Success of Twice-Exceptional College Students Screened by ACT versus SAT Scores and Major Declaration in Line with Academic Strength

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ABSTRACT

Educational outcomes of college students (e.g., GPA, retention, graduation, and years to graduation) of undergraduate students screened and selected for 2e status (2e; giftedness with a learning disability) did not differ significantly ($p > .05$) based on two operationalizations (of 2e status): ACT or SAT scores. However, significantly more 2e students were screened from ACT scores relative to the number screened from SAT scores ($p < .05$). Further investigation into academic outcomes revealed that students screened as 2e by the ACT were significantly more likely to be retained after their first year of college when they declared a major in line with their academic strength ($p < .05$), relative to the number retained by the SAT. Finally, 2e students screened by the ACT were less likely to graduate within six years of initial enrollment at UT when they did not declare a major in line with their academic strength, though the difference was not statistically significant ($p > .05$). Implications are discussed, and particularly suggestions regarding how these data may improve advising practices.

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CHAPTER ONE

LITERATURE REVIEW

In 1977, C. June Maker identified a particular subset of public school students that require a special set of accommodations, students who were initially identified as gifted and handicapped. Today, this subset of students is known by a different name: twice-exceptional (2e). Twice-exceptional learners are those students who demonstrate giftedness while simultaneously experiencing an academic disability of some kind (Reis, Baum, & Burke, 2014), such as a specific learning disability, attention deficit hyperactivity disorder, or a high functioning autism spectrum disorder (Assouline & Whiteman, 2011). Because 2e students exhibit both giftedness and a disability, their learning needs can differ drastically from peers with no diagnosis or a single diagnosis (Brody & Mills, 1997).

Much of the current research for the 2e population focuses on identification techniques and intervention strategies to service the unique set of educational needs these learners experience in K-12 settings (Ruben & Reis, 2005). Research into the needs of the 2e college student population is limited. As more and more students with learning disabilities are choosing to pursue a college education, it is likely that the 2e student population is also increasing (Gregg, 2007; Holzer, Madaus, Bray, & Kehle, 2009). Because 2e students have characteristics associated with both giftedness and a disability, they are believed to have a unique set of learning needs (Olenchak, 1995; Reis, Neu, & McGuire, 1995). Thus, further research with the 2e population is warranted. Consequently, the design of this study allows an investigation of the success of these college students based on screening techniques; 2e was defined as those who exhibit exceptional academic talent but who may also have a learning disability. Specifically, the relations between two competing operational definitions of twice-exceptionality, students' major declaration, and their success operationalized by first-year retention, graduation within six years, number of years to graduation, and grade point average (GPA) was investigated.

Traditional Predictors of College Success

Today, more and more students are making the decision to attend college. Thus, determining what it means to be 'college ready' and what will make students most successful in college has become important to educators (Conley, 2007). Individual colleges and universities have different methods for determining college readiness among applicants. While most states require students to pass standardized tests in order to be eligible for graduation, universities have focused much of their college readiness evaluation on high school coursework and college entrance exam scores (Roderick, Nagaoka, & Coca, 2009). In addition to consideration of how advanced placement courses in high school curriculums affect college performance (Education Commission of the United States, 2000), universities now must navigate the substantial racial and geographic differences that exist in evaluating the likelihood of success in college (Greene & Foster, 2003; Roderick et al., 2009).

Historically, the debate on the determination of college readiness has been controversial; however, there has been some agreement as well. Simply graduating from high school and earning a diploma does not mean that a student is college ready

(Kobrin, 2007). In fact, approximately one-third of students require some remedial coursework in their first semesters at colleges and universities (U.S. Department of Education, 2006). According to the National Center for Higher Education Management Systems [NCHEMS] (2007), only three-fourths of college freshman return for their sophomore year. Student recruitment is often the highest priority for college admissions offices (Astin, 1993); however, further study of student retention is necessary as it provides a subjective measure of the college or university's success as well as the student's success (Fike & Fike, 2008). The American College Testing (ACT) reports college readiness benchmarks within their college entrance exam. Results of these benchmark studies indicate most entering freshmen are not adequately prepared for college level coursework (Greene & Winters, 2005), which may explain why about one-fourth of college freshman make the decision to drop out after the first year. Of course, there may be other explanations (e.g., persistence, executive functioning, social supports, financial exigencies, and disability status).

"College readiness." The skills necessary to succeed in college may be broken down into four board categories: basic skills and knowledge, basic academic skills, basic intuitive skills, and "college knowledge" (Conley, 2007; Roderick et al., 2009). Basic skills include the ability to read, write, and do arithmetic, while basic knowledge is specific to different subjects (Roderick et al., 2009). Basic academic skills are not specific to any particular subject. Instead, these skills are essential to a student's ability to engage in a variety of academic activities and are often cited as the biggest area of weakness for entering freshman (Conley, 2007). Intuitive skills include interpersonal skills, time-management, study skills, and work habits among others, and have been strongly linked to success in college (Bowles & Gintis, 1976). Finally, knowledge needed to successfully navigate the college application process, as well as other aspects of college, is commonly referred to as “college knowledge” (Conley, 2007; Roderick et al., 2009).

Traditionally, the bedrock definition of college readiness has included basic reading skills, obtaining a high school diploma, and completing the minimum high school coursework requirements (Greene & Foster, 2003). However, as implied by the above discussion, a student who meets only these three criteria likely would not be successful under the demands of the current college curriculum. Operationalizations of college readiness have changed somewhat over the years and some have been added to this basic definition. Cumulative high school grade point average (HSGPA) has long been thought to be the strongest predictor of college success (DeBerard, Spielmans, & Julka, 2004; Geiser & Santelices, 2007). Additional research has shown that scores on college entrance exams are related to academic success in college, though the predictive power is not as strong as the predictive power of HSGPA (Hoffman & Lowitzki, 2005).

When used in conjunction with entrance exam scores, such as combined Scholastic Aptitude Test (SAT) scores, HSGPA is a strong predictor of college graduation (Stumpf & Stanley, 2002). Perhaps somewhat surprising, HSGPA strongly predicts intuitive skills, which can be just as crucial to college success as basic knowledge (ACT, 2008). The ACT-based college readiness benchmarks provide minimum ACT scores that need to be achieved by entering freshman in order to obtain a B in a college course (Noble & Sawyer, 2002), which is considered to be one good operationalization of college success (Roderick et al., 2009). Perhaps these data support the decision to use ACT and SAT scores in combination with other measures to predict college success. For example, state assessments offer comparisons across multiple cohorts of entering freshman, and might also be a good predictor of college success (Roderick et al., 2009). In general, combining numerous measures proves to be the best and strongest prediction of many important outcomes, including college success because that strategy provides a more comprehensive characterization of the applicant. In this context, the combination of cumulative HSGPA, class rank, state graduation test scores, and college entrance exam scores have been identified as strong predictors of success among entering freshman (Berkner & Chavez, 1997). Below is a description of additional literature addressing in some detail the predictive capability of two important operationalizations of college readiness—the SAT and ACT—in part because they are used by most higher education institutions to aid in determining readiness, and because the measures are critical in defining 2e status in this study.

College entrance exams. Approximately 90 percent of the colleges and universities in the United States require an SAT or an ACT score as part of their admission requirements (Breland, Maxey, Nickerson, Trapani, & Walker, 2002). Standardized test scores allow admission counselors to review applicants without considering geographic and resource differences that inevitably confound the utility of high school grades and curriculum reviews (Zwick, 2007). Even so, colleges and universities rank HSGPA as the most important criterion for admission, though standardized test scores are a close second (Breland et al., 2002); however, as the size of institution increases, the relative weight placed on standardized test scores also increases (Zwick, 2007). Ramist, Lewis, and Jenkins (2001) investigated the predictive power of HSGPA and standardized test scores on college success; their results indicated that HSGPA (r = .67) alone predicted college success slightly better than SAT (r = .65) or ACT (r = .66) composites alone. When admission test scores were added into a regression equation with HSGPA, the predictive power significantly increased (r = .75). However, it is important to note that there are important differences between the two most commonly used standardized entrance exams. For example, scores from the ACT and SAT are created to reflect differences on an aptitude – achievement continuum. The ACT is more related to high school curriculums (Koenig, Frey, & Detterman, 2008) and falls more on the achievement end of the spectrum (Zwick, 2007). On the other hand, the SAT, assesses more general academic application skills, which allows examinees to apply their generalized knowledge (Korbin, Patterson, Shaw, Mattern, & Barbuti, 2008); consequently, it falls more on the aptitude end of the spectrum (Zwick, 2007).

***Scholastic Aptitude Test*.** The SAT is divided into 9 subsections, with questions covering application of reading, math, and writing skills in multiple-choice and free response formats (Korbin et al., 2008). Generally, SAT results are influenced by critical thinking and reasoning abilities in addition to academics (Zwick, 2007). Significantly correlated (r = .87) with measures of general intelligence (Frey & Detterman, 2004), the SAT is accepted by nearly all colleges and universities as a measure of college preparedness (Koenig et al., 2008; Korbin et al., 2008). For admissions decisions some universities (e.g., the University of Tennessee) utilize the superscoring method. That is, when multiple administrations are recorded for a particular examinee, the highest Verbal, Math, and Writing scores across all testing dates are identified and a "superscore" is created.

The SAT yields strong psychometric properties. For example, reliability estimates for the SAT are generally high based on a systematic sample of examines who took national administrations between January 2014 and December 2014. Subsection reliabilities were reported as .91 - .92 for Critical Reading, .92 - .94 for Critical Math, and .89 - .91 for Critical Writing. Test development information, available from the SAT technical manual (Korbin et al.,2008), states that the test has high content validity. Each test question is reviewed by a team of experts, including teachers, to ensure the questions reflect current content being taught in today's schools. Additional testing is conducted on each test question to ensure fairness across all student populations. Item difficulty has a mean of .62 and a range of difficulty from .56 to .67.

Validity evidence for the SAT is also impressive. Korbin et al., (2008) conducted a validity study using approximately 150,000 admitted students in the fall 2006 cohort of freshman. Results of this study indicate that the writing portion (r = .51) of the SAT has the strongest predictive power of college performance, though only slightly higher than the reading (r = .48) and mathematics (r = .47) sections. SAT scores also had slightly higher predictive power for first year college performance than HSGPA. The predictive ability of the SAT is further supported in the literature. For example, Astin and Oseguera (2005) found that higher HSGPA and SAT scores are highly correlated with degree attainment in four year universities. SAT scores also predict retention and graduation (Hezlett et al., 2001). When combined, HSGPA and SAT scores are highly correlated with first year college GPA (r = .62).

