A PATH ANALYSIS OF DISABILITY TYPE, ACADEMIC MAJOR, AND POSTSECONDARY DEGREE COMPLETION

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Table of Contents

Chapter 1. Introduction 1

Disabilities and College Completion 2

Career Aspirations of Students with Disabilities 3

Relationship between Type of Disability and Academic Major 5

Present Study 7

Chapter 2. Literature Review 10

Prevalence of Students with Disabilities in Higher Education 10

Reasons for Increase in Prevalence Rates 13

Characteristics of Various Disabilities 16

Learning Disability 16

Attention Deficit Hyperactivity Disorder 17

Autism Spectrum Disorder 19

Demographic Variables Related to Disability, Field of Interest, and Degree Completion 21

Gender and disability 22

Gender and field of study 22

Gender and postsecondary degree completion for students with disabilities 23

Socioeconomic status and disability 24

Socioeconomic status and field of study 25

Socioeconomic status and postsecondary degree completion 25

Race and disability 26

Race and field of study 27

Race and degree completion 28

Reasons for Lack of Degree Completion 29
Decision-Making Regarding Postsecondary Field of Study 31
Secondary school decision-making..... 31
Postsecondary school decision-making..... 34
Relationship between College Major and Employment 35
Holland's vocational choice theory..... 37
Current Research Regarding Individuals with Disabilities in Higher Education 38
Services for individuals with disabilities..... 38
Transitional needs..... 40
Summary 41
Chapter 3. Method 44
Database Overview 44
Data collection..... 45
School program survey..... 46
Parent/youth interview and survey..... 46
Study Variables 46
Disability type..... 47
Type of postsecondary student 48
Postsecondary field of study..... 48
STEM vs. non-STEM majors..... 49
Majors by level of social interaction 49
Student success 50
Demographic variables..... 51

Gender..... 51

Income..... 51

Race..... 51

Participants 52

Description of Models..... 53

Chapter 4. Results..... 65

Key Findings 66

Question 1: Disability type in relation to career interest 66

Question 2: Disability type in relation to postsecondary success..... 68

Question 3: Area of study in relation to postsecondary success 68

Question 4: Mediation of area of study on disability type and postsecondary success 69

Additional Analyses 70

Chapter 5. Discussion 73

Comparison to Previous Research Using the NLTS2..... 74

Disability Type and Area of Study 77

Disability Type and Postsecondary Success 77

Area of Study and Postsecondary Success 78

STEM and non-STEM areas of study..... 79

Areas of study based upon social interaction required..... 79

Demographic Factors 81

Gender 82

Income 83

Race..... 84

Limitations and Future Research 85

Implications 90

Conclusion 91

References 93

Table 1. Characteristics of Participants: Frequency Statistics for Categorical Variables 109

Table 2. Frequency Statistics for Disability, Major, and Outcome 113

Table 3. Path Model 1 Results 115

Table 4. Path Model 2 Results 118

Figure 1. Path Model 1 120

Figure 2. Path Model 2 121

Appendix A. NLTS2 Data Collection Across Waves 122

Appendix B. Major or Primary Course of Study at a 4-Year College or University 123

Appendix C. STEM and Non-STEM Fields of Study 124

Appendix D. Fields of Study by Level of Social Interaction Required 125

Appendix E. Annual Household Income 126

Abstract

The present study utilized data from the National Longitudinal Transition Study – 2, which is a longitudinal study of a nationally represented sample of students with disabilities between the years 2000 and 2010. Using this dataset, the relationships among disability type area of study, and degree completion were explored. The final sample included approximately 310 students classified as having learning disabilities (LD), attention deficit hyperactivity disorder (ADHD), or autism spectrum disorder (ASD). It was hypothesized that individuals with ASD would prefer fields of study where there was limited social interaction to a greater degree than those with LD or ADHD. Additionally, it was hypothesized that students with ASD would be more likely than their LD and ADHD counterparts to choose fields of study in the areas of science, technology, engineering, and mathematics (STEM). Results from two path analysis models, however, revealed no significant findings. Consequently, it appears as though other factors or a combination of factors better account for the postsecondary outcomes of students with disabilities. The primary implication of these findings is that professionals and caregivers should refrain from making assumptions about area of postsecondary study or degree completion based simply on students' disability types. Furthermore, it does not appear warranted to direct students with disabilities to select specific types of academic majors simply because it is assumed that pursuing those majors will result in better postsecondary outcomes.

Chapter 1

Introduction

For many high school graduates today, obtaining a postsecondary education is viewed as a necessity. Consequently, the incoming first-year classes at most colleges and universities are steadily growing. Between 1990 and 2000, there was an 11% increase in the number of students in higher education. This rate tripled in the next ten years. Approximately 20 million individuals were enrolled in institutions of higher education in 2010, a 37% increase from 2000 (U.S. Department of Education, 2012). Estimates indicate that by 2019, 22.4 million individuals will be enrolled in higher education (Hussar & Bailey, 2011).

This phenomenon also holds true for those with disabilities. By 1998, 72% of postsecondary institutions indicated enrollment of students with a variety of self-disclosed disabilities (Hurst & Smerdon, 2000). In fact, data from the Postsecondary Education Quick Information System (PEQIS) indicated that 100% of large institutions, 99% of medium institutions, and 63% of small institutions reported enrollment of students with disabilities (Lewis & Farris, 1999). This is an increase from "only a handful of colleges and universities that could be identified as educating students with disabilities" in the 1970s (Henderson, 1995, p. 1). It is not a surprising trend since most students with disabilities (88%) have indicated that they want to go to college (Greenbaum, Graham, & Scales, 1995). Primary reasons for the desire to obtain a postsecondary education are consistent with reasons cited by students without disabilities: to obtain a better career or to fulfill parental expectations. Students with disabilities also identified encouragement from mentors and the desire to improve reading or study skills as reasons for attending college (Henderson, 1995, 2001).

Although the enrollment of students with disabilities in higher education is growing, the attrition of these students is an area of continued concern for educators and researchers. What is lacking, however, is research regarding the attrition of students with specific types of disabilities and how their major may play a role in completion rates. Consequently, the present study examined college success in college students with learning disabilities (LD), attention deficit hyperactivity disorder (ADHD), and autism spectrum disorders (ASD). The relationships among disability, area of study, and degree completion were also explored.

Disabilities and College Completion

While research regarding attrition based upon disability or academic major is lacking, research has concluded that overall, students with disabilities are less likely to earn a degree than students without disabilities (Horn & Berktold, 1999; Hurst & Smerdon, 2000; Murray, Goldstein, Nourse, & Edgar, 2000; Wessel, Jones, Markle, & Westfall, 2009). In fact, using a large sample, longitudinal study approach, Wessel et al. (2009) assessed graduation rates for students with and without disabilities who were first enrolled in college from 1994 to 1996. Results of this study indicated that while 20.38% of students with disabilities graduated within four years, only 11.96% of students with nonapparent disabilities (i.e., learning disabilities, ADHD, psychological disabilities, serious health problems) graduated within that time frame. Furthermore, research assessing only students with disabilities enrolled in institutions of higher education in 1994 concluded that only 41% of students with disabilities graduated with a degree within five years and 12% were continuing to work toward degree completion beyond their fifth year. The remaining 47% had not successfully completed postsecondary education (Horn & Berktold, 1999). Adelman and Vogel (1990) indicated that 22% of students with LD withdrew

from a small college due to academic failure. An additional 11% of students transferred to another institution of higher education.

More recent research confirms that college completion continues to be an area of concern for students with disabilities. Of all of the students with disabilities who had attended an institution of higher education up to eight years after their high school graduation, the average number of credits earned was well below what is required to earn even an associate's degree. Additionally, completion rates for students with disabilities by 2009 remained at 41%. There was, however, a significant difference in attrition based upon the type of institution attended. Students with disabilities who attended business, technical, or vocational schools were more likely to graduate from their programs than those who attended four-year institutions (Newman et al., 2011).

Career Aspirations of Students with Disabilities

Overall, the most prevalent college majors for students with disabilities in the 1990s included arts and humanities, business and management, behavioral and social sciences, health, and general studies (Adelman & Vogel, 1999; Greenbaum et al., 1995). Similarly, the most prevalent majors in 2009 and 2010 were in the fields of arts and humanities, life sciences, architecture, health professions, business, education, and social sciences (U.S. Department of Education, 2012). In another analysis of students with disabilities, the most prevalent academic majors were health care, business, social sciences, engineering, and the arts (Newman et al., 2011). Among the entire population of students who earned bachelor's degrees in the 2012 to 2013, similar fields of study were identified; starting with the highest rate, the most prevalent fields of study were business, health fields, social sciences, history, psychology, education, and biology (U.S. Department of Education, 2016). Thus, it is evident that similar to their

counterparts without disabilities, academic interest, as determined by major, is highly varied in students with disabilities. Therefore, although very little research has investigated the career aspirations of students with disabilities, it is likely that career interests are similar among those with and without disabilities. It is important to note, however, that the limited research in this field is dated. Consequently, it is unclear whether prior results are consistent with today's population of students with disabilities.

The 1994 HEATH Resource Center study surveyed 237,777 students with and without disabilities from over 450 institutions of higher education. Results indicated that all students, including those with documented disabilities, are equally interested in entering professional fields. In fact, when asked to identify what professions in which they were most interested, the highest ranked professions for students with disabilities were business executive, nurse, engineer, and elementary school teacher (Henderson, 1995). Using the same assessment process in 2000, it was found that students with disabilities identified business and arts or humanities as their top career choices (Henderson, 2001). Regardless of their interest, students with disabilities were less optimistic about their ability to obtain a professional degree. Additionally, they were more likely than those without disabilities to abandon their interests in professional fields to enter technical fields (Henderson, 1995). However, equal representation of those with and without disabilities in higher education programs for business, humanities, and health fields was noted in 1996 (Horn & Berktold, 1999).

Recent research using the National Longitudinal Transition Study – 2 (Lee, 2011), however, indicates that students with disabilities are more likely than students without disabilities to choose career paths in science, technology, engineering, and mathematics (STEM).

The increase has also expanded to graduate programs, where approximately 7% of STEM students have self-identified disabilities (CEOSE, 2009).

Previous data, however, show that students with disabilities have slightly different lifelong career achievement goals than those without disabilities. Rather than a focus on obtaining high rates of pay and having the opportunity to support a family, students with disabilities were more interested in helping others who face difficulty, developing their own philosophy of life, creating original artistic or writing pieces, and achieving recognition in a performing art than students without disabilities (Henderson, 1995, 2001). Students with disabilities seem to more highly prioritize social concerns and creative contributions than their peers without disabilities.

Relationship between Type of Disability and Academic Major

The characteristic differences between those with LD, ADHD, and ASD may also impact career aspirations. When high school students with specific learning disabilities are compared to their general education counterparts, researchers have found that those with LD report less prestigious occupational aspirations, including a higher preference for careers in the fields of construction and law enforcement (Kortering et al., 2010; Rojewski, 1999; Taylor & Walter, 2003). Due to limited research regarding the career aspirations of students with disabilities in higher education, academic major may be used to generalize academic interests to career aspirations.

Adelman and Vogel (1990) reported that the most prevalent majors for students with LD in their study included education and business management. In contrast, large sample research conducted with students with disabilities indicated that first year students with LD were more likely than students with other disabilities to consider majoring in arts and sciences. They were

also the least likely group of students to be interested in professional fields. Data from the U.S. Department of Education (2016) indicated that approximately 35% of the degrees earned in the 2012-2013 school year were within professional fields. The lower prevalence rates for students with LD may be related to their negative perceptions regarding math ability, academic ability, writing ability, and intellectual self-confidence (Henderson, 2001).

Although very little research is available regarding college majors of students with ADHD, one small-sample study (Sparks, Javorsky, & Philips, 2004) does identify the academic majors chosen by individuals with ADHD who received support services from a university in Florida. Results indicated that three quarters of the students majored in areas within the college of arts and sciences; psychology, followed closely by speech or mass communication, was the most frequently cited major. Similar to the general population of postsecondary students who majored in business (20%; U.S. Department of Education, 2016), nearly one quarter of the participants with ADHD graduated with that major. Only a few students majored in engineering, nursing, art history, or education.

In contrast to their peers with other disabilities, individuals with ASD are more likely to choose college majors in STEM. This is an interesting finding given the increasing number of STEM degrees earned among the general population of bachelor's degree recipients. The U. S. Department of Education (2016) indicated that engineering degrees increased 31%, physical science and science technology degrees increased 49%, and mathematics degrees increased 35% between the years of 2002 and 2013. Consequently, it seems that this trend among the general population of students impacts students with disabilities. Recent research (Wei et al., 2013), however, has concluded that college students with ASD were significantly more likely to enroll in STEM majors than students with any other form of disability. This is particularly true for

Science and Computer Science majors where the concentration of students with ASD was particularly high. Perhaps the 32% increase in computer and information science bachelor's degrees conferred between 2007 and 2013 was heavily impacted by the population of students with ASD (U.S. Department of Education, 2016). Interestingly, Wei et al. (2013) also found that there were higher rates of students with ASD in the non-STEM majors of health care and social science than in engineering.

In another investigation, Baron-Cohen, Wheelwright, Burtenshaw, and Hobson (2007) compared students who majored in mathematics to students in a control group (i.e., medicine, law, and social sciences majors) at one university. Results indicated that there were nine times more students with ASD in the mathematics group than in the control group (1.85% and 0.24%, respectively). Consequently, not only are students with ASD more likely to enroll in STEM programs, but within STEM majors (mathematics, in particular), there are more students with ASD than in other majors.

Present Study

Although researchers have investigated the career aspirations of those with disabilities, much of the focus has been on students with learning disabilities. In fact, very little research investigates students with ADHD or ASD in higher education at all. Moreover, researchers have yet to explicitly explore differences between college students with LD, ADHD, and ASD. Additionally, of the literature that does exist, much of it is very dated. Given the shift in expectations at the secondary level and the increase in services for students with disabilities at all education levels, it is likely that previous research does not reflect current trends. Consequently, it would be highly beneficial to students with disabilities, their parents, and both secondary and postsecondary educators to have updated, empirical data to assist in the transition process in and

out of higher education. Therefore, the present research aimed to fill this gap by assessing the relationship between disability and postsecondary field of study among individuals with documented LD, ADHD, and ASD. Specifically, this research answered the questions below. Race, gender, and socioeconomic status (SES) were included as control variables.

1. Is disability type related to career interest, as measured by postsecondary field of study? In this research, areas of study examined were delineated in two ways. First, they were based upon whether they are STEM- or non-STEM-related. Then, they were also delineated by the level of social interaction required. Understanding the variation in career interest, as determined by field of study, of students with disabilities, may help colleges and universities to provide better support and instructor training in the fields for which students with disabilities are most likely to study.

    1a. It was hypothesized that due to social deficits associated with the diagnosis of ASD, individuals with this disability would prefer fields of study where there was limited social interaction to a greater degree than those with LD or ADHD.

    1b. Given the characteristics and diagnostic criteria for LD and ADHD, it is not likely that social interaction will be inherently challenging for individuals with these disorders. Consequently, for those with LD and ADHD, variation in fields of study, based upon social interaction, was not expected.

    1c. Based upon previous research, it was hypothesized that students with ASD would be more likely than their LD and ADHD counterparts to choose STEM-related fields of study.

1d. Research regarding STEM majors among students with LD and ADHD is limited, and consequently, no hypothesis was formed regarding preferences for these populations of students.

2. Is disability type related to successful completion of postsecondary degree programs?

   Each year, approximately 41% of the students with disabilities fail to complete their postsecondary degree program (Newman et al., 2011) and a variety of reasons for leaving are cited. If the type of disability strongly impacts degree completion, it would be highly beneficial for colleges and universities to be aware of which students may require more support.

3. Is area of study (i.e., STEM vs. non-STEM and level of social interaction required for each major) for students with disabilities related to successful completion of postsecondary programs?

   Identification of fields for which students with disabilities tend to be least successful can be a beneficial advising tool for students, parents, high school counselors, and college advisors.

4. Is the effect of disability type on successful completion of postsecondary programs mediated by area of study?

Chapter 2

Literature Review

It is evident in the current literature regarding students with disabilities that there is an increase in postsecondary enrollment among this population of students (HEATH Resource Center, 2001; Henderson, 1995, 2001; Horn & Berktold, 1999; Hurst & Smerdon, 2000). Additionally, while previous research focused primarily on students with LD, there has also been an increased prevalence of postsecondary students with other disorders (i.e., ADHD and ASD; U.S. Government Accountability Office, 2009; Wei et al., 2013). Researchers (Cowen, 1993; Lee, 2011; Mull, Sitlington, & Alper, 2001; Thomas, 2000; Vogel et al., 1998) have begun to explore the reasons for increased enrollment of students with disabilities on college campuses, but it is also important to consider how the characteristics associated with particular disabilities might also impact postsecondary success. Furthermore, academic major and career interest may also impact success for students with disabilities in higher education. Consequently, this chapter reviews the literature regarding prevalence, characteristics, academic major, and success for postsecondary students with disabilities.

Prevalence of Students with Disabilities in Higher Education

Given the drive toward postsecondary education by students with and without disabilities, there are more students with disabilities in higher education now than ever before. Overall increases in the number of students with disabilities are particularly evident in smaller institutions, including community colleges and four-year independent colleges, who reported more individuals with disabilities than larger institutions (Hurst & Smerdon, 2000; Vogel et al., 1998). Initial surveys that included questions regarding students with disabilities in higher education indicated that less than 3% of first year college students in 1978 reported having a

disability (Henderson, 1995). Reports from 1994 to 2000 indicated a dramatic increase with estimates of 6% to over 9% of undergraduate students self-disclosing at least one documented disability (HEATH Resource Center, 2001; Henderson, 1995, 2001; Horn & Berktold, 1999; Hurst & Smerdon, 2000). More recently, in 2008, 11% of postsecondary students reported the presence of a disability (U.S. Government Accountability Office, 2009). England and Scotland are also experiencing growth in the rates of students with disabilities entering higher education (Riddell, Tinklin, & Wilson, 2005), suggesting a world-wide expansion across western countries.

The most prevalent and previously, the fastest growing disability of students in higher education, is that of a learning disability (Henderson, 1995, 2001; Lewis & Farris, 1999). In fact, from 1985 to 1988, only 1% of full-time freshmen had a LD, but by 1994, 3% of first-year students self-identified as having a LD (Henderson, 1995). Of the entire population of students with disabilities, earlier estimates for the percentage of students with LD in postsecondary education were 29% to 35% (Henderson, 1995; Horn & Berktold, 1999; Hurst & Smerdon, 2000). However, Lewis and Farris (1999) reported that from the years 1996 to 1998, almost half of the students with disabilities on college campuses had an identified LD (approximately 195,000). Data from the 2000 to 2001 school year also indicated that 40 to 50% of all students with disabilities in college reported having LD (Henderson, 2001).

