States Department of Education (USDOE) as a follow-up to the first National Longitudinal Transition Study (NLTS), which spanned from

1985 to 1993. NLTS was used to assess the IDEA (USDOE, 2010a) and to examine how students with disabilities were being served under that act. NLTS2 revisited many of the topics addressed in the first NLTS, which was designed and conducted by SRI International (2000). NLTS2 also gathered data on issues for youth after they left secondary school and transitioned into social activities, adult programs and services, education, residential, and social domains. NLTS2 data was collected for over 10 years from the parents, youth, and schools and provided insights into the transition to early adulthood for students with disabilities. NLTS2 (2000a) included 11,270 U.S. youth who were of the ages of 13-16 at the inception of the data collection.

The U.S. Department of Education required that the NLTS2 (2000a) must meet the following requirements to serve the multiple purposes for which it was created:

- There must be a focus on students. It must produce accurate estimates about the special education characteristics and the outcomes of the programs. Sample local education agencies (LEAs) were selected and then the students were selected from those sample LEAs.
- There must be a generalization for each disability category. There must be a reasonably precise representation of the various disability categories for those ages 13-16 and in the 7th grade or above.
- The data must be longitudinal in nature. It was to cover a nine-year period, and the initial sample must be large enough to maintain sufficient numbers in the 9th year of the data collection after allowing for attrition. The NLTS had a 6% loss per year or iteration and the NLTS2 was more conservative and planned for an 8% loss per year.
- Multiple data sources are utilized. There is a need to record more data than a test score. Some students will not have information from all the data sources, and this decreased

sample size limits and its use for some purposes. There must be enough students to accommodate missing information from the various data sources.

- The design and data collection must support multiple analytic purposes. The richness of the NLTS2 database supports a variety of analyses that will have data collection design implications and must be large enough to support subgroup and secondary data analysis.
- It must be comparable to the NLTS, which was the original data collection (1985-1993). It must permit comparisons between the two such as changes in the experiences and achievement of students over the years.

The NLTS2 collected in-depth longitudinal information on the secondary school and post-secondary experiences of 13- to 16-year-olds who were in at least the 7th grade and received special education services at the beginning of the 2000-2001 school year. The NLTS2 was collected in five waves, at 2-year intervals. The three main data collection sources were (1) telephone interviews with youth or parents, (2) direct assessment (i.e., WJIII subtests), in person interviews of students, and school personnel, and (3) information about the school. Telephone interviews included parents answering questions about their child's experiences and, when possible, students answered questions about their own experiences. Students who could not or would not engage in a phone interview were given the option to complete written or web-based versions of the surveys. Direct assessments occurred at the school and were performed by on-site professionals. These professionals were trained to conduct and analyze the assessments. Student interviews were performed at their school by these professionals as well.

Setting.

The NLTS2 utilized a random selection design in which researchers chose school districts based on region, SES, and enrollment. The districts had the option to decline participation. The

districts that chose to participate were asked for each students' grade, date of birth, and classification of disability. Data was collected on

- characteristics of the students in special education;
- characteristics of the households of students selected;
- the experiences of students in special education including their schools, programs, services, and extracurricular activities;
- students' experiences as they leave secondary school and move on to adult programs and services;
- measures of outcomes in secondary schools and after high school of the youth regarding education, employment, social and residential domains; and
- factors in the students' secondary and after-high-school experiences that contributed to more positive outcomes.

The NLTS2 (2000c) consisted of five waves of data collection spaced at two-year intervals. The first wave of the NLTS2 included the following initial data collection activities: (1) parent telephone interviews (see Table 1); (2) direct assessments and student in-person interviews; (3) teacher surveys; (4) school program survey; (5) school background survey; (6) transcripts; and (7) some analysis of the data collected. The second wave of the NLTS2 included follow-up activities for Wave 1 (i.e., parent telephone interviews, direct assessments, teacher survey, school program survey, school background survey, transcripts, analysis of data) and added youth telephone interviews as a data collection tool. Waves 3 and 4 included only parent and youth telephone interviews, direct assessments, transcripts, and analysis of data collected. Wave 5 included parent and youth telephone interviews and analysis of the data collected. Direct assessments and student interviews were only done once for each student. Students aged 16-18

were assessed in Year 2, during Wave 1, while students under 16 years were assessed in Year 4 during Wave 2. The primary goal of the NLTS2 was longitudinal data analysis, with the possibility of eventual comparisons. However, there are challenges regarding comparisons of the two groups of students with EBD in Waves 1 and 2. First, the older students in Wave 1 did not undergo similar tracking and testing as the Wave 2 students experienced. In addition, the Wave 2 students may not have had access to the same teachers and resources as those tested in Wave 1 due to teacher attrition, movement among schools, and professional development and education. In addition, potentially varied or new interventions and policy changes over time may have also occurred in the meantime.

Table 1

Summary of Planned Data Collection Activities over the Nine Years of the Study. Reprinted from "National Longitudinal Transition Study – 2 (NLTS2) Study design, timeline and data collection plan," by SRI International, 2000.

	Year 1 2000-2001	Year 2 2001-2002	Year 3 2002-2003	Year 4 2003-2004	Year 5 2004-2005	Year 6 2005-2006	Year 7 2006-2007	Year 8 2007-2008	Year 9 - 2008-2009	Year 10 2009-2010
Parent telephone	X		X		X		X		X	
Youth telephone interviews			X		X		X		X	
Direct assessment/student in-person interviews*		X		X						
Teacher survey		X		X						
School program survey		X		X						
School background		X		X						
Transcripts		X		X		X		X		
Analysis	X	X	X	X	X	X	X	X	X	X

*Direct assessment/student interviews will be done once for each student: students aged 16 to 18 in year 2 of the study will be assessed in year 2, and those who are younger than 16 in year 2 will be assessed in year 4 when they are 16 or 17 years old.

Research Design

The current study employed a prediction-type design based on the NLTS2 (2000a) dataset to investigate the relative importance of student characteristics and parent/guardian characteristics for predicting achievement in mathematics for students with EBD. A prediction study requirement is such that the predictor (independent) variables are measured some time before the criterion (dependent) variable is measured, thus data collected on student characteristics and parent or guardian characteristics during the first wave of the NLTS2 were utilized as predictors of mathematics achievement of students with EBD collected later in subsequent waves in the NLTS2.

Stratification was utilized because it increased precision of estimates by

- decreasing variance between strata,
- ensuring types of LEAs are proportionally represented,
- improving comparisons with other research findings, and
- making NLTS2 responsive to concerns voiced in policy debates.

For the purposes of this collection of data, an LEA is identified as having teachers and administrators operating the schools of students; it excludes supervisory unions, public and private agencies, Bureau of Indian Affairs schools, correctional facilities, schools in United States territories, and LEAs with fewer than ten students. These schools would have an estimated enrollment of less than one student in special education in the range of ages under consideration.

The first stratum utilized was region. The 50 U.S. states and the District of Columbia were divided into regions. Policy and funding differences exist by region, and this step helped ensure most areas could be included. The U.S. regions, as defined by the United States

Department of Commerce, the Bureau of Economic Analysis, and the NAEP, are Central (12 states), Northeast (12 states), Southeast (12 states), and West/Southwest (15 states).

The next stratum was LEA size. Quality Education Data (QED, 1999) maintains a universal public-school file that was utilized to construct the sampling frame, or a list of the LEAs forming the population from which a sample is taken. A large LEA was defined as having an estimated enrollment of 4,661 to 14,930. A medium LEA had an estimated enrollment of 1,622 to 4,660, and a small LEA had an estimated enrollment of 11 to 1621 (NLTS2, 2000a).

The third stratum was community wealth. The NLTS2 included measures of the Orshansky index (the proportion of student population living at or below the federal poverty level), a well-accepted measure (Fisher, 1992). The four categories each included about 25% of the student population from grades 7-12. A high community wealth rating was 0% to 13%. A medium community wealth rating was 14% to 24%. A low community wealth rating was 25% to 43%, and a very low community wealth rating was more than 43% on the Orshansky Index.

Because of the expected rate of refusal to participate, 2,634 LEAs were invited to participate. Of those, 497 (18.9%) agreed to participate. Previous experience with NLTS found LEAs typically declined participation because of concerns that the confidentiality of student records might be compromised during the process. In the initial data collection, 55% of the LEAs decided not to participate. They declined, did not respond, or made it too difficult (i.e., lengthy requirements, not responding in a timely manner) for the NLTS2 researchers to include them. Larger LEAs were intensely recruited because they contained more students with disabilities for the sample. The smaller LEA recruitment was less intensive because there were so many of them to contact. This creates a potential for bias because the LEAs may differ from the larger LEAs in their practices and their student populations. There were 501 LEAs that provided students for the

sample representing approximately 14% of those students invited to participate. Several analyses were conducted to ensure the stratified random sample approach did not have a skewed distribution of variables. After analysis, it was determined the sample LEAs underrepresented African American students and college-bound students. It was also determined the sample included an overrepresentation of Hispanic students and rural area LEAs. Analysis of region, size and wealth of the LEA sample, both weighted and unweighted, confirmed the weighted sample more closely resembled the LEA U.S. population (NLTS2, 2000c). The weighted sample accommodated for the underrepresentation of African American students and those who were college-bound, and it also corrected for the overrepresentation of Hispanic students and rural area LEAs. The weighted sample was a better representation and proved to be generalizable by including the appropriate proportions of students from all categories.

The sampling approach included two stages. The primary sampling unit was the LEA, and the secondary sampling unit was the individual student. NLTS2 researchers hypothesized that a sample of 11,500 students with disabilities would yield a sample size representative and sufficient to the analytic needs of the NLTS2 through the final wave. Their goal was to gather data on 1,250 students in each disability category (including students with EBD) except for three categories that occurred at lower rates. The approximate number of students, ages 13-16, being served in special education in the United States for serious emotional disturbance is 230,081 or approximately 1.15% of the students of those ages. The target standard of error for the NLTS2 was 3.6% in Year 9 for the most populous categories, including EBD. The expansion of the sample size to achieve this standard of error for all categories was determined to be cost prohibitive (NLTS2, 2000).

Overall and Sample Populations

Overall population.

NLTS2 (2000a) included 11,270 youth from the entire nation from the ages of 13-16 since the inception of the data collection. The sample population includes approximately 1,000 students with EBD (Wagner & Cameto, 2004).

Sample population.