American College Testing. American College Testing (ACT) was developed around 1960 as an alternative testing option for college entrance; nearly all colleges and universities accept it as a measure of college preparedness (Koenig et al., 2008). The test is divided into four multiple-choice subsections of academic readiness: Math, English, Reading, and Science; scores from these subsections are combined for an overall composite score (Zwick, 2007). The test content is closely related to high school curriculums (Keonig et al., 2008). Therefore, success on the test varies greatly depending on examinees' course selection during high school (Paszczyk, 1994) and the high school attended (Noble, Davenport, Scheil, & Pommerich, 1999). For admissions purposes, some universities (e.g., the University of Tennessee) uses the superscoring method described above for the SAT scores when there are multiple administrations; the highest ACT subset and composite scores are created across all testing dates and superscores are created.

Psychometric evidence for the ACT is impressive. For example, reliability estimates for the ACT are generally high when based on a systematic sample of 2,000 examines who took one of six national administrations during the 2005-2006 school year. Scale score reliabilities were reported as .85 for Reading, .91 for Math, and .96 for the Composite score. Test development information, available from the ACT technical manual (2014), indicates the test has high content validity. To ensure content validity, curricular analyses inform item construction. Beginning with a curricular analysis, content specialists are trained in writing the test items, which are regularly reviewed to determine relevancy. Item difficulty variability is necessary to allow for discrimination between high and low performing examinees; a difficulty index mean score of .58 was obtained, along with a range of difficulty from .20 to .89. Item total scale correlations are also evaluated, and test items must demonstrate a correlation of .20 or higher with the content area scale in order to be included on the ACT.

Finally, the majority of colleges and universities accept ACT scores as valid predictions of academic success and college retention in part because its predictive validity has been demonstrated in the literature (ACT, 2008). In addition, convergent validity evidence has been shown in studies between ACT scores, subject area coursework, and HSGPA (for review, see ACT, 2006).

Concordance between ACT and SAT. As mentioned above, most colleges and universities require either the ACT or SAT. While on different ends of the aptitude-achievement continuum, constructs tested by the ACT and the SAT certainly overlap. The SAT produces three test scores: Critical Reading, Critical Writing, and Critical Mathematics scores. The ACT produces an overall composite score and four subscores in Reading, English, Mathematics, and Science. Because these two tests measure academic knowledge in slightly different ways, colleges and universities should be aware of the relation between the two sets of scores.

In addition to evaluating convergent or concurrent validity estimates between two tests, concordance may also be used determine relation between two tests. Two test scores are thought to be concordant if they yield the same (or a very similar) percentile rank for individuals who take both tests. Because of recent changes in format for both tests, updated concordance tables have been published by both the ACT (2014) and Korbin et al., (2008), for the SAT. The following example indicates how universities may use concordance tables. If a student obtains a score of 24 on the ACT, the concordance table will show a predicted range of SAT scores. In this case, the SAT score range for an ACT score of 24 is 1090 – 1120. Of note, the University of Tennessee uses the published Concordance Table to convert SAT scores to ACT composite scores for comparisons.

In addition, ACT (2014) recently published an Estimating Relationship Table. The advantage of the Estimating Relationship table is that it is simple and easier to use than a concordance table. Concordance tables consider ACT and SAT scale scores separately, when estimating the relation between the two tests. The Estimated Relationship table combines the Reading, Mathematics, and Writing components into a composite to estimate the relation between the global scores. This strategy reduces error by relying on composite scores, rather than scale scores separately; for example, when considering an overall ACT score of 24, the Estimated Relationship table predicts a score of 1620 – 1670 on the SAT, combining Reading, Math, and Writing subsections.

In sum, the SAT and the ACT are accepted by almost all colleges and universities as a valid measure of college preparedness. Studies conducted by the College Broad and ACT have allowed researchers to begin to estimate the relationship between the two college entrance exams, despite the different score ranges produced by each individual test. While college entrance exam scores are an important variable in college admissions, they are one of many used to predict college success. Major declaration literature is important to review because major declaration is also related to college success.

Major Declaration among College Students

Once admitted to a college or university, students face another major decision. In fact, being admitted to a college or university is sometimes thought to be the easy part in that those decisions are made based upon things already completed. When a student enters a college or university as a freshman, the next major decision is choice of a major and ultimately, a career path (Allen & Robbins, 2008). Differences in how college students choose their majors has been investigated thoroughly and numerous influential factors have been identified as summarized below.

Most college students view the declaration of their major as one of the most important decisions they make in their lives (Allen & Robbins, 2008). Ability level, personality traits, social class, gender, and political orientation have all been linked to prediction of college major among entering freshman (Giacomino & Akers, 1998; Noel, Michaels, & Levas, 2003; Porter & Umbach, 2006). Specifically, a student high on a social activism scale is more likely to declare a social science or education major than a status-driven student; these students are likely to declare a major in architecture or agriculture (Astin, 1993). Further, research indicates that if a student chooses their major according to their personality characteristics and work values, they are likely to be more successful in their future career (Balsamo, Lauriola, & Saggino, 2013). Values and future success have also been linked to major choice (Galotti, 1999), though research on work values link to major declaration has been limited (Balsamo et al., 2013). One of the most important predictive factors of major success is an interest and skill in a particular field (Malgwi, Howe, & Burnaby, 2005). However, students' belief in their ability levels has been shown to be just as predictive as actual skill level for success in particular majors (Farley & Staniec, 2004; Montmarquette, Cannings, & Mahseredjian, 2002).

Factors outside of the student have been linked to major declaration as well. Other people in the student's life may provide information, opinions, encouragement, or examples of different career paths (Downey, McGaughey, & Roach, 2011), which the student then can use in making their major choice. Job security and projected salary also have strong influences on major declaration (Walstrom, Schambach, Jones, & Crampton, 2008) because of their influence on the quality of life in the future. The reputation surrounding the career has also been linked to major choice (Thomas & Allen, 2006). Finally, the level and amount of coursework and the difficulty level of the major also influences major declaration (Calkins & Welki, 2006).

Declaring major in line with strengths. In 1985, John Holland developed a theory of career choice based upon personality types. According to the theory, the positive fit between a student and their environment predicts success in academic achievement (Henry, 1989). Students who choose a major congruent with their personality types will be more academically successful than those who do not (Bruch & Krieshok, 1981). Smart, Feldman, and Ethington (2000) have conducted numerous empirical investigations supporting several notions proposed by Holland. First, students should select an academic environment that is congruent with their personality traits. Second, differences in reinforcement contingencies affect student persistence in academic disciplines. However, the final conclusion states that when congruence between the student's interests and the discipline is high, the differences in reinforcement have little impact.

Researchers have shown that a specific percentage of undergraduate students will not graduate from college. Declaration of a major outside of a student's academic strengths is one possible explanation for this phenomenon (Montmarquette et al., 2002). Though thoroughly investigated in the literature, the results about the effects of ability level on major declaration have been mixed (Bartolj & Polanec, 2012). Two types of ability have been investigated through empirical studies: general ability, reported via HSGPA and scores on standardized tests, thus reflecting problem-solving abilities; and major specific ability, reported via grades in curriculum relevant coursework (Bartolj & Polanec, 2012). Major specific ability, or declaration of major in line with academic strength, predicts academic success better than general ability (Arcidiacono, Hotz, & Kang, 2010; Fiorito & Dauffenbach, 1982; Paglin & Rufolo, 1990). For example, deficiencies in math and science achievement often lead to declaration of education or humanities majors; conversely, strengths in mathematics or science likely result in declaration of medical, business, or engineering majors (Stater, 2011).

A majority of college students change their major during their college education. According to Kramer, Higley, and Olsen (1994), when students encounter a field of study that is more in line with not only their interests, but also their strengths, they are likely to persist in their major. As the strength of the major-interest relation increases, the likelihood the student will persist in that major also increases (Smart et al., 2000). As might be expected, when students declare majors in line with their interests and their strengths, they are likely to be more successful in college (Porter & Umbach, 2006); in fact, if the reciprocal relationship between major and interest in that major is high, students have higher retention and graduation rates (Tracey & Robbins, 2005). When students declare major in line with their interests and strengths, their general satisfaction at their universities also increases (Allen & Robbins, 2008).

Generally, declaring a major in line with academic strengths is considered crucial to academic success and ultimately, future career success. More specifically, the stronger the major-interest relation is, the more likely it is the student will persist not only in the major, but also at the university. The present study aims to investigate whether college students, specifically 2e students, are more successful when they declare majors in line with their academic strengths. Characteristics of gifted students, students with learning disabilities, and 2e students are discussed below.

College Success among Students with Exceptionalities

Characteristics of gifted students. The definition of giftedness has undergone numerous modifications since it was originally characterized in the literature in 1972. Despite the changes, the basic tenant has remained the same: a student can be classified as gifted if he or she demonstrates high aptitude in a particular area (Assouline, Foley-Nicpon, & Huber, 2006; Stephens & Karnes, 2000). The U.S. Department of Education (2006) identifies students as gifted if they demonstrate high ability in intellectual, creative, artistic areas, or leadership. Because of this superior ability, gifted students often require supplemental educational services in order to achieve their full potential (Marland, 1972). New concepts have been added to gifted definitions, including motivation, self-concept, and creativity (Bracken & Brown, 2006). In the K-12 population, when a student is classified as gifted, typically he or she has demonstrated superior intellectual ability (Crepeau-Hobson & Bianco, 2011). Therefore, much of what is known about giftedness is related to characterizations of level and types of intellectual ability (Assouline et al., 2006).

Identification techniques for gifted students vary considerably, which contributes to the variability in the percentage of gifted children identified among public school children. In public school systems, gifted students are often screened because of high academic achievement, then identified by superior performance on norm-referenced intelligence tests (Assouline, et al., 2006; Crepeau-Hobson & Bianco, 2011). Between 5% and 20% of students in U.S. schools have been identified as gifted (Pfeiffer, 2012). The ever-changing definition of giftedness often makes receiving services difficult

(Bracken & Brown, 2006). Because their needs are unique, they often require modifications to curriculums to ensure that the content is both challenging and motivating (Newman & Sternberg, 2004). With adequate services, gifted students generally do well academically and go on to succeed in college and professionally, unless they demonstrate significant cognitive, emotional, or behavioral limitations consistent with a more complicated diagnosis/status (e.g., 2e).