Similar data is found in other countries, as well. An assessment of students with disabilities in England and Scotland from 1995 to 2000 indicated large increases in the number of postsecondary students with dyslexia, a form of LD. In the 1995-1996 school year, 17.9% of first year undergraduate students in the UK reported having dyslexia. The percentage increased to 32.7% by the 1999-2000 academic year (Riddell et al., 2005).

With regard to ADHD, symptom prevalence rates vary greatly and definitive numbers of college students diagnosed with ADHD are unknown (Norwalk, Norvilitis, & MacLean, 2009). However, second to LD, ADHD is the next most frequently reported disability in higher education (Faigel & Brandeis, 1995). A more recent study indicated that approximately two to eight percent of college students in the United States, Italy, and New Zealand reported symptoms of ADHD that meet diagnostic criteria from the *Diagnostic and Statistical Manual of Mental Disorders, 4th Edition* (Weyandt & DuPaul, 2006). Government data of undergraduate students reporting having ADHD, however, indicated an increase from seven percent of students in 2000 to over nineteen percent in 2008 (U.S. Government Accountability Office, 2009).

It is important to note that prevalence rates for students with ADHD are expected to increase due to increasing rates of childhood ADHD diagnoses. Nearly 7% of children under the age of 17 had been diagnosed with ADHD in the years 1998 to 2000. This rate increased to 9% of children by 2009 (Akinbami, Liu, Pastor, & Reuben, 2011). The most recent data from 2013 to 2014 indicated that up to 11% of children have been diagnosed with ADHD (Centers for Disease Control and Prevention, 2014). Given the rising numbers of children being diagnosed with ADHD, it is likely that the prevalence rates for college students with ADHD will also increase as these children begin to seek postsecondary education.

Although the prevalence rate of students with ASD is also on the rise, when comparisons are made to ten other disability-types, those with ASD are the least likely individuals to enroll in two- or four-year colleges. The only other populations of students that were lower for enrollment in higher education were those with intellectual disabilities and those with multiple disabilities (Wei et al., 2013). This was supported by Raue and Lewis (2011) who found that during the 2008-2009 academic year, 86% of institutions of higher education enrolled students

with specific learning disabilities, while 79% enrolled students with ADHD, and only 56% enrolled students with ASD.

Similar to ADHD, rising childhood prevalence rates of ASD will likely contribute to increased postsecondary enrollment of students with ASD. Among all children, there was an average increase of 57% in the number of 8-year-old children with ASD between 2002 and 2006 across all ten states surveyed (U.S. Department of Health and Human Services, 2009). Additional increases were observed between 2007 and 2012. Presently, approximately one in fifty school-aged children have an ASD (Blumberg et al., 2013). This increase in prevalence rates is credited to an increased knowledge base in diagnosticians regarding identification of ASD symptoms (Blumberg et al., 2013; Safran, 2002).

It is important to note that in the 2011 to 2012 school year, most students between the ages of six and seventeen with ASD were described by parents as having a mild ASD (Blumberg et al., 2013). Similarly, the prevalence rates for preschool students in England are highest for individuals with mild forms of ASD (Chakrabarti & Fombonne, 2001). Students with mild forms of ASD are increasingly included in mainstream classrooms prior to enrolling in higher education (Safran, 2002), and therefore, may be more likely to pursue postsecondary education.

Reasons for Increase in Prevalence Rates

The influx of individuals with disabilities in colleges is attributed to a variety of factors, many of which are related to legislation. An initial impetus for the increase was the implementation of the Individuals with Disabilities Education Act (IDEA) and its amendments in 1997. IDEA was enacted to ensure that children with disabilities have access to free appropriate public education as well as services required for post-graduation success. Though IDEA is not applicable to postsecondary settings, it was implemented after the Guckenberger vs. Boston

University court case which ruled that institutions of higher education are required to provide appropriate and reasonable accommodations to students with disabilities. Section 504 of the Rehabilitation Act and the Americans with Disabilities Act are also directly related to the rise in students with disabilities in higher education (Mull et al., 2001; Thomas, 2000; Vogel et al., 1998). Section 504 of the Rehabilitation Act of 1973 is a civil rights law that prohibits the discrimination of individuals in any program, agency, or activity due to the presence of a disability (U.S. Department of Labor, 2010). Institutions of higher education are listed as included settings where discrimination due to disability is forbidden. Therefore, any individual with a disability wishing to attend a postsecondary institution cannot be rejected solely due to the presence of a disability.

Section 504 led to the Americans with Disabilities Act (ADA), which was enacted in 1990 to address the estimated 43 million Americans with mental and medical disabilities (U.S. Department of Justice, 2009). The original document indicated that the primary reason for the act was to eliminate discrimination toward those with disabilities. Therefore, ADA prohibits disability-based employment discrimination and requires that individuals with disabilities have access to public services (primarily transportation) and public accommodations. Consequently, individuals with disabilities must have access to public transportation systems and public buildings (U.S. Department of Justice, 2009). Title II and Title III of ADA apply to state funded and private institutions of higher education, and as a result, require postsecondary institutions to ensure all programs, including extracurricular activities, are available to students with disabilities. Additionally, accessibility to living and academic buildings is required (Leuchovius, 2003).

A variety of case law decisions, most notably, the Guckenberger vs. Boston University case, have also been cited as a reason for the increase in students with LD, and also ADHD, in higher education (Mull et al., 2001). Guckenberger indicated that Boston University discriminated against those with LD and ADHD through their eligibility criteria, failure to provide appropriate measures for reviewing accommodation requests, and requirements for foreign language and mathematics. The court ruling in this case concluded that retesting college students with LD every three years is in violation of ADA and the Rehabilitation Act as it tends to screen out eligible students from receiving accommodations. Additionally, the court ruled that universities do have a requirement to provide appropriate and reasonable accommodations including substitutions for certain course requirements (Guckenberger v. Boston University, 1998). As a result of this case law, students with disabilities are more likely to be ensured reasonable and appropriate accommodations, including course substitutions, if one's disability impedes his or her ability to complete university course requirements (e.g., foreign language requirements).

Other factors for the increase in students with disabilities, LD in particular, include higher distribution of resources regarding services at specific institutions (Cowen, 1993), an increase in the aspirations and expectations of students with learning disabilities, increased willingness for colleges and universities to accept students with LD who may not meet the admissions requirements, greater self-understanding and self-advocacy skills in those with disabilities, and an increase in awareness about students with LD in higher education (Vogel et al., 1998). Additionally, Lee (2011) cited the transition planning provisions of the Individualized Education Plans (IEP) of students exiting high school as a reason for the increased rates of students with disabilities in higher education.

Additional personal reasons for entering higher education are similar to those given by those without disabilities. Students want to find a worthwhile occupation and feel successful in their adult lives (Burchardt, 2004; Hart, Grigal, & Weir, 2010).

Characteristics of Various Disabilities

Given the increased population of students with disabilities in higher education and the shift in prevalence rates of students with LD, ADHD, and ASD, it is important to recognize the similarities and differences among characteristics associated with these disabilities. Additionally, exploration of how these characteristics relate to college functioning is warranted.

LD. In contrast to students with ADHD or ASD who may have difficulties across several academic areas, college students with LD may find difficulty in specific academic areas. Specific learning disorders with impairment in reading, mathematics, and written expression are diagnosed in individuals who have difficulties learning and using academic skills though targeted interventions have been provided. Additionally, the affected academic skills must be below what is expected of the person's chronological age, which creates difficulties academically, occupationally, or in managing daily life. Often, individuals with LD have average intelligence, but are unable to successfully achieve in a specific academic area. Importantly, individuals with LD have varied severity (specified as mild, moderate, or severe). Those with mild and moderate LD generally require accommodations and support services to learn information. Highly specialized and intensive instruction, however, is required for individuals with severe LD to understand content in the affected academic area (American Psychiatric Association, 2013). Consequently, students with severe LD are likely to have great difficulty in college, where individualized instruction is not provided regularly. Those with mild and moderate forms of LD

may also suffer academically if the accommodations and support services they require are not available or utilized.

ADHD. ADHD is a disorder wherein individuals exhibit persistent inattention, hyperactivity, or both. Symptoms of inattention include failure to pay close attention to details, making careless mistakes, not seeming to listen, not following through with instructions, having difficulty organizing, often losing things, and being forgetful in daily activities. Those with ADHD, predominantly inattentive presentation have several symptoms of inattention and fewer symptoms of hyperactivity or impulsivity. Symptoms of hyperactivity are the focus of ADHD, predominantly hyperactive-impulsive presentation and include fidgeting, running around and excessive climbing, excessive talking, difficulty waiting one's turn, and interrupting others. Individuals with ADHD, combined presentation have several symptoms of both inattention and hyperactivity-impulsivity. Similar to those with LD, individuals with ADHD usually have typical cognitive functioning (American Psychiatric Association, 2013). Regardless of the type of ADHD, Barkley (1998) postulated that a lack of behavioral inhibition is the underlying impairment found in those with ADHD. Those with ADHD also seem to be driven by instant gratification (Casey, Durston, & Fosella, 2001; Power, 2003, as cited in Dipeolu, 2011). Overall, students with ADHD have lower GPAs and are more likely to be on academic probation than students without disabilities (Heiligenstein, Guenther, Levy, Savino, & Fulwiler, 1999).

Additionally, recent research provided evidence of specific difficulties students with ADHD face in higher education. For example, the presence of ADHD, inattention in particular, has been linked to poorer time management skills, concentration, and test-taking strategies (Norwalk et al., 2009; Reaser, Prevatt, Petscher & Proctor, 2007). A variety of attention problems, including selective attention, sustained attention, and orienting attention deficits may

also hinder students' abilities to filter out irrelevant information or focus for the duration of class sessions (Tsal, Shalev, & Mevorach, 2005). Although Norwalk et al. (2009) found that impulsivity was not predictive of poorer study skills and academic adjustment, prior research noted that high levels of impulsivity resulted in poor study skills and impaired self-regulation, which in turn negatively correlated with college exam grades (Spinella & Miley, 2003). It is also important to note that some of these deficits are not present while in grade school but emerge in college. Consequently, Heiligenstein et al. (1999) postulated that these symptoms are the result of external factors, such as increased academic rigor and loss of family and school support. Compared to students without the disorder, the presence of ADHD has been linked to poorer social-emotional and overall college adjustment (Shaw-Zirt, Popali-Lehane, Chaplin, & Bergman, 2005) in some research studies, but not others (Norwalk et al., 2009).

In addition, executive functioning weaknesses are prevalent among students with ADHD. Specifically, recent research indicated that children with ADHD demonstrated difficulty with decision-making and planning, in addition to difficulties with sustaining attention (Corbett, Constantine, Hendren, Rocke, & Ozonoff, 2009; Glozman & Shevchenk0, 2014), working memory, inhibition (Corbett et al., 2009; Happe, Booth, Charlton, & Hughes, 2006), shifting activities (Glozman & Shevchenko, 2014), and error correction (Glozman & Shevchenko, 2014). Among adults with ADHD, executive dysfunctions included poor planning and impulsivity in responding (Bramham et al., 2009). Given these areas of difficulty, college students with ADHD may have difficulties with planning and problem-solving not only in their academics, but also when choosing their careers. With assistance managing inattention and hyperactivity-impulsivity, however, those with ADHD should demonstrate success in higher education. Without assistance, college students with ADHD are likely to have difficulty with many of the

activities that are required in higher education (e.g., time management, organization, and attention to instruction). Consequently, they may find it challenging to complete assignments on time, study well, or recall facts from class.

ASD. Individuals with ASD present with similar and different characteristics than those with LD and ADHD. Specifically, the *Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition* (DSM – 5; American Psychiatric Association, 2013) indicated that those with ASD have persistent deficits in social communication and social interaction, as well as restricted and/or repetitive patterns of behavior, interests, or activities. Severity of the disorder is specified based upon the presence of an intellectual or language impairment and in three levels: (1) requiring support, (2) requiring substantial support, and (3) requiring very substantial support. Individuals with ASD who seek postsecondary education most likely fall into level 1 as they require support, but are not likely to have intellectual impairments, and therefore, may demonstrate success with said supports in place. Prior to the most recent revision to the *Diagnostic and Statistical Manual of Mental Disorders*, individuals falling within level 1 of ASD were diagnosed as having Asperger's Syndrome. The diagnostic criteria for Asperger's Syndrome is nearly identical to the current diagnostic criteria for ASD. The primary difference is that cognitive deficits were absent from those diagnosed with Asperger's Syndrome, whereas those diagnosed with ASD may have intellectual impairments (American Psychiatric Association, 2009, 2013). Today, most students with ASD are described by parents and professionals as having milder forms of ASD (Blumberg et al., 2013; Chakrabarti & Fombonne, 2001). In contrast to students with more severe forms of ASD, these students are not likely to have cognitive deficits that would impair their academic functioning. This in turn results in higher rates of inclusion in mainstream classrooms prior to enrolling in higher education (Safran,

2002) which may lead to an easier transition to postsecondary education. Like students with ADHD, those with ASD are also likely to have executive function weaknesses that could impact their success in college. Specifically, those with ASD may demonstrate difficulty with working memory, vigilance (Corbett et al., 2009), inhibition (Corbett et al., 2009; Robinson, Goddard, Dritschel, Wisley & Howlin, 2009), flexibility (Corbett et al., 2009; Happe et al., 2006), planning, and strategy selection (Bramham et al., 2009; Robinson et al., 2009). Furthermore, Corbett et al. (2009) noted that some of these impairments were more severe in children with ASD than in children with ADHD. Given the severity and nature of these deficits, these impairments are also likely to be seen in college students with ASD and may be linked to difficulty with time management, organization, and problem solving in and out of the classroom.

Baron-Cohen (2006) also related ASD to systemizing behavior, which he posits is a way in which humans search for patterns and predict change. Specifically, all people rely on patterns in their everyday lives in order to predict when change would occur. For example, he described the sun as a pattern that we have established, as we know that it will rise in the east and set in the west. By testing these patterns, individuals can determine whether change might occur. He hypothesized that while individuals in the general population usually fall within the first four levels of systemization, people with ASD fall within level five. Levels one to three include only slight variation in systemizing among individuals. For example, in level one, individuals have little drive to systemize, while in levels two and three, systemization is based upon typical male and female characteristics (e.g., emotions and mechanics). Level four represents a higher level of systemization than what is typical in the general population and may include scientists and mathematicians. Individuals with ASD, however, fall at level five because they can systemize at an even higher level than scientists and mathematicians in the general population. This is why

those with ASD may be drawn to historical chronologies or computers; they can easily see the patterns and discern whether change will occur.

Additionally, according to the Mind-Blindness Theory (Baron-Cohen, 1995; Baron-Cohen, Leslie, & Frith, 1985), individuals with ASD have weaker development of their theory of mind, or the ability to take the perspectives of others. Consequently, those on the autism spectrum tend to find people's behavior confusing, unpredictable, and sometimes frightening. In a postsecondary setting, this could manifest itself in an inability to communicate effectively with or an avoidance of faculty members and peers. Recently, Baron-Cohen (2009) combined theories regarding systemizing behavior and mind-blindness to develop the Empathizing-Systemizing Theory to further explain the characteristics of individuals with ASD. This theory states that it is a discrepancy between empathy and systemizing that predicts the development of an ASD. More specifically, below average empathy explains social and communication deficits, while above average systemizing explains the narrow interests, repetitive behavior, and resistance to change in individuals with ASD. Therefore, college students with ASD living independently may devote much of their time and attention to their specific interests rather than other activities. This could impact the student's ability to complete coursework in the classes they find less interesting. Given their resistance to change, students with ASD may also have difficulty managing the variations in teaching styles and formats of instructors in higher education.

Demographic Variables Related to Disability, Field of Interest, and Degree Completion

In addition to the characteristics often displayed by individuals with disabilities, it is also beneficial to identify which demographic variables are related to disability type, academic interest, and postsecondary success.

Gender and disability. Overall, most research data indicated that males with disabilities are more prevalent on college campuses than females with disabilities. The only exception was a study published in 2009 (U.S. Government Accountability Office), which indicated that 57% of students with disabilities self-identified as female. This contrasts earlier results where more than half of first year college students with disabilities indicated that they were male (52%: Henderson, 2001). Comparisons regarding gender and LD indicated that there were more first year college male students with LD (55%) than female students with LD (45%) in 2000 (Henderson, 2001). This represents a shift from 1988, where nearly 62% of adolescents with LD were male (Rojewski, 1999). Among smaller samples of college students with LD, similar distributions by gender were noted (56 – 67% identified as male: Greenbaum et al., 1995; Murray & Wren, 2003; Troiano et al., 2010). In another assessment of students with disabilities, both ASD and LD were male-dominated; 84.2% of those with ASD and 64.81% of those with LD were male (Wei et al., 2013). These results are not surprising given the fact the DSM – 5 (2013) reports that ASD is four times more likely to occur in males than females and LD is two to three times more likely to occur in males than females. According to the DSM – 5 (2013), ADHD is also diagnosed more frequently in males than females, though the discrepancy is smaller in adulthood than in childhood.

Gender and field of study. Recent data from the U.S. Department of Education (2010) indicated that there is gender disparity among some postsecondary fields of study. Based upon the bachelor's degrees earned by college students, it was apparent that female-dominant fields of study fell within the following categories: health professions (85.1% female, 14.9% male), education (79.5% female, 20.5% male), social sciences (63.7% female, 36.3% male), and arts and humanities (61.7% female, 38.3% male). In contrast, math, computer science, and

engineering (often considered STEM areas) fields were heavily male-dominated (78.6% male, 21.4% female). This is consistent with early data that indicated males were three to four times more likely than females to choose mathematics-based majors while females were more likely to choose majors in health fields, social sciences, and education (Ma, 2009; Ware & Lee, 1988). Lee's (2011) analysis of college students with disabilities also indicated that regardless of disability and type of institution (i.e., vocational, 2-year, 4-year) attended, males were consistently more likely to pursue STEM majors than females. The largest discrepancies, however, were observed in vocational/technical schools and two-year colleges, where there were substantially more males participating in STEM majors than females. When accounting for disability, ASD in particular, males (39%) were significantly more likely to enroll in STEM fields than females (3%) with the same disorder (Wei et al., 2013).