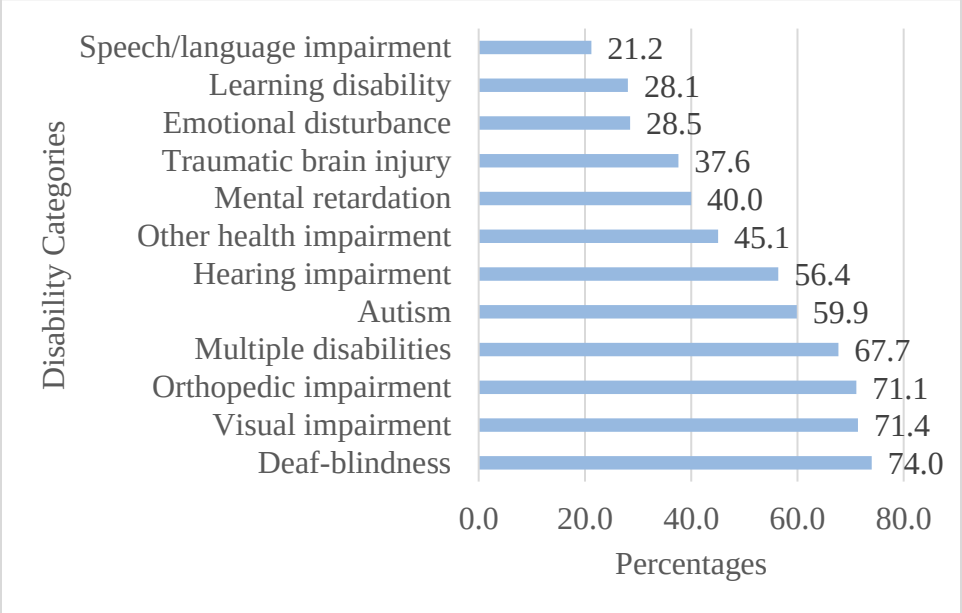
For this study, the sample was created by first drawing youth from Waves 1-5 who had EBD as a primary diagnosis. The five waves of data collection were conducted at two year intervals. Each wave included three main data collection methods: telephone interviews with parents and youth, direct assessments and in-person interviews with the students while they were in secondary school, and school data including surveys from students, parents, teachers, and administrators (NCSER, 2009). Data collection was designed to provide information on the educational, vocational, social, and personal experiences of students from adolescence to early adulthood. Unweighted sample demographics used for this study are

- race/ethnicity categories,
- academic placement,
- parent or guardian characteristics (i.e. work status, education status),
- the three family income categories (i.e., $25,000 or less, $25,000 to $50,000, and above $50,000), and
- binary gender categories.

Table 2 shows the self-reported disability percentages of students from the interview/phone surveys during Wave 2 of the data collection (NLTS2, 2000b).

Table 2

Youth's Self-reports of a Disability, by Disability Category. Reprinted from "National Longitudinal Transition Study – 2 (NLTS2) Study design, timeline and data collection plan," by SRI International, 2000.



Access to Site

Gaining Access and Entry.

Institutional Review Board (IRB) approval from Kennesaw State University (KSU).

A category 4 exemption from KSU's IRB was requested because the current research utilizes existing data and secondary datasets. The subjects cannot be identified from the data obtained from the National Center for Education Statistics (NCES) due to the use of non-traceable subject numbers and all information will be reported in aggregate.

Applying for a restricted-use data license from NCES.

The first step to applying for a restricted-use data license from NCES is to designate a Principal Project Officer (PPO), Senior Official (SO), and Systems Security Officer (SSO). Each must sign the required documents for the license. The PPO is responsible for the day-to-day

operations of the requested data and must be at least a post-doctoral fellow. The SO has the legal authority to sign the request on behalf of the institution. The SSO will oversee the security of the data. The SSO must be a full-time employee of the institution or organization applying for the license. The PPO can serve as the SSO (NCES, n.d.).

The PPO must submit a formal request for a license from the Institute of Education Services (IES). In the request, it must note why public use data is not sufficient for the research needs. The public data did not include special education status, which was necessary for the appropriate analyses within the current secondary research design and examinations. Also, the formal request must include the final research objective and explain how the data will be utilized. The sector of the community served must be clear and IES must be convinced that the data will not be utilized for any other purposes than those stated in the request. Once the IES approves the formal request, then the PPO must submit the following three documents: signed IES license document, notarized executed affidavits of nondisclosure, and a signed security plan. Once approved information was sent to the campus-based PPO about receiving the requested materials, and the data was received within a matter of months (NCES, n.d.).

Obtaining consent.

The process utilized by NLTS2 researchers to obtain consent for youth to participate in NLTS2 included parental consent for students under 18 years and student consent once students turned 18 years (NLTS2, 2000c). At the completion of the parental interviews, the interviewer described all the components of the data collection and asked parents to authorize their child's participation in the data collection by participating in the assessment and allowing the school to release pertinent school information. A form was mailed to the parent to return in a postage-paid envelope indicating their agreement or refusal to allow the student in the data collection. When a

student reached the age of 18, a similar consent was required. Active consent (a positive indication of agreement) and passive consent (not refusing to participate) were their options. Students who did not return their consent forms were retained in the data collection. The letter to the parents/guardians clearly stated the consent forms be returned and that, if not returned, students would be retained in the study. Students retained would have missing data because the parent/guardian surveys would not be completed. An included letter from the U.S. Family Educational Rights and Privacy Act (FERPA) stated that for the purposes of NLTS2, the data collection contractor is an agent of the U.S. Department of Education, and schools and districts can share information about students with the data collection contractor.

Using the NLTS2 Dataset

Justification for analyzing a large dataset.

Because the population of students with EBD was approximately 1.15% of the population of 13-to-16-year-old students in the U.S. at the time of the study (NLTS2, 2000c), a large longitudinal dataset is necessary for the analysis of the education of students with EBD (Wagner et al., 2005). Longitudinal and cross-sectional data are vital in building the knowledge base needed regarding students with EBD. However, attrition is an issue with a longitudinal collection because generalization can be compromised if the subjects who stay in the data collection differ from those that drop out. Large sample sizes in the beginning can alleviate this issue later in the data collection. A cross-sectional dataset only provides information about students at one point in time. It is a snapshot of what is occurring in the population in one instance and does not follow individual trajectories. This type of dataset would not allow for certain research questions to be explored. Some research on students with EBD is limited by these constraints, which makes it difficult to research best practices and develop policy. A longitudinal design can examine

relationships between past experiences and later achievement. Predictions can be made by reviewing earlier factors, both alone and in combination. Restricted-use data is essential because it provides a level of demographic detail for a large sample that is rarely provided in existing studies (NCSER, 2009). This large sample size and research design helps protect the confidentiality of the survey respondents due to untraceable student identities. The data collection included the following variables: disability category, gender, age, race/ethnicity, academic placement, SES, parent/guardian characteristics, and mathematics assessment scores (USDOE, 2010b).

The NLTS2 design ensured that sufficient numbers of participants were included from each of the 12 disability groups surveyed, including EBD. Wagner et al. (2005) stated NLTS2 (2000a) is an exemplar of the types of studies needed to supply crucial information to the field of special education. The data collection has the potential to include information on the characteristics, experiences, and outcomes of students with EBD. Analysis of these data has possible implications for practice, research, advocacy, and the development of policies to assist students with EBD. The NLTS2 gathered repeated measures of the phenomena under study, and the factors potentially associated based on suggestions from prior concepts and theory (Wagner et al., 2005). Because the schools were randomly selected and then students were randomly selected from those schools, the results of data analyses are generalizable to the rest of the special education population in the U.S. for the categories under study.

Appropriateness of NLTS2 for current study.

NLTS2 (2000a) is appropriate for the current study for several reasons. More information is essential regarding policies and the design of programs most effective in meeting the behavior, social, and academic needs of students with EBD. Most of the existing research

(e.g., Greenbaum et al., 1996; Lane et al., 2008) has been based on convenience samples which limit the types of analysis that can be conducted. The NLTS2 is specifically designed to provide information on special education students including students with EBD. More information can be extrapolated from factors that affect academic achievement for students with EBD including the data in the NLTS2. This data collection utilized multiple data sources, including interviews, surveys, and assessment scores. The longitudinal design of the data collection can illuminate the respective contributions of programs over time to the students' outcomes.

Instrumentation (reliability and validity) of the NLTS2 dataset assessments.

Research editions of Woodcock Johnson (WJRIII) were selected as the direct assessment of achievement for the NLTS2 (See Figure 3). This assessment is widely utilized in the special education field and utilized for progress and testing eligibility. WJRIII is well designed regarding psychometric (e.g., knowledge and abilities) properties and was normed in 1998-1999 for those aged 2 to 90 years. Of more than 25 possible WJRIII tests, the five subtests listed in Figure 3 were selected to represent an emphasis on core academic skills. These tests were utilized in the Special Education Elementary Longitudinal Study (SEELS), and this selection of tests enabled comparisons between the two studies. The Calculations subtest measures a student's ability to do paper and pencil math computations. The items range from simple numerical operations to geometry, trigonometry, and other operations as deemed appropriate. Students are not required to make decisions about what data to use or which operation is needed to obtain the answer. The Applied Problems subtest measures a student's ability to analyze and then solve math problems. Many of the items require the student to read the problem, to determine what mathematical procedure must be done, and complete the problem. Application of skills indicates a shift in emphasis on learning a skill to applying it, which is an extension of the skill set under study.

POTENTIAL DIRECT ASSESSMENT INSTRUMENTS, ASSOCIATED TASKS, AND ESTIMATED TIME
STANDARD ASSESSMENT

	Assessment	Task	Estimated minutes
Reading	Woodcock-Johnson Research Edition - Letter-Word Identification	Student identifies isolated letters-and words; it is not necessary that the student know the meaning of any words correctly identified.	5
	Woodcock-Johnson Research Edition - Passage Comprehension	Student reads a short passage and identifies a missing word.	5
Math	Woodcock-Johnson Research Edition - Applied Problems	Student analyzes and solves problems in mathematics; student decides the appropriate mathematical operations to use and which of the data to include in the calculation.	5
	Woodcock-Johnson Research Edition – Calculation	Student performs mathematical calculations ranging from simple addition to calculus, but is not required to make decisions about what operations to use or what data to include.	5
Aptitude	Woodcock-Johnson Research Edition – Composite measure of verbal and visual ability	Student completes phrase with words that indicate appropriate analogies; although the vocabulary remains relatively simple, the relationships among the words become increasingly complex.	5
Self-concept	Student Self Concept Scale (SSCS) - Portions of academic social and self-image subscales (secondary form)	Student rates his/her self-confidence in response to a variety of academic and social questions.	8
Attitude toward School	School Attitude Measure (SAM) - Motivation for schooling and student's sense of control over performance subscales (5 forms based on grade level)	Student is asked a series of semantic differential items related to engagement in school and the learning process.	14

Figure 3. *Estimated Times for WJRIII Standard Assessment. Copyright 2010 by WJRIII.*

Data Collection Procedures of NLTS2 dataset.

Data collection at each school also included teacher surveys on each individual student completed by the teacher who taught the child in the first academic class of the day. Because there is no information about what subject the student is taking during the first academic class, teacher characteristics would not be helpful to include as a possible predictor of mathematics achievement. The survey covered classroom practices and the student's achievement in that class. The school program survey was completed by a special education teacher or another staff member who could describe the student's overall school program. The survey questions assessed the program and performance of the student in a broader sense (e.g., accommodations received, student's instructional setting for the entire day, and any vocational or transitional planning experiences). The school background survey was completed by an administrator. It asked for

characteristics of the entire school and data on measures of school performance. Student transcripts were reviewed, and information was gathered on attendance, grades and courses taken during the student secondary school careers. Course-taking patterns were also retrieved from student transcripts.

Procedures for using the NLTS2 dataset.

During the time between the request for materials, receiving approval, and receiving the additional data, descriptive data analysis began on the information that was not constrained by restricted use. Once the restricted data was received, the data was extracted that was necessary to address the research questions of this study. Several files were merged, followed by a series of checks and balances to ensure it was correctly merged in a series of datasets. The descriptive data in the merged file included student characteristics (e.g., gender, race/ethnicity, type of school attended), and parent or guardian characteristics (e.g., mother/guardian's education and work status, father/guardian's education and work status, household income). The datasets were sequestered in a secure and locked university office and only utilized on a stand-alone computer, disconnected from the internet and other networks. The data were locked in a cabinet and the office where the material was housed remained locked and secure the entire time data were with the PPO. Once merging and checking were complete, the regression analyses were completed with independent or predictor variables and the dependent or outcome variables. Once data analyses are completed, the PPO submitted a form to close out the license and the original data was returned to the IES (NCES, n.d.).