Learning outcomes of gifted students. Generally speaking, students identified as gifted display high academic potential by middle school (Pfeiffer, 2012). Despite their high academic potential, gifted students often experience a tough time transitioning and succeeding in higher education (Conejeros-Solar & Gomez-Arizaga, 2015). Special academic programs and resources are often beneficial to gifted students, as they aid them in achieving their highest potential (Pfeiffer, 2012). Educators of gifted students should facilitate their development by employing a good balance between skill development and new challenges (Bozeman & Feeney, 2007). By utilizing such a balance, educators encourage gifted students to achieve their full potential, both academically and personally (Rogers, 1986).

Colleges and universities offer several options that aid gifted students. Honors colleges within a school are designed to deliver gifted students the balance between skill development and academic challenge; this balance is essential, as it is likely to enhance motivation and sustain interest in academic learning for gifted students (Bozeman & Feeney, 2007). Often accelerated learning strategies allow most gifted students to develop critical thinking abilities, thus enhancing both academic and personal growth (Colangelo, Assouline, & Gross, 2004). Finally, some colleges or universities throughout the country offer programs that allow gifted students to enter college early, which is another way colleges and universities employ a balance between skill development and challenging academic experiences (Sayler, 2006).

Characteristics of students with specific learning disabilities. According to the Diagnostic and Statistical Manuel of Mental Disorders, Fifth Edition (DSM-V), a specific learning disability can be diagnosed if

> The learning difficulties have persisted despite intervention for longer than six months and cause the individual to score significantly and markedly lower than peers of their chronological age. The learning difficulties may not be fully seen until the individual is asked to complete a task that require more than their limited ability. Finally, the learning difficulties must not be better explained by something else (i.e., visual, hearing, or motor impairment, emotional disturbance, other mental disability, or environmental or cultural disadvantage (American Psychological Association, 2013).

Numerous identification models have been proposed and modified for students with specific learning disabilities, including ability-aptitude discrepancy, response to intervention (RTI) and Patterns of Strengths and Weaknesses (PSW). The ability-aptitude discrepancy model requires that aptitude, operationalized by IQ, be considerably higher than academic ability, typically operationalized by standardized academic achievement test scores. This model has been criticized for psychometric and outcome (e.g., treatment validity) limitations. RTI is a new model assumed to address some of the limitations of the aptitude-treatment discrepancy model (e.g., delayed attention to academic problems, characterized as “wait to fail”), and provides educators with a tiered approach, and consistent progress monitoring, to classify students potentially in need of special education services (Gersten & Dimino, 2006). PSW, which includes the Aptitude-Achievement Consistency model (Flanagan, Ortiz, & Alfonzo, 2007), the Consistency-Discrepancy model (Naglieri, 1999), and the Concordance-Discordance model (Hale & Fiorello, 2004), requires assessment of cognitive and academic strengths/weaknesses and evidence of linkage be established between these cognitive and academic areas for a diagnosis; this model requires a comprehensive psychoeducational evaluation. Some students who enter college have been identified as having a learning disability by one of these models during their K-12 years. But, if a student has not been identified before entering college, he/she is unlikely to obtain a diagnosis once enrolled, even though she/he may struggle academically.

While students identified as gifted typically excel academically, students with specific learning disabilities experience difficulty, specifically in the subject area linked to their disability. Approximately half of all students eligible for special education services are classified under the SLD category (National Joint Committee on Learning Disabilities, 2011) and receive special services (Yewchuk & Lupart, 2000).

Learning outcomes of students with specific learning disabilities. Researchers have shown that approximately only 28 percent of students with learning disabilities complete their undergraduate degrees (Gregg, 2009), which is about half the graduation rate of all other students (Connor, 2012). Some students with learning disabilities begin college underprepared, not only for the new academic demands of college, but also because success in college requires considerable independence. While most federal regulations are automatically put in place in the K-12 population, only two laws govern educational services for college students (Lombardi, Gerdes, Murray, 2011). Section 504 of the Rehabilitation Act of 1973 requires colleges and universities to make services accessible and provide appropriate accommodation. The American with Disabilities Act prevents discrimination against students with disabilities and specifically states these individuals are eligible for accommodations (Connor, 2012). However, in order to receive services, college students must be proactive, i.e., they must bring current evidence of having a learning disability to the Office of Disability Services at the college or university they attend (Finn, 1998; Janiga & Costenbader, 2002). Of course, some students may have a learning disability, but be unaware, and more troubling, may not know how to obtain an evaluation to determine if a disability exists.

Students with learning disabilities likely will be more successful in college if they are supported from the college or university and their professors; in fact, student success might be dependent upon professors' ability to adapt their instructional techniques (Connor, 2012). Adjustments to the educational expectations (i.e., extended time on tests and assignments, audio textbooks, advanced class notes, etc.) might be necessary in order for students with learning disabilities to achieve their greatest potential (Brinckerhoff, 1996; Madaus & Shaw, 2004).

Characteristics of twice-exceptional students. An additional group of students, those who experience both giftedness characteristics and characteristics of specific learning disabilities, have been identified as 2e. Because of the unique profile 2e students' exhibit, there has been much debate surrounding the definition of this exceptionality. Since this type of 2e was first identified, it has undergone modifications as the characteristics of giftedness and specific learning disabilities have changed. However, the main tenets have remained the same. Students can be screened as at risk for twice-exceptionality if they demonstrate superior ability in one academic domain while also experiencing academic difficulty in another domain (Brody & Mills, 1997; McCallum et al., 2013; Reis et al., 2014), and this academic variability is not better explained by other factors.

Twice-exceptionality has continued to garner research attention, particularly efforts to best operationalize it (Baum & Owen, 2004; Foley-Nicpon, Allmon, Sieck, & Stinson, 2011; Trail, 2010). Often, these students are difficult to identify because they do not fit into the traditional definition of either exceptionality (Reis et al., 2014). Some students have an obvious discrepancy between two academic areas, and are easily identified, while others have less obvious discrepancies (Ruban & Reis, 2005). Thus, consensus among researchers continues to be of the utmost importance.

***Identification of twice-exceptional students*.** To some extent the difficulty in establishing an identification technique for twice-exceptionality occurs because it needs to be broad enough to account for all those at risk, but also specific enough to allow for accurate identification (Reis et al., 2014). Certainly, a clear and accepted definition needs to be established. Only then can educators hope to address the particular set of needs 2e learners experience (Reis et al., 2014). In 2006, the National Education Association identified approximately 400,000 students across the United States as potential 2e learners. Traditional criteria of SLD require that students demonstrate "unexpected achievement deficits," limitations not better explained by other factors (McCallum et al., 2013). Additionally, in order to receive services in public schools, the student's achievement must be significantly below what is expected based on chronological age, when compared to same-age peers. This requirement presents an additional challenge for 2e students. Because 2e students experience both superior and inferior ability (in different academic areas), they may perform within the average range overall (if global scores are created). In addition, despite the variability in their performance, 2e students may not qualify for the services they need because their performance is not normatively low, or low enough, due to their ability to compensate (Assouline et al., 2010; Mastropieri & Scruggs, 2005; McCallum et al., 2013; Scruggs & Mastropieri, 2002). So, 2e students' difficulties might be "masked," e.g., the difficulties associated with the student's disability are masked by the strengths associated with the student's giftedness (Baum, 1990; Silverman, 2003).

Use of the aptitude-achievement discrepancy model and the PSW model will likely will miss 2e students' normatively low performance that is required for identification (Scruggs & Mastropieri, 2002). Traditional RTI models also are likely to miss 2e students because they are able to compensate somewhat for their disabilities and will not be identified as at-risk. Thus, even though 2e students may struggle academically, they may not perform low enough for their learning disabilities to be identified (Crepeau-Hobson & Bianco, 2011; McKenzie, 2010).

Recently, an efficient screening model consistent with traditional definitions of learning disability and giftedness has been identified. McCallum et al. (2013) developed a screening technique for 2e students that focuses on determining whether a significant/large discrepancy exist between performance in key academic areas. This model is characterized by some advantages. First, this type of model takes into account specific academic performance on multiple subject areas, as opposed to focusing solely on composite scores as estimates of ability level. Second, this type of model can be adjusted to create a more liberal or conservative screening model for 2e students. Third, the model is efficient because it relies on group scores already available to either K-12 school systems or, in the case of college students, the university. Typically, performance variability is one important criterion for diagnosing a learning disability, and this model begins the screening process by determining the extent to which a discrepancy is present. Those identified as potentially at-risk because of a high score in one academic area but a low score in another would need further testing in order to be identified conclusively.

***Learning outcomes of twice-exceptional students*.** While numerous researchers agree that aligning instruction to students' strengths and weaknesses allows teachers to be more successful (Ruben & Reis, 2005), this strategy becomes particularly important when the students are 2e (Schultz, 2012). Even more important, the strengths and weaknesses need to be considered together (Schultz, 2012);

consideration of optimal instruction based on both strengths and weaknesses is the most efficient way to ensure specific educational needs are met (Foley Nicpon et al., 2011).

Often, 2e students are an anomaly to teachers (Schultz, 2012) because of their unique educational needs (Foley Nicpon et al., 2011). Researchers have conducted numerous empirical investigations exploring effective learning strategies for 2e students. Providing a flexible environment where students have the ability to self-direct their studies, utilizing multiple educational approaches that cater to both academic strengths and weaknesses, and accelerated academics are among the most successful classroom techniques identified for 2e students (Assouline & Whiteman, 2011; Baum, Cooper, Neu, & Owen, 1997; Neilson, 2002; Weinfeld, Barnes-Robinson, Jeweler, & Shevitz, 2002). Regardless of the strategy investigated, researchers agree on one important notion: the educational services of 2e students must address both their strengths and weaknesses in order to provide the student the optimal academic environment (Baum, 2005).

While there has been substantial investigation into the academic, social, and emotional needs of 2e students over the past few decades within public schools, there has been little research into how twice-exceptionality affects a students' ability to succeed in college. To date, 2e status in college students has received minimal attention (Hays, 2015; Reis & Colbert, 2004). Given what is known about K-12 2e populations, 2e students who decide to pursue a college education are likely to experience difficulty in their courses (Reis & Colbert, 2004). Approximately five percent of the K-12 population receives SLD services (National Joint Committee on Learning Disabilities, 2011), and almost 10 percent of those students pursue a college education after graduating from high school (Wagner, Newman, Cameto, Garza, & Levine, 2005). The number of students under the SLD category pursuing a college education has continued to increase over the last decade (Gregg, 2007). Given the growing demographics of college students with learning disabilities, a percentage of those students likely exhibit 2e characteristics (Hays, 2015). But, we know little about how these 2e students perform on important outcome measures.