Turner et al. (2011) found that males with disabilities were significantly more interested in what the researchers described as *realistic* careers than females with disabilities. Additionally, males rated their abilities as higher for what was described as *realistic, investigative,* and *enterprising* careers than females. Consequently, as supported by the research above regarding STEM majors, males appear to have more of an interest in and/or strength in the fields of engineering (realistic), science or research (investigative), and business (enterprising).

Gender and postsecondary degree completion for students with disabilities. Using large-sample datasets, Horn and Berktold (1999) reported that there was a higher percentage of male than female students with disabilities who earned bachelor's degrees in 1993. With regard to graduates with LD, however, there were more females (15.8%) than males (13.6%). This is in contrast to Murray et al.'s (2000) findings which indicated that males with LD were significantly more likely to graduate from both four-year and community colleges. In fact, of a sample of

nearly 300 high school graduates with LD, 0% of the females had graduated from a postsecondary institution five years after high school; 4.7% of males had completed a postsecondary degree within the same time frame. Additionally, 10 years following high school, 11.5% of females with LD had graduated from a community college, but 0% had graduated from a four-year institution. This is in contrast to 12.1% of males with LD who graduated from a community college and 3.4% of males that graduated from a four year college within 10 years after earning a high school diploma. The U.S. Census Bureau (2010) also indicated that when comparing all of the people who identified as having a disability and also earned a bachelor's degree, approximately 72,000 more graduates were male than female.

SES and disability. While SES is generally determined by a combination of several factors, research regarding SES and college students with disabilities is not presently available. Family income (usually primarily provided by parents), however, is available and therefore is described below. While based only upon descriptive data, Henderson (2001) found that college students with disabilities came from slightly higher income families ($66,790 median income) than students without disabilities ($64,500 median income). In the same study, when compared to first year students with other disabilities, students with LD were more likely to come from families whose income exceeded $100,000 and had a significantly higher median family income ($84,375). Recent data (Wei et al., 2013), however, suggested that in comparison to all other postsecondary students with disabilities, those with ASD were the most likely group to be in the highest SES category (annual income over $75,000). When comparing within groups, though, the largest percentage of students with ASD (31.85%) fell within the $50,001 – 75,000 annual income bracket. In contrast, the largest percentage of students with LD (35.85%) fell within the

lowest income bracket (annual income less than $25,000) and only 8% were in the highest category.

Upon assessing the income of individuals with disabilities (rather than their parents), the U.S. Census Bureau (2010) also confirmed that the median monthly earnings for individuals with LD are $1,901 which equates to less than $25,000 annual income. With regard to ADHD, the mean annual household income ($41,511) was significantly less than a comparison group of individuals without ADHD ($52,053) in one sample (Biederman & Faraone, 2006).

SES and field of study. The available literature that examines the relationship between socioeconomic status and postsecondary field of study among college students is limited and appears to use dated resources. For example, using the NELS: 88-94 dataset, Ma (2009) reported that students from low-SES families were more likely to major in fields that may result in high financial returns than less lucrative fields. Specifically, students from low-SES families were more likely to choose majors in mathematics-related fields, business, and health fields than in humanities and social sciences. Additionally, students from high-SES families were more likely to choose majors in the fields of humanities, arts, social science, and education. Although the distinction between SES categories may have varied, this finding seems to conflict with earlier results where middle-class students were very likely to enroll in lucrative fields, such as engineering or business (Davies & Guppy, 1997).

SES and postsecondary degree completion. Recent longitudinal data analyzed for all postsecondary students, regardless of the presence of a disability, indicated that students from the low-SES category were the least likely to have obtained a bachelor's or higher degree, with only 14% reporting degree completion. Among middle-SES students, 29% reported earning at least a four-year degree. Meanwhile, 60% of students of the high-SES category had completed the

requirements for a bachelor's or higher degree (Kena et al., 2015). Research using only students with disabilities also indicated that financial burden decreases postsecondary degree completion. Newman et al. (2011) reported that 16.9% of students with disabilities did not complete their postsecondary degree because it was too expensive to continue. Additionally, first-generation postsecondary students with disabilities had even greater financial stress than students with disabilities who had family members who previously attended college (Lombardi, Murray, & Gerdes, 2012). Consequently, while explicit data regarding SES and degree completion among students with disabilities is not presently available, it can be inferred from the resources available that because students of lower-SES in the general population are less likely to graduate from a four-year program than those of higher-SES, the same trend would be observed for students with disabilities. Additionally, this impact is likely to be strongest for first-generation college students.

Race and disability. Overall, previous research generally indicated that regardless of disability type, most students with disabilities self-identified as white, non-Hispanic (Henderson, 2001; Horn & Berktold, 1999; U.S. Government Accountability Office, 2009). This trend, however, may be changing slightly. In fact, early data indicated that 77% to 83% of those with disabilities were white (Henderson, 1995). Only a few years later, Henderson (2001) reported that 72% of first-year college students with disabilities were white/Caucasian, while data from 2008 indicated that 67% of all postsecondary students with disabilities were white (U.S. Government Accountability Office, 2009).

With regard to specific disability types, Horn and Berktold (1999) reported a total of 86.5% of undergraduates with LD who identified themselves as white, non-Hispanic. This is similar to 1994 data which indicated that 83% of first year students with LD identified as white

(Henderson, 1995). Data regarding the races of college students with ADHD and ASD in large representative samples is not available in the current literature, but the proportion of students with ADHD and ASD among different racial groups can be estimated using childhood data. For example, among over 5,000 children with ASD across 11 states, there were significantly more non-Hispanic, white children (9.9/1,000 children) than non-Hispanic, black children (7.2/1,000 children) and Hispanic children (5.9/1,000 children: U.S. Department of Health and Human Services, 2009). In an assessment of children with ADHD, though, there appears to be a shift in prevalence rates by race. From 1998 to 2000, the highest race prevalence for children with ADHD was non-Hispanic, white. Data from 2007 to 2009, however, indicated similar prevalence rates for children with ADHD who were non-Hispanic, white and non-Hispanic, black (Akinbami et al., 2011).

Race and field of study. With regard to race, researchers indicated that across all academic areas, most students identify as white (Dickson, 2010; U.S. Department of Education, 2012). For example, one national survey reported that nearly 70% of those who received bachelor's degrees in 2010 identified as white. Additionally, white was the most frequently identified race and reflected the majority of the population (i.e., more than 68%) of degree recipients from every major (U.S. Department of Education, 2012).

While previous research has not indicated that there are significant variations among different races within majors, the U.S. Department of Education (2012) found that when comparing races, bachelor's degree recipients in business were substantially more likely to be earned by people who identified as white (83.4%) than any other race. Among African American students, physical sciences followed by arts/ humanities, biological/life sciences, and education were the highest degree categories. The most prevalent degree categories for students

identifying as Hispanic also included arts/humanities and physical sciences. Social sciences, health professions, and math/computer science/engineering fields were the most common degrees earned by those who identified as Asian/Pacific Islander (U.S. Department of Education, 2012). Additionally, in an assessment of only students with disabilities, Lee (2011) concluded that African American students with disabilities pursued study in STEM fields significantly less than White, Hispanic, and Asian students.

Race and degree completion. Race appears to be highly correlated with degree completion for all postsecondary students. Since 1990, when comparing among races, the percentage of degree recipients has been highest among people who identify as white. Comparisons within races, however, indicated that the highest degree completion rates occurred among those who identify as Asian/Pacific Islander; in 2014, 61% of college students who identified as Asian/Pacific Islander earned a bachelor's degree. Degree attainment, however, appears to be increasing for all students, regardless of race. For example, whereas only 26% of white students completed a degree program in 1990, 2014 data indicated that 41% completed a degree. Increases were also seen among those who identified as black (13% in 1990 to 22% in 2014), Hispanic (8% in 1990 to 15% in 2014), and Asian/Pacific Islander (43% in 1990 to 61% in 2014) (Kena et al., 2015). Similar trends were depicted for students with disabilities; descriptive data indicated that students who identify as white had the highest degree completion rate. Forty-four percent of those who identified as white earned a postsecondary degree. This is in contrast to 37% of students with disabilities who identified as Hispanic and 33% who identified as African American (Newman et al., 2011).

Reasons for Lack of Degree Completion

While characteristics associated with one's disability, as well as demographic factors, may play a role in degree completion, researchers have identified additional factors that appear to contribute to postsecondary success for students with disabilities. Specifically, Horn and Berktold (1999) indicated that students with disabilities are more likely to delay their enrollment in higher education by at least a year. By doing so, they are more likely to have a spouse and dependents, in addition to other circumstances that make postsecondary education challenging. Financial burdens, for example, can also impact one's ability to maintain enrollment until degree completion.

Additional research found that students with disabilities are more likely than students without disabilities to indicate that they do not fit in to the college environment and, therefore, were considering dropping out. This is particularly true for students with hidden disabilities, such as LD and ADHD, because they feel more pressured to justify their disability to others on campus (i.e., professors, peers, and counselors) (Adams & Proctor, 2010). Still, Murray, Lombardi, and Kosty's (2014) results showed varied college adjustment. In their analysis of 200 students with disabilities, 29% of the students were defined as having low adjustment while only 13.5% were defined as being highly adjusted (57.5% had average adjustment). The students in the low adjustment group rated the campus climate more poorly and had lower self-efficacy, social efficacy, and self-advocacy skills than those in the average and high adjustment groups. The negative overall experience in college for these students is likely to have contributed to less degree completion.

Academically, students with disabilities may also be underprepared for the rigor of postsecondary education. Although large-sample research is dated and very limited,

comparisons between students with and without disabilities show that students with disabilities have lower average SAT scores and lower high school GPAs (Horn & Berktold, 1999; Ruban, McCoach, & Nora, 2002). Additionally, they are less likely than their counterparts without disabilities to have taken advanced placement (AP) courses to prepare for the college experience (Horn & Berktold, 1999). Using a 2002 longitudinal study, Shifrer, Callahan, and Muller (2013) also concluded that students with LD were much less likely than students without disabilities to have completed college preparatory courses. More recent data indicated that approximately 50% of the students with ADHD or LD earned at B+ or higher cumulative high school GPA. This is in contrast to 70% of the general population of students who earned the same GPA (Higher Education Research Institute, 2011).

In addition to academic deficits when enrolling in higher education, many students with disabilities were also apprehensive due to perceived stigma about their disabilities (Cawthon & Cole, 2010; Dowrick, Anderson, Heyer, & Acosta, 2005) or lacked the advocacy skills required to obtain the accommodations required for academic success (Cawthon & Cole, 2010). Section 504, part E of the Rehabilitation Act of 1973 indicates that a student with a disability must self-identify and disclose their disability to offices for students with disabilities on campus in order to receive services. Those who are unable to advocate are not likely to demonstrate success and therefore, may not complete their program.

Students with disabilities also have significantly more dysfunctional career thoughts than those without disabilities. Although half of the population of students with disabilities studied by Strauser, Lustig, and Uruk (2004) had cognitive disabilities, the results indicated that regardless of the presence of cognitive deficits, students with disabilities were highly indecisive and had limited information regarding how to choose a career. Additionally, those with

disabilities had high levels of anxiety regarding choosing a career path and had trouble balancing the importance of their own perceptions with the perceptions of others when choosing a career. Consequently, students with disabilities may have more difficulty choosing a major or program of study than their peers without disabilities. This could result in taking courses that do not match student strengths or changing majors multiple times; both consequences could impact students' ability to successfully complete a degree program.

Decision-Making Regarding Postsecondary Field of Study

Because students with disabilities may have difficulty choosing a degree program, and related, may also have degree completion problems, it is important to assess their decision-making process for choosing a field of study. Unfortunately, however, much of the research in this area is dated and focused only on students with LD and the impact of their parents and secondary schools on career aspirations. Research regarding the choice of major in postsecondary settings is limited.

Secondary school decision-making. Prior to enrolling in institutions of higher education, students are likely to seek support from secondary school personnel and parents in order to make decisions regarding their college majors. For example, the authors of one qualitative study found that families were very influential in career interests of their children; most of the students with LD reported pursuit of the same career as a close family member even if there had been no formal discussion with that person regarding the career. Additionally, students in this study reported that family was the primary source of future planning, although students also consulted with significant others, teachers, friends, and other community members (Morningstar, Turnbull, & Turnbull, 1995).

In contrast, one small-sample study revealed that parents' education levels and occupations did not relate to the career goals of students with LD. Those who came from families of low SES reported stronger career aspirations than their parents. Regardless of SES, few of the families in this study were involved in the career planning process with their children with LD (Lindstrom, Doren, Metheny, Johnson, & Zane, 2007). Morningstar et al. (1995) also reported that students with LD failed to report encouragement from families to begin career planning.

With regard to particular areas of study, one middle school setting developed a STEM program explicitly for students with LD (Lam, Doverspike, Zhao, Zhe, & Menzemer, 2008). Although the sample was very small and not generalizable to all students with LD, results did indicate that the students with LD had increased knowledge and attitudes toward STEM-related careers after completion of the program. Consequently, specific training programs, such as this one, may contribute to particular fields of study in aspiring college students with disabilities.

These results contrast with earlier findings which concluded that both parents and teachers believed that when communicating with students with LD, adults should refrain from encouraging them to take courses in science and engineering. Moreover, while the belief was not held by parents, teachers reported that students with LD lacked the educational preparation required for success in science and engineering fields (Alston, Bell, & Hampton, 2002; Alston & Hampton, 2000). Consequently, it is possible that students with disabilities, LD in particular, choose non-STEM-related fields because they have taken fewer preparatory courses and are guided by school personnel, who believe they will demonstrate more success in other major areas. Additionally, students with LD are more likely than students without LD to participate in

vocational training in high school (Dowdy, Carter, & Smith, 1990). Consequently, this education may direct them toward specific majors related to the area they have already been studying.

While some researchers have suggested that more secondary support (i.e., training workshops, mentoring programs, and job shadowing) for students with disabilities is necessary (Alston et al., 2002), the underutilization of existing career development support is also reported. In one survey, college students reported having participated in significantly fewer career-related opportunities in high school than their peers without disabilities. The only activity that was cited by the majority of students (70%) was completion of a career interest inventory. Less than half of the students with disabilities utilized career materials (e.g., books) and less than one quarter of the students spoke with school personnel (i.e., teacher or counselor). In contrast, all of the students without disabilities utilized career materials and nearly one third of the students spoke with a counselor or teacher (Hitchings et al., 1998). High school students with LD in another study also reported that they had not begun planning for their futures (Morningstar et al., 1995).

This is unfortunate given the IDEA requirements for transition planning as part of IEPs. Specifically, by age 16, IEPs are supposed to include transition services to assist students with disabilities in reaching their postsecondary goals (Individuals with Disabilities Education Act). Early research indicates that while parents frequently attended meetings to discuss their children's IEP meetings, students frequently reported not being invited or not wanting to attend to those meetings (Morningstar et al., 1995.) Consequently, they may not have been fully involved in the transition process designed to assist them in preparing for college.

Recently, however, there is evidence that students are attending meetings related to their IEP more often. James, Marshall, and Sale (2004) found that 70% of IEP meetings were attended by students with disabilities over a three year span of time. Additionally, when students

were in attendance, the meeting was focused much more on student strengths and interests. Committee members, however, reported having less influence on decision making when students were present. Thus, participating in IDEA transition services does appear to increase the discussion regarding future occupational interests and how students would attain their goals via postsecondary education. Additionally, being present at meetings regarding one's IEP may promote decision-making based upon one's personal goals and interests rather than the interests of those around them.

Postsecondary school decision-making. Presently, there is no empirical data regarding field of study decision-making in postsecondary students with disabilities. Recommendations, however, have been provided by some researchers. For example, Hitchings et al. (1998) recommended that because students with disabilities enroll in postsecondary settings with less career preparation than their nondisabled counterparts, colleges and universities should assume the responsibility of helping students identify a career. Specifically, it has been suggested that institutions of higher education should work with students with disabilities to develop individual career plans and also provide opportunities to explore various fields of study (Belch, 2005; Hitchings et al., 1998).

Belch (2005) also indicated that is imperative for academic advisors and career development counselors to work in collaboration with students with disabilities in finding a purpose and field of study. Specifically, she reported a need for students with disabilities to consider several things, including their skills, values, aptitude, and interests, when attempting to choose a particular field of study.

Relationship between College Major and Employment

Although dated, there is limited research regarding the match between education and employment. This research, however, focuses primarily on the relationship between the number of years one is educated and job requirements to better understand the overeducation and undereducation of employees (Robst, 2007a; 2007b). Recent researchers have begun to expand upon this area of study in order to address the match between college major and employment. In an analysis of over 124,000 college graduates, Robst (2007b) concluded that most of the graduates described their work as being closely related (55%) or somewhat related (25%) to their postsecondary field of study. This is particularly true for graduates of majors that focus on *occupation specific skills*, such as business management, engineering, health professions, computer science, and law. Majors that emphasize *general skills* are more likely to produce graduates who choose a profession that differs from their academic major. Robst (2007b) noted that the variation in matching by type of major (i.e., occupation specific vs. general skills) may also be related to the financial consequences of a mismatch. Overall, a mismatch between major and employment is related to a decrease in salary, but this is particularly significant for those who studied in occupation specific majors.

Gender also seems to play a role in the match between major and career. Using the same dataset, Robst (2007a) concluded that males were more likely to be mismatched than their female counterparts. Moreover, the financial consequences of mismatch were also higher for males than females. Results indicated that the wages of mismatched females were 8.9% less than the wages of matched females, while mismatched males were paid 10.2% less than matched males. This is an important finding because income plays a large role in job satisfaction. After surveying approximately 2,500 college graduates, Wolniak and Pascarella (2005) reported that

income is a stronger predictor than college major congruence on all dimensions of job satisfaction. Overall results indicated that congruence between postsecondary major and employment predicted income, and therefore, played an indirect role in job satisfaction. The only exception was for those who majored in arts and humanities. These participants had significantly more job satisfaction with regard to personal job autonomy and personal fulfillment derived from their job than all other majors even though they earned less than some of their counterparts.

With regard to students with disabilities, research (Robst, 2007b) shows that a mismatch between college major and employment is reported more often by those with self-identified disabilities (25.3%) than by those who do not report the presence of a disability (19.9%). This finding is in contrast to early research that showed no difference in the match between degree and job based on the presence of a disability; 58% of graduates with disabilities and 55% of graduates without disabilities reported a match between their job and major (Horn & Berktold, 1999). Additionally, among a small group of students with LD, researchers found that approximately 61% were employed in the same field as their academic major (Adelman & Vogel, 1990).