Preliminary Data Analysis

For the students with an EBD primary diagnosis who completed the direct assessment (during Wave 1 of the NLTS2, with 95% confidence), students scored an average standard

score of 87.88 with a *SD* = 15.01 on the Applied Problem subtest. The scores ranged from 1 to 112 with an *N* = 420. This standard score is in the low average range based on the classification of the WJIII scores. On the calculation test students scored an average standard score of 86.21 with a *SD* = 17.23. The scores ranged from 1 to 132 with an *N* = 420. This standard score is also in the low average range based on the classification of the WJIII scores.

For all the NLTS2 (2000) students, excluding students with EBD, who completed the direct assessment, (during Wave 1, with 95% confidence), students scored an average standard score of 79.22 with a *SD* = of 22.33 on the Applied Problem subtest. This standard score is in the low range based on the classification of the WJIII scores. The scores ranged from 1 to 118 with an *N* = 4660. On the calculation test students scored an average standard score of 82.34 with a *SD* = 23.96. The scores ranged from 1 to 165 with an *N* = 4720. This standard score also is in the low average range based on the classification of the WJIII scores (SRI, 2007).

T-tests were utilized to compare student achievement scores of students' EBD as their primary diagnosis, and those students without EBD as their primary diagnosis in the data collection. An independent-samples *t*-test was conducted to compare the mean score on the WJRIII Applied Problems subtest of students with a primary diagnosis of EBD and students who do not have a primary diagnosis of EBD in the NLTS2 (see Figure 4). There was a significant difference in the scores for students with EBD ($M = 88.2$) and the scores of students who do not have EBD ($M = 78.8$); $t\ (10) = 3.19$, $p < .01$. Specifically, the results suggest that students with EBD scored higher than the students without an EBD primary diagnosis. The results support the conclusion that students within this study with EBD had mean scores on the Applied Problems subtest that were significantly higher than students with disabilities who do not have a primary

EBD diagnosis.

Subtests	Other health impairment	Visual impairment	Emotional disturbance	Learning disability	Speech/ language impairment	Orthopedic impairment	Hearing impairment	Traumatic brain injury	Autism	Deaf-blindness	Multiple disabilities	Mental retardation
	Mean standard score / standard error											
Passage comprehension	85.8 (1.10)	84.7 (2.33)	84.2 (1.42)	81.9 (1.00)	81.4 (1.15)	78.8 (1.59)	75.6 (1.73)	74.1 (2.96)	69.6 (2.38)	66.3 (3.81)	61.5 (2.66)	55.7 (1.41)
Synonyms/antonyms	95.0 (0.86)	94.0 (1.89)	93.4 (1.12)	89.5 (0.81)	89.9 (0.93)	88.2 (1.23)	84.1 (1.44)	83.7 (1.95)	81.3 (2.16)	75.5 (2.88)	71.6 (2.11)	65.3 (1.06)
Mathematics calculation	88.2 (1.07)	92.2 (2.41)	86.2 (1.22)	86.1 (1.09)	91.7 (1.14)	82.6 (1.64)	91.5 (1.42)	80.0 (2.65)	80.2 (2.39)	77.7 (3.39)	65.6 (2.89)	61.4 (1.43)
Applied problems	88.4 (0.85)	87.6 (2.23)	88.2 (1.06)	88.3 (0.77)	87.9 (0.98)	79.8 (1.44)	83.9 (1.32)	80.6 (2.23)	71.2 (2.36)	72.8 (3.45)	62.9 (2.42)	63.4 (1.31)
Social studies	87.7 (0.99)	88.4 (2.28)	87.8 (1.23)	86.6 (0.90)	85.6 (1.01)	84.3 (1.27)	80.5 (1.57)	79.1 (2.47)	73.9 (2.42)	73.8 (3.03)	67.5 (1.95)	65.1 (0.98)
Science	90.0 (0.94)	88.8 (2.05)	89.3 (1.25)	87.6 (0.91)	85.6 (1.02)	83.4 (1.28)	75.4 (1.77)	80.0 (2.74)	75.7 (2.21)	68.4 (3.65)	69.3 (2.04)	67.0 (1.15)

Figure 4. Mean standard scores of youth with disabilities on Woodcock Johnson III subtests, by disability category (USDOE, 2010).

An independent-samples *t*-test was conducted to compare the mean score on WJRIII Calculations subtest of students with a primary diagnosis EBD and students who do not have a primary diagnosis of EBD in the NLTS2. There was no significant difference in the scores for students with EBD (M = 86.2) and students who do not have EBD (M = 81.56); t (10) = 1.49, p = .17. Specifically, the results suggest that students with EBD scored higher than the students without an EBD diagnosis. The results confirm that the difference between the mean scores of those who do not have a primary EBD diagnosis and those who do have a primary EBD diagnosis on the Calculations subtest are not large enough to be statistically significant.

Data Analysis Procedures

Forward selection stepwise regression analyses were performed to investigate the influence of predictors. Each predictor was utilized alone to predict mathematics achievement in students with EBD. Multiple regressions utilizing the forced-entry procedure were employed to investigate the relative impact of each predictor variable when it was analyzed concurrently with

other variables to predict mathematics achievement in students with EBD. Stepwise multiple regression analysis was utilized for predicting mathematics achievement in students with EBD. The following data assumptions were checked, based on Philadelphia Statistics Solutions (n.d.) recommendation, to ensure that multiple linear regressions were appropriate for analyzing the data:

- Level of measurement – Multiple linear regression involves two or more independent variables and one dependent variable.
- Sample size – Total N based on the ratio of cases to independent variables.
    - Minimum five cases per predictor (5:1) – enough data to provide estimates that are reliable.
    - Ideally at least 20 cases per predictor (20:1), with an overall N =100.
- Normality – When residuals of the variables are normally distributed, the findings are more reliable and stable.
    - Check univariate descriptive statistics (i.e., M, SD, skewness and kurtosis). Skewness greater than two is considered non-normal and depending on sample size kurtosis greater than seven is non-normal (West, Finch, & Curran, 1996).
    - Impose a normal curve over the histogram and visually check for normality.
- Linearity – There must be a linear relationship between each independent variable and the dependent variable to use multiple linear regression.
    - Check correlations and scatterplots to determine if there is a linear relationship between each dependent variable and each independent variable.
- Homoscedasticity – Determine if the bivariate distributions are evenly spread about the best fit line.

    - Check scatterplots between the dependent variable and each independent variable and/or check the scatterplot of the residuals and the predicted values. There should be no clear pattern in the distribution. If there is a pattern, such as a cone-shaped, pattern the data is heteroscedastic.
- Multicollinearity – Determine if the independent variables are highly correlated to each other.
    - Examine bivariate scatterplots and correlations between each of the independent variables (anything above 0.7 is over correlated).
    - Check the collinearity statistics in the table of coefficients.
        - Variance Influence Factor (*VIF*) should be low (1-10).

Validity of Interpretation

Given the random selection of schools to participate in the stratified data collection, findings can be generalized for students with EBD in the United States. Because the data collection was longitudinal, the findings can be generalized more consistently than previous studies that utilized convenience or cross-sectional samples without randomization. The current data collection covered a 10-year period, and the data collection process has been validated and determined to be reliable. This ensures the NLTS2 can be generalized to a greater degree, enabling review at the policy change level, and the potential trajectories of achievement of students with EBD, particularly by gender, race/ethnicity, and SES.

Limitations and Delimitations

Built-in limitations of a longitudinal or cross-sectional design must be considered. Attrition is problematic in studies such as the NTLS2, and thus data may be missing in the later waves of the data collection. Also, ensuring enough data for conducting a particular statistical

analysis is key in deciding which methods are appropriate. Direct assessments are only conducted once for each student in the NLTS2. Direct assessments were conducted for students age 16-18 during Wave 1 of the data collection and for students age 16-17 during Wave 2 of the data collection. The primary role of the NLTS2 direct assessment was as a predictor of later possible explanatory variables in evaluating accomplishments before and after high school. This contributes to understanding the trajectory of academic achievement for an adolescent, particularly one who is a student diagnosed with EBD.

Chapter 4: Findings

This chapter will discuss the analysis of data, results for the sub samples, and the interpretation of the results of the data collection. The chapter will include descriptive data analysis for all participants, students with EBD, and the group of students with EBD who completed two WJRIII subtests: Applied Problems and Calculations. Stepwise regression was utilized to determine the predictors that may have an influence on mathematics achievement scores.

Descriptive Data

Total NLTS2 sample.

NLTS2 is a longitudinal data collection of a large, nationally representative sample of all U.S. students ranging in age from 13 through 16 and in at least 7th grade on December 1, 2000, including those receiving special education services. At the time of the final data collection, the oldest youth was 26. Each of the 12 federal special education disability categories had statistical summaries generated from NLTS2. These summaries allowed for generalization of the information to the entire group of special education students. The entire NLTS2 included 9,230 students overall (see Table 3).

Table 3

Descriptive Statistics of Students and School Setting

	Total NLTS2 Population %	Students with EBD %	Students with EBD & assessment %
Gender			
Male	64.8	73.0	73.7
Female	35.2	27.0	26.3
Race/ethnicity			
White	60.0	65.3	68.6
African American	18.9	16.7	16.3
Hispanic	17.3	15.2	11.3
Asian/Pacific Islander	2.2	0.8	1.4
American Indian/Alaska Native	0.0	0.0	1.4
Multiracial/other	0.3	1.8	1.0
School attended previous year			
Regular school	82.1	71.8	78.1
Serve only students with disabilities	13.6	17.3	12.9
Specializes in subject area	1.0	0.8	0.2
Vocational/technical school	0.8	1.1	1.5
Charter School	0.4	0.4	0.2
Alternative School	1.5	6.2	5.0
Another kind of school	0.2	0.6	0.5
Home instruction by a professional	0.2	0.9	0.0
Home schooling by parent	0.0	0.2	0.2
Medical/convalescent center	0.1	0.3	0.2
Mental health facility	0.0	0.2	0.5
Correctional/juvenile justice facility	0.1	0.2	0.5

For statistical analysis, especially regression, standard scores for the WJIII are preferable to percentile ranks when reporting scaled data (NCSER, 2009). Standard scores communicate average performance relative to a comparison group by age or grade. Standard scores have a mean of 100 and a *SD* = 15. Half of the students score below the mean and half score above the mean. Most youth (95%) will perform within two standard deviations of the mean, between 70 and 130. Approximately 2% of the sample score more than two standard deviations below the mean. The Washington Center of Cognitive Therapy (WCCT, n.d.) classifies standard score ranges as follows: 131 and above, very superior; 121-130, superior; 111-120, high average; 90-110, average; 80-89, low average; 70-79, low; and 69 and below as very low.

For the entire NLTS2 (2001) population, with 95% confidence, students scored an average standard score of 79.93 with a *SD* = 21.96 on the Applied Problem test. The scores ranged from 1 to 117 with an *N* =5070. On the Calculation test students scored an average standard score of 82.65 with a *SD* = 23.51. The scores ranged from 1 to 165 with an *N* =5130.

Students diagnosed with EBD in the NLTS2 sample.

Participants in this data collection were students who were identified as having a primary diagnosis of EBD. This subsample population consisted of 930 students. Their ages ranged from 13 to 16, and they were receiving special education services in December 2000. Gender, ethnicity, school characteristics, and household characteristics were reported during Wave 1 of the NLTS2. The subsample includes all the students with EBD as their primary diagnosis in the population sample, 420 students with EBD had WJRIII assessment data in Wave 1, so those are the subjects included in the current data analysis related to mathematics academic achievement. The representation of other school settings designations (i.e., specializes in a subject area, vocational/technical school, charter school, etc.) were similar across the NLTS2 and the students

with EBD populations.