Hays (2015) investigated the academic outcomes, specifically retention and graduation rates, of 2e college students compared to the general student population. Results indicated that 82.4 percent of 2e students were retained after completion of the first year of study; however, 2e students were significantly less likely to be retained than their gifted peers. Additionally, 70.5 percent of 2e students graduated from college within six years. Hays (2015) also investigated major declaration in 2e students and found they are more likely to declare a Bachelor of Arts or Education major than their non 2e peers. Additionally, 2e students were more likely to begin college as an Undecided major than non 2e and gifted peers.

Statement of the Problem

McCoach, Kehle, Bray, and Siegle (2001) have defined 2estudents as those who demonstrate superior ability in one academic domain while simultaneously demonstrating inferior ability in another academic domain. This specific subset of students is often misunderstood because of the dual presence of giftedness and a SLD

(Whitemore & Maker, 1985); thus, identifying then providing services to these students is often difficult. Twice-exceptional students in the K-12 population have been investigated for years and identification techniques, intervention strategies, and educational approaches have often been the subject of empirical investigation. However, little is known about 2e students who choose to pursue a college education. More specifically, not much is known about the extent to which 2e students exist and succeed in the college environment. Hays (2015) investigated graduation and retention rates among college students screened as twice-exceptional. Results indicated that students screened as potentially 2e were significantly less likely (x^2 (1) = 9.49, p< .01) to return after their first year of college when compared to their non-2e peers. Additionally, students screened as 2e were less likely to have declared a major compared to their non-2e peers, despite their obvious academic strengths and weaknesses.

Although the results from Hays (2015) contributed significantly to the literature describing how 2e status affects college students, a number of questions remain. For example, 2e status may be operationalized according to scores obtained by students on two major instruments (i.e., ACT or SAT), and nothing is known about how academic outcomes might vary as a function of assigning 2e status based on the ACT versus assignment based on the SAT. Furthermore, there is no literature available describing outcomes for 2e students who graduate after six years versus those who do not. Nor is there literature characterizing the academic success of 2e students who declare a major in line with their strong academic area versus those who do not. The purpose of the present study is to continue to explore academic outcomes for students who are screened as twice-exceptional, specifically those who are screened as gifted with a potential SLD in reading or math. The following specific research questions are addressed:

1. To what extent do the percentage of students screened as 2e by the SAT overlap with students screened as 2e by the ACT?
2. Do retention rates of students identified as 2e by the SAT differ from those identified by the ACT after one year of college?
3. Do students screened as 2e by the SAT perform as well as students screened as 2e by the ACT, based on graduation rate within six years of initial enrollment?
4. Do students screened as 2e by the SAT perform as well as students screened as 2e by the ACT, based on the number of years it took students to graduate?
5. Do students screened as 2e by the SAT perform as well as students screened as 2e by the ACT, based on CGPA?
6. Do the first-year retention rates among 2e students who declared a major in line with their academic strength differ from those students who did not declare a major in line with their academic strength?
7. Do the six-year graduation rates among 2e students who declared a major in line with their academic strength differ from those students who did not declare a major in line with their academic strength?
8. Do students screened as 2e who declared a major in line with their academic strength perform as well as students screened as 2e who did not declare a major

in line with their academic strength, based on the number of years it took the students to graduate?

9. Do students screened as 2e who declared a major in line with their academic strength produce a statistically significant different mean exiting CGPA when compared to 2e students who did not declare a major in line with their academic strength?

CHAPTER TWO
METHOD

Participants

Data on the demographics, SAT/ACT college readiness test scores, high school and college GPA, choice of major, exiting college GPA, and year of graduation or exit were obtained for 33,748 undergraduate students at the University of Tennessee (UT). These data were obtained as a database compiled and maintained by the UT Office of Institutional Research. The dataset includes information on all students who enrolled in the university as first-time freshman between 2007 and 2014. To be included in the present study, students must have submitted both ACT and SAT college readiness scores; both scores were unavailable for 27, 665 students, and these students were excluded from the dataset. Due to possible confounds in English language fluency, non-resident/aliens were excluded from the final dataset. Additionally, due to possible confounds, any student whose race/ethnicity was unknown was also excluded from the final dataset, resulting in a final sample size of 6,083 students. The 2014 cohort (n = 547) was set aside for the purpose of establishing cutoff criteria for screening for giftedness and 2e status. These criteria were applied to the remaining dataset (N = 5,536), which was used for all analyses. Of the full sample, 50.0 % (n = 3,042) were female and 50.0 % were male (n = 3,041). 84.8 % of the students were White (n = 5,157), with Black (n = 341), Asian/Pacific Islanders (n = 263), Hispanics (n = 166), American Indian (n = 17), and those students who identify with two or more races (n = 139) comprising 15.2 % of the sample population. Of note, these percentages are slightly different than the reported percentages for the University of Tennessee for the 2015 – 2016 academic school year, via the annual report. Approximately 79% of the students are White, with African American, Asian/Pacific Islanders, Hispanics, American Indians, and those students who identify with two or more races comprising about 21% of the student population. About 20 % of students were undecided in their choice of major upon initial enrollment (n = 1,217), while approximately 35 % of students had declared an intent to pursue a specific major (n = 2,129) and 45 % of students had declared a specific major (n = 2,737).

Establishing criteria for gifted and twice-exceptional screening. A modified version of the screening method proposed by McCallum et al. (2013) was used to screen for twice-exceptionality in the present study. ACT and SAT superscores for students in the 2014 freshman cohort at UT are shown in Table 1. In the 2014 cohort, the average reading ACT score was 28 (M = 28.05, SD = 4.90) and the average math ACT score was 27 (M = 26.71, SD = 4.28). Additionally, for the 2013 cohort, the average verbal SAT score was 590 (M = 586.73, SD = 86.98) and the average math SAT score was 580 (M = 582.06, SD = 85.64).

Based on these distributions, students in the larger dataset were screened for giftedness and then subsequently screened for 2e status. Table 2 summarizes how the groups were defined. Students are first screened for giftedness, and then subsequently screened for twice-exceptionality. Despite the typical 1 and 1/3 standard deviation above the mean criteria for giftedness screening suggested by some researchers (Lovett & Sparks, 2013), a more inclusive criteria was used in the present study. As recommended by other researchers (McCallum et al., 2013), a more inclusive criterion allowed for screening of more students who are at risk for twice-exceptionality. Thus, students who are one standard deviation above the mean on either reading or math on either the ACT or SAT were screened as potentially gifted. Students were screened as gifted in reading if they achieved an ACT superscore of 33 or higher or if they achieved an SAT superscore of 680 or higher. Students were screened as gifted in math if they achieved an ACT superscore of 31 or higher or if they achieved an SAT superscore of 670 or higher.

Among those students screened as gifted in reading by the ACT, those who also demonstrated a discrepancy between their reading and math scores of two standard deviations above the mean discrepancy level (M = 5.02, SD = 3.33) were screened as twice-exceptional. Similarly, among those students screened as gifted in reading by the SAT, those who also demonstrated a discrepancy two standard deviations above the mean discrepancy level (M = 76.15, SD = 57.95) were screened as twice exceptional. Among students screened as gifted in math by the ACT, those who also demonstrated a discrepancy between their math and reading scores of two standard deviations above the mean discrepancy level (M = 3.16, SD = 2.71) were screened as twice-exceptional. Additionally, among students screened as gifted in math by the SAT, those who also demonstrated a discrepancy between their math and reading scores of two standard deviations above the mean discrepancy level (M = 73.03, SD = 56.27) were screened as twice-exceptional. These levels of discrepancy ensures a cutoff beyond the typical level of variability expected of a student screened as gifted in one academic domain.

Among the students in the 2014 cohort, the mean discrepancy between reading and math scores was approximately four points (*M* = 3.73, *SD* = 2.82), which is slightly lower than among students screened as gifted. In the large dataset, the mean discrepancy score between reading and math scores was also about four points (*M* = 3.80, *SD* = 2.87), which is slightly lower than among students screened as gifted.

In the large dataset, 20% of the students were screened as gifted in reading by the ACT, while 15% of the students were screened as gifted in reading by the SAT. In the large dataset, 15% of the students were screened as gifted in math by the ACT, while 17% of the students were screened as gifted in math by the SAT. Among those screened as gifted, only 6% of the students were screened as 2e by the ACT, while 5% of the students were screened as 2e by the SAT. Between five and six percent of students in the current study were screened as meeting criteria of both giftedness and SLD, which parallel estimates in the literature for the K-12 population (Bracamante, 2010). Although these cut scores are appropriate for screening for giftedness and twice-exceptionality in the current study, the definition of giftedness used may not be appropriate in the general population. The ACT and SAT scores of UT students were well-above the national average of all high school students who took the tests. For example, the average composite SAT scores obtained by high school seniors in the 2015 academic year was 1006 (Korbin et al., 2008). Additionally, the ACT college readiness benchmarks for the Reading and Math Composites were 22 (ACT, 2014). So, although the screening strategy described for UT students may be applied to students from any university, the particular cut scores will change based on the ability levels as operationalized by ACT and SAT across universities. Current screening criteria may be appropriate and applicable for other higher education institutions with similar demographics and ACT and SAT score distributions.

Students screened as gifted in math. Among all students screened as gifted (*n* = 2,043), 57.17% (*n* = 1,168) were screened as gifted in math. More specifically, 30.54% (*n* = 624) were screened as gifted in math by the ACT, while 26.63% (*n* = 544) were screened as gifted in math by the SAT. Among those screened as gifted in math by the ACT, about 70% also met criteria for giftedness in reading (*n* = 452). Among those screened as gifted in math by the SAT, about 65% also met criteria for giftedness in reading (*n* = 371). The average math superscore among students screened as gifted by the ACT and the SAT is 31.14 (*SD* = 3.71) and 655.10 (*SD* = 72.03), respectively. The average reading superscores for all students in the sample is 28.02 (*SD* = 4.76) and 587.70 (*SD* = 83.03) for the ACT and the SAT, respectively.