Due to the potential financial costs of changing careers after graduation, Robst (2007b) recommends that advisement that emphasizes occupation specific skills should be provided to students before they choose a major. This recommendation is particularly true for students with disabilities as they were more likely to mismatch than their counterparts without disabilities. Additionally, students with disabilities reported that higher education does not prepare them well for finding employment that is related to their major (Dowrick et al., 2005). Consequently, increased advisement is not only warranted, but would likely be appreciated by students.

Holland's vocational choice theory. Disability characteristics play a role not only in academic success, but in job-related decision making, as well. However, Holland (1966) suggested that vocational choice is based upon personality. In fact, he noted that the match between education and career is related directly to one's primary personality-based vocational interest type. In this theory, Holland proposed six primary personality types: realistic, investigative, social, conventional, enterprising, and artistic. Each personality type includes specific behavioral, social, emotional, educational, and intellectual characteristics. These characteristics are then related to vocations in which individuals with the particular type of personality would be interested. For example, a few characteristics of individuals with the social personality type include strong verbal and interpersonal skills, as well as a preference for solving problems through communication of feelings. Consequently, the vocational preference for people with the social personality type may include the fields of psychology, counseling, and education.

Several studies evaluated Holland's theory. Holland (1966) postulated that congruence between personality and vocational choice is related to greater job satisfaction, higher performance, and longer work-related persistence. More recent researchers (Deng, Armstrong, & Rounds, 2007), however, suggested that Holland's model of vocational choice does not account well for gender differences in career choice or the personal importance of career prestige. Consequently, these factors appear to be independent predictors of career choice that should be evaluated in addition to Holland's personality types.

With regard to college-age students, Huang and Healy (1997) confirmed that Holland's types are related to choice of academic major and that the indication of vocational growth (i.e., increase in work values) throughout college is also related to the congruence between personality

type and major. In fact, Smart and Feldman (1998) reported that students enter college with strong individual preferences that correlate with Holland's interest types. Additionally, after four years of experience studying in a corresponding field, students with artistic and enterprising abilities and interests became even more interested in the characteristics for those vocational fields. This finding was not found in students with the other four types of personality types.

Consequently, it is not surprising that some people are employed in fields that are not related to their area of postsecondary study. Most people identify several reasons for the mismatch between their education and employment (Robst, 2007a). The most common reasons cited include pay and promotion opportunities (59.8%), change in career interests (47.3%), and working conditions (41.1%).

Current Research Regarding Individuals with Disabilities in Higher Education

To date, most research regarding individuals with disabilities in higher education is not related to career aspirations. Instead, it falls into two primary domains: services offered to individuals with disabilities in higher education and transition needs for individuals with disabilities moving from secondary education to postsecondary educational programs. Additionally, previous literature focuses primarily on individuals with LD rather than other disability types.

Services for individuals with disabilities. As a result of federal legislation, students with disabilities are entitled to reasonable accommodations from institutions of higher education. What services are provided, however, are up to the discretion of individual institutions. Consequently, much of the research in the field has assessed the services offered to students with disabilities. In their literature review, Mull et al. (2001) reported that a need for instructional strategies was identified in 65% of research articles regarding services for students with

disabilities. For ease of understanding, Rath and Royer (2002) divided instructional services into two categories: environment-changing and student-changing approaches.

Environment-changing approaches include services that make the curriculum easier to access or allow a student to best demonstrate their understanding of the material. These can be further divided into two categories: academic adjustments (e.g., extended time on exams) and auxiliary aides (e.g., notetakers) (U.S. Government Accountability Office, 2009). In contrast, student-changing approaches (Rath & Royer, 2002) refer to direct instruction, counseling, and/or consultation between a student and a professional. The U.S. Government Accountability Office (2009) notes that student-changing services may be provided by outside agencies, and therefore, may be fee-based services.

Student-changing approaches, in particular, have been linked with the success of students with disabilities. For example, in one longitudinal study of students with LD, proactivity, perseverance, and goal-setting were strongly correlated with success (Raskind, Goldberg, Higgins, & Herman, 1999). Additionally, self-advocacy and self-determination have also been linked to college student success, particularly for students with LD (Field, Sarver, & Shaw, 2003; Webb, Patterson, Syverud, & Seabrooks-Blackmore, 2008).

Early research (Lewis & Farris, 1999) of all postsecondary institutions in the United States indicated that between 1996 and 1998, 98% provided at least one support service or accommodation. At that time, the most common accommodations were alternative exam formats and extended time to complete exams (88% of institutions). This was followed by 69% of schools that provided readers, notetakers, and scribes. Assistive listening devices and books on tape were provided by over half of the institutions, as well. With regard to personnel services, 77% provided tutors.

Survey research conducted across 74 institutions in New York State in 2002 indicated that there was no consistency with regard to service availability. There were, however, specific accommodations that were cited by a majority of colleges and universities. Three quarters of the schools offered students extended time on tests and note takers. Additionally, 40% to 70% of the schools provided alternative testing locations, readers for examinations, and books on tape. With regard to student-changing services, nearly 60% of the surveyed institutions provided tutors, 41.7% provided individual counseling, and 29.2% provided seminars designed to teach students with disabilities study skills and college survival skills (Janiga & Costenbader, 2002).

Transitional needs. Transition services for students with disabilities is a strong focus of the research regarding students with disabilities in higher education because students with disabilities may have more difficulty succeeding in college than those without disabilities (Adelman & Vogel, 1990; Horn & Berktold, 1999; Hurst & Smerdon, 2000; Murray et al., 2000). Additionally, it is harder for some students to obtain services in institutions of higher education than in high school settings because self-advocacy is required by students; that is, they must request services themselves. In fact, under Section 504, part E of the Rehabilitation Act of 1973, a student with a disability is defined as one who *voluntarily self-identifies* as having a disability. College-level service coordinators for students with LD agree that many students lack the required advocacy skills needed to obtain services. They noted that students enrolling in higher education are not well-informed regarding services available to them in college or how to go about receiving those services. Consequently, it was their belief that a large number of students with LD do not seek assistance. Moreover, in some cases, students who do seek support do not know how their disability is related to the services they need. The surveyed service

coordinators postulated that this lack of awareness is caused by a heavy reliance on parents and special educators during the secondary education years (Janiga & Costenbader, 2002).

Moreover, secondary institutions are often unlikely to aid in the development of skills needed to obtain services in higher education. Through interviewing college students with learning disabilities, Hitchings et al. (2001) found that a majority of students (79%) recalled attending meetings to address high school services, but only eight percent met with their counselors to discuss higher education, including what high school courses to select and choosing a college. Thus, from the interviews, it was concluded that postsecondary transition planning needs to occur more often because students with disabilities appeared to have a lack of knowledge regarding higher education.

To address the inadequate transition planning conducted in secondary schools, researchers have begun to identify how to improve the process. In a research review, it was found that there are five major practices recommended by researchers that students should develop to promote a positive transition into postsecondary education: self-determination strategies, social and interpersonal strategies, academic preparation, accommodations, and assistive technology (Webb et al., 2008).

Summary

In today's society, higher education holds a stronger value than it has in the past. Given additional supports throughout high school, the drive to achieve a postsecondary degree is also growing among students with disabilities. Over the course of 30 years, the prevalence rate of students with disabilities enrolling in institutions of higher education has grown tremendously. In 2008, nearly 11% of all college students self-disclosed the presence of a disability (U.S.

Government Accountability Office, 2009). This is an increase from 1978 where less than 3% of first year college students reported having a disability (Henderson, 1995).

Historically, LD was the most prevalent and fastest growing disability among postsecondary students (Henderson, 1995, 2001; Lewis & Farris, 1999). However, the second highest disability among college students is ADHD (Faigel & Brandeis, 1995) and it is expected that the prevalence will continue to grow. Additionally, although prevalence is believed to be lower than LD and ADHD, students with ASD are more frequently enrolling in institutions of higher education, as well.

Given the increase in students with disabilities on college campuses and the wide variety of characteristics associated with their disabilities, it is important to consider the career goals and outcomes for these students. Previous research has indicated that academic interest, as determined by academic major, is highly varied among students with and without disabilities (Adelman & Vogel, 1999; Greenbaum et al., 1995; U.S. Department of Education, 2012). However, much of this research is dated and the participants included primarily students with LD only. Consequently, the literature is lacking recent research regarding the relationship between a variety of disabilities and career interest.

Additionally, students with disabilities are less likely to successfully complete their postsecondary programs than students without disabilities (Horn & Berktold, 1999; Hurst & Smerdon, 2000; Murray, et al., 2000). Research has yet to address whether the specific type of disability or major area of study is related to students with disabilities' completion of postsecondary programs.

Given the gaps in the literature, the goals of the present study were to determine whether there are relationships between (1) disability type and postsecondary field of study, (2) disability type and degree completion, and (3) area of postsecondary study and degree completion.

Chapter 3

Method

In order to identify how disability relates to area of study and degree completion, as well as the relationship between field of study and degree completion without consideration of disability type, this study employed a multivariate research design using pre-existing, longitudinal data. Given the prediction that there would be multiple relationships among the three variables (i.e., disability type, area of study, and degree completion), path analysis was used for analysis. This approach determined how well the developed model and hypotheses explain the data.

Database Overview

The present study used data from the National Longitudinal Transition Study – 2 (NLTS2), a pre-existing dataset which is sponsored by the Institute of Education Sciences (IES). It is a longitudinal study that followed a nationally representative sample of students with disabilities (based on the 13 IDEA disability categories) from 2000 to 2010. The first level of sampling included a stratified random sample of school districts that was selected on the basis of geographic location, size, and district wealth. Upon agreeing to participate, school districts provided NLTS2 with a list of students with disabilities, including grade levels, dates of birth, and disability classification. This data was used to select student participants. Students beginning the study were required to be 13 to 16 years old, in at least seventh grade, enrolled in a middle or secondary school, and receiving special education services in December, 2000. Students were randomly selected in a stratified manner based on disability type so that there would be approximately 1,000 students for each disability category. Consequently, all of the eligible students were separated by disability category and approximately 1,000 students from

each category were randomly selected to participate. The final sample during the base year included approximately 11,270 students with disabilities, along with their parents or guardians and teachers.

This NLTS2 dataset utilized a complex survey design and therefore, one cannot assume that a random sample is present. Additionally, the sample was clustered; schools were selected first, and then, students were selected from those schools. Consequently, rather than randomly selecting a sample that was representative of the population, stratified sampling was used in order to ensure that there were approximately equal numbers of participants for each disability category, geographic location, district size, and district wealth category. This is in contrast to much of the previous literature (cited above) which indicates that there are many more students with LD than with ADHD and/or ASD. Using this sampling method, however, there were relatively equal numbers of participants with LD, ADHD, and ASD. Oversampling was conducted in this way so that there would be enough participants to continue analyzing variation in later waves of the study.

Data collection. Information regarding the youth with disabilities was collected in five waves, beginning in the 2000-2001 school year and ending in the 2009-2010 school year, as they transitioned from secondary school to early adulthood. The most extensive data collection occurred during waves 1 (2001-2002) and 2 (2003-2004) and included administration of the parent/youth interviews/surveys, student assessments, school program surveys, teacher surveys, and collection of transcript data. The school characteristic survey was only administered during wave 1. Data collected in waves 3 (2005) through 5 (2009) included the parent/youth interview/survey and transcript data. A description of the data collected across the five waves is seen in *Appendix A.*

The variables in the present study came from items on the school program survey, as well as the parent/youth phone interviews and surveys.

School program survey. The school program survey was completed one time (in wave 1 or 2) by a school employee who knew the student and their program well; this was usually a special education teacher. This survey assessed transition planning, special education services, accommodations, modifications, and related services received, as well as student performance.

Parent/youth interview and survey. During all five waves of the NLTS2, structured telephone interviews with parents or guardians and youth (when possible) were completed in order to assess youth and family characteristics, nonschool activities, satisfaction with secondary school programs, and postsecondary activities. Paper questionnaires including the same questions as the interviews were sent by mail to parents, guardians, and students who could not be reached by phone.

Study Variables

Although data was collected across five distinct waves, most of the variables used in this study were created by the NLTS2 after data collection was complete. Consequently, the data in this study was based upon the most recent responses available for each participant and as a result, when data was collected varied by participant. For example, in some cases, responses about the same topic were based upon wave 3 data while in other cases, responses were based upon wave 5 data.

Additionally, while participants recruited for the NLTS2 study were required to be in at least seventh grade, only those who began the study in eighth grade were included in the analyses in the current study. The children who were seventh grade in the 2000 – 2001 school

year would not have had enough time to complete their postsecondary education by the final wave of the study (2008 – 2009) and therefore, were not included in the analyses.

Disability type. Disability type was defined using questions from the school program survey which was completed by a school employee (usually a special educator) who knew the student well. Because the survey was completed one time during wave 1 or wave 2, which spans 3 school years, disabilities were reported across several different grade levels. Since disability diagnoses generally remain constant and disability status is available for all students by twelfth grade, disability was based upon the diagnosis identified when the student was in twelfth grade. Disability was based upon the school program survey question that asked the respondent to mark the student's primary disability. Although a variety of disabilities were possible, for this study, the participants included those who were identified as having ADHD/ADD, autism or Asperger's Syndrome, or LD. Additionally, the survey question which asks the respondent to mark all of the student's disabilities, not just the primary disability, was considered in order to eliminate participants with comorbid ADHD, ASD, and/or LD diagnoses. Participants with comorbid diagnoses other than ADHD, ASD, and LD were excluded from this study in order to ensure that the primary diagnosis was the primary factor related to any relationships found to be significant. The only exception to this rule, however, was with regard to ASD and speech and language impairment. Nearly 50% of the NLTS2 participants with ASD also reported speech and language impairments, which is not surprising given the fact that social and communication skills, as well as developmental delays (e.g., in speech) are part of the diagnostic profile of ASD. Consequently, participants with comorbid ASD and speech and language impairment were included in the study.

Type of postsecondary student. Identification of whether a student was enrolled in a two-year or four-year institution was based upon two NLTS2-created variables that were based upon combinations of data from the parent/youth interviews across all five waves. The variables indicate whether a student had ever attended a four-year institution and whether a student had ever attended a two-year institution. Options for both variables included: never attended, attended and left, currently attending, graduated and currently attending, and graduated. To determine the most recent institution attended, data from both variables were used. For example, if a student reported that he or she did not attend a four-year institution, it was assumed that he or she attended a two-year institution since students who did not attend a postsecondary institution were removed from the dataset. Furthermore, if a student indicated that they were currently attending or had graduated from a two-year or four-year institution, they were placed in the category that they had indicated.

Postsecondary field of study. Postsecondary field of study was determined based upon an NLTS2-derived variable that was created using responses to the parent/youth interview or survey questions, "What is/was his/her/your major or primary course of study in a 4-year college or university?" and "What is/was his/her/your major or primary course of study in a 2-year college or university?" across the final four waves of data collection. These questions were asked after confirmation that a student was currently attending a four-year or two-year school and were answered by the youth with the disability and/or his or her parent. Because this variable used the most recent response to these questions by either a parent or youth, changes in area of study were not be analyzed in this study. Categories that were coded for this question are located in *Appendix B*.

Based upon the hypotheses, two variables for postsecondary field of study were created for this study by categorizing the majors: a dichotomous variable for STEM versus non-STEM majors and a continuous variable for amount of social interaction required in majors. It is important to note, however, that the distinction between types of majors is based more upon skills required for specific professions that are likely to result from having these majors than from the areas of study themselves. For example, psychology as an area of study requires the use of the scientific method, but it is not identified as a STEM-related major because it is not likely to lead to a profession that would be identified as STEM-related.

STEM vs. non-STEM majors. STEM-related fields of study (see *Appendix C*) included the same majors designated by previous research (Wei et al., 2013) using the NLTS2 dataset. However, in contrast to previous literature, the comparison group of non-STEM majors included a much more widespread selection of majors. Specifically, Wei et al. (2012) only used two NLTS2 categories (i.e., social sciences and health/health care/medical) as their non-STEM comparison group. In this study, all of the remaining NLTS2 categories for area of study were considered non-STEM majors. In the analysis, dummy codes were used where STEM-related majors were equal to 1 and non-STEM majors were equal to 0.

Majors by level of social interaction. The level of social interaction required for the fields of study were determined based upon data collected from the National Center for O*Net Development O*Net 20.3 Production Database. This database includes nearly 1,000 professions for which individuals have rated a variety of characteristics. Reference data regarding the education level required for each profession was also used to eliminate professions for which postsecondary education was not required. The remaining 383 professions were then categorized into the NLTS2 field of study categories using the National Center for O*Net Development

education requirements for each occupation. In order to identify how much social interaction is required of various professions, the importance score for the work activities *communicating with persons outside organization* and *communicating with supervisors, peers, or subordinates* were analyzed and a mean communication score was determined for each NLTS2 field of study. Given this method of determining social interaction, four NLTS2 fields of study categories were eliminated. The liberal arts/general studies and undeclared/undecided categories yielded no related professions and there were no professions that required postsecondary education identified for the clerical and travel/recreation categories. In the analyses, mean communication scores (see *Appendix D*) for each field of study were used. Potential ranges for this variable were between 1 and 5, with higher scores indicating higher levels of social interaction required. In the present study, means ranged from 3.15 to 4.16 (M=3.87; SD=.2).

Student Success. Student success was based on whether one received a degree from a two- or four-year institution. This variable was determined by an NLTS2-created variable that identified attendance status at a postsecondary institution based upon several parent/youth interview/survey questions across the final four waves of data collection. Variable responses included currently enrolled, graduated/completed program, and no longer attending. In order to differentiate between the students who had successfully completed a degree program from those who were continuing or had withdrawn from the program, two dummy variables were created. Because the success of students who were currently enrolled is in between the other two options (i.e., graduated and dropped out), currently enrolled was used as the reference category. Thus, one variable compared students who had graduated to those who were currently enrolled and the other variable compared students who had withdrawn to those who were currently enrolled.

Demographic variables. In addition to the research variables, three demographic variables were also controlled for in the analysis.

Gender. Gender was based upon parent responses to the parent/youth interview/survey question that asked if the youth was male or female. If a response was provided by parents in wave 1, the question was not asked again in later waves and instead is assumed to have remained constant. If the question was not answered in the first wave, however, it was asked again in a later wave. Consequently, gender was reported when students were in different grade levels. Because all students should have data for gender by twelfth grade, gender in twelfth grade was used for this analysis. In the analysis, dummy codes were created where female is 0 and male is 1.