Approximately 7% more students with EBD came from a household with an income of $25,000 or less when compared to the overall NLTS2 population consisting of all the special education students, and 5% fewer students with EBD had a household income of $50,000 or more (see Table 4). For students with EBD, mother/female guardian's education status is very similar to the status for the NLTS2 population. Under the category of mother/female guardian's work status for students with EBD, about 4% more are not employed and 4% fewer are employed full time when compared to the NLTS2 population. For the father/male guardian for students with EBD, the education levels are within 2% of those of the NLTS2 population. Lastly, the work status of the father/male guardians for students with EBD includes approximately 4% more not employed and 4% fewer employed full time when compared with the NLTS2 population. An interesting statistic is that for both the entire NLTS2 population and the population of students with EBD about 60% more of the father/male guardians have full time employment when compared to mother/female guardians.

Table 4

Descriptive Statistics of SES and Parent or Guardians

	Total NLTS2 Population %	Students with EBD %	Students with EBD with assessment %
Household Income			
Under $25,000	33.8	40.8	37.2
$25,001-$50,000	30.5	28.6	29.7
Over $50,000	35.7	30.7	29.2
Mother/Female Guardian			
Less than high school	17.4	17.6	17.4
High school diploma or GED	34.7	31.7	38.3
Some college	28.1	31.2	31.9
BA or higher	19.7	19.6	12.5
Father/male Guardian			
Less than high school	15.8	17.3	17.3
High school diploma or GED	35.8	33.5	33.5
Some college	24.0	25.9	25.9
BA or higher	24.3	23.3	23.3
Mother/female Guardian			
Not employed	31.6	34.8	30.4
Employed part time	21.5	21.3	19.4
Employed full time	47.0	43.9	50.1
Father/male Guardian			
Not employed	12.3	15.8	15.9
Employed part time	4.6	4.9	4.2
Employed full time	83.1	79.3	79.9

Sample of students with EBD and direct mathematics assessment.

The students in this subsample of the NLTS2 were those with a primary diagnosis of EBD and who had also completed the WJRIII direct mathematics assessments Applied Problems and Calculations in Wave 1 of the NLTS2 data collection. This subsample population included 420 students with EBD in the nationwide data collection.

Ethical considerations.

Although no direct information (e.g., name, school attended) was provided in the NLTS2, the length to which the coded data is protected ensures individual students, teachers, and schools are safeguarded from being identified in the reporting of this study or other studies conducted utilizing the NLTS2. The surveys and interviews are coded utilizing only identifiers, and measures were taken to ensure the information was secure and under stringent security to protect the identities of those involved. Parents/guardians had the right to decline participation in the data collection for their child at any time if they did not feel it was appropriate. All results in the current study are reported in aggregate and not individually as to protect the identity of the students.

Data Analysis

Stepwise regression.

Applied Problems subtest for all students with EBD.

The assumptions of multiple linear regression were tested. Multiple independent variables were tested as possible predictors of the dependent variable. The sample size (N = 370) was above the suggested minimum of N =100. Linearity was checked by looking at the scatter plots of each independent variable with the dependent variable (the Applied Problems subtest). All independent variables had linear relationships with the dependent variable. Tests for normality were conducted. A histogram with a normal curve imposed was inspected for

skewness (*S* = -1.92) indicating a medium deviation from the normal curve and kurtosis (*K* = 7.25), larger deviation from the normal curve. Skewness was within the parameters of normality, but kurtosis was just outside the parameter of seven (West et al., 1996), which would indicate that it was just beyond the edge of non-normal.

Tests for multicollinearity indicated no collinearity was present (*VIF* = 1.01 father/male guardian's education, 1.01 student's race/ethnicity, 1.00 school the student attended last year) because they all fell within the guidelines of no collinearity. All correlations were well under the criteria of 0.7 or less, with the highest correlation being between the father/male guardian's education and the mother/female guardian's education ($r = .49$, $p < .01$). Homoscedasticity was inspected utilizing a scatter plot of the residuals and predicted values. There was no pattern in the scatter plot as the distributions were evenly spread about the line of best fit.

Because there was a borderline violation of normality, a rank based inverse normal transformation (INT) was utilized to analyze the data in a more normal distribution. The assumptions of multiple linear regression were tested using the transformed data. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (*N* = 370) was over the suggested minimum of 100. Linearity was checked by examining the scatter plots of each independent variable with the dependent variable (the Applied Problems subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (*S* = -.02) indicated a small deviation from the normal curve and approximately symmetric and kurtosis (*K* = -.22) also indicated a small deviation from the normal curve and hence approximately symmetric (see Table 5). Skewness and kurtosis were within the parameters of normality.

Table 5

Descriptive Statistics of Variables

	N	M	SD	Skewness	Kurtosis	R^2	Regression Adj. R^2	p value
Calculations Subtest	370	86.72	17.15	-0.38	0.52	0.07	0.06	p <.01
Male	270	87.03	17.13	-0.49	1.04	0.08	0.07	p < .01
Female	100	85.90	17.25	-0.08	-0.75	0.17	0.15	p < .01
White	260	88.48	17.24	-0.56	1.18	0.04	0.03	p < .05
African American	60	84.00	16.40	-0.15	-0.48	n/a	n/a	n/a
Hispanic	50	79.74	15.76	0.25	-0.85	0.39	0.34	p < .05
Applied Problems Subtest (transformed data)	370	88.11	14.77	-0.02	-0.22	0.11	0.09	p <.01
Male	270	88.74	14.96	-0.13	-0.12	0.16	0.14	p <.01
Female	100	86.38	14.15	0.32	-0.34	0.31	0.29	p <.01
White	260	90.71	14.56	-0.13	-0.31	0.04	0.03	p < .05
African American	60	82.51	11.80	-0.07	-0.03	n/a	n/a	n/a
Hispanic	40	80.24	15.02	0.39	1.23	0.47	0.42	p < .01

Tests for multicollinearity indicated no collinearity was present (*VIF* = 1.17 household income, 1.05 race/ethnicity of student and 1.12 mother/female guardian's education) because they all fell within the guidelines of no collinearity, *VIF*'s greater than one and less than 10. All correlations were well under the criteria of 0.7 or less (see Table 6), with the highest correlation being between the father/male guardian's education and the mother/female guardian's education ($r = .50$, $p < .01$). Homoscedasticity was inspected with a scatter plot of the residuals and predicted values. There was no pattern in the scatter plot as the distributions were evenly spread about the line of best fit.

Table 6

Pearson's Correlation Coefficients for Applied Problems subtest

Pearson Correlation Coefficient *r*	Applied Problems Subtest (p-value)	Race/Ethnicity (p-value)	Household Income (p-value)	Mother/Female Guardian Education (p-value)
Applied Problems Subtest (p-value)	1	-.27** (.001)	.28** (.001)	.27** (.001)
Race/Ethnicity (p-value)	-.27** (.001)	1	-.30** (.001)	-.16** (.003)
Household Income (p-value)	.28** (.001)	-.30** (.001)	1	.36** (.001)
Mother/Female Guardian Education (p-value)	.27** (.001)	-.16** (.003)	.36** (.001)	1

*p<.05 **, p<.01, ***p<.001

Stepwise regression analysis, using the transformed data, was utilized to test whether the students' academic setting, parent or guardian characteristics (i.e. SES, work status, education status), and student characteristics (i.e. gender, race/ethnicity) significantly predicted students' standard scores on the Applied Problems subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that provide the maximum prediction power is done automatically within the computer program, Statistical Package for the Social Sciences (SPSS). The independent variables were chosen based on the review of literature. Because the *N* values for several ethnicities were too small (Asian/Pacific Islander, American Indian/Alaska Native, and Other), they were removed from the dataset for a more precise analysis. The *N* values for many of the school settings were also very small and so the only ones analyzed were those for students who reported attending regular school, attending a school that only serve students with disabilities, and attending an alternative school. To test the hypothesis that a student's score on the Applied

Problems subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that three predictors explained 9% of the variance (R^2_{adj}=.09, (3,192) = 2.65), $p < .01$) (see Table 5). It was found that household income (β = 2.76, $p < .05$), in addition to student's race/ethnicity (β = -4.89, $p < .01$), and mother/female guardian's education level (β = 2.62, $p < .05$) significantly predicted the score on the Applied Problems subtest. Gender ($r = .06$) and description of the school attended the previous year ($r = .09$) were excluded variables even though they were close to being included in the model, but they did not meet the required $p < .05$ in the stepwise regression analysis.

Calculations subtest for all students with EBD.

Multiple linear regression assumptions were tested. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size ($N = 380$) was higher than the suggested minimum of 100. Linearity was determined by examining the scatter plots of each independent variable with the dependent variable (the Calculations subtest score). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness ($S = -0.38$) indicated a small deviation from the normal curve and kurtosis ($K = 0.52$) and a medium deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present ($VIF = 1.00$ household income) as it was the only predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 7), with the highest correlation being between the father/male guardian's education and the mother/female guardian's education ($r = .51$, $p < .01$). Homoscedasticity was inspected with a scatter plot of the residuals and predicted values. No pattern in the plot was

evident as the distributions were evenly spread about the line of best fit.

Table 7

Pearson's Correlation Coefficients for Calculations Subtest

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Household Income (p-value)
Calculations Subtest (p-value)	1	.24** (.001)
Household Income (p-value)	.24** (.001)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was also utilized to test whether student academic setting, parent or guardian and student characteristics significantly predicted students' standard scores on the Calculations subtest of the WJIII test. Because the *N* values for several ethnicities were too small (Asian/Pacific Islander, American Indian/Alaska Native, and Other), these were removed from the dataset to provide more precise results. Again, the *N* values for many of the school settings were also very small and thus the only categories that were analyzed were attending regular school, attending a school that only serve students with disabilities, and attending alternative school. To test the hypothesis that a student's score on the Calculations subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated one predictor explained 6% of the variance (R^2_{adj} = .06, F (1,200) = 3.89, p < .01). It was found that household income was the only predictor that significantly predicted the score on the Calculations subtest (β = 5.77, p < .001) (see Table 5).

Applied Problems subtest by gender.

Applied Problems subtest for males.

Multiple linear regression assumptions were tested using the transformed data. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 270) was over the suggested minimum of 100. Linearity was determined by examining the scatter plots of each independent variable with the dependent variable (the Applied Problems subtest). All independent variables held a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = -.13) indicated a small deviation from the normal curve and kurtosis (K = -.12) a small deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (VIF = 1.00 student's race/ethnicity, 1.00 father/male guardian's employment status and 1.00 description of the school attended previous year). All correlations were well under the criteria of .7 or less (see Table 8). The correlation between race/ethnicity and school attended in the previous year was a little over the criteria at r = .72. The correlation (r = .53) between student's race/ethnicity and father/male guardian's education was the next highest correlation. Homoscedasticity was inspected with a scatter plot of the residuals and predicted values. There was no pattern in the plot as the distributions were evenly spread about the line of best fit.