Students screened as gifted in reading. Among all students screened as gifted (*n* = 2,043), 53.35% (*n* = 1,090) were screened as gifted in reading. More specifically, 31.78% (*n* = 649) were screened as gifted in reading by the ACT, while 21.59% (*n* = 441) were screened as gifted in reading by the SAT. Among those screened as gifted in reading by the ACT, about 70% (*n* = 452) also met criteria for giftedness in math. Among those screened as gifted in reading by the SAT, about 80% (*n* = 371) also met criteria for giftedness in math. The average reading superscore among students screened as gifted by the ACT and the SAT is 29.40 (*SD* = 3.68) and 655.96 (*SD* =

72.35), respectively. The average math superscore for all students in the sample is 26.70 (*SD* = 4.18) and 583.11 (*SD* = 83.09) for the ACT and the SAT respectively.

Students screened as twice-exceptional. Students screened as gifted with a possible SLD in reading or math accounted for 3.5% of students in the sample (*n* = 214). This percentage is slightly smaller than estimates from the K-12 populations (Bracamante, 2010). The mean, standard deviation, skewness, and kurtosis of all students screened as 2e in the sample for each numeric used in the current study are displayed in Table 3. The measures were as expected, with negative skewness characterizing some measures (e.g., ACT Composite score, ACT Reading Composite, ACT Discrepancy, SAT Math Composite, and SAT Discrepancy). With the exception of ACT and SAT reading and math composites, all kurtosis values are within the expected range of –1.0 to +1.0.

Twice-exceptional: Gifted with a SLD in reading. Among students screened as gifted in math, 114 students were screened as possibly 2e. Specifically, students screened as gifted with a SLD in reading by the ACT (*n* = 59) scored an average ACT superscore of 33.19 in math and 22.63 in reading. The majority of these students were male (*n* = 45), making up 76.3% of the group. Additionally, 76.3% of these potentially 2e students were White (*n* = 45), with Asian/Pacific Islanders accounting for 13.6% (*n* = 8), and Black students (*n* = 2), Hispanic students (*n* = 2), and biracial students (*n* = 2) comprised an additional 3.4% each.

An additional 55 students were screened as gifted with possible SLD in reading by the SAT. These students obtained an average SAT superscore of 732.00 in math and 522.18 in reading. Slightly over half of these students are female (n = 31), with 81.4% being White (n = 48). The remaining seven students are either Black (n = 4) or students who identify as biracial (n = 3).

Twice-exceptional: Gifted with a SLD in math. Among students screened as gifted in reading, 100 students were screened as possibly 2e. Specifically, students screened as gifted with a SLD in math by the ACT (n = 63) earned an average ACT superscore of 34.48 in reading and 22.02 in math. A majority of these students are female (n = 38), with about 95% being White (n = 60). The remaining three students are Black (n = 1), Asian/Pacific Islander (n = 1), and a student who identified as biracial or multi-racial (n = 1).

An additional 37 students were screened as gifted in reading with a possible SLD in math by the SAT. These students earned an average SAT superscore of 743.78 in reading and 510.81 in reading. The majority of these students are male (n = 33), and most of these students are White (n = 26) or Asian/Pacific Islander (n = 8). The remaining three students are Black (n = 1), Hispanic (n = 1); one student identified with two or more races (n = 1).

Measures

The mean, standard deviation, skewness, and kurtosis of all students in the sample for each numeric used in the current study are displayed in Table 4. The measures were as expected, with negative skewness characterizing some measures (e.g., ACT Composite score, ACT Reading Composite score, ACT Math Composite score, and college GPA). With the exception of the discrepancy score for the SAT and college GPA, all kurtosis values are within the range of -1.0 to +1.0.

ACT/SAT superscores. The University of Tennessee accepts both SAT and ACT scores for admissions purposes. The University of Tennessee utilizes the superscoring method, or the highest scores obtained across all testing administrations. The highest score across all testing dates is identified for each subject area (e.g., reading and math) and for each composite score. National averages for ACT and SAT composite and subject areas scores are reported in the Appendix (Table 15). However, the national averages were not used to establish cutoff scores in the current study, as the current study focuses specifically on college students. National averages for discrepancy scores between subject areas are not available.

Discrepancy. The size of the discrepancy between reading and math composites on both the ACT and the SAT were computed by taking the absolute value of the difference between the Reading composite superscore and the Math composite superscore for each student. The discrepancy scores were then used to screen for twice-exceptionality. A mean discrepancy level was computed among students in the 2014 cohort. Then, among students screened as gifted, any student who also demonstrated a discrepancy score two standard deviations above the mean discrepancy level were then screened for twice-exceptionality.

College GPA. The reported college GPA (CGPA) was the final reported cumulative GPA for each student during their tenure at the University of Tennessee. It was recorded for the last term they attended, in most cases just prior to graduation, but in some cases just prior to leaving the university. This GPA is based on a 0.00 – 4.00 scale and reflects the students' grades in courses taken only at UT. CGPA is calculated by total quality points divided by the total number of credits hours taken by the student are contribute to the student's GPA. Simply put, the grade assignment a student receives in a course is converted to a 4.0 scale and multiplied by the number of credit hours the course is worth to calculate total quality points. This number is then divided by the total number of credit hours (e.g., specifically those that contribute to the GPA) the student has taken at the university. The resulting number is the student's CGPA.

Only three grade replacements may be reflected in a student's CGPA; a student is eligible for grade replacement (e.g., repeating a course and have the new grade replace the old grade) if he/she received an original grade of C- or below and the class was lower-division. Several courses at UT do not effect CGPA: grades of withdraw (the student dropped out of the course before the end of the semester), satisfactory (the student passed the course but the course was not on an A-F grading scale), or no credit (the student failed the course but the course was not on an A-F grading scale).

The University of Tennessee maintains strict standards about academic standing: to maintain good academic standing, students must maintain a CGPA of 2.0 (e.g., a C average). If a student's CGPA falls below a 2.0, or if a student earns less than 2.0 in two consecutive terms, the student is placed on academic probation. If the student fails to make a 2.0 during the semester he/she is on probation, and his/her CGPA remains below 2.0 at the end of the term, he/she is dismissed from the university. Following the first academic dismissal, students are permitted to return to the university after sitting out a fall or spring term. Should a student be dismissed again, the reapplication process is more intensive, including successful completion of 12 credit hours at another institution and a year absence from UT.

To graduate from UT, students must maintain a CGPA of 2.0 or higher. At the time of data collection, CGPA information was available for the 2007 and 2008 entering freshman cohorts of students. All analyses using college GPA are limited to students in the 2007 or 2008 cohort (n = 2,252).

First year retention. First year retention is defined as continuation of college education after the first academic year following the onset of the college education. Students who reenroll for the next fall term at the end of their first academic year are considered retained. The retention rate at UT is currently 85%. Among students included in the sample for the current study, the retention rate is slightly higher at 88.4%.

Graduation. Years to graduation was calculated based on graduation term reported for each student in the dataset. For the current study, graduation is defined as graduating within six years of initial enrollment at UT. The University of Tennessee's current graduate rate is 66%, meaning there is .66 probability a student who enrolls as a first time freshman at the UT will graduate within six years of initial enrollment. For the current study, six year graduation rate could only be identified for the 2007 and 2008 cohorts; therefore, all analyses where graduation was used as an outcome measure, only students in the 2007 or 2008 cohorts were included in the sample.

Major declaration. Once enrolled at UT, freshmen are given the opportunity to declare a major, to declare intent for a specific major, or to be classified as undeclared. Students included in the present study choose one of 91 majors, declared an interest in one of 51 majors, or were classified as undeclared. For the purposes of the current study, the following major distinctions will be used: a) STEM (e.g., Science, Technology, Engineering, or Math), b) Bachelors of Arts and Education majors (e.g., humanities, social sciences, etc.), c) Business majors, and d) Agriculture majors. Discretion was used to classify majors that seem to fit more than one category (e.g., Agricultural Leadership and Communications). Student who did not declare a major and who did not declare an interest in a specific major were classified in a fifth category: Undeclared. Table 5 shows how each major encountered in the current study was classified.

Declaring in line with strength. Based on previous research regarding person-environment fit (Holland, 1985) and declaration of major in line with academic strengths (Montmarquette et al., 2002), the following distinctions were made among students screened as 2e. For students screened as gifted in reading with a SLD in math, Bachelor of Arts, Education, and English majors will be considered declaration of major in line with strength. For students screened as gifted in math with a learning disability in reading, STEM majors and Business majors will be considered declaration of major in line with strength. Discretion was used for some majors that seemed to fit more than one category (e.g., Agriculture and Communications). Table 6 shows how each major encountered in the current study was classified.

Analyses

The analyses used to evaluate each research question are summarized in Table 7. Specific analyses are described below.

Percentage of overlap. The first research question was reported as a percentage of overlap between students identified as 2e by the ACT and students identified as 2e by the SAT. To determine the percentage of overlap, first students were screened as gifted by the ACT and the SAT. Once gifted students were identified, any student who had a discrepancy score between his/her reading and math subtest composite scores that was two standard deviations or higher above the mean discrepancy score was screened as 2e by scores from the ACT (n=122) and from the SAT (n=92). Once students were identified as 2e, the percentage of overlap was investigated by comparing those individuals identified by the ACT with those identified by the SAT. In addition, a nonparametric chi-square test was performed to determine whether the difference between the percentages of students screened as 2e by the ACT is different from the percentage obtained from screening by the SAT.

Academic outcomes. Chi square analyses were used to evaluate research question two. To compare the retention rates of 2e students identified by the ACT to those identified by the SAT, each student was identified based on retention after the first year and then whether or not he/she had been identified as 2e by the ACT or the SAT. Once these binary classifications had been established, the chi square analysis was used to determine whether the percentage of students screened as 2e and not retained after the first year by the ACT was different from the percentage obtained by screening from the SAT.

Chi square analysis was to evaluate research question three. To compare academic success operationalized by graduation rate within six years of initial enrollment at the university between 2e students identified by the ACT versus those identified by the SAT, each student was identified according to whether or not he/she graduated within six years of enrolling at UT. Due to the availability of graduation data, the sample for this particular analysis was limited to students who first entered the university in the fall of 2007 or the fall of 2008 (n = 2,252). Sixty-four students in the 2007 or 2008 freshman cohorts were identified as 2e by either the ACT (n = 37) or the SAT (n = 27). The graduation rates were then compared via a chi-square analysis.