Income. Because the NLTS2 did not compile data from several factors in order to develop a broad measure of socioeconomic status, for this study, household income was used to determine SES. This variable was based upon three questions from the parent/youth interview/survey question that asked the respondent to indicate what the total income of all persons in the household was in the past tax year. The initial question is based upon income brackets (e.g., more or less than $25,000) and then, further specified. Responses from these questions were collapsed into one variable to include family incomes ranging from less than $5,000 to more than $75,000 (see *Appendix E*.) For this analysis, however, the income brackets were standardized, using z-scores. While this information is recorded in each wave and asked of both parents and youth, for this study, the household income used was reported by parents when the student was in twelfth grade.

Race. The parent/youth interview/survey question that asked the respondent to indicate what category best described the youth's race was used for the race control variable. The race

categories were: white; African American or black; American Indian or Alaska Native; Asian, Native Hawaiian or Other Pacific Islander; and other. Consideration of ethnicity, based upon a previous question asking if the youth was of Hispanic, Latino, or other Spanish origin was also included. Both of these questions were asked in each wave of the NLTS2 and were reported only by parents. For this study, however, race was based upon responses provided by parents when the youth was in twelfth grade. Frequency data indicated that very few participants were reported to be of a race that was not white. Thus, all of the other race and ethnicities were combined together. Based on this coding, one dummy variable was constructed; white was coded as 1 and non-white races were coded as 0.

Participants

The final sample of participants, who fit the variable restrictions above, included nearly 310 students. This sample is less than the total population of students with ADHD, ASD, and LD recruited for the NLTS2 for several reasons. First, very few of the NLTS2 participants pursued higher education, and of those who did pursue postsecondary education, not all of them had identified a major. Additionally, there was high comorbidity among the NLTS2 participants and comorbidity was eliminated from the study.

Characteristics of participants, including frequency data for categorical variables, are listed in Table 1. With regard to disability, most of the participants in the present study had LD (70%) as their primary disability. Approximately 30% of the participants were identified as having ASD as their primary disability, while only 10% of the participants had ADHD. Though relatively equal numbers of participants from each disability category were recruited for participation in the NLTS2, the significant variation among disability types in the present study was due to the population of students who had enrolled in postsecondary education. To be

eligible to participate in the NLTS2, students simply had to have one of the 13 classifications of disabilities, but among those participants, there was an unequal distribution of students who sought postsecondary education.

Among the current sample, 60% of the participants were identified as male and 40% were female. Additionally, approximately 70% of the participants were white and the remaining participants (approximately 30%) identified with a race or ethnicity other than white. Household income varied greatly; however, the largest percentage of students (about 20%) were from homes with a family income greater than $75,000. Upon enrolling in postsecondary education, distribution of students among two- and four-year institutions were equivalent; approximately 50% were enrolled in two-year programs and about 50% were enrolled in four-year programs. In assessing academic major, most participants reported non-STEM majors (80%) rather than STEM majors (20%). The delineation of area of study based upon the amount of social interaction required resulted also in some variability. Using mean scores for the amount of communication involved in particular areas of study that ranged from 3.15 to 4.16 (on a scale from 1 to 5), most participants' majors required a moderate level of social interaction. Using the categories for academic success, 60% of the participants had completed a postsecondary degree, while 20% were continuing to pursue a degree, and 20% had withdrawn from their degree program. Descriptive data regarding disability, area of study, and postsecondary outcome are available in Table 2.

Description of Models

The relationship between disability type, academic major, and degree completion was evaluated through use of two path analysis models which were analyzed using the MPlus statistical software package. While they are very similar, two models were required in order to

make comparisons among all three types of disabilities. In the first model (Figure 1), LD and ADHD were compared to ASD, while in the second model, comparisons between LD and ADHD were made (Figure 2). Because the dependent variable, degree completion, is dichotomous, the path analysis was expected to be done using binary logistical regression rather than least squares regression.

Path analysis is a statistical approach used to simultaneously determine the strength of multiple relationships between variables in a proposed model. Using directional hypotheses, which suggest that specific variables occur before or directly influence other variables (e.g., disability is present before and may influence what area of study one chooses), path analysis allows for the calculation of direct, indirect, and total effects. Direct effects indicate the strength of a relationship between one variable and another variable. In path analysis models, a direct effect is represented by a straight arrow that points from one variable to the variable it is hypothesized to influence. For example, in the models for the present study, straight arrows from the types of disability to the areas of study are drawn, and suggest that disability directly influences area of study. In contrast, indirect effects signify that a relationship between one variable and another variable is the consequence of a mediating variable – a variable that is directly influenced by an earlier variable, but also directly influences a later variable. For example, in this analysis, it is hypothesized that disability will directly influence area of study. It is also hypothesized that area of study will directly impact degree completion. Consequently, using area of study as the mediating variable, the indirect effect of disability on degree completion due to the effects of area of study can be determined. In path analysis models, indirect effects are observed using straight arrows from variable A to variable B to variable C. Finally, total effects are a combination of all direct and indirect paths in a model. They indicate

the overall relationship between one variable and another variable, including both direct relationships and indirect relationships. For example, in the present study, total effects can be used to determine the overall relationship between disability type and degree completion by using the sum of the direct and indirect effects between disability type and degree completion.

In addition to the evaluation of direct and indirect effects, path analysis also allows for the analysis of correlations between variables. In these cases, the model does not predict that one variable influences another variable, but instead suggests that the two variables are simply related. Correlations in path analysis are depicted using curved, multidirectional arrows. For example, in the models for the present study, a correlation is predicted between the two distinctions for area of study (i.e., STEM vs. non-STEM and level of social interaction required).

In the present study, the independent variables included disability type and postsecondary area of study, while the dependent variable was degree completion in both models. It is important to note, however, that the demographic variables (i.e., SES, race, and gender) could have impacted the independent variables, as well as the dependent variable. Consequently, they were included in this path analysis as control variables. Because the demographic variables are likely to occur before the other variables, chronologically, and are also believed to impact all of the other variables, they were included first in the model. Using saturated or just identified path models, all of the one-way straight arrows that could possibly be drawn between variables were included. Consequently, it was assumed that all of the demographic variables are correlated with each other, but were also thought to influence the independent and dependent variables. The hypothesized relationships between variables were supported by previous literature, as well as theory derived from diagnostic criteria. Specifically, researchers have previously indicated that the demographic variables (i.e., SES, gender, and race) are related to disability type, area of

study, and degree completion. Additionally, while research is limited for some disabilities, the diagnostic criteria for ASD, LD, and ADHD seem to suggest particular major choices (e.g., ASD and STEM majors). Furthermore, prior literature reported that having a disability does impact degree completion (Horn & Berktold, 1994; Newman et al., 2011). Given the variation in diagnostic features among LD, ADHD, and ASD, however, it seemed likely that the type of disorder could differently impact degree completion.

While the other demographic variables are not as likely to significantly impact the results of this study, previous literature indicated that gender is significantly related to STEM-related majors, as well as ASD diagnoses. Consequently, if significant results had been found, a separate analysis would have been conducted in order to ensure that gender was not a moderating factor on disability or field of study. A moderating variable is one that impacts the strength of the relationship between two other variables and therefore, in this case, would indicate that the effect of disability on the choice of STEM vs. non-STEM related majors was significantly impacted by gender. To assess whether gender was serving as a moderator, separate models would have been run for males and females while leaving the paths between disability and STEM or non-STEM majors free to vary. Then, these models would have been compared to another analysis in which the male and female paths were constrained to equality. When the paths are constrained to equality, they are restricted in such a way that the variables are assumed to equal one another, whereas when they are free to vary, that restriction is removed. If the chi square difference test were significant, it would have been apparent that the means for males and females were different and therefore, gender would have been serving as a moderating variable between disability and the choice of STEM or non-STEM related majors. If this was the case, rather than analyzing just two path models where gender served as a control variable, four

separate path models would have been assessed. Specifically, path model 1 would have been analyzed separately for males and females. The same separate analyses by gender would have been conducted for path model 2, as well. If gender was not serving as a moderator, additional analyses would not be required.

Based upon previous research, as well as chronological order, the arrangement of the variables in the models suggest a causal order of relationships. Therefore, disabilities were included after demographics for several reasons. First, using the NLTS2 dataset, all of the participants were diagnosed with LD, ADHD, or ASD prior to enrolling in institutions of higher education. Consequently, diagnoses were measured before students selected a type of postsecondary institution, area of postsecondary study, and degree completion. Additionally, previous research suggested that disability may have causal relationships on choosing an area of postsecondary study, which was included in the model after disability. Thus, the distinction between STEM and non-STEM majors and majors with various levels of social interaction were next in the model. Furthermore, STEM-related majors likely require less social interaction than non-STEM related majors. Consequently, a correlation, as depicted by a curved line with multidirectional arrows, between both divisions for area of study was drawn in the models.

Degree completion, the dependent variable, chronologically occurs last, and therefore, is the final variable depicted in the models. Using the NLTS2 dataset, disability and area of postsecondary study must have already been determined prior to completing a degree program. Furthermore, previous research (Horn & Berktold, 1999; Hurst & Smerdon, 2000; Murray et al., 2000; Wessel et al., 2009) also indicated that the presence of a disability impacted degree completion. The relationship between specific disabilities and degree completion, however, was unknown. Consequently direct effects, as depicted by straight arrows, between disability (i.e.,

LD and ADHD) and degree completion were drawn in the models. While straight arrows between area of study and degree completion were also drawn in both models, it was not known how area of study would impact degree completion.

In the first model (Figure 1), LD and ADHD were compared to ASD, the reference category. ASD was chosen as the reference category because of the explicit hypotheses regarding ASD and area of study. It was predicted that area of study for those with ASD would be significantly different from those with LD and ADHD. It was unknown, however, whether differences between LD and ADHD would be present. Consequently, of the three diagnoses, ASD appeared to be the diagnosis that would produce the most variation.

The second model (Figure 2) compared LD to ADHD, while excluding ASD. In this model, ADHD was used as the reference category because those with ADHD are less likely than those with LD to demonstrate significant deficits due to the possibility of pharmacological treatment which is not available for LD. Additionally, it was believed that the symptoms of ADHD were less likely to have an effect on one's choice of major with regard to STEM versus non-STEM and higher versus lower interaction required than LD.

Because the NLTS2 sample was derived from a complex survey design, weighting was required for analyses. Sampling weights compensate for the oversampling of specific populations of participants. For example, in the NLTS2, there are approximately 1,000 students for each disability category which implies an equal distribution of students with those categories of disabilities in the population. Because some of the categories of disabilities (e.g., ASD) are less prevalent than other disabilities (e.g., LD) in the population of postsecondary students, sample weights are applied to better represent the population. This, in turn, increases the generalizability of results. Jackknifing procedures using NLTS2 replicate weights were also used

to correct standard errors for design effects. In addition to one full sample weight, the NLTS2 provides 32 replicate weights for each data file. They produced these weights by dividing the sample in half and then, weighting that half of the data up to the national population. Using the replicate weights, one is able to represent the true variability of the full sample. Consequently, the adjusted standard errors provide greater confidence that variations observed are truly differences in the population.

In order to answer the research questions, the following analyses of the path coefficients from the path analysis model were examined.

1. Is disability type related to career interest, as measured by postsecondary field of study?

   1a. Given the diagnostic criteria for the disorder, it was hypothesized that due to social deficits associated with the diagnosis of ASD, individuals with this disability would prefer fields of study where there was limited social interaction to a greater degree than those with LD or ADHD.

   In order to determine whether this hypothesis could be accepted, the direct effect of having LD as opposed to ASD, on choice of major based upon level of social interaction was evaluated using path model 1. Additionally, the direct effect of having ADHD instead of ASD on area of study based upon level of social interaction required was also evaluated in path model 1. Direct effects were determined based upon path coefficients for the straight arrows from LD to area of study based upon social interaction and ADHD to area of study based upon social interaction. Significant path coefficients would have indicated that more students with ASD than LD or ADHD chose majors with lower social interaction required.

1b. Given the characteristics and diagnostic criteria for LD and ADHD, it did not seem likely that social interaction would be inherently challenging for individuals with these disorders. Consequently, the variation in area of study between those with LD and ADHD, based upon social interaction, was not expected.

In order to determine whether variation existed between LD and ADHD with regard to the amount of social interaction required for a field of study, the direct effect of having LD on the choice of major based upon interaction required was evaluated using path model 2. The direct effect was determined based upon the path coefficient for the straight arrow that pointed from LD to area of study based upon social interaction. A significant path coefficient would have indicated that there was a significant difference in the area of study with regard to level of social interaction between those with LD and ADHD.

1c. Based upon previous research, it was hypothesized that students with ASD would be more likely than their LD and ADHD counterparts to choose STEM-related fields of study.

In order to determine whether this hypothesis could be accepted, the direct effects of having LD and ADHD, as opposed to ASD, diagnoses on the choice of STEM or non-STEM fields of study using path model 1 was evaluated. Direct effects were determined based upon the path coefficients of the straight arrows pointing from LD and ADHD to the STEM vs. non-STEM area of study chosen. Significant path coefficients would have indicated that there was a significant difference between STEM and non-STEM areas of study for those with LD versus those with ASD and those with ADHD versus those with ASD.

1d. Research regarding STEM majors among students with LD and ADHD is limited, and consequently, no hypothesis was formed regarding preferences for these populations of students.

Using path model 2, an analysis of the direct effect of LD, as opposed to ADHD, on the choice of STEM versus non-STEM area of study was conducted in order to compare LD to ADHD. The direct effect was determined based upon the path coefficient of the straight arrow leading from LD and pointing to the STEM or non-STEM area of study. A significant path coefficient would have indicated that there was a significant difference between those with LD and those with ADHD in their choices to pursue STEM and non-STEM areas of study.

2. Is disability type related to successful completion of postsecondary degree programs?

To answer this question, the total effects of LD as opposed to ASD and ADHD as opposed to ASD diagnoses on degree completion were evaluated using path model 1. The total effects were determined based upon a sum of the straight arrows in the model that represent both direct and indirect effects between disability and degree completion. Specifically, the straight arrows included in this analysis would be those that go from disability type directly to the two degree completion variables, as well as the straight arrows that go from disability type through the two major variables (i.e., STEM vs. non-STEM and major by level of social interaction) to the two degree completion variables. Significant results would have indicated that there was a significant difference between degree completion for those with LD versus those with ASD, as well as those with ADHD versus those with ASD.

In order to determine variation in degree completion between those with LD and ADHD, excluding those with ASD, total effects for path model 2 were evaluated. Again, the total effect, using the sum of the straight arrows that represent direct and indirect effects from LD to degree completion was analyzed. These included the straight arrows that went directly from disability type to the two variables for degree completion, as well as the straight arrows that began at disability, went through the two variables for area of study, and then to the degree completion variables. Significant results in this model would have indicated that there was a significant difference in degree completion between those with LD and those with ADHD.

3. Is area of study for students with disabilities related to successful completion of postsecondary programs?

   The direct effect of STEM versus non-STEM majors as well as the direct effect of majors based upon level of social interaction required on degree completion was analyzed in order to answer this research question. The direct effects were determined based upon the path coefficients of the straight arrows that point to degree completion from STEM, as opposed to non-STEM majors, and the straight arrows that began with majors with varied levels of social interaction required to degree completion. Significant path coefficients would have indicated significant variation in degree completion based upon whether a student chose a STEM or a non-STEM area of study or the amount of social interaction required in their selected fields of study.

4. Is the effect of disability type on successful completion of postsecondary programs mediated by area of study?

This mediation effect was analyzed by assessing several indirect effects in both models. First, using path model 1, the indirect effect of having LD, as opposed to ASD, on degree completion based upon the choice of a STEM or a non-STEM area of study was assessed. This was determined based upon the straight arrows that led from LD to STEM or non-STEM areas of study and from STEM or non-STEM areas of study to degree completion. Similarly, the indirect effect of having LD rather than ASD on degree completion based upon the social interaction required within an area of study was evaluated. The straight arrow that began at LD and pointed to areas of study based upon social interaction and the straight arrow from area of study based upon social interaction to degree completion was evaluated. In both of these analyses, significant results would have indicated that degree completion was significantly different between those with LD and those with ASD due to the choice of a STEM vs. non-STEM major or amount of social interaction required for the selected major.

The same analyses were conducted using ADHD. The indirect effect of having ADHD, as opposed to ASD, on degree completion based upon the choice of a STEM or non-STEM major was analyzed using the straight arrows that led from ADHD to STEM versus non-STEM area of study and from area of study to degree completion. Additionally, the indirect effect of having ADHD rather than ASD on degree completion based upon choosing areas of study with varied levels of social interaction was also evaluated using the straight arrow that derived from ADHD and pointed to social interaction required within areas of study, as well as the straight arrow that began at area of study and pointed to degree completion. Again, significant results

would have indicated that degree completion was significantly different between those with ADHD and ASD because of a variation in their choice of majors. The mediation effects in path model 2 were also analyzed. To do so, the indirect effects of the arrows pointing from LD versus ADHD to STEM versus non-STEM areas of study, and then to degree completion were analyzed. Additionally, the indirect effect of having LD, as opposed to ADHD, on degree completion based upon the social interaction required for areas of study was also assessed. For this analysis, the path coefficients for the straight arrows from LD to higher or lower area of study, as well as from area of study to degree completion were interpreted. Significant results would have indicated that the impact of having LD, rather than ADHD, on degree completion was significantly impacted by the amount of social interaction required within a major.

Chapter 4

Results

The aim of the present study was to determine whether there were relationships between (1) disability type and postsecondary field of study, (2) disability type and degree completion, and (3) area of postsecondary study and degree completion. Thus, variables included disability type, type of postsecondary student, postsecondary field of study, and student success. Gender, income, and race were included as control variables.

Using path analysis, two path models were examined. Within these models, several goodness of fit statistics were evaluated. The purpose of these analyses is to indicate how well the proposed model fits the data. One such way to determine goodness of fit is to assess chi square data; in this case, models with good fit will have nonsignificant chi squares. Additional fit tests include: root mean square error of approximation (RMSEA), where models with good fit should be less than or equal to .05; the comparative fit index (CFI), where good models have values greater than .90; and the Tucker Lewis index (TLI), where models with good fit are also greater than .90 (Kline, 2005). In the present study, model 1 fit statistics indicated a poor fit. Additionally, modification indices were evaluated in order to see if there was a way to improve the fit of the model, but the suggestions were not relevant to the research questions and would have changed the purpose of the model. Thus, changes to the model were not made. For model 2, the fit statistics were perfect, but these cannot be interpreted because the perfect fit is the consequence of using a saturated path model.