Table 8

Pearson's Correlation Coefficients for Applied Problems Subtest for Male Students Only

Pearson Correlation Coefficient *r*	Applied Problems Subtest (p-value)	Race/Ethnicity (p-value)	Description of school attended previous year (p-value)	Father/Male Guardian Work p-value)
Applied Problems Subtest (p-value)	1	-.28** (.001)	-.13* (.030)	.23** (.002)
Race/Ethnicity (p-value)	-.28** (.001)	1	.02 (.719)	-.05 (.534)
Description of school attended previous year (p-value)	-.13* (.030)	.02 (.719)	1	.36** (.001)
Father/Male Guardian Work (p-value)	.23** (.002)	-.05 (.534)	.36** (.001)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis, using the transformed data, was performed to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Applied Problems subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the computer program, SPSS. The independent variables were chosen based on the review of literature. Because the *N* values for several ethnicities were very small (Asian/Pacific Islander, American Indian/Alaska Native, and Other), they were removed from the dataset to achieve more precise results in the analyses. The sample sizes for many of the school settings were also very small, and the only school settings that were included in the analysis were attending regular school, attending a school that only serve students with disabilities, and attending alternative school. To test the hypothesis that a student's score on the Applied Problems subtest is a function

of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that three predictors explained 14% of the variance (R^2_{adj} = .14, F (3,150 = 2.67), p < .01). It was found student's ethnicity (β = -.59, p < .01), in addition to father/male guardian's employment status (β = 4.80, p < .01), and description of the school attended previous year (β = -2.94, p < .05) significantly predicted the score on the Applied Problems subtest for males only.

Applied Problems subtest for females.

The assumptions of multiple linear regression were tested using transformed data. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 100) was just below the suggested minimum of 100. Linearity was checked by looking at the scatter plots of each independent variable with the dependent variable (the Applied Problems subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = -.85) indicated a medium deviation from the normal curve and kurtosis (K = 2.09) a deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality of the data (George & Mallery, 2010). If skewness and kurtosis are within two standard deviations of the mean, the normality can be assumed.

Tests for multicollinearity indicated that no collinearity was present (*VIF* = 1.00 for mother/female guardian's education status) as it was the only predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 9). The highest correlation (r = .52) was between mother/female guardian's education level and father/male guardian's education level. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values.

No pattern in the plot existed as the distributions were evenly spread about the line of best fit.

Table 9

Pearson's Correlation Coefficients for Applied Problems Subtest for Female Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Mother/Female Guardian Education (p-value)
Calculations Subtest (p-value)	1	.48** (.001)
Mother/Female Guardian Education (p-value)	.48** (.001)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was also utilized to test whether student academic setting, parent or guardian and student characteristics significantly predicted students' standard scores on the Applied Problems subtest of the WJIII test for females only. To test the hypothesis that a student's score on the Applied Problems subtest is a function of one or more of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated one predictor explained 27% of the variance (R^2_{adj} = .27, F (1,50) = 4.06, p < .01). It was found that mother/female guardian's education status (see table 5) was the only predictor that significantly influenced the score on the Applied Problems subtest test for females only (β = 7.05, p < .001). No other predictors were close to being significant for the model.

Applied Problems subtest by race/ethnicity.

Applied Problems subtest for White students.

The assumptions of multiple linear regression were tested using the transformed data. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 260) was beyond the suggested minimum of 100. Linearity was checked by examining the scatter plots of each independent variable with the dependent variable (the Applied Problems subtest score). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = -.13) indicated a small deviation from the normal curve and kurtosis (K = -.31), which is also a small deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (VIF = 1.00 for father/male guardian's education status) because there is only one predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 10). The correlation (r = .49) between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. No pattern in the plot was evident as the distributions were evenly spread about the line of best fit.

Table 10

Pearson's Correlation Coefficients for Applied Problems Subtest for White Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Father/Male Guardian Work (p-value)
Calculations Subtest (p-value)	1	.18* (.014)
Father/Male Guardian Work (p-value)	.18* (.014)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Applied Problems subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Applied Problems subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that one predictor explained 3% of the variance (R^2_{adj} = .03, F (1,160 = 3.9), p < .05). It was found father/male guardian's education status (β = 2.94, p<.05) significantly predicted the score on the Applied Problems subtest for White students (see Table 5).

Applied Problems subtest for African American students.

The assumptions of multiple linear regression were tested using the transformed data. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 60) which is more than the 20 cases per independent variable in the analysis, was based on no predictors being significant. Linearity was checked by looking at the scatter plots of each independent variable with the dependent variable (the Applied Problems

subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = -.071) indicated a small deviation from the normal curve and kurtosis (K = -.034) a small deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present because there were no predictors in the model. All correlations were well under the criteria of 0.7 or less. The correlation of r = .49 between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. No pattern in the plot was evident as the distributions were evenly spread about the line of best fit.

Stepwise regression analysis, using the transformed data, was utilized to test whether student academic setting and parent or guardian and student characteristics significantly predicted students' standard scores on the Applied Problems subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Applied Problems subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that no predictor explained any of the variance in the academic score on the Applied Problems subtest for African American students.

Applied Problems subtest for Hispanic students.

The assumptions of multiple linear regression were tested using the transformed data.

Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 40) is above the required 20+ cases per independent variable needed, taking into consideration that only one predictor was significant in the model. Linearity was checked by examining the scatter plots of each independent variable with the dependent variable (the Applied Problems subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = .39) indicated a small deviation from the normal curve and kurtosis (K = 1.23) a large deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (VIF = 1.00 for mother/female guardian's work status) because there is only one predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 11). The correlation (r = .61) between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. There was no pattern in the plot as the distributions were evenly spread about the line of best fit.

Table 11

Pearson's Correlation Coefficients for Applied Problems Subtest for Hispanic Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Mother/Female Guardian Education (p-value)
Calculations Subtest (p-value)	1	.09 (.562)
Mother/Female Guardian Education (p-value)	.09 (.562)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis, using the transformed data, was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Applied Problems subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Applied Problems subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that one predictor explained 42% of the variance (R^2_{adj} = .42, F (1,10 = 4.75), p < .01). It was found mother/female guardian's employment status (β = 12.86, p <. 05) significantly predicted the score for Hispanic students on the Applied Problems subtest (see table 5). None of the other predictors were close enough to being significant enough to include in the model.

Calculations subtest by gender.

Calculations subtest for males.

The assumptions of multiple linear regression were tested. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 270) is more than the suggested 100. Linearity was checked by examining the scatter plots of each independent variable with the dependent variable (the Calculations subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = -.49) indicated a small deviation from the normal curve and kurtosis (K = 1.04) a large deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (VIF = 1.00 for household income and 1.00 for student's race/ethnicity) All correlations were well under the criteria required of 0.7 or less (see Table 12). The correlation (r = .51) between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. There was no pattern in plot as the distributions were evenly spread about the line of best fit.

Table 12

Pearson's Correlation Coefficients for Calculations Subtest for Male Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Race/Ethnicity (p-value)	Household Income (p-value)
Calculations Subtest (p-value)	1	-.16** (.007)	.21** (.001)
Race/Ethnicity (p-value)	-.16** (.007)	1	-.26** (.001)
Household Income (p-value)	.21** (.001)	-.26** (.001)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Calculations subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Calculations subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that two predictors explained 7% of the variance (R^2_{adj} = .07, F (2, 150 = 3.06), p < .01). It was found that household income (β = 4.27, p < .01) and the student's ethnicity (β = -5.19, p < .01) significantly predicted the score on the Calculations subtest for male students (see table 5). None of the other predictors were close to being significant to include in the model.

Calculations subtest for females.

The assumptions of multiple linear regression were tested. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 100) which is the suggested N = 100. Linearity was checked by looking at the scatter plots

of each independent variable with the dependent variable (the Calculations subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected and skewness (*S* = -.08) indicated a small deviation from the normal curve and kurtosis (*K* = -.75) indicated a medium deviation from the normal curve (see Table 5), Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (*VIF* = 1.02 for mother/female guardian's education status) because there is only one predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 13). The correlation (*r* = .52) between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. There was no pattern in the plot as the distributions were evenly spread about the line of best fit.

Table 13

Pearson's Correlation Coefficients for Calculations Subtest for Female Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Mother/Female Guardian Education (p-value)
Calculations Subtest (p-value)	1	.36** (.001)
Mother/Female Guardian Education (p-value)	.36** (.001)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Calculations subtest of the WJIII test. Stepwise regression was utilized because there were

multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program, SPSS. To test the hypothesis that a student's score on the Calculations subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that one predictor explained 15% of the variance (R^2_{adj} = .15, F (1,50) = 4.06), p < .01). It was mother/female guardian's education status (β = 7.84, p < .01) that predicted the score on the Calculations subtest for females (see table 5). Household income (r = .09) was a predictor that was close to being included in the model.

Calculations subtest by race/ethnicity.

Calculations subtest for White students.

Multiple linear regression assumptions were tested. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 260) is more than the suggested N =100. Linearity was checked by looking at the scatter plots of each independent variable with the dependent variable (the Calculations subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = -.56) indicated a medium deviation from the normal curve and kurtosis (K = 1.18) a large deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (VIF = 1.00 for household income) because there is only one predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 14). The correlation (r = .49) between mother/female guardian's education and father/male guardian's education was the highest correlation.

Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. There was no pattern in the plot as the distributions were evenly spread about the line of best fit.

Table 14

Pearson's Correlation Coefficients for Calculations Subtest for White Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Household Income (p-value)
Calculations Subtest (p-value)	1	.21** (.001)
Household Income (p-value)	.21** (.001)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Calculations subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Calculations subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that one predictor explained 3% of the variance (R^2_{adj} = .03, F (1,160) = 3.9), $p < .05$). It was household income ($\beta = 4.65$, $p < .05$) that predicted the score on the Calculations subtest for White students (see table 5). Mother/female guardian's education status (r = .08) was a predictor that was close to being included in the model.

Calculations subtest for African American students.

The assumptions of multiple linear regression were tested. Multiple independent variables were utilized to predict the dependent variable. The sample size (N = 60) which above

the $N = 20$ for each predictor given no predictors were found. Linearity was checked by looking at the scatter plots of each independent variable with the dependent variable (the Calculations subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness ($S = -.15$) indicated a small deviation from the normal curve and kurtosis ($K = -.48$) a medium deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present as there were no predictors in the model. All correlations were well under the criteria of 0.7 or less. The correlation ($r = .50$) between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. There was no pattern in the plot as the distributions were evenly spread about the line of best fit.

Stepwise regression analysis was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Calculations subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Calculations subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that no predictors were significant to build a model to estimate academic achievement for African American students.

Calculations subtest for Hispanic students.

The assumptions of multiple linear regression were tested. Multiple independent variables were tested for their usefulness in predicting the dependent variable. The sample size (N = 50) which is above the suggested of N =20 for one independent variable being significant in the model. Linearity was checked by looking at the scatter plots of each independent variable with the dependent variable (the Calculations subtest). All independent variables had a linear relationship with the dependent variable. Tests for normality were conducted. A histogram with the normal curve imposed was inspected. Skewness (S = .25) indicated a small deviation from the normal curve and kurtosis (K = -.85) a medium deviation from the normal curve (see Table 5). Both measures were within the parameters of assuming normality.

Tests for multicollinearity indicated no collinearity was present (VIF = 1.00 for mother/female guardian's employment status) because there is only one predictor in the model. All correlations were well under the criteria of 0.7 or less (see Table 15). The correlation (r = .52) between mother/female guardian's education and father/male guardian's education was the highest correlation. Homoscedasticity was inspected using a scatter plot of the residuals and predicted values. There was no pattern in the plot as the distributions were evenly spread about the line of best fit.