An independent samples *t* test was used to evaluate research question four. To compare academic success operationalized by the number of years it took to graduate for 2e students identified by the ACT relative to those identified by the SAT, each student was identified according to whether or not he/she graduated within six years of enrolling at UT. Among students who graduated, the number of years it took each student to graduate was then calculated and the mean number of years to graduation for those screened by the ACT was compared to the mean number of years to graduation for those screened by the SAT. The 64 students identified as 2e from the 2007 and 2008 cohorts were included in the analysis.

An additional independent samples *t* test was used to evaluate research question five. To compare academic success operationalized by final CGPA for students who had graduated within six years, means obtained from final CGPA for the 64 who graduated were compared based on screening by either the ACT or the SAT.

Major declaration. The number of students who declared a specific major, declared intent to pursue a specific major, and undecided are reported in Table 11 for all students in the sample. Chi square analyses were also used to answer the sixth research question of the current study. This analysis yielded information about whether 2e students were more successful (operationalized by first-year retention rates) if they declared a major in line with their academic strength. Specifically, students were screened according to criteria described above to determine whether they had declared a major or intent to major in an academic area in line with their strength. Once this classification was obtained, a comparative analysis was conducted between students who did declare a major in line with their academic strength and students who did not declare a major in line with their academic strength.

Chi square analyses were also used to evaluate the seventh research question. To evaluate whether 2e students are more likely to graduate if they declare a major in line with their academic strength, each students was identified according to whether he/she graduated and whether he/she declared a major in line with his/her academic strength. Once these binary classifications were obtained, chi square analyses were used to determine whether 2e students were more likely to graduate if they had declared a major in line with their academic strength. Due to the availability of graduation data, the sample for this particular analysis was limited to students who first entered the university in the fall of 2007 or the fall of 2008 (n=2,252). Sixty-four students in the 2007 or 2008 freshman cohorts were identified as 2e by either the ACT (n = 37) or the SAT (n = 27).

An independent samples *t* test was used to evaluate the eighth research questions of the current study. This analysis yielded information about whether 2e students were more successful (operationalized by the number of years it took to graduate) if they declared a major in line with their academic strength. Among students screened as 2e, 48 were identified via a binary classification as students who graduated. The number of years it took to graduate was then calculated for each student who graduated. The mean number of years to graduation of those who declared a major in line with their academic strengths was compared to the mean years to graduation for students who did not declare a major in line with their academic strength.

An independent samples *t* test was used to evaluate the final research question of the current study. That is, the analyses was conducted to determine whether 2e students who declared a major in line with their academic strength earned a statistically significantly different mean exiting CGPA relative to those who did not declare a major in line with their strengths.

Of note, there is some literature that supports applying a one-tailed *t* test when considering some mean differences (e.g., a mean difference analysis evaluating 2e screening by the SAT versus the ACT and a mean difference analysis evaluating the effect of declaring a major in line with academic strength). In those instances (e.g., research questions four, five, eight and nine) *p* values were considered for statistical significant for both a one-tailed and two-tailed outcome.

CHAPTER THREE

RESULTS

Initially descriptive data are presented for students screened as 2e and, for context, students screened as gifted as well as those from the general student population. Of the 5,536 students in the sample, 214 (3.86%) were screened as 2e and 2,043 (36.88%) students were screened as gifted. Of the full sample, 470 (8.49%) were screened as gifted in reading while 682 (12.31%) were screened as gifted in math by the ACT; an additional 541 (9.77%) students were screened as gifted in reading *and* math by the ACT. Of the full sample, 544 (9.82%) were screened as gifted in reading while 441 (7.96%) were screened as gifted in math by the SAT; an additional 371 (6.70%) were screened as gifted in reading *and* math by the SAT. Significant overlap was observed in gifted screening between the ACT and the SAT. Average composite ACT and SAT scores are reported for students screened as gifted, students screened as 2e, and students from the general population and are reported in Table 8. Among students screened as gifted, the average composite ACT score was 30.71 (*SD* = 2.46) and the average SAT composite score was 1298.83 (*SD* = 107.44). Among students screened as 2e, the average ACT composite score was 28.27 (*SD* = 2.50) and the average SAT composite score was 972.92 (*SD* = 285.20). Among the remaining students in the general population, the average composite ACT score was 25.40 (*SD* = 2.84) and the average composite SAT score was 1096.28 (*SD* = 108.00)

With regard to college academic success, six-year graduation information and CGPA information was limited to the 2007 and 2008 cohort of students. Retention rates among students screened as gifted, students screened as 2e, and students in the general population are reported in Table 9. The first-year retention rate was approximately 86% for students in the general population, about 92% for students screened as gifted, and about 90% for students screened as 2e. Six-year graduation rates for students screened as gifted, students screened as 2e, and students in the general population are reported in Table 10. The six-year graduation rate was approximately 82% for students in the general population, about 89% for students screened as gifted, and 75% for students screened as 2e. Major declaration information for students screened as gifted, students screened as 2e, and students in the general population are reported in Table 11. With regard to major declaration, all students in the sample fell into one of three categories: declaration of major (40.48%), declaration of intent in specific major (36.22%), or undeclared in major (23.30%).

Comparison of Twice-Exceptional Students Screened by the ACT versus the SAT

Among students screened as 2e, the average ACT composite score was 28.27 (*SD* = 2.50) and the average SAT composite score was 972.92 (*SD* = 285.20); these scores can be compared to those obtained by students from the general population, who earned an average ACT score of 25.40 (*SD* = 2.84) and an average SAT score of 1096.28 (*SD* = 108.00). The first year retention rate was approximately 90% among students screened as 2e by both measures versus approximately 87% in the general student population. Among students screened as 2e by both measures, 64 students (41.56%) were members of the 2007 or 2008 cohort. The six-year graduation rate among this group of students was about 75% (versus 83% in the general population) and the students averaged 4.58 years (*SD* = 0.82) to graduate, versus 4.31 years (*SD* = 0.77) in the general population. The average final CGPA reported for these 64 students was 3.11 (*SD* = 0.79), versus 3.12 (*SD* = 0.49) in the general population. Approximately 45% (*n* = 69) had declared a specific major upon initial enrollment at UT, while about 35% (*n* = 54) had declared an interest in a major track; 20% (*n* = 31) did not declare a major initially. Comparative percentages within the general population of students were 38%, 37%, and 25%, respectively.

Further examination of students screened as 2e by both the ACT and the SAT revealed that all students were screened as gifted in reading *or* math by either the ACT or the SAT; some were screened as gifted in reading with a possible SLD in math, some were screened as gifted in math with a possible SLD in reading, and some did not fit this pattern. For example, student 322 was screened as gifted in reading with possible SLD in math by the ACT; however, when screened as 2e by the SAT, student 322 was screened as gifted in math with possible SLD in reading. These students were excluded from the remaining analyses comparing students identified solely by the ACT versus by the SAT, and vice-versa.

To address research question one, overlap between those screened as 2e by both the ACT and SAT was determined. Among the 214 students screened as 2e, 93 (43.46%) were screened based only on ACT scores, while 61 (28.50%) were screened based only on the SAT, resulting in a 14.49% percentage of overlap (*n* = 31 students). Approximately 25% of the students screened as 2e by the ACT were also screened as 2e by the SAT. Additionally, about 34% of the students screened as 2e by the SAT were also screened as 2e by the ACT. Based on the Chi-square analyses the difference in the percentage of students identified as 2e by the SAT was statistically significantly different from students identified as 2e by the ACT, $\chi^2(1) = 4.21$, $p < .05$; more students were screened as 2e by the ACT.

Retention. To address research question two, first year retention rates for all students in the sample were determined and are displayed in Table 9. Because the first-year retention did not vary significantly between students screened as 2e by the SAT whose giftedness was in math and those who giftedness was in reading, $\chi^2(1) = .204$, $p > .05$, all students screened as 2e by the SAT were combined into one group for comparison. Similarly, because the first-year retention did not vary significantly between students screened as 2e by the ACT whose giftedness was in math and those who giftedness was in reading, $\chi^2(1) = 2.46$, $p > .05$, all students screened as 2e by the ACT were combined into one group for comparison. Retention rates among students screened as 2e by the SAT and the ACT were similar, 93.4% and 88.2% respectively. Results from the Chi-square analyses revealed no statistically significant difference between the retention rates among 2e students screened by the SAT and the ACT, $\chi^2(1) = 1.16$, $p > .05$. For context, the percentage of 2e students who were retained after the first year of college was higher than for the general population (90.3% versus 86.6%).

Graduation. To address research question 3, six-year graduation data were collected from the 2007 (n = 1,159) and the 2008 (n = 1,093) cohorts of students. The number and percentages of students in the 2007 and 2008 cohort who graduated within six years of initial enrollment at the university are shown in Table 10 for all groups of students. All students screened as 2e by the SAT were combined in a single group for comparison, as there was no statistical significantly differences between those who giftedness was in reading and those whose giftedness was in math, $\chi^2(1) = 0.94$, $p > .05$. Similarly, all students screened as 2e by the ACT were combined into a single group for comparison because no statistical significantly differences were found between students who giftedness was in reading and those who giftedness was in math, $\chi^2(1) = 1.38$, $p > .05$. Chi-square analyses revealed no statistically significant difference between the graduation rates among 2e students screened by the SAT (70.4%) and the ACT (78.4%), $\chi^2(1) = 0.53$, $p > .05$. Of course, this difference might have been statistically significant if the same ratio held for a larger sample size.

Years to Graduation. Among 2e students who graduated ($n = 48$), an independent samples *t* test was used to determine if those screened as 2e by the SAT took longer to graduate than those screened as 2e by the ACT (research question four). Students screened as 2e by the SAT were combined into a single group for comparison, as no statistically significant differences were observed between students whose giftedness was in reading and students whose giftedness was in math, $t(17) = 0.51$, $p > .05$, $d = 0.25$. Results indicate a small effect size between the mean difference of years to graduation between students whose giftedness was in math and those whose giftedness was in reading when screened as 2e by the SAT. Similarly, students screened as 2e by the ACT were combined into a single group for comparison, as no statistically significant differences were observed between students whose giftedness was in reading and those whose giftedness was in math, $t(27) = -0.11$, $p > .05$, $d = -0.04$. Results indicate a small effect size between the mean difference of years to graduation between students whose giftedness was in math and those whose giftedness was in reading when screened as 2e by the ACT. Results from this analysis revealed no statistically significant difference between the mean years to graduation between 2e students screened by the SAT ($M = 4.74$; $SD = 0.81$) and the ACT ($M = 4.48$; $SD = 0.83$), $t(46) = -1.05$, $p > .05$, $d = -0.31$. Although not statistically significant, results indicate a small to moderate effect size in the difference in the mean number of years to graduation between 2e students screened by the SAT and those screened by the ACT, with students screened by the SAT taking slightly longer to graduate.