Results indicated that none of the paths were significant (see Tables 3 and 4). Similar nonsignificant findings were also found when sensitivity analyses were conducted with simpler models and statistical analyses. Specifically, to ensure that results were not based upon error or

the use of ordinary least squares regression, cross tabulations and simple regressions that included only two or three variables were analyzed. Additionally, regressions and the path models were analyzed with and without weights. Thus, because there was no variation in the results using different methodology, the results described are based upon the originally proposed models. It is important to note, however, that ordinary least squares regression was used to estimate the models rather than binary logistic regression as was proposed. When attempting to analyze the path models using binary logistic regression, they would not run, so, comparisons using both least squares and binary logistic regressions with simpler models were analyzed. There was no variation in the results, so, the path models were analyzed using ordinary least squares regression. A description of the specific results for each of the research questions and hypotheses are as follows.

Key Findings

Question 1: Disability type in relation to career interest. The first path coefficients that were analyzed involved determination of whether disability type was related to career interest, as measured by postsecondary field of study.

1a. First, given the diagnostic criteria for the disorder, it was hypothesized that due to social deficits associated with the diagnosis of ASD, individuals with this disability would prefer fields of study where there was limited social interaction to a greater degree than those with LD or ADHD. Using ASD as the reference category, the direct effect of having LD, as opposed to ASD, on the choice of major using model 1 was not statistically significant ($\beta = -.009$; $p = .978$). Similarly, the direct effect on major due to the presence of ADHD, as opposed to ASD, resulted in nonsignificant findings ($\beta = .111$; $p = .890$). Therefore, the present hypothesis can be rejected

as the presence of an ASD did not relate to the students' choice of major with regard to social interaction required.

1b. Given the characteristics and diagnostic criteria for LD and ADHD, it was deemed unlikely that social interaction would be inherently challenging for individuals with these disorders. Consequently, the variation in area of study between those with LD and ADHD, based upon social interaction, was not expected. As hypothesized, the selection of postsecondary areas of study based upon levels of social interaction did not vary depending on whether a student's primary diagnosis was LD or ADHD. Using path model 2, nonsignificant results (β= -.072; p = .907) for the direct effect of having LD, rather than ADHD, were found.

1c. Based upon previous research, it was hypothesized that students with ASD would be more likely than their LD and ADHD counterparts to choose STEM-related fields of study. Using ASD as the reference category, the present results indicated that those with LD, as opposed to ASD, did not significantly differ in their choice of STEM or non-STEM fields of study (β = .114; p = .907). Nonsignificant results (β = .094; p = .947) were also found when assessing the direct effect of having ADHD, rather than ASD, on the choice of STEM or non-STEM majors.

1d. Research regarding STEM majors among students with LD and ADHD is limited, and consequently, no hypothesis was formed regarding preferences for these populations of students. Using path model 2, the direct effect of having LD, as opposed to ADHD, on the choice of STEM and non-STEM areas of study was not significant (β = -.117; p = .952). Thus, major choice with regarding to STEM-related fields does not seem to be related to the presence of ADHD or LD.

Question 2: Disability type in relation to postsecondary success. The second research question assessed whether disability type was related to successful completion of postsecondary degree programs using two dummy variables to compare participants who: had successfully completed a program, were continuing to work toward degree completion, and had withdrawn from a degree program. Findings indicated that disability is not significantly related to postsecondary degree completion. Using path model 1, total effects were analyzed to answer this question and they yielded nonsignificant results. Specifically, the total effect of having LD, rather than ASD (β = -.240; p = .846) and the total effect of having ADHD, as opposed to ASD (β = .349; p = .940) on whether a student withdrew from their education, rather than continue or graduate were not significant. Similar, nonsignificant findings were found for the presence of LD, instead of ASD (β= .102; p = .930), and the presence of ADHD, rather than ASD (β = -.428; p = .908), on students' ability to graduate, as opposed to continue or withdraw from their education. Using path model 2, total effects also yielded nonsignificant findings with regard to the presence of LD compared to ADHD on students' withdrawal versus persistence (β = -.689; p = .885), as well as on their ability to graduate rather than continue or withdraw from their degree program (β = .633; p = .858).

Question 3: Area of study in relation to postsecondary success. Using the same variables for area of study and postsecondary degree completion, the aim of the third research question was to determine how these variables were related. Analyzing the direct effects of area of study on degree completion yielded nonsignificant findings. More specifically, the selection of STEM- over non-STEM-related majors was not significantly related to whether students graduated, as opposed to continuing or withdrawing from their education (β = .053; p = .988). STEM versus non-STEM area of study selection also did not significantly relate to whether a

student withdrew, rather than persisted, with their program (β = -.446; *p* = .873). With regard to the selection of areas of study based upon social interaction, results were similar. Major based upon social interaction did not significantly relate to students' ability to graduate, rather than continue or withdraw (β = .066; *p* = .981), or withdraw from their programs, as opposed to graduate or continue (β = .311; *p* = .927). Consequently, the selection of area of study did not appear to be related to students with disabilities' postsecondary success.

Question 4: Mediation of area of study on disability type and postsecondary success. The final research question assessed the impact of disability type on postsecondary outcome based upon the area of study that was selected. Thus, the indirect effects that included the paths from disability type to the variables for area of study, and then the paths from areas of study to postsecondary outcome were analyzed. Given the fact that the direct effects for these variables are not significant, it is not surprising that the results from the present study suggest that area of study does not serve as a mediator between disability type and degree completion. In fact, using ASD as the reference category, path 1 indirect effects of having LD, as opposed to ASD, on postsecondary graduation, based on the choice of a STEM or non-STEM area of study (β = .006; *p* = .990) or area of study with varying levels of social interaction required (β =-.001; *p* = .997) were not statistically significant. Similarly, students with LD instead of ASD did not significantly differ in postsecondary discontinuation due to the choice of a STEM versus non-STEM major (β = -.051; *p* = .928) or an area of study that required varied levels of social interaction (β = -.003 *p* = .988). With regard to students with ADHD, as opposed to ASD, results indicated that the selection of STEM and non-STEM areas of study did not mediate on students' postsecondary withdrawal (β = -.042; *p* = .970). Having ADHD rather than ASD, and selecting a major based upon social interaction required also did not significantly relate to students'

withdrawal, rather than persistence in postsecondary education (β = .035; *p* = .947). Additionally, selecting STEM versus non-STEM areas of study (β = .005; *p* = .996) or areas of study with varied social interaction required (β = .007; *p* = .986) by those with ADHD, instead of ASD, did not appear to mediate on students' postsecondary graduation.

The indirect effects in path model 2 were also analyzed in order to identify whether area of study served as a mediator between disability type (LD or ADHD) and postsecondary success. Overall, the results indicated that selecting STEM, as opposed to non-STEM-related majors did not significantly mediate upon the relationship between students' disability (i.e., LD or ADHD) and their postsecondary graduation (β = -.009; *p* = .994). Similarly, for those with LD, rather than ADHD, the selection of areas by social interaction required did not significantly relate to whether students graduated, in contrast to continuing or withdrawing from their degree programs (β = -.015 ; *p* = .982). Furthermore, the indirect effects from disability to STEM or non-STEM (β = .057; *p* = .964) and levels of social interaction required (β = -.036; *p* = .952) in areas of study to postsecondary withdrawal were nonsignificant. Consequently, in both models, areas of postsecondary study did not have mediating effects on the relationship between disability type and degree completion.

Additional Analyses

While not related directly to the research questions and hypotheses, several correlational relationships were also assessed within the path models. First, relationships between the demographic (i.e., control) variables were examined. Among the demographic variables, results of both models indicated that SES was not significantly related to race (*r* = .135; *p* = .753 [model 1]; *r* = .144; *p* = .782 [model 2]). Additionally, betas for the paths between demographic variables and the primary variables were nonsignificant. Specifically, when using ASD as the

reference category in model 1, gender (β = .107; *p* = .926), SES (β = -.267; *p* = .521), and race (β = .218; *p* = .873) were not significantly related to whether students' primary disability was LD rather than ASD. Similarly, the presence of ADHD instead of ASD yielded nonsignificant relationships with gender (β = .094; *p* = .879), SES (β = .080; *p* = .870), and race (β = -.093; *p* = .906). Model 2 results yielded the same findings for the relationship between disability type and the demographic variables (i.e., gender β = -.034; *p* = .947, SES β = -.112; *p* = .842, and race β = .101; *p* = .915)

With regard to area of study, the selection of STEM as opposed to non-STEM majors in model 1, was not significantly related to students' gender (β = .114; *p* = .907), SES (β = -.130; *p* = .888), or race (β = .267; *p* = .881). Students' gender (β = .017; *p* = .962), SES (β = .017; *p* = .950), and race (β = .000; *p* = .999) in model 1 also did not significantly relate to preferences for areas of study based upon the amount of social interaction required. Model 2 results indicated that the demographic variables (i.e., gender β = -.097; *p* = .945, SES β = -.198; *p* = .844, and race β = .371; *p* = .843) were not significantly related to whether a student selected a STEM or non-STEM area of study. Nonsignificant findings for area of study with regard to levels of social interaction required and the demographic variables of gender (β = .043; *p* = .909), SES (β = .041; *p* = .901), and race (β = -.024; *p* = .965) in model 2 were also nonsignificant.

Finally, the demographic variables (i.e., gender β = -.089; *p* = .942, SES β = -.033; *p* = .970, and race β = -.053; *p* = .972) did not significantly relate to whether students would successfully complete their degree in the first model. Using model 2, gender (β = .135; *p* = .913), SES (β = .002; *p* = .998), and race (β = -.041; *p* = .982) did not result in significant relationships with postsecondary degree completion. Results for the first model were also nonsignificant for the relationships between gender (β = .075; *p* = .951), SES (β = -.106; *p* =

.892), and race (β = .514; *p* = .759) and whether or not students withdrew from their degree programs. Similarly, model 2 data indicated that demographic variables (i.e., gender β =-.449; *p* = .693, SES β = -.083; *p* = .923, and race β = .410; *p* = .795) did not significantly relate to students' withdrawal from postsecondary programs.

Relationships between the two areas of study were also examined. Nonsignificant correlations were identified in both models for the relationship between STEM or non-STEM majors and majors by level of social interaction (*r* = -.020; *p* = .756 [model 1]; *r* = -.014; *p* = .794 [model 2]).

Chapter 5

Discussion

The purpose of the present study was to determine if students with ADHD, ASD, and LD differ in terms of their selection of postsecondary area of study and postsecondary success. This research is unique in that no other study has evaluated the relationship between all three of these variables together. There are several strengths to the present study. First, by using the NLTS2 dataset, the participants in the present sample are nationally representative of students with disabilities in the United States. Furthermore, this study utilized strict inclusion criteria (e.g., no participants with comorbid diagnoses) which allows for better generalizability of results. To provide stronger comparisons based upon academic major, all postsecondary students, regardless of area of study, were included in this study. In past research, several academic majors were excluded from analyses.

In this study, area of postsecondary study was identified using two separate variables—one to differentiate between those with STEM-related versus non-STEM-related majors and one to differentiate between those who selected majors that required varied levels of social interaction. With regard to postsecondary success, two additional variables were developed in order to compare those who successfully completed a postsecondary degree program, those who were continuing to work toward a degree, and those who had withdrawn from their degree program. The use of two separate variables for postsecondary success was beneficial as it allowed for the comparison among three different outcome options. In the past, researchers have included those who were continuing their education in the same category as those who had completed their programs and referred to them as persisters rather than non-persisters (those who withdrew). Because one cannot assume that a student who is continuing their education will in

fact complete their degree, it is important to analyze these two groups separately. Using path analysis, several relationships were expected among these variables.

Overall, none of the relationships between the independent and dependent variables that were assessed in the present study were significant. In some cases, the present results are consistent with previously established trends. In most cases, however, the results indicate opposing findings with regard to variable relationships. Because the sample for the present study came from a large, nationally-representative dataset, the NLTS2, the variation could indicate that the global findings represented in previous literature cannot be generalized to more specific samples, such as the ones selected for this study. For example, the results of this study allow for a clear distinction in the relationships between disability type and area of study or postsecondary outcome. Because comorbid diagnoses were excluded, one can be certain that the results of this study are related to specific diagnoses rather than a combination of diagnoses where one could not be sure which diagnosis was impacting the relationships most.

Comparison to Previous Research Using the NLTS2

Furthermore, it is important to highlight and explore the variations that exist between the present study results and results from other researchers using the same dataset. Lee (2011) used the NLTS2, as well as the Educational Longitudinal Study of 2002 (ELS 02/06) to evaluate the differences between students with and without disabilities in their pursuit of STEM areas of study. Thus, while Lee (2011) also utilized students with disabilities who attended two- and four-year institutions, he compared students with disabilities to those without disabilities. In contrast, the present study only used students with disabilities to make comparisons among disability categories. Therefore, Lee's (2011) finding that students with disabilities were more likely to pursue STEM fields of studies may be different from the present study because in this

study, comparisons were made within the population of students with disabilities, not between those with and without disabilities. Furthermore, Lee (2011) used all of the NLTS2 postsecondary students, whereas the present study collected data from students in only three disability categories (i.e., ADHD, ASD, and LD). Therefore, Lee's (2011) findings regarding the relationship between STEM major selection and gender or major and race may not relate directly to the results from the present study because different disabilities were included. Lee (2011) also utilized only wave 4 data, while this study used data across all five waves. As a result, the present study allowed for inclusion of all students who had identified a major, while Lee's (2011) study excluded students who declared their majors in the final wave of the study. It is possible that the limitation of these extra participants could have impacted his results.

Wei et al. (2013) also utilized the NLTS2 dataset, but they compared the enrollment in STEM majors for students with ASD to those in other disability categories. In contrast to the present study where comparisons were made among only three disability groups, those researchers compared ASD to 10 other disabilities. Additionally, whereas the present study explored all of the possible majors available to students with disabilities in the NLTS2 dataset, Wei et al. (2013) compared the same STEM majors to only two non-STEM categories: social sciences and health. Thus, their results may not generalize as well as the results from the current research. It is important to note, however, that the changes made in present study for delineation of non-STEM majors could have been what resulted in null findings. This is particularly true since some of the additional non-STEM areas of study included majors, such as accounting, that seem STEM-related.

In another study, Wei et al. (2013) used the NLTS2 dataset to evaluate the postsecondary outcomes for students with ASD in STEM and non-STEM majors. While there are many

similarities between this study and the present research, it is important to note some significant differences. Specifically, whereas the present study included three categories (i.e., completed, continuing, and withdrew from degree program) for postsecondary outcome, Wei et al. (2013) utilized only two different parameters for determining postsecondary persistence: persisters and non-persisters. In their study, they combined students who had graduated with students who were continuing their degree programs into one group, persisters. As a result, though students who completed a program are different from those who are continuing to pursue their education, it is possible that there is a similar factor between them that impacts the relationship with major. If that is the case, separating those groups in the present study could have yielded different results. Additionally, Wei et al. (2013) accounted for change in major across waves. Thus, non-persisters included not just students who had failed to complete a degree, but also students who had switched their major from STEM fields to another area. This could have led to differing results because students who had switched from STEM fields to other areas of study could have been included in the completed or continuing degree program groups in the present study.

Moreover, in comparison to all of the other research studies that have used the NLTS2, the present study had the lowest sample size, which could have contributed to the varied results. This is due to more rigid exclusion criteria than had been used in the past. For example, in the present study, three disability categories were selected and all participants with comorbid diagnoses were excluded. While this did limit the sample size, it can be ensured with more confidence that the results of this study are based upon the disabilities selected and not combinations of disabilities. It is also important to note that while the sample size of 310 was smaller than in previous studies, Kline (2005) indicates that a large sample, which is required for structural equation modeling and path analysis, is one that has at least 200 participants.

Furthermore, using Soper's (2017) power calculator for multiple regressions, power for the present models was well above the typical recommendation (Klein, 2005) of β=0.8. Therefore, while the sample size was smaller than previous studies, it appears as though there was an adequate level of statistical power in the present study.

Disability Type and Area of Study

Results from the current study indicated that disability type (i.e., LD vs. ADHD vs. ASD) did not significantly relate to major selection (i.e., STEM vs. non-STEM and level of social interaction required). While prior researchers had not examined how social interaction related to students' selection of majors, previous literature has indicated that there was a relationship between the presence of ASD and the selection of STEM areas of study (Baron-Cohen et al., 2007; Wei et al., 2013). Given the present findings, the results of the present study seem surprising. Perhaps the current results are due to the relatively small portion of the sample that selected STEM majors. Over 80% of the participants in the present study selected non-STEM areas of study. Consequently, variation in major by disability may not have occurred because most of the sample selected non-STEM fields.

Moreover, previous data indicated that students with disabilities have highly varied interests that result in selecting majors across many different fields (Newman et al., 2011; U.S. Department of Education, 2016). Consequently, like their peers without disabilities, it is possible that major selection for students with disabilities is based upon a variety of different factors where disability type may or may not serve as a predictor of academic major.

Disability Type and Postsecondary Success

In the present study, the largest percentage of the total sample obtained a postsecondary degree. Similar percentages of the sample were continuing or had withdrawn from a degree

program. These results are inconsistent with the results from several research studies which have indicated that students with any form of disability are less likely to earn a postsecondary degree than their peers without disabilities (Horn & Berktold, 1999; Hurst & Smerdon, 2000; Murray et al., 2000; Newman et al., 2011; Wessel et al., 2009). Several reasons for this relationship have been postulated. For example, students with disabilities often delay enrollment in postsecondary education and therefore, have more nonacademic obligations that those without disabilities (Berktold, 1999). Additionally, students with disabilities often have difficulty adjusting to the college environment due to social and emotional difficulties (Adams & Proctor, 2010; Murray et al., 2014) or lack of preparation for the rigor of higher education (Horn & Berktold, 1999; Ruban et al., 2002; Shifrer et al., 2013). The difference in the present study may have been related to demographic factors, such as family income. Specifically, participants in the present sample came from families with higher incomes than in the total population of NLTS2 participants. Because family income is generally believed to be related to postsecondary success (Kena et al., 2015), the higher incomes of the participants in this study could have resulted in the increased proportion of students who had completed their degree programs.

Variation in postsecondary outcome based upon disability type, however, has not been fully established in the literature. Therefore, the present study aimed to fill this research gap and results indicated that disability type did not significantly relate to degree completion. Regardless of the disability comparison, there were no significant differences in those who graduated, were continuing, or withdrew from their education. Consequently, having a disability and all of the factors that might be affected because of that may be more significant predictors of postsecondary outcome than disability type.