Table 15

Pearson's Correlation Coefficients for Calculations Subtest for Hispanic Students Only

Pearson Correlation Coefficient *r*	Calculations Subtest (p-value)	Mother/Female Guardian Education (p-value)
Calculations Subtest (p-value)	1	.15 (.348)
Mother/Female Guardian Education (p-value)	.15 (.348)	1

*p<.05, **p<.01,***p<.001

Stepwise regression analysis was utilized to test whether student academic setting, and parent or guardian and student characteristics significantly predicted students' standard scores on the Calculations subtest of the WJIII test. Stepwise regression was utilized because there were multiple independent variables. The selection of the minimum number of predictors that give the maximum prediction power is done automatically within the statistical program. To test the hypothesis that a student's score on the Calculations subtest is a function of one or many of the variables, a stepwise multiple regression analysis was performed. The results of the stepwise regression indicated that one predictor explained 15% of the variance (R^2_{adj} = .15, F (1,10) = 4.75), $p < .05$). It was mother/female guardian's education status ($\beta = 11.8$, $p <$ .05) that predicted the score on the Calculations subtest. Father/male guardian's employment status ($r = .06$) was a predictor that was close to being included in the model (see Table 5).

Addressing the Research Questions

1. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and SES) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States?

When analyzing the data for Applied Problems subtest, the student's race/ethnicity, the household income, and the mother/female guardian's education status were the predictors of mathematics achievement. Approximately 9% of the variability in mathematics achievement on the Applied Problems subtest score was due to those three predictors. None of the other variables (e.g., gender, mother/female guardian's work status, school attended previous year, and father/male guardian's work or education) were predictors for the Applied Problems subtest scores.

When analyzing the data for Calculations subtest scores, the only predictor found to predict mathematics achievement was household income level. Approximately 6% of the variability in the Calculations subtest can be attributed to household income. None of the other variables (e.g., gender, race/ethnicity, mother/female guardian's work or education status, school attended previous year, or father/male guardian's work or education) were predictors for the Calculations subtest scores.

2. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and SES) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States of a specific gender or race/ethnicity?

    a) Are the predictors different if males and females are analyzed separately?

When analyzing the data for Applied Problems subtest scores for males only, the predictors to predict mathematics achievement were student's race/ethnicity, father/male guardians work status, and school attended in the previous. Approximately 14% of the variability in the Applied Problems subtest can be attributed to these predictors. When analyzing the data for Applied Problems subtest for females only, the only predictor found to

predict mathematics achievement was the mother/female guardian's education level. Approximately 27% of the variability in the Applied Problems subtest can be attributed to this predictor. This variability is very high and shows a major contribution to the Applied Problems subtest score.

When analyzing the data for Calculations subtest scores for males only, the student's race/ethnicity and household income level were the predictors of mathematics achievement. Approximately 7% of the variability in mathematics achievement on the Calculations subtest was due to those three predictors. When analyzing the data for Calculations subtest for females only, mother/female guardian's education status was the only predictor of mathematics achievement. Approximately 15% of the variability in mathematics achievement on the Calculations subtest was attributed to this predictor. This variability is very high and shows a major contribution to the Calculations subtest score.

When analyzing the data for Applied Problems subtest scores for White students only, the only predictor of academic achievement was father/male guardian's education level. Approximately 3% of the variability in the Applied Problems subtest can be attributed to this predictor. When analyzing the data for Applied Problems subtest scores for African Americans only, no predictors were found to predict mathematics achievement. In analyzing the data on Applied Problems subtest for Hispanic students only, the one predictor found to predict academic achievement was the mother/female guardian's work status. Approximately 42% of the variability in the Applied Problems subtest scores can be attributed to this predictor. This is a very significant predictor as it accounts for closer to half the variability. However, the *N* was not large enough to drive the statistical analyses, so a larger study would need to be completed to see if this is true for all Hispanic students.

When analyzing the data for Calculations subtest for White students only, the household income was the one predictor of mathematics achievement. Approximately 3% of the variability in mathematics achievement on the Calculations subtest was due to this one predictor. When analyzing the data on the Calculations subtest for African American students only, no predictors could predict academic achievement. When analyzing the data for Hispanic students, the mother/female guardian's education level was the only predictor of academic achievement. Approximately 15% of the variability in mathematics achievement on the Calculations subtest was due to this predictor.

Summary

Overall, each of these six predictors (i.e., student's race/ethnicity, household income, school attended previous year, parent/guardian's education and work) that were discussed in the literature review were included in at least one of the regression equations (see Table 16). Gender was analyzed as well but did not show up in any regression equations. Of the eight separate equations (by gender and race/ethnicity), the predictor most often included in three equations was the mother/female guardian's education status. Next in frequency of occurrence in two equations was student's race/ethnicity and household income. The following variables were only included in one equation: school attended previous year, mother/female guardian's work status, father/male guardian's education level, and father/male guardian's work status. Household income was the only predictor for the Calculation subtest score while the Applied Problems subtest had three: student's race/ethnicity, household income, and mother/female guardian's education status.

Table 16

Summary of the Significant Predictors Included in the Regression Models

	Gender	Ethnicity	Household Income	School attended last year	Mother/ Female Guardian Education	Mother/ Female Guardian work status	Father/ Male Guardian Education	Father/ Male Guardian work status
Calculations Subtest			x					
Male		x	x					
Female					x			
White			x					
African American								
Hispanic					x			
Applied Problems Subtest		x	x		x			
Male		x		x				x
Female					x			
White							x	
African American								
Hispanic						x		

Chapter 5: Discussion, Conclusions, and Implications

Introduction

USDOE (2000) found that students in the United States are typically behind other countries in mathematics achievement and that students with disabilities lag even farther behind, including students with EBD. Mattison and Blader (2013) identify classroom placement, socioeconomic status (SES), race/ethnicity, and gender as contributing factors affecting mathematics achievement for students with EBD. Kauffman and Landrum (2012) estimate that between 3% and 6% of school children are diagnosed with EBD. Students with EBD can face additional challenges as teachers and schools are subject to increasing accountability. According to NCLB (2001), all students must achieve at their grade levels in the core areas of mathematics, science, English/Language Arts, and history. Students with a diagnosis of EBD must demonstrate academic achievement at the grade level they should be in by age, similar to their non-disabled peers. Students with EBD typically score one to two grade levels lower than their non-disabled peers in academic areas, including mathematics, and the achievement gap is growing (e.g., Cullinan, 2007; Trout, Nordness, Pierce, & Epstein, 2003).

The current study examined the predictive potency of several variables identified in the literature on the mathematics achievement of students with a primary diagnosis of EBD by analysis of secondary data from the NLTS2. The NLTS2 is a longitudinal data collection project of a large, nationally representative sample of 9,228 students with a focus on students receiving special education services in the United States. The NLTS2 included data on 930 youth with EBD between 13 and 16 years of age. The current study focused on the 418 students who had a

primary diagnosis of EBD and who had also participated in the two WJRIII Academic Knowledge mathematics subtests: Calculations and Applied Problems during Wave 1 of the study. The Calculations subtest measured the ability to perform basic computations and the Applied Problems subtest required more conceptual understanding and problem solving skills. This study explored predictive relationships between mathematics achievement and other characteristics of students with EBD.

Summary of Findings

1. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States?

Findings for the Academic Knowledge Calculations test indicated that household income was the sole predictor of mathematics achievement. Approximately 6% of the variability in mathematics achievement on the Calculations subtest was due to the household income level. The parent or guardian's characteristics (i.e., education status, work status), gender, student's race/ethnicity, or type of school attended in the previous year were not significant predictors in this model.

When analyzing the data for the Academic Knowledge Applied Problems subtest, the following predictors in combination were shown to predict mathematics achievement: mother/female guardian's education level, student's race/ethnicity, and household income level. These three variables can explain approximately 9% of the variability in the Applied Problems subtest. Gender was not a predictor in this equation, neither were father/male guardian characteristics (i.e. education status, work status), mother/female guardian's work status, or the type of school attended in the previous year.

2. Which variables (i.e., race/ethnicity, gender, academic placement, parent or guardian characteristics, and socioeconomic status) alone or in combination can be utilized to predict mathematics achievement of students with EBD in the United States of a specific gender or race/ethnicity?
    a. Are the predictors different if males and females are analyzed separately?

When interpreting the findings for the Academic Knowledge Calculations subtest for males only, student race/ethnicity and household income were the only significant predictors in the model. The type of school in the year prior to the beginning of data collection and the parent or guardian's characteristics (i.e., education status, work status) were not significant predictors. Approximately 7% of the variability in mathematics achievement on the Calculations subtest was due to the student's race/ethnicity and household income. When interpreting the findings for Academic Knowledge Applied Problems subtest for males only, student's race/ethnicity and type of school in the previous year were significant and explained approximately 14% of the variability in mathematics achievement.

When analyzing the data for Academic Knowledge Calculations subtest for females only, the only predictor was mother/female guardian's education level. Approximately 15% of the variability in the Calculations subtest can be attributed to the education level of the mother/female guardian. Household income was on the threshold ($p < .10$) of inclusion in the model, but it did not meet the criteria of $p < .05$. When interpreting the findings for Academic Knowledge Applied Problems subtest for females, the only significant predictor included was the mother/female guardian's education level. Approximately 29% of the variability in the Applied Problems subtest can be attributed to the education level of the mother/female guardian. Non-significant variables were socioeconomic status, mother/female guardian's work status, and

father/male guardian's characteristics (i.e., education status, work status) at the threshold ($p < .10$) of being included in the model but was not significant at the $p < .05$ level. Type of school attended may be a significant predictor if another study was conducted regarding academic achievement with a larger sample of students with a primary diagnosis of EBD. Percent of variability is the relative contribution that the predictor(s) had on the mathematics academic score.

b. Are the predictors different for students who identify as White, African American, and Hispanic, when analyzed separately?

Based on the analysis of the Academic Knowledge Calculations subtest scores for White students, household income was the only significant predictor included in the model. Approximately 3% of the variability in mathematics achievement on the Calculations subtest was due to household income. The predictors that were not significant included gender, type of school attended the previous year, mother/guardian's work status, and father/guardian's characteristics (i.e., education status, work status). The education level of the mother/female guardian was relatively close ($p < .10$) to being included in the model, but was not added because it did not meet the criteria of the stepwise regression parameters ($p < .05$).

When analyzing the data for the Academic Knowledge Applied Problems subtest for White students only, the father/male guardian's education level was the only significant predictor indicated. Approximately 3% of the variability in mathematics achievement on the Applied Problems subtest was due to the father/male guardian's education level. Again, gender was not significant nor was the type of school attended in the year prior to testing, socioeconomic status, mother/female guardian's characteristics (i.e., education status, work status), or father/male guardian's work status.

When analyzing the data for the Academic Knowledge Calculations subtest and Applied Problems subtest for African American students, no predictors evaluated were significant enough to be included in the model based on the criteria for stepwise regression. Gender, type of school attended, socioeconomic status, and parent or guardian's characteristics (i.e., education status, work status) were not included in either mathematics achievement model.

When analyzing the data for Academic Knowledge Calculations subtest for Hispanic students only, mother/female guardian's education was the only significant predictor for this area of mathematics achievement at 34% of the variability, which is over one third of the variability. The work status of the father/male guardian was on the threshold ($p < .10$) of inclusion in the model, but did not meet the criteria of $p < .05$. The following variables were not found to be significant: gender, type of school attended in the previous year, socioeconomic status, mother/female guardian's work status, and father/male guardian's education status.

Based on the analysis of data for the Academic Knowledge Applied Problems subtest for Hispanic students only, mother/female guardian's work status was the only significant predictor. Approximately 42% of the variability in mathematics achievement on the Applied Problems subtest was due to the mother/female guardian's work status.