There is some literature that supports applying a one-tailed *t* test when considering some mean differences (i.e., a mean difference analysis comparing 2e screening by the SAT versus the ACT evaluating the number of years to graduation). In those instances, *p* values were also considered for statistical significant for a one-tailed outcome; however, the statistical significance levels did not change as a function of applying a one-tailed outcome ($p = .15$).

Cumulative GPA. Among students who graduated ($n = 48$), an independent samples *t* test was used to determine whether or not the final mean CGPA of those students screened as 2e by the SAT differed from the final mean CGPA of those screened by the ACT (research question five). Students screened as 2e by the SAT were combined into a single group for comparison, as no statistically significant differences were observed between students whose giftedness was in reading and students whose giftedness was in math, $t(17) = 1.35$, $p > .05$, $d = 0.65$. Results indicate a moderate to large effect size in the mean difference of final CGPA between students whose giftedness is in reading and those whose giftedness is in math when screened as 2e by the SAT. Similarly, students screened as 2e by the ACT were combined into a single group for comparison, as no statistically significant differences were observed between students whose giftedness was in reading and those whose giftedness was in math, $t(27) = -0.95$, $p > .05$, $d = -0.37$. Results indicate a small to moderate effect size in the mean difference of final CGPA between students whose giftedness is in reading and those whose giftedness is in math when screened as 2e by the ACT. Analyses revealed no statistically significant difference between the mean CGPA of 2e students screened by the SAT ($M = 3.26$; $SD =0.47$) and the ACT ($M = 3.09$; $SD =0.81$), $t(46) = 0.40$, $p > .05$, $d = 0.18$, and the effect size was small.

There is some literature that supports applying a one-tailed *t* test when considering some mean differences (i.e., a mean difference analysis comparing 2e screening by the SAT versus the ACT evaluating final CGPA). In those instances, *p* values were also considered for statistical significant for a one-tailed outcome; however, the statistical significance levels did not change as a function of applying a one-tailed outcome ($p = .35$).

Academic Outcomes: Major Declaration among Students Screened as Twice-Exceptional

The number and percentage of students who declared major in line with their academic strength are presented in Table 13 for students screened as 2e, and more specifically students screened as 2e by the SAT and the ACT. Approximately 50% of students screened as 2e declared a major in line with their academic strength. Percentages varied among students screened as 2e by the SAT and the ACT; about 20% of students screened by the SAT declared a major in line with their academic strength, while 68% of students screened by the ACT declared a major in line with their academic strength.

Retention. All students screened as 2e were initially combined into a single group for comparison purposes. Data from a Chi-square analysis addressed research question six; no statistically significance difference was found in retention rate between 2e students who declared a major in line with their academic strength (48.7%) and those who did not (51.3%), $\chi^2(1) = 0.50$, $p > .05$. As a follow up analysis students screened as 2e by the SAT were separated from students screened as 2e by the ACT and additional statistical tests conducted to further investigate the relationship between major declaration in line of strength and retention. Among students screened as 2e by the SAT, analysis revealed no statistically significant differences between students who declared a major in line with their academic strength (19.7%) and students who did not (80.3%), $\chi^2(1) = 1.05$, $p > .05$. Among students screened by the ACT, a statistically significant difference exists between students who declared a major in line with their academic strength (67.7%) and students who did not (32.3%), $\chi^2(1) = 3.80$, $p < .05$.

Graduation. Chi square analyses were also utilized to investigate the association between major declaration in line with academic strength and graduation for 2e students (research question seven). Six-year graduation data were available for only

48 students screened as 2e. All students screened as 2e were combined into a single group for comparison purposes. The analysis revealed no statistically significant association between declaration of major in line with academic strength and graduation rate, $\chi^2(1) = 3.05$, $p > .05$. To further investigate the association between major declaration in line with academic strength and graduation within six years, 2e students were separated into those screened by the SAT and those screened by the ACT. Among students screened as 2e by the SAT, analyses revealed no statistically significant difference in the percentage of student who declared a major in line with their academic strength (21.1%) and students who did not (78.9%) and graduation within six year, $\chi^2(1) = 1.98$, $p > .05$. Among students screened by the ACT, no statistically significant difference exists between six-year graduation rate of students who declared a major in line with their academic strength (69.0%) and students who did not (31.0%) , $\chi^2(1) = 0.26$, $p > .05$.

Years to graduation. An independent samples *t* test was used to investigate research question eight, the relation between declaration of major in line with academic strength and the mean number of years to graduation. All students screened as 2e were initially combined into a single group for comparison. Analyses revealed no statistically significant difference between the mean number of years to graduation of students who declared a major in line with their academic strength ($M = 4.46$; $SD = 0.72$) and those who did not ($M = 4.71$; $SD = 0.91$), $t(46) = 1.06$, $p > .05$, $d = 0.31$. Although not statistically significant, results indicate a small to moderate effect size in the mean number of years to graduate between 2e students who declare a major in line with their academic strength and those who do not, with those who do not declare a major in line with their academic strength taking longer to graduate. To further investigate the relation between declaration of major in line with academic strength and the number of years it took students to graduate, 2e students were separated into those screened by the SAT and those screened by the ACT. Among students screened by the SAT, a statistically significant mean difference was found between students who declared a major in line academic strength (M = 5.00; SD = 0.82) and students who did not (M = 4.67; SD = 0.82) in the number of years graduation, $t(25) = -1.41$, $p < .001$, $d = -0.56$. Among students screened as 2e by the SAT, results reveal a moderate effect size in the mean number of years to graduation between students who declared a major in line with their academic strength and those who did not, with students who did not declare a major in line with their academic strength taking longer to graduate than those who did. Among students screened by the ACT, no statistically significant mean difference in years to graduation was revealed between students who declared a major in line academic strength (M = 4.35; SD = 0.67) and students who did not (M = 4.78; SD = 1.09), $t(35) = -0.98$, $p > .05$, $d = -0.33$. Among students screened as 2e by the ACT, results reveal a small to moderate effect size in the mean number of years to graduation between students who declared a major in line with their academic strength and those who did not, with students who did not declared a major in line with their academic strength taking slightly longer to graduate than those who did.

There is some literature that supports applying a one-tailed *t* test when considering some mean differences (i.e., a mean difference analysis evaluating the effect of declaring a major in line with academic strength on the number of years to graduation). In those instances, p values were also considered for statistical significant for a one-tailed outcome; however, the statistical significance levels did not change as a function of applying a one-tailed outcome ($p = .15$).

Cumulative CGPA. Among 2e students who graduated within six years of initial enrollment at UT, an independent samples t-test was used to investigate the association between declaration of major in line with academic strength and CGPA (research question nine). Average mean CGPA among 2e students screened by the SAT and the ACT and the combined group of 2e students are reported in Table 14. All students screened as 2e were initially combined into a single group for comparison. Analyses revealed no statistically significant mean CGPA difference between students who declared a major in line with their academic strength ($M = 3.22$; $SD = 0.68$) and those who did not ($M = 3.01$; $SD = 0.87$), $t(62) = 0.93$, $p > .05$, $d = 0.24$. The mean difference also reflects a small effect size in final CGPA between 2e students who declare a major in line with their academic strength and those who do not. To further investigate the relation between declaration of major in line with academic strength and exiting CGPA, 2e students were separated into those screened by the SAT and those screened by the ACT. Among students screened by the SAT, no statistically significant mean CGPA difference were found between students who declared a major in line academic strength ($M = 3.30$; $SD = 0.35$) and students who did not ($M = 3.11$; $SD = 0.83$), $t(25) = 0.44$, $p > .05$, $d = 0.18$, and the effect size is small. Among students screened by the ACT, no statistically significant mean difference exists between students who declared a major in line academic strength (M = 3.20; SD = 0.72) and students who did not (M = 2.88; SD = 0.95), $t(35) = 0.31$, $p > .05$, $d = 0.10$, and the effect size is considered very small. There is some literature that supports applying a one-tailed *t* test when considering some mean differences (i.e., a mean difference analysis evaluating the effect of declaring a major in line with academic strength on final CGPA). In those instances, *p* values were also considered for statistical significant for a one-tailed outcome; however, the statistical significance levels did not change as a function of applying a one-tailed outcome ($p = .45$).

CHAPTER FOUR

DISCUSSION

The purpose of the present study was to compare the number of students screened as 2e by the ACT versus the SAT, compare academic outcomes between students screened as 2e based on the screening instruments used (i.e., SAT versus ACT), and then to compare academic outcomes among 2e students who declare a major in line with academic strengths and those who do not. Results indicate that more students were screened as 2e based on ACT scores. There were few differences in academic outcomes (e.g., retention and graduation rates, years to graduate, and CGPA) between students screened by the SAT versus the ACT; in addition, academic outcomes for 2e students who declare a major in line with their strengths differ very little from those who do not declare a major in line with strengths. The few differences that do exist are discussed below, as are implications, limitations of the study, and suggestions for future research.

Pattern of Dual Identification among those screened as Twice-Exceptional

Among students screened as 2e (n = 214), a small percentage (14%) of students were dually identified by both screening methods (e.g., the SAT and the ACT). Further analysis revealed that the differences in the percentage of students identified as 2e by the SAT and students identified as 2e by the ACT was statistically significant, $p < .05$. More students were screened using the ACT scores as the basis for the screening process. Approximately four percent of the students in the current study were screened as potentially 2e; this percentage is slightly lower than the percentage of students (between 5% and 6%) screened as 2e in the K-12 population (Assouline et al., 2006). This lower percentage can be explained by a couple of factors: to be included in the current study, students must have submitted both an SAT and an ACT score and conservative screening criteria were employed in the current study (discrepancy scores of 2 standard deviations or higher).