Area of Study and Postsecondary Success

Though previous research had yet to address the relationship between area of study and degree completion in students with disabilities, results from the present study yielded nonsignificant results. Selecting majors in STEM rather than non-STEM fields or selecting majors based upon levels of social interaction required did not significantly relate to either of the two postsecondary outcome variables in the current study. Perhaps this is the consequence of the way in which academic major was classified.

STEM and non-STEM areas of study. With regard to STEM and non-STEM areas of study, the present study used the same distinction for NLTS2 STEM majors that Wei et al. (2013) used. However, the non-STEM comparison group in the study conducted by Wei et al. (2013) included only two major categories: social sciences and health areas of study. To improve upon this, this study used all of the remaining areas of study offered by the NLTS2 as the comparison group. This is important for generalizability, as it allows for comparisons to be made across a larger spectrum of academic majors. Therefore, whereas a student who was majoring in art, for example, would not have been included in the previous research, in the present study, that student was included. As a result, the findings of the present study can be related to those in all majors, not just those who were in the four STEM or two non-STEM categories.

Areas of study based upon social interaction required. For the distinction between areas of study based upon social interaction required, categorization was based upon the social interaction required in associated professions. Consequently, it is possible that the social interaction that is required while pursuing academic study varies from that which is required while actually performing job responsibilities of a corresponding profession. For example, of the major categories used in the present study, mechanics had the lowest mean for importance of

social interaction. In postsecondary settings, however, it is likely that social interaction will be required in the classroom in order for students to best learn how to do mechanical repairs. Therefore, the social interaction associated with the professional job responsibilities may not directly relate to what is expected of students pursing the field in higher education settings.

Additionally, when reviewing the mean social interaction scores required across all academic majors, there was very little variation. Most of the fields of study required at least moderate levels of social interaction; none of the areas of study had mean scores below 3 (on a scale of 1 to 5). As a result, it seems as though all postsecondary areas of study require regular social interaction and as a result, using this method of assessing social interaction by academic major, the amount of social interaction is not likely to impact degree completion.

Furthermore, in considering postsecondary success, it may be more important to consider *how* academic major is selected rather than *what* the area of study is. Prior literature has indicated that students with disabilities are indecisive and have difficulty selecting career trajectories (Strauser et al., 2004). This may be due to limited career preparation opportunities at the secondary level. In fact, Hitchings et al. (1998) indicated that while the completion of career inventories was prevalent among college students, most of them had not utilized career planning materials or consulted with school personnel about the future. Consequently, students with disabilities often make decisions based upon professions that important people in their lives also hold, even if direct consultation regarding the career has not occurred (Morningstar et al., 1995). By determining career aspiration based upon what they observe others doing, some students with disabilities may identify areas of study that will best suit their strengths and weaknesses, while other students with disabilities may select majors that do not fit with their personal characteristics. Perhaps it is more the *fit* of the area of study to one's strengths than the area of

study itself that best predicts postsecondary outcome. For example, participating in an area of study that is uninteresting could result in low motivation and as a result, minimal effort toward coursework. It is likely that if this were the case, academic performance in that field would be poor and therefore, degree completion would be impacted. Therefore, an evaluation of how students select their fields of study and how those fields relate to their personal strengths and weaknesses may better relate to degree completion.

Demographic Factors

Finally, demographic factors (i.e., gender, SES, and race) were examined in the present study to determine if they were related to disability type, area of study, and degree completion. Results indicated that the demographic variables were not correlated with one another and also were not significantly related to the primary variables. Prior to addressing these results, however, it is important to note that the demographic characteristics of the sample for the present study did vary from the total NLTS2 sample. For example, the male to female ratio in this study was less male dominant (60%) than in the total NLTS2 population (nearly 70% men). Additionally, the sample for the current study had a smaller proportion of non-white students (30%) than the total NLTS2 population (approximately 40% not white). Furthermore, in assessing income level, most of the students in this study came from higher income categories than is depicted across the total NLTS2 population. Whereas, the highest percentage of students in the NLTS2 population are within the $25,001-50,000 income category (approximately 30%), in this study, the highest percentage of students fell within the $50,001-75,000 income category (40%). Additionally, the sample for this study had a much lower percentage of students in the lowest income categories and a higher percentage of students in the highest income category than the total NLTS2 population of students. This variation is likely the result of the selection and

exclusion criteria used in the present study and may account for variation seen between the results in this study and those presented by other researchers.

Gender. In the present study, nonsignificant findings were present when assessing the relationship between gender and disorder type. Descriptive data from the present study are consistent with diagnostic data provided by the American Psychiatric Association (2013) which indicate that prevalence rates for all three disorders tend to be higher among men than women (American Psychiatric Association, 2013). Furthermore, much of the literature has reported descriptive statistics which allude to higher rates of males than females with these disorders in college settings (Greenbaum et al., 1995; Henderson, 2001; Murray & Wren, 2003; Rojewski, 1999; Troiano et al., 2010; Wei et al., 2013). Given the expectation that men will be more likely to present with each of the three disorders, it is not surprising that significant variation between gender and disability type was not found.

Past data has indicated men are much more likely to study STEM-related fields than women (Ma, 2009; Ware & Lee, 1988; U.S. Department of Education, 2010). Consequently, the results of this study conflict with the prior literature. It is important to note, however, that the present population of students varied from those who were assessed in the past. Whereas previous researchers have surveyed all postsecondary students, the present study utilized only students with particular types of disabilities who had no other diagnoses. While the reason for this finding is unknown, based upon the results of this study, it appears as though men and women with ADHD, ASD, and LD are equally likely to select STEM or non-STEM fields of study.

Gender has also been related to degree completion in the past (Murray et al., 2000; U.S. Census Bureau, 2010). Specifically, Kena et al. (2015) indicated that completion rates within six

years of first enrolling in a postsecondary institution were higher for women than men. The present results, however, did not suggest a significant difference in degree completion, continuation, or withdrawal based upon gender. Again, previous researchers have assessed the relationship between gender and postsecondary success by comparing students with and without disabilities. Thus, these results may not generalize to a sample of students with ADHD, ASD, and LD only. Furthermore, the students with LD assessed in Murray et al.'s (2000) study were high school graduates approximately 30 years ago. During this period of time, postsecondary enrollment was increasing, but a majority of students who sought higher education were male. Currently, access to services at the secondary and postsecondary levels is similar for men and women. Consequently, the gender disparity in degree completion found in the past could have been the result of differing access to postsecondary preparation at the secondary level.

Income. The results indicated that there was no significant relationship between family income and disability type. Descriptive statistics indicated that the largest percentage of students with LD (20%) and ASD (20%) fell within the highest income category. This is contrast to results from Wei et al. (2013), who also used family income to measure SES, and reported that there were variations in SES with relation to those with ASD and LD. In that study, the largest percentage of students with LD fell within the lowest income bracket whereas the largest percentage of students with ASD fell within a higher bracket. These results, however, were descriptive in nature and therefore, do not indicate that statistically significant variation was present. It is also important to keep in mind that Wei et al.'s (2013) sample did not eliminate comorbid diagnoses and therefore, results may have varied from the present study because of the inclusion of students with more than one diagnosis. Additionally, Wei et al. (2013) only utilized

participants with one of the 13 IDEA classifications, and therefore, did not account specifically for students with ADHD, which is not its own classification.

While not assessed in students with disabilities in the past, SES has been related to degree completion among the general population; students who come from high SES backgrounds are very likely to successfully earn a postsecondary degree whereas those from low SES families are less likely to complete a degree program (Kena et al., 2015). Consequently, the same trend for students with disabilities seemed possible. The varied income levels of the present sample, though, did not significantly relate to degree completion. It is important to note, however, that SES is not based entirely on family income. Therefore, the results from the present study may not directly correlate with previous literature that assessed SES using multiple factors (i.e., parents' occupation, education level, and income) rather than income alone.

Race. Limited research was also previously available regarding the relationship between race and area of study for students with disabilities. The only such study (Lee, 2011) indicated that STEM fields were selected significantly more often by those who identified as white, Hispanic, and Asian than those who identified as African American. While there were no significant differences by race in the present study, descriptive data indicates that more students who identified as Hispanic (30%) or white (20%) select STEM majors than students who identified as African American (10%) or Asian (10%).

The racial makeup of the present sample was also not significantly related to degree completion. Additionally, previous research has yet to evaluate this relationship using inferential statistics. Newman et al.'s (2011) descriptive analyses indicated that students with disabilities who identified as white had the highest degree completion rate. However, their descriptive statistics appear to be visually similar with degree completion ranges from 33% in African

American students to 44% in students who identified as white. While white students also had the highest degree completion rate in the present study, descriptive statistics show more promising rates for students from all races. Approximately 60% of those who identified as white or Hispanic and nearly 40% of those who identified as African American or Asian graduated from a postsecondary institution.

With regard to race, there was no previous research about the relationship with disability type. Additionally, use of childhood data showed varied results when comparing within disability categories, with some indicating that there were significantly more white than nonwhite children with ASD (U.S. Department of Health and Human Services, 2009) and others reporting that most college students with disabilities in general self-identify as white (Henderson, 2001; Horn & Berktold, 1999; U.S. Government Accountability Office, 2009).

Limitations and Future Research

In evaluating the present results, several limitations are noteworthy. One such limitation of the present study is with regard to variable selection. To overcome problems with missing data, most of the variables for this study were derived by NLTS2 after data collection was completed. These variables compiled responses from across all five waves of the study. Therefore, it could not be guaranteed that data were derived from one particular wave or from one point in a student's life. For example, the identification of major for some students could have been based upon when they were first year students whereas major choice for other students could have been based upon when they were in their fourth year of postsecondary education. This made it impossible to compare students based upon a consistent timeline. Though the use of these variables was not likely to significantly impact the results, selecting data from specific times in one's life or by a particular wave would allow for more consistent data.

Furthermore, the use of NLTS2-created variables made it impossible to assess changes in area of postsecondary study. Among the general population, changes in major are very common; national data indicated that nearly 50% of postsecondary students who enrolled for the first time in 2003 changed their major at least one time prior to 2009 (Sklar, 2014). This is likely to occur among students with disabilities, as well. In this study, however, major changes could not be assessed.

Another related limitation in the present study involves the way in which social interaction required for majors was determined. In this study, the amount of social interaction required within a particular major category was based upon professions associated with areas of study, rather than assessment of social interaction within the areas of study at the postsecondary level. Therefore, it was assumed that the importance of social interaction identified by professionals working within the job field directly related to the importance of social interaction in the classroom. Because educational settings often require extensive participation and interaction among students and faculty, it is possible that the distinctions in social interaction required within the fields of study are more relevant to the workforce than to postsecondary education. In the future, researchers may consider developing other methods for determining the amount of social interaction required within areas of postsecondary study.

Additionally, area of study was limited to only two delineations (i.e., STEM vs. non-STEM and social interaction required) in this research. Given the fact that there are many fields of study available to postsecondary students and there are several different ways to categorize them, the present study utilized what had been done in the past (i.e., STEM vs. non-STEM) and derived a new categorization based upon theory regarding social interaction and ASD. These appeared to be the best options for comparisons as they seemed to be related to the disabilities

selected for this study, but using these systems, variations among specific fields within these broad categories were not evaluated. Consequently, it may be beneficial to examine new delineations for area of study in the future. For example, use of Holland's (1966) personality-based vocational interest types could better reflect variations in selection of academic majors for students with particular disabilities. Specifically, students with ASD may be less likely to select social majors and more likely to select investigative majors. In the present study, some of the non-STEM areas of study were investigative in nature, so, in the future, researchers may consider Holland's theory when developing categories for comparison of various areas of study.

The way in which the NLTS2 created major categories also serves as a limitation in the present study. This is particularly true for the delineation between STEM and non-STEM majors. Each NLTS2 category for area of study identified within the dataset included several different majors and in some cases, categories included majors that appeared to be both STEM- and non-STEM-related. For example, the business fields of study included accounting, which could be considered a STEM field even though marketing, another major in that category, is not related to STEM. Because specific majors were unknown, it is possible that many of the students in the business category could have been studying accounting, which could have skewed the results of the present study. While specific areas of study were not identified using the NLTS2 dataset, future researchers could try to be more precise in their determination of STEM and non-STEM areas of study by asking participants for their specific majors rather than allowing them to choose from a broad category of majors.

Another limitation is related to the outcome measure in the present study. Approximately one third of the sample in this study was identified as being *currently enrolled* in postsecondary education by the final wave of data collection. Though all of the students would have had

enough time to complete a degree by the time data collection ended, a large percentage of the students had yet to finish or withdraw. Because the data was preexisting, the author was not able to inquire with students about why they were still enrolled. Thus, it is unknown whether the students had taken leaves of absences, were taking fewer credits each semester than expected, or were failing courses. Having knowledge of this information would have allowed for better conclusions to be drawn. For example, it may be the case that the students who were still enrolled were doing well academically in their courses, but had yet to graduate because of reduced course loads. If this were the case, the students in this category would be more related to those who had successfully graduated than those who had withdrawn. In contrast, it is possible that those who were continuing to work toward their degree were doing so because they had experienced unsatisfactory grades in their courses which was causing an extension in education to earn the credits required to graduate. If that were the case, the students in this group would more closely align with those who were unsuccessful in completing a degree program.

Additionally, because data collection ended, it is unknown whether these students eventually completed a degree or whether they withdrew from their programs. In order to better predict postsecondary success, it would be best to have a large sample of students who had either completed or withdrew from their programs. Given the nonsignificant findings of the present study, future research should further examine what contributes most to postsecondary success among college students with disabilities.

While also a strength of the present study, to ensure that results were based only on the presence of students' primary disability, comorbidity was eliminated from this study. In reality, though, many college students with disabilities are impacted by more than one disorder. Consequently, while the present results can only be generalized to students who have ADHD,

ASD, or LD and no other diagnosis, it would be worth exploring the impact of different forms or combinations of disorders on area of study and degree completion in the future.

Generalizability of the results from the present study to students enrolled in postsecondary education today is also impacted by the fact that the data collection for the present study began approximately 16 years ago and ended eight years later. Within and since that period of time, there has been substantial growth in the prevalence of college students with disabilities. Consequently, today's students may be more academically, socially, and emotionally prepared for college than the participants in the present study and as a result, if students were evaluated today, results may vary.

Furthermore, since data collection has ended, STEM fields of study appear to be expanding (U.S. Department of Education, 2016). Through presidential initiatives, there has been an increase in the importance of STEM study within secondary schools. Specifically, the *Educate to Innovate* and *Race to the Top* campaigns both allowed for financial resources to be allotted specifically toward STEM education in elementary and secondary school settings (Handelsman & Smith, 2016). Therefore, although not likely a reason for the present study's results, in the future, disability may not be as strong a predictor as the cultural shift in prioritization of study in science, technology, engineering, and mathematics as expected. Given the legal requirements for students with disabilities to be included in general education settings to the greatest degree possible (IDEA 1997), students today are likely being exposed more to STEM fields than in the past. This could contribute to increased interest in STEM fields, regardless of the presence of a disability in the future. Therefore, the variables in the present study should be reexamined with students who are currently preparing for or enrolling in postsecondary education now.

Implications

The current study was designed to assist students with disabilities, as well as their parents, teachers, counselors, and postsecondary institutions better understand the relationship between disability type, area of study, and degree completion. For example, with regard to the relationship between disability type and area of study, it was anticipated that specific fields of study would be more highly selected by students with specific disability types than others. This could in turn inform institutions of higher education of the departments and programs that might require the most support or training regarding students with disabilities. Because disability type does not appear to be directly related to area of study, however, all instructors are likely to have students with a variety of disabilities in their classes. Consequently, postsecondary institutions could provide training and support regarding all forms of disability to all faculty, regardless of the field, in order to facilitate more effective advising and instruction for students with disabilities.

The present findings also indicate that disability type is not significantly related to degree completion. In fact, results imply that students with ADHD, ASD, and LD have relatively equivalent chances of graduating, continuing longer than is expected, or withdrawing from their degree programs. Thus, it cannot be assumed that students with one particular type of disability, ASD for example, will have more difficulty than those with a different type of disability. Therefore, rather than selecting services and support level based upon disability category, it appears that postsecondary institutions would serve students better by addressing the needs of individual students.

Additionally, when advising students at both the secondary and postsecondary levels, area of study may be best considered with regard to an individual student's skills and interests.

The present study suggests that there is not a significant relationship between academic major and degree completion. Therefore, while in the past students with disabilities have been advised to refrain from particular fields due to concerns about degree completion (Alston et al., 2002; Alston & Hampton, 2000), this does not serve students well. Instead, during career counseling, academic advising, or informal conversations, faculty, counselors, and parents could be encouraged to assess each student individually and suggest that students pursue whichever field appears to suit them best.

Conclusion

The present study evaluated the relationship between disability type (i.e., ADHD, ASD, and LD), area of postsecondary study (i.e., STEM vs. non-STEM and levels of social interaction required), and postsecondary success (i.e., degree completion, continuation, or withdrawal). Using two path analysis models, the results indicated that there were no statistically significant relationships among these variables. Consequently, it appears as though other factors or a combination of factors, some of which may include area of study and disability type, better account for the postsecondary outcomes of students with disabilities. For example, it is possible that postsecondary preparation more strongly impacts degree completion than the presence of a particular disability or area of study alone. Furthermore, the selection of area of study may be more heavily influenced by secondary academics than by disability. Therefore, further analyses of these factors on major selection and postsecondary success is needed.

The primary implication of these findings is that postsecondary outcome may be better accounted for by individual differences among students with disabilities than common characteristics (e.g., demographic data, disability type, academic major) that they may have. Consequently, students with disabilities would be better served if they were advised in the same

ways and provided the same opportunities as students without disabilities at the secondary and postsecondary levels. Professionals and caregivers could be encouraged to refrain from making assumptions about area of postsecondary study or degree completion based simply on the students' disability types. Furthermore, we may refrain from pressuring students with disabilities to select specific types of academic majors simply because it is assumed that they will result in better postsecondary outcomes. Instead, encouraging students with disabilities to explore their individualized interests based on their unique strengths and weakness is recommended. This could in turn lead to more appropriate selections of academic majors, higher postsecondary satisfaction, and increased degree completion rates.