Household income was the sole predictor for the Calculations subtest. Household income along with student's race/ethnicity and mother/female guardian's education were predictors for the Applied Problems subtest. When analyzed separately by gender, student's race/ethnicity was a predictor for males on both subtests. School attended the previous year, and father/male guardian's work status were also predictors for the Applied Problems subtest. Mother/female guardian's education status was a predictor for both Applied Problems and Calculations subtest

for females. This was the only predictor of significance included in both models based on solid evidence.

The Calculations subtest measured the ability to perform basic computations, and the Applied Problems subtest required more conceptual understanding and problem-solving skills. Household income is significant in more of the prediction equations for Calculations subtests than in the Applied Problems subtests. Race/ethnicity was indicated as a predictor in more Applied Problems subtests than Calculations subtests. This could be from various issues (i.e. suspension from class, focus of teacher in classroom, etc.). For the Applied Problems subtest for males only, the school attended in the previous year was a predictor and perhaps this could explain a more limited conceptual understanding and ability to perform problem solving. This could be from the setup of the classroom and the focus of the teacher (i.e. behavior modifications, academic interventions). Sutherland and Wehby (2001) affirm the more time spent on dealing with behavior problems gives less time to spend on instruction. The more behavioral problems led to less time for academic instruction needed to teach at a conceptual level. Lane et al. (2008) note that more focus was on basic skills and problem solving was not important to focus on during academic instruction time. More behavior interventions in a classroom of students with EBD is an obstacle when moving from basic skills to conceptual understanding. This could be the reason why students with EBD are struggling on the Applied Problems subtest more than the Calculations subtest. This is an argument for LRE for student with EBD because of the gap between those in inclusion classes and those in self-contained classes is significant. Gonzalez and Cramer (2013) found 93% of students with EBD placed in inclusion classes were passing their classes compared to 72% of students in self-contained classes.

Interpretation of Findings

Household income was a predictor for both the Applied Problems and Calculations subtests. When analyzing results separately by race/ethnicity, household income (e.g. White students) for the Calculations subtest and the mother/female guardian's education level (e.g. Hispanic students) were the predictors across race/ethnicity. For African American students, no predictors were at a significance level to include in the model for either subtest. Hispanic students had mother/female guardian's characteristics in common as predictors: her education status for Calculations subtest and her work status for Applied Problems subtest.

Throughout the regression analyses, each one of the predictors investigated in the literature review was included in at least one model except for gender. Gender ($p < .10$) was not included in the Applied Problems subtest regression equation based on statistical analysis ($p <.05$). Stepwise regression utilizes a specific formula to determine which predictors are part of the model.

The significant predictors most commonly included were student race/ethnicity, household income, and mother/female guardians' education status (see Table 16). The following only appeared in one of the subtests: school attended the previous year, mother/female guardian's work status, father/male guardian's education, and father/male guardian's work status. This could mean that students are not receiving the resources they need to understand and engage in basic calculations in school. This may also be because of lack of resources for students who struggle in mathematics. Their parents may not be able to help their children because of their own insecurities about their education or afford tutoring because of lack of money due to work status or household income to address the issues on their own. Thus, policy makers may

want to consider ways to provide additional resources that may be necessary to ensure success for these students.

The findings of this current secondary analysis study address a gap in the existing literature, which is also related to current educational policy in the state of Georgia that is being legally challenged by the USJD. The type of school attended was a predictor in the Academic Knowledge Applied Problems subtest for males only, and that finding supports the lawsuit against GNETS (USJD v. State of Georgia, 2016). The type of school attended in the previous year was close to being included as a predictor in two models, but did not meet the statistical threshold. These two were the model for Applied Problems subtest for all student with EBD and the one for Applied Problems subtest for female students with EBD. The USJD (2016) alleges that GNETS was segregating students with disabilities. The current study illustrates that the type of school attended (e.g., regular school, school with only students with disabilities, or alternative school) is a predictor of mathematics academic achievement, which supports the USJD case against the state of Georgia. The current study also adds to the ongoing debate on gender differences in mathematics academic achievement. Prior related research (e.g., Kremer et al., 2016) concluded that males scored higher than females on the Academic Knowledge Applied Problems subtest of the WJRIII, the subtest that was utilized in this study. Wilkins and Ma (2002) found no gender differences, which aligns with the current secondary analysis study. This also reinforces the meta-analyses (e.g., Hyde, Lindberg, Linn, Ellis & Williams, 2008; Lindberg, Hyde, Peterson & Linn, 2010) that revealed that on standardized assessments, gender differences in mathematics ability are negligible. The finding of null results for gender differences in the current study may be an indicator that the gender gap does not exist, at least for students in the current study with an EBD primary diagnosis. Perhaps a greater understanding among educators

and more concerted supports for closing the historical mathematical achievement gap among males and females has had an impact.

Context of Findings

For the Academic Knowledge Applied Problems subtest scores, the findings were aligned with the previous research that investigated the relationship between academic achievement and school setting. Lane et al. (2008) noted that academic achievement may be a function of the setting in which the student is educated. For father/male guardian's and mother/female guardian's education, the findings were consistent with Klebanov, Brooks-Gunn, and Duncan (1994). They posit that the literature on academic achievement indicates that the education of both parents is an important predictor. Jimerson, Egeland, and Teo (1999) also studied the variable of parent education and reported a finding of a positive, direct influence on higher academic achievement. In the current study, the father/male guardian and mother/female guardian's education appeared as a predictor in at least one of the regression equations.

The current findings contradict some of the prior research on socioeconomic status and academic achievement. Dixon-Floyd and Johnson (1997) noted that individuals in the general student population with varied socioeconomic levels have well-documented academic performance differences, and this may also be true within the EBD population of students. Mattison and Blader (2013) found that 44.9% of students diagnosed with EBD qualified for free or reduced lunch, an indicator or proxy of socioeconomic status. Socioeconomic status was not a predictor of mathematics achievement for the Applied Problem subtest, but it was for the Calculations subtest. The findings for the Calculations subtest mirror Dixon-Floyd and Johnson's (1997), where they noted that individuals with different socioeconomic status levels have well-documented academic performance differences. Students with a lower SES may do poorly on the

Calculations subtest because their parents/guardians may struggle in mathematics and may not feel confident enough to help their children in basic mathematics. It could also be the structure of the classroom. A teacher may see the deficits in calculations for a student but does not have time to go back and teach the concept, so they look for a quick way (i.e., calculator) to help students catch up with their peers. Lower SES students may not have access to the tools that higher SES students have access to (i.e., calculators, computers, tutoring) and this may be a reason why they score poorly on the Calculations subtest.

This study's finding of race/ethnicity as a predictor of mathematics achievement aligns with the research (e.g., Meece & Kurtz-Costes, 2001) that found achievement differences among racial/ethnic groups to be well documented and may also occur within the EBD student population. Gender was also not a predictor in this study, a finding similar to that of Nelson et al. (2004) as they noted that male and female students with EBD have comparable achievement deficits. This difference may be true because of an interaction with other factors, such as school setting. A predictor for male students was school setting but not for female students in the current study.

Gender gaps have been closing in mathematics within the general population (Hyde & Mertz, 2009). For instance, Wilkins and Ma (2002) do not identify gender differences in the regular education setting in mathematics achievement scores. However, Kremer et al. (2016) noted that males, aged 3 to 17, scored higher than females on the Applied Problems subtest, which was not confirmed in the current study of youth with EBD. In the current study, there were no significant differences in either the Applied Problems subtest or the Calculations subtests across gender for students with a primary diagnosis of EBD. The study of Kremer et al. (2016) utilized a different longitudinal dataset from 1997-2007 and had a different research

design than the current study. Few of these studies had the information, sample size, or research designs to determine the factors that influence academic achievement in students with a primary diagnosis of EBD. Hence, the importance and relevance of the current secondary analysis study.

For the Academic Knowledge Calculations subtest, the current findings were aligned with several prior studies that investigated the relationship between socioeconomic level and academic achievement. Individuals with varying socioeconomic levels have well documented differences in academic performance, and this finding may also hold true within the EBD population of students (Dixon-Floyd & Johnson, 1997). Mattison and Blader (2013) found 44.9% of students with EBD qualified for free or reduced lunch, an indicator of socioeconomic status. Academic setting was not a predictor, which is contrary to prior research (e.g., Lane et al., 2008). They reviewed the academic profiles of students in self-contained classrooms and self-contained schools and found both groups of students had broad academic deficits, but the students in self-contained schools had higher deficits than those in self-contained classrooms. Again, gender was also not a predictor, which is comparable to Nelson et al. (2004) because they noted that EBD boys and girls have similar achievement trajectories. It is thought provoking that race/ethnicity was only a predictor in a few of the regression equations within the current study because certain previous research has found achievement differences among racial/ethnic groups that can also occur within the EBD student population (Meece & Kurtz-Costes, 2001). The findings of the current examination could be indicative that the achievement gap is indeed possibly closing for students with EBD as with other students. There could be other possible explanations, perhaps interactions among the other predictor variables. More research of students with EBD would need to be conducted to verify the achievement gap is closing for students with EBD. But this result may be due to directed efforts to recognize and assist students with

disabilities. From school placement to extra help in and out of the classroom, students have quite possibly been able to overcome challenges and succeed.

Klebanov, Brooks-Gunn and Duncan's (1994) meta-analysis reported the literature on academic achievement and indicate that parent education is an important predictor. Also, most of the literature (e.g., Jimerson, Egeland, & Teo, 1999) regarding parents' education describes the positive, direct influence that it can have on academic achievement. In the current examination of the NTLS2 study, the Academic Knowledge Calculations assessment, this finding did not hold true, as neither mother/female guardian's or father/male guardian's education were significant predictors in the main model for mathematics achievement. However, mother/female guardian's education level was a predictor for the Academic Knowledge Applied Problems subtest for the main model.

Implications of Findings

The results of this secondary analysis study highlight the specific characteristics of students, socioeconomic status, parents/guardians, and school setting that can be utilized to predict academic achievement in mathematics for EBD students. Teachers can only have an impact in some areas, as most of the predictors found in this study are beyond the control of the classroom teacher, particularly as students have a number of different mathematics teachers during their schooling. Teachers should take into consideration those variables that they can influence such as student placement in the appropriate classroom/school environment. Teachers can offer extra help and help identify other means of support for students with EBD when they have knowledge of the student and previous mathematics achievement. The results of this study can assist with increasing understanding of opportunity gaps while identifying students who most

need targeted support. The predictors in the current study (i.e., race/ethnicity, household income, gender, etc.) could help determine what students are most at risk and need support.

The greatest influence that a teacher can have is advocacy in the setting within which a student is being educated. As a part of the IEP team, the teacher plays a key role in the placement, education, and support of the student. LRE for the student is the most important consideration if the student is going to be successful. Inclusion has been proven to improve academics, but it may not be the most appropriate LRE for the student. In the current study, the only evidence that academic setting made a difference on mathematics academic achievement was when separating males from the females. Teachers can be an advocate for students to be provided the LRE that is the best fit for them and their academics. Teachers could participate in more consistent and formal training with ongoing professional development pertaining to students with disabilities, including students with a diagnosis of EBD. This will help them understand what constitutes the best LRE for a student, which in turn can increase student achievement when the student is given the appropriate supports and scaffolds needed to be successful. They can provide better guidance as a part of the IEP team and keep the parents informed along the way so that they can be a key part of the process. Teachers can also help with concrete skills including structured studying methods, test-taking strategies, and goal setting as potentially positive influences for not just students diagnosed with EBD but other students.