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Table 1

Characteristics of Participants: Frequency Statistics of Categorical Variables

Variable Name	Frequency	Percent
Independent Variables		
Gender		
Male	180	60
Female	130	40
Race		
White	230	70
Non-white	80	30
African American	40	10
American Indian	<10	<10
Asian	10	<10
Hispanic, no Race	30	10
Income		
$5,000 or less	10	<10
$5,001 to $10,000	10	<10
$10,001 to $15,000	10	<10
$15,001 to $20,000	20	10
$20,001 to $25,000	20	10
$25,001 to $30,000	10	<10
$30,001 to $35,000	10	<10
$35,001 to $40,000	10	<10

Table 1 Continued

Characteristics of Participants: Frequency Statistics of Categorical Variables

Variable Name	Frequency	Percent
Independent Variables		
Income		
$40,001 to $45,000	10	<10
$45,001 to $50,000	10	<10
$50,001 to $55,000	30	10
$55,001 to $60,000	20	10
$60,001 to $65,000	30	10
$65,001 to $70,000	20	10
$70,001 to $75,000	20	10
Over $75,000	70	20
Disability		
ADHD	20	10
ASD	80	30
LD	210	70
Student type		
2 year	160	50
4 year	150	50
Major		
Agriculture	<10	<10
Animal Science	<10	<10

Table 1 Continued

Characteristics of Participants: Frequency Statistics of Categorical Variables

Variable Name	Frequency	Percent
Independent Variables		
Major		
Arts	20	<10
Business	30	10
Communications	20	10
Computer Science	20	10
Education	20	10
Engineering	10	10
English	10	<10
Food Science	10	<10
Foreign Language	<10	<10
Health	20	10
Mathematics	<10	<10
Mechanics	10	<10
Science	10	10
Skilled Crafts	10	<10
Social Science	30	10
STEM	40	20
Non-STEM	210	80

Table 1 Continued

Characteristics of Participants: Frequency Statistics of Categorical Variables

Variable Name	Frequency	Percent
Dependent Variable		
Success		
Completed	170	60
Continuing	60	20
Discontinued	70	20

Note. Frequencies and percentages rounded to nearest 10

Table 2

Frequency Statistics for Disability, Major, and Outcome

Variable Name	Frequency	Percent
ADHD		
STEM	10	80
Completed	<10	50
Continuing	<10	50
Discontinued	<10	<10
Non-STEM	<10	20
Completed	10	60
Continuing	<10	10
Discontinued	<10	30
ASD		
STEM	10	20
Completed	10	50
Continuing	<10	40
Discontinued	<10	10
Non-STEM	50	80
Completed	30	60
Continuing	10	20
Discontinued	10	20

Table 2 Continued

Frequency Statistics for Disability, Major, and Outcome

Variable Name	Frequency	Percent
LD		
STEM	30	20
Completed	110	60
Continuing	10	30
Discontinued	<10	10
Non-STEM	120	80
Completed	80	70
Continuing	20	10
Discontinued	20	20

Note. Frequencies and percentages rounded to nearest 10

Table 3

Path Model 1 Results

Path	*B*	*p*
Demographics to Disabilities		
Gender → LD	.107	.926
Gender → ADHD	.094	.879
Income → LD	-.267	.521
Income → ADHD	.080	.870
Race → LD	.218	.873
Race → ADHD	-.093	.906
Demographics to Majors		
Gender → STEM	-.035	.971
Gender → Social	.017	.962
Income → STEM	-.130	.888
Income → Social	.017	.950
Race → STEM	.267	.881
Race → Social	.000	.999
Demographics to Outcome		
Gender → Completed	-.089	.942
Gender → Discontinued	.075	.951
Income → Completed	-.033	.970
Income → Discontinued	-.106	.892
Race → Completed	-.053	.972

Table 3 Continued

Path Model 1 Results

Path	*B*	*p*
Demographics to Outcome		
Race → Discontinued	.514	.759
Disabilities to Majors		
LD → STEM	.114	.907
LD → Social	-.009	.978
ADHD → STEM	.094	.947
ADHD → Social	.111	.890
Disabilities to Outcome		
LD → Completed	.102	.930
LD → Discontinued	-.240	.846
ADHD → Completed	-.428	.908
ADHD → Discontinued	.349	.940
Majors to Outcome		
STEM → Completed	.053	.988
STEM → Discontinued	-.446	.873
Social → Completed	.066	.981
Social → Discontinued	.311	.927
Disabilities to Majors to Outcome		
LD → STEM → Completed	.006	.990
LD → STEM → Discontinued	-.051	.928

Table 3 Continued

Path Model 1 Results

Path	*B*	*p*
Disabilities to Majors to Outcome		
LD → Social → Completed	-.001	.997
LD → Social → Discontinued	-.003	.988
ADHD → STEM → Completed	.005	.996
ADHD → STEM → Discontinued	-.042	.970
ADHD → Social → Completed	.007	.986
ADHD → Social → Discontinued	.035	.947

Note. Goodness of fit statistics: chi square = 55.287, $p < .001$; RMSEA = .420, $p < .05$; CFI = .868; TLI = -4.540. Completed = completed degree program; discontinued = withdrew from degree program.

Table 4

Path Model 2 Results

Path	*B*	*p*
Demographics to Disabilities		
Gender → LD	-.034	.947
Income → LD	-.112	.842
Race → LD	.101	.915
Demographics to Majors		
Gender → STEM	-.097	.945
Gender → Social	.043	.909
Income → STEM	-.198	.844
Income → Social	.041	.901
Race → STEM	.371	.843
Race → Social	-.024	.965
Demographics to Outcome		
Gender → Completed	.135	.913
Gender → Discontinued	-.449	.693
Income → Completed	.002	.998
Income → Discontinued	-.083	.923
Race → Completed	-.041	.982
Race → Discontinued	.410	.795
Disabilities to Majors		
LD → STEM	.117	.952

Table 4 Continued

Path Model 2 Results

Path	*B*	*p*
Disabilities to Majors		
LD → Social	-.072	.907
Disabilities to Outcome		
LD → Completed	.633	.858
LD → Discontinued	-.689	.885
Majors to Outcome		
STEM → Completed	.073	.986
STEM → Discontinued	-.486	.878
Social → Completed	.202	.969
Social → Discontinued	.500	.920
Disabilities to Majors to Outcome		
LD → STEM → Completed	-.009	.994
LD → STEM → Discontinued	.057	.964
LD → Social → Completed	-.015	.982
LD → Social → Discontinued	-.036	.952

Note. Goodness of fit statistics: chi square = 0.000, p <.001; RMSEA = 0.000, p <.05; CFI = 1.000; TLI = 1.000. Completed = completed degree program; discontinued = withdrew from degree program.

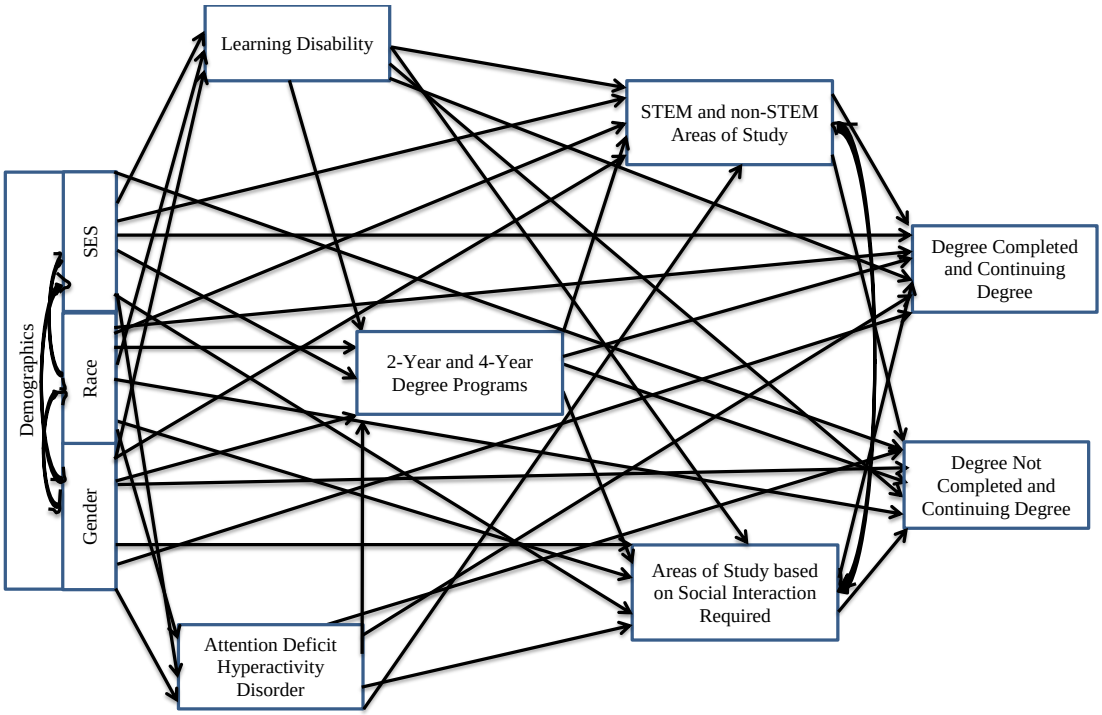

Figure 1. Path Model 1 - Proposed model of relationships between LD and ASD, as well as ADHD and ASD, with regard to postsecondary area of study and college degree completion.

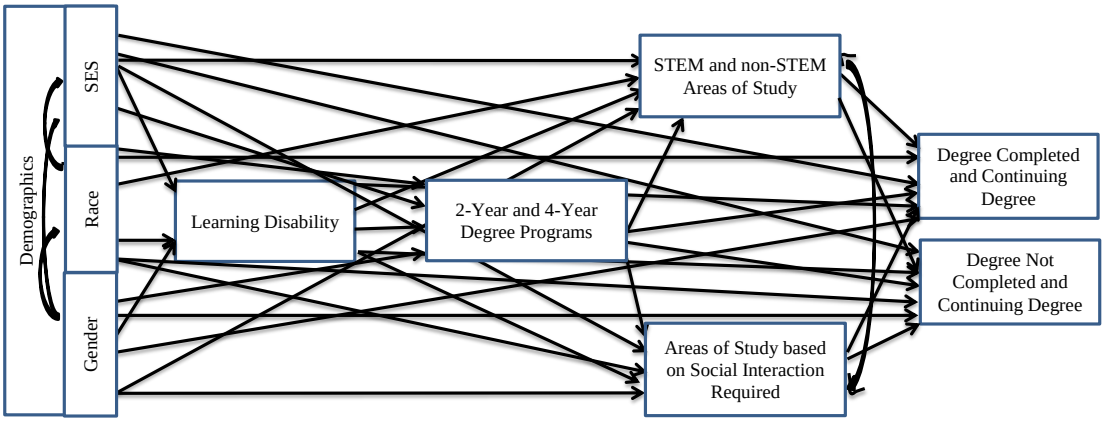

Figure 2. Path Model 2 – Proposed model of relationship between LD and ADHD with regard to postsecondary area of study and college degree completion.

Appendix A

NLTS2 Data Collection Across Waves

Instruments	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Parent/Youth Phone Interview and/or Mail Survey	2001	2003	2005	2007	2009
Student Assessment	2002	2004			
School Characteristic Survey	2002				
School Program Survey	2002	2004			
Teacher Survey	2002	2004			
Transcript	2002	2003/04	2005	2006/07	2008/09

Highlighted instruments were used in the present study

Appendix B

Major or Primary Course of Study at a College or University

AGRICULTURE, HORTICULTURE, VITICULTURE, FORESTRY, GROUNDSKEEPING
ANIMAL CARE, E.G. VETERNINARY HELPER, PREVET
ARTS, DRAMA, DANCE, MUSIC, GRAPHIC DESIGN/ARTS, FASHION DESIGN
BUSINESS, MARKETING, ADVERTISING, MANAGEMENT, FINANCE, ACCOUNTING
CLERICAL, E.G. FILING, RECEPTIONIST, SECRETARY, TYPIST
COMMUNICATIONS, JOURNALISM, TV/RADIO, ENTERTAINMENT INDUSTRY
COMPUTER SCIENCE, PROGRAMMING, ARTIFICIAL INTELLIGENCE, INFORMATION TECHNOLOGIES, COMPUTER SUPPORT, DATA ENTRY, WEB PAGE DEVELOPMENT
EDUCATION, TEACHING, CHILD DEVELOPMENT, EARLY CHILDHOOD EDUCATION, HOME ECONOMICS, CHILD CARE
ENGINEERING, ELECTRICAL, MECHANICAL, CHEMICAL
ENGLISH, LITERATURE, LIBRARY SCIENCE
FOOD SERVICE, RESTAURANT MANAGEMENT
FOREIGN LANGUAGE
HEALTH CARE - PRE-MED, NURSING, PUBLIC HEALTH, PHYSICAL THERAPY, RECREATION THERAPY, PERSONAL CARE ATTENDANT, NURSES AIDE
HISTORY, POLITICAL SCIENCE, ECONOMICS, SOCIOLOGY, PSYCHOLOGY, HUMANITIES, PUBLIC POLICY, PHILOSOPHY, RELIGION, URBAN STUDIES, WOMEN'S STUDIES, AMERICAN STUDIES, ETHNIC STUDIES, INTERNATIONAL RELATIONS, SOCIAL SCIENCES
LIBERAL ARTS, GENERAL STUDIES
MATHEMATICS, STATISTICS
MECHANICS (AUTO, MACHINERY REPAIR)
POLICE SCIENCE, CRIMINAL JUSTICE
SCIENCE, BIOLOGY, EARTH SCIENCE, GEOLOGY, PHYSICS, CHEMISTRY, ENVIRONMENTAL SCIENCE
SKILLED CRAFTS, E.G. PLUMBING, ELECTRICAL, CARPENTRY
UNDECLARED, UNDECIDED
TRAVEL, RECREATION

Appendix C

STEM and Non-STEM Fields of Study

STEM	Non-STEM
COMPUTER SCIENCE, PROGRAMMING, ARTIFICIAL INTELLIGENCE, INFORMATION TECHNOLOGIES, COMPUTER SUPPORT, DATA ENTRY, WEB PAGE DEVELOPMENT	AGRICULTURE, HORTICULTURE, VITICULTURE, FORESTRY, GROUNDSKEEPING
ENGINEERING, ELECTRICAL, MECHANICAL, CHEMICAL	ANIMAL CARE, E.G. VETERNINARY HELPER, PREVET
MATHEMATICS, STATISTICS	ARTS, DRAMA, DANCE, MUSIC, GRAPHIC DESIGN/ARTS, FASHION DESIGN
SCIENCE, BIOLOGY, EARTH SCIENCE, GEOLOGY, PHYSICS, CHEMISTRY, ENVIRONMENTAL SCIENCE	BUSINESS, MARKETING, ADVERTISING, MANAGEMENT, FINANCE, ACCOUNTING
	COMMUNICATIONS, JOURNALISM, TV/RADIO, ENTERTAINMENT INDUSTRY
	EDUCATION, TEACHING, CHILD DEVELOPMENT, EARLY CHILDHOOD EDUCATION, HOME ECONOMICS, CHILD CARE
	ENGLISH, LITERATURE, LIBRARY SCIENCE
	FOOD SERVICE, RESTAURANT MANAGEMENT
	FOREIGN LANGUAGE
	HEALTH CARE - PRE-MED, NURSING, PUBLIC HEALTH, PHYSICAL THERAPY, RECREATION THERAPY, PERSONAL CARE ATTENDANT, NURSES AIDE
	HISTORY, POLITICAL SCIENCE, ECONOMICS, SOCIOLOGY, PSYCHOLOGY, HUMANITIES, PUBLIC POLICY, PHILOSOPHY, RELIGION, URBAN STUDIES, WOMEN'S STUDIES, AMERICAN STUDIES, ETHNIC STUDIES, INTERNATIONAL RELATIONS, SOCIAL SCIENCES
	MECHANICS (AUTO, MACHINERY REPAIR)
	POLICE SCIENCE, CRIMINAL JUSTICE
	SKILLED CRAFTS, E.G. PLUMBING, ELECTRICAL, CARPENTRY

Appendix D

Fields of Study by Level of Social Interaction Required

Field of Study	Importance Score (out of 5)
AGRICULTURE, HORTICULTURE, VITICULTURE, FORESTRY, GROUNDSKEEPING	4.13
ANIMAL CARE, E.G. VETERNINARY HELPER, PREVET	3.54
ARTS, DRAMA, DANCE, MUSIC, GRAPHIC DESIGN/ARTS, FASHION DESIGN	3.82
BUSINESS, MARKETING, ADVERTISING, MANAGEMENT, FINANCE, ACCOUNTING	4.16
COMMUNICATIONS, JOURNALISM, TV/RADIO, ENTERTAINMENT INDUSTRY	4.07
COMPUTER SCIENCE, PROGRAMMING, ARTIFICIAL INTELLIGENCE, INFORMATION TECHNOLOGIES, COMPUTER SUPPORT, DATA ENTRY, WEB PAGE DEVELOPMENT	3.75
EDUCATION, TEACHING, CHILD DEVELOPMENT, EARLY CHILDHOOD EDUCATION, HOME ECONOMICS, CHILD CARE	3.97
ENGINEERING, ELECTRICAL, MECHANICAL, CHEMICAL	3.79
ENGLISH, LITERATURE, LIBRARY SCIENCE	3.68
FOOD SERVICE, RESTAURANT MANAGEMENT	3.62
FOREIGN LANGUAGE	3.65
HEALTH CARE - PRE-MED, NURSING, PUBLIC HEALTH, PHYSICAL THERAPY, RECREATION THERAPY, PERSONAL CARE ATTENDANT, NURSES AIDE	3.88
HISTORY, POLITICAL SCIENCE, ECONOMICS, SOCIOLOGY, PSYCHOLOGY, HUMANITIES, PUBLIC POLICY, PHILOSOPHY, RELIGION, URBAN STUDIES, WOMEN'S STUDIES, AMERICAN STUDIES, ETHNIC STUDIES, INTERNATIONAL RELATIONS, SOCIAL SCIENCES	3.95
MATHEMATICS, STATISTICS	3.66
MECHANICS (AUTO, MACHINERY REPAIR)	3.15
POLICE SCIENCE, CRIMINAL JUSTICE	3.87
SCIENCE, BIOLOGY, EARTH SCIENCE, GEOLOGY, PHYSICS, CHEMISTRY, ENVIRONMENTAL SCIENCE	3.79
SKILLED CRAFTS, E.G. PLUMBING, ELECTRICAL, CARPENTRY	3.46

Appendix E

Annual Household Income

$5,000 or Less
$5,001 to $10,000
$10,001 to $15,000
$15,001 to $20,000
$20,001 to $25,000
$25,001 to $30,000
$30,001 to $35,000
$35,001 to $40,000
$40,001 to $45,000
$45,001 to $50,000
$50,001 to $55,000
$55,001 to $60,000
$60,001 to $65,000
$65,001 to $70,000
$70,001 to $75,000
More than $75,000