Swain, French, and Cameron (2003) assert that the disabled, including those students with a diagnosis of EBD, want to pursue the same opportunities (e.g., LRE) and chances in life as non-disabled people. People with disabilities value education, want to participate in a career, and engage in meaningful relationships (i.e., social, and employment). Vgotsky (1993) reminds us to introduce into the conversation characteristics of the human makeup that have typically

been the interest of those in areas such as abnormal psychology, learning disabilities, and special education. The current study highlighted how important the parent or guardian's work and education status and household income were in predicting academic achievement. This indicates more attention needs to be focused on helping teachers and parents/guardians understand the long-term effects of educational attainment (i.e., obtaining GED, advancing education through a trade or academic tract), which in turn could improve working status and household income from the students of the next generation.

Students have a proactive role to play. They also have a role to play in their own advocacy. They are welcome in IEP meetings and should be given a voice in the IEP process that determines their education plan. Even with a diagnosis of EBD, they can move beyond the diagnosis and try to achieve to the best of their ability. Trajectories can be changed with the support of all involved, but the student needs to take ownership of their learning. Mentoring programs have been successful (Ference & Rhodes, 2002) in promoting successful academic and social outcomes for students with EBD. Possibly students who are mentored can be motivated to goal setting and thus have a greater self-efficacy (a belief in the ability to succeed) when they succeed. They will grow and develop into more competent learners through this process. Students with a diagnosis of EBD, and specifically those in GNETS can work toward their behavioral goals to move out of the separate classroom into the general education classroom. The current study indicates that academic achievement is higher for those students with EBD in regular education settings than for students with EBD placed in more restrictive settings.

Also, students who fall behind will need to make up classes and may not be able to complete their required courses for high school graduation in a timely manner. This interrupts their academic trajectory, especially in mathematics, where success in one course is a

prerequisite for success in the next. Also, students can be steered toward arithmetic instead of the algebra/calculus strand that is needed for college or any other further education. They may also be recommended or even mandated to take only academic classes to ensure an on-time graduation. School size and setting (i.e., urban, suburban, rural), type (i.e., charter, magnet, vocational), and location may also affect scores on mathematics achievement because of the resources and teacher to student ratios.

Parents and guardians of students diagnosed with EBD can inform themselves of the ramifications of an LRE and become more effective advocates for their child. The current study findings can be used to inform all stakeholders, including parents, that the LRE is important and the more included students, males with EBD specifically, are in their education process and school, the more they will achieve in mathematics. In the IEP process, parents and guardians can participate in important decisions so that their children can become more successful in their education. If parents had a better understanding of how important obtaining an education is and the potential long-term consequences, this may impact not only their child, but generations to come. In the current study, education status was an important predictor for mathematics academic achievement in several regression equations. Parents can contribute to the student's beliefs and encourage them to succeed despite challenges that may arise. The current study shows that parent/guardian's education status contributes to academic achievement.

For policymakers, the current study can scaffold current ongoing efforts to assist in the allocation of resources dedicated for students with disabilities. The current study revealed type of school matters for certain populations of students with EBD, and the policymakers need to make changes. Currently, students are not receiving the therapeutic benefits that GNETS promises for students with EBD and that academic and behavior interventions were found unsuccessful in a

2010 audit (Pratt, 2017). Over 67% of students in GNETS are completing their courses on computer software programs (Pratt, 2017), and a move back to actual face to face classroom teaching may be needed to address the issues of students with EBD. Some EBD students have been segregated from the general population in the past, and this may require a reexamination of current policies. More resources and funding are needed to ensure that all students are achieving on the levels that they can with the appropriate supports. Georgia needs to ensure that all students in GNETS are in their appropriate LRE. Georgia, in particular, should look for ways to integrate students in GNETS into the student body (i.e., extracurricular activities, arts, drama). Georgia needs to minimize segregation by allowing students in GNETS to participate in lunch times and in the scheduling of their classes.

Limitations of the Study

Limitations of a quantitative longitudinal or cross-sectional design must be considered. Attrition is problematic in longitudinal studies such as the NTLS2 and thus data may be missing in the later waves of the study. Next, ensuring enough data for conducting a statistical analysis is key in deciding which statistical methods are appropriate. For the students with a primary EBD diagnosis who began the study, direct assessments were only conducted once during Wave 1 and Wave 2 for each student participating in the NLTS2. If the direct mathematics assessments were given at the beginning of the NLTS2 and at the conclusion of the NLTS2, comparisons could be made about gains that students might have accomplished over the time. This may have shown what interventions were successful and which were not.

For the students identified with EBD, only approximately half were available for the direct mathematics assessments in Wave 1. The other half were done during Wave 2 for the students who did not participate in Wave 1 due to age. Wave 2 could have been analyzed

separately from Wave 1, due to the differences in teachers, administration and programs that could have occurred since Wave 1. Comparisons could be made but with caution as the groups were tested at different times during the NLTS2 data collection. Additionally, only certain ethnicities and the school that student attended in the year prior to testing were available to include in the regression models due to the *N* values available for analysis. If Wave 2 included more ethnicities or schools than Wave 1, analyses could be done including those that were not in Wave 1 analyses.

Another limitation is the dates of the data collection (2000-2009) so the data were almost ten years old at the time of secondary analysis. Although the NTLS2 is a comprehensive study designed to provide useful data on some of the impacts of education on students with EBD, a follow-up study needs to begin data collection soon so that it can continue to assess progress and inform future policy related to students with a primary diagnosis of EBD. When analyzing the dataset for predictors of the Applied Problems subtest of the Academic Knowledge, only 9% of the variability in the subtest score could be explained by the education setting, the father's education, and the ethnicity of the student. This means that almost 91% of the factors were not determined in this study. A follow-up to the NLTS2 might include factors including externalizing, and internalizing behaviors as mentioned by Kremer et al. (2016) in their study.

For the other subtest, Calculations, household income was the only predictor that was significant, and it explained only 6% of the variability in the subtest score. About 94% of the predictors could not be explained using the variables included in the stepwise regression. Again, there are limitations in the NLTS2 and it is important that another comprehensive iteration of this research design is conducted in the future or other new data is collected that focus specifically on

variables that might further explain mathematics achievement of students with a primary diagnosis of EBD.

The last limitation of the present study was that the data collection only allowed for choices of mother/female guardian and father/male guardian. Valuable information might have been lost because other family contexts were ignored (e.g., two fathers, a grandmother and a mother, foster parents, etc.)

Future Research Directions

Because the NLTS2 covered the 10 years from 2000-2009, a follow-up comprehensive longitudinal study regarding special education students is overdue. Many changes in educational policy, including IDEA, have been implemented since the beginning of the initial study and research is necessary to explore potential impacts on student learning and achievement. Other studies are needed to examine other research questions including more qualitative studies of how students' academic, behavioral, and emotional needs are being met in the classroom; the experience, certification, and education of those who teach mathematics to students with EBD; and more about the overall IEP team and the processes involved in placing students with EBD.

Academic setting was a predictor in one of the regression equations utilized with the Applied Problems subtest and more information is needed about the characteristics of each type of school setting and the impact of each on students with EBD and other special needs. On the policy level, there needs to be a way to measure and evaluate the extent to which state (e.g., GNETS) and federal (e.g., NCLB, IDEA) are being followed and implemented in different school settings. Future research might explore why students score differently on the Applied Problems subtest and the Calculations subtest.

Teacher variables have an impact on student achievement. Teacher characteristics were not utilized for this study as the teacher who filled out the questionnaire regarding the student was not the teacher that the student was placed with when tested in Wave 1, and that teacher may or may not be the student's mathematics teacher at the time. Educators spend time preparing for lessons and advancing their knowledge and pedagogical skills through professional development and graduate education. Experience is important because a teacher improves with practice (Fung, Kutnick, Mok, & Leung, 2016).

Other future studies are needed to analyze the parent and guardian characteristics that were included in this study in more depth, such as socioeconomic status and parent/guardian work and education status. Some of the variables recommended for inclusion would be teacher characteristics, school placement, an increased pool of ethnicities, more comprehensive information about the background of students, the age of the student's EBD diagnosis and implementation of any interventions and what type, and information about prior achievement of the student. Additional data that could be collected from a follow up to the NLTS2 study would be the of the family structure (i.e., single parent, raised by grandparents or extended family members, number in household including siblings), urban/suburban/rural classification, access to technology, healthcare, and counseling, in addition to any supports and interventions. Even though household income did not meet the criteria as significant for some of the models, it is a predictor that should be included in a larger and/or different study. Trout et al. (2003) claimed only 34% reported SES as one of the descriptive predictive components of the students with EBD, which makes it difficult to use if it is not recorded. A larger study could record this information and would be more helpful in determining if household income is related to mathematics academic achievement.

Another area of future study is the examination of the father/male guardian's working status in combination with the mother/female guardian's working status. In the present study, working status was not significant for the Applied Problems subtest, but more comprehensive and focused studies may yield different results and tell a new story.

School attainment (i.e., high school graduation, college degree, technical degree, trade training) needs to be emphasized to all students. Parent/guardian's education status was a predictor for many of the regression equations, some more than others. Teacher, counselors, and administrators could engage parents by offering volunteer opportunities for parents, by offering programs for second language families, and encouraging parents to attend events (e.g., sporting events, arts, drama, awards ceremonies). By implementing these types of programs, future studies can investigate the effect they might have on mathematics academic achievement.

Since the variability of the Applied Problems subtest was 42% for mother/female guardian's work status, teachers/principals/districts should be aware of the impact so that students can have better support and more successful trajectories. There was no Hispanic-specific information because the *N*'s were too small for analysis. This needs to be further researched with a study that includes a larger number of Hispanic students. Also, all students should be encouraged to complete their high school education and prepare for the future. Parent/guardian's education status was a predictor in mathematics academic achievement in the current study. Whether it be learning a trade such as welding or plumbing, completing computing or human resources courses, attending college to become a nurse/doctor, or joining the military, students should be encouraged to excel.

A number of the variables in the current study were shown to be predictors of the mathematics achievement of students with a primary diagnosis of EBD, except for gender.

Gender was included in the literature review and other studies have shown it to be a factor in academic achievement, but this was not the case in the current study. A more current study could enlighten the field as to whether the gender gap in mathematics still exists.

The results of this study and the literature review suggest the inclusion of other factors that should be investigated in the future. In the Social Model of Disability (Swain et al., 2003), there were many tenets (i.e. attitudes, isolation, ignorance, labeling) that could not be addressed with the use of the NLTS2 study quantitative data used in the current study. Many of those would need to be answered using the interview data that were not provided in this quantitative study.

Other variables such as the prior mathematics achievement of the student may be important as well as it sets a trajectory of course taking. Mulcahy et al. (2014) maintain that, as a group, students with EBD experience higher rates of lower mathematics achievement, and these deficits increased as students became older. Anderson et al. (2001) found that students who have both EBD and academic deficits do not see their achievement improve as much as might be expected over time.

Conclusion

In conclusion, students with EBD are not achieving at the levels of the general population overall. This study found several variables that predict mathematics achievement for students with disabilities, but there are many other variables that contribute to academic achievement that were not part of this study. For the Applied Problems subtest, the significant student achievement predictors were father's education, student's ethnicity, and the academic setting of the student. For the Calculations subtest, the only predictor of academic achievement was household income. These predictors are significant, but there are other variables that may be significant and deserve

further study as contributions to mathematics achievement scores in students with disabilities, including those with a primary diagnosis of EBD. This study contributes to the literature because the predictors, except gender, from the literature review were included in at least one of the regression equations for predicting mathematics academic achievement for students with a primary diagnosis of EBD. It is very important that these factors continue to be examined in quantitative cross-sectional and longitudinal studies, including mixed methods and qualitative investigations, and that other factors are considered as mentioned prior in the future topics for study.

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