An interesting pattern was observed among the 31 students screened as 2e by both methods. The students were screened as gifted in either math or reading by the ACT and were subsequently screened as gifted in the other academic domain by the SAT. All students screened as 2e by both methods followed the same pattern. While composite ACT and SAT scores are commonly accepted and widely-referenced measures of high school students' academic achievement (National Association for College Admissions Counseling, 2013), the measures falls on opposite ends of the aptitude/achievement continuum (Zwick, 2007). The ACT is more related to high school curricula (Koenig, et al., 2008) and falls more on the achievement end of the spectrum (Zwick, 2007). The SAT assesses more general academic application skills, which allows examinees to apply their generalized knowledge (Korbin et al., 2008); consequently, it falls more on the aptitude end of the spectrum (Zwick, 2007). This difference in assessment focus provides a likely explanation for the small percentage in overlap and a rationale for the different pattern of strengths/weaknesses among 2e students screened by both the SAT and the ACT.

The ACT is more likely to be reported as a college entrance test score by students, as evidenced by the database in the current study. Approximately 17% of the students in the current study reported an SAT score, while 83% of the students reported an ACT score. Results of the current study revealed that a statistically significant higher percentage of students were screened as 2e by the ACT than by the SAT, suggesting the ACT is a more efficient screening mechanism for 2e status in the college population. Of note, using the Concordance Table to compare the magnitude of the scores from the two tests, the means did differed, with the converted SAT scores being significantly lower than the ACT scores. Among the students screened as 2e by both measures, SAT Composite scores were converted to ACT composite scores; the converted ACT Composite scores were compared to ACT Composite scores. The mean ACT score was 28.39 (SD = 1.75), and the mean of the converted SAT score was 27.13 (SD = 1.63), $t(60) = 2.94$, $p < .05$. Thus, students in the current study achieved higher mean composite scores on the ACT.

Comparison of Twice-Exceptional Students Screened by the ACT versus by the SAT

In general, 2e students screened by the SAT demonstrated no statistically significant differences from students screened as 2e by the ACT on various academic outcomes, as determined by investigating results relevant for addressing research questions two through six. That is, students screened as 2e by the SAT were just as likely to be retained after their first year and to graduate within six years as students screened as 2e by the ACT. Further, no mean differences between students screened as 2e by the ACT and those screened by the SAT were observed in the number of years it took students to graduate or in final CGPA. However, based on effect sizes, several practically significant differences were observed. Students screened as 2e by the SAT took moderately longer to graduate than students screened by the ACT; but, students screened as 2e by the SAT achieved a slightly higher final CGPA than students screened as 2e by the ACT. Based on these results college and university personnel should not expect different academic outcomes based on using ACT versus SAT, and this screening procedure seems reasonable for this population.

Evidence for masking effects. In K-12 settings, 2e students often underachieve academically (Reis et al., 1995). Masking often occurs, resulting in an average performance. More specifically, 2e students usually do not achieve high enough for the potential associated with their giftedness to be noticed, but also do not perform low enough to cause concern (Baum, 1990; Brody & Mills, 1997; McCoach et al., 2001). Results of this study indicate that 2e students may still fall short of their academic potential, even as they pursue higher education. A comparison of SAT and ACT composite scores among students screened as 2e, students screened as gifted, and students in the general population in the current study revealed that 2e students often appear average in their academic abilities, despite their multiple exceptionalities. Specifically, students screened as gifted averaged ACT composite scores of 31 and SAT composite scores of 1300. Students in the general population averaged ACT composite scores of 25 and SAT composite scores of 1100. Students screened as 2e averaged ACT composite scores of 28 and SAT composite scores of 970. Results of the current study show lower composite scores among 2e students when compared to their non 2e peers.

Previous studies revealed significant correlations with first-year retention, six-year graduation, and exiting CGPA with ACT composite scores for students screened as gifted in reading or math and students in the general population; however, for 2e students, composite scores may not be as good a predictor (Hays, 2015). Results of the current study provide further evidence that composite scores for 2e students appear average, particularly SAT composite scores, despite the strength in one area. Thus, two of the most widely accepted measures predicting academic abilities and success in college may not fully reflect the ability levels of 2e students and like in the K-12 2e population, masking seems to operate in the college age 2e population.

Academic Outcomes: Major Declaration among Students Screened as Twice-Exceptional

Twice-exceptional students exhibit obvious academic strengths and weaknesses, the implications of which served as the basis of several research questions in the present study. Those strengths and weaknesses may have implications for declaring a major. Presumably, students are more inclined to pursue a major if they have demonstrated the ability to perform well in that area (Arcidiacono et al., 2010; Stater, 2011). Perhaps of note, more students (68%) screened by the ACT (relative to the SAT, 20%) reported a major in line with their strengths. Perhaps, students who are screened as 2e by the ACT show a great aptitude subject specific ability, as the ACT is more related to high school curricula (Koenig et al., 2008). This is a possible explanation for why more students screened by the ACT declared a major in line with their academic strength. Further investigation into academic outcomes among 2e students revealed that students screened as 2e by the ACT (but not the SAT) were significantly less likely to be retained after their first year of college when they did not declare a major in line with their academic strength, $p < .05$. Furthermore, when the total number of 2e students were considered they were not less likely to graduate within six years of initial enrollment at UT when they failed to declare a major in line with their academic strength. However, within a more molecular analysis, those screened as 2e by the SAT took more years to graduate if they declared a major in line with their strengths. Perhaps these students are more diligent students, and because they have declared a major in line with their academic strength, and are more likely to persist in their degree to completion, even though it takes longer. Though minimal statistically significant differences were observed, several practically significant differences were observed as reflected by effect sizes between 2e students who declared a major in line with their academic strength and those who did not. Twice-exceptional students who did not declare a major in line with their academic strength took moderately longer to graduate and achieved a slightly lower final CGPA than 2e students who did declare a major in line with their academic strength.

Average performance with above average potential. One unique characteristic of 2e students is their obvious pattern of academic strengths and weaknesses. In fact, Shaywitz characterized K – 12 students who have a learning disability as having a weaknesses in a sea of strengths (Shaywitz, 2003). Though thoroughly investigated in the literature, the results about the effects of ability level on major declaration in college students are mixed (Bartolj & Polanec, 2012). Results focusing specifically on 2e students are even rarer. Hays (2015) found that 2e students were more likely than their gifted peers and students in the general population to be undeclared in their major upon initial enrollment. Additionally, when a 2e student's giftedness was in math, the student was significantly more likely to declare a STEM major than students in the general population (Hays, 2015). Current results extend these findings. Among 2e students, specifically those screened by the ACT who also declared a major in line with their academic strength were significantly more likely to be retained after their first year than 2e students who did not. Additionally, 2e students were significantly more likely to graduate within six years if they declared a major in line with their academic strength when compared to 2e students who did not. Though no statistically significant differences were observed between students who declared a major in line with their academic strength and those who did not in final CGPA, a small effect size was observed between these two groups of students, with 2e students who declared a major in line with their academic strength achieving a slightly higher mean CGPA.

Students screened as 2e demonstrated average first-year retention, six-year graduation rates, and CGPA. More specifically, students screened as 2e were more likely to be retained, to graduate, and to achieve higher mean exiting CGPA if they declared a major in line with their academic strength. These findings have several implications not only about advising processes of 2e students, but also identification techniques as well. Achieving up to potential may be difficult for 2e students and they may be less college ready than their gifted peers (Reis & Colbert, 2004). Due to their exceptional strengths in some areas 2e students are likely to have above average potential if given the appropriate support. Identifying and classifying 2e students presents a significant challenge facing college or university officials, in part because these students “fly under the radar.” That is, they are unidentified by college advisors. Classifying the student as average is inappropriate given they have an empirically-supported superior academic ability in at least one subject area. Classifying student as gifted may be problematic as well given the presence of an SLD and the masking effect of 2e status. Twice-exceptional students are neither fish nor fowl, and because of their unique characteristics they may require unique guidance/advising.

When using models of SLD identification typically used in the K-12 setting (e.g., RTI, cognitive/achievement discrepancy, and Pattern of Strengths and Weaknesses), a student’s strengths are used to make inferences about the student’s academic potential. The result of these identification techniques is to then inform intervention strategies, with a goal of helping the students achieve their potential. If the same practices are utilized with 2e college students, advising may be idiosyncratically determined and optimally effective.

Advising practices. Results of this study clearly suggest that 2e students may benefit from early and unique academic advising or career counseling. Academic advising has been shown to be one of the most influential strategies for improving retention and academic performance among students (ACT, 2004). Most universities have screening methods in place for students who will receive extra academic advising; at such institutions, the screening methods proposed in the current study could also be implemented to identify prospective 2e students as a target population for extra services. Results of the present study show that students screened as 2e are statistically more likely to be retained after the first year, to graduate within six years, and have a tendency to have a higher exiting CGPA when they declare a major in line with their academic strength. Researchers have discovered that a certain number of undergraduate will not return for their second year, and thereby won't graduate. Perhaps, declaring a major outside of the student's area of academic strength is one possible explanation (Montmarquette et al., 2002). Early consultation with students screened as 2e could provide the students with information about academic programs and classes that closely align with their aptitude and potential, and more importantly, their interests. In the K-12 setting, students experiencing an SLD have shown high levels of academic frustration and weakened academic motivation (Baum & Owen, 1988; Olenchak & Reis, 2002; Reis & Colbert, 2004). It is safe to assume that these academic frustrations continue when potential 2e students choose to pursue higher education. Thus, it is vitally important that 2e students, in particular, choose majors and classes that align with their strengths and to obtain continued support throughout their class education.

In sum, the pros/cons twice-exceptionality is a subject of debate among educators, specifically in the K-12 population. To some, the sheer presence of normative deficits warrants intervention (Flanagan et al., 2007; Lovett & Sparks, 2013; Stanovich, 1999); however, achieving at an average level would not warrant intervention. To others, normatively low comparisons to peers warrant intervention and support (Assouline et al., 2011; Mastropieri & Scruggs, 2005; McCallum et al., 2013; Scruggs & Mastropieri, 2002). Results of this study, together with the results from Hays (2015) suggest that appropriate and targeted support and services, (i.e., advising practices focusing them on their academic strengths) for 2e students may be helpful in promoting increased academic outcomes for this unique population.

Summary

A major rationale for the current study was a comparison between the two most widely-accepted measures of academic achievement among colleges and universities: the SAT and the ACT. Students were screened as 2e by the SAT and by the ACT and then compared across several measures of academic success, thus comparing the screening techniques. In general, the academic outcomes in college students do not differ as a function of the screening instrument employed. Additionally, no statistically significant differences were found between those students whose giftedness was in reading and students whose giftedness was in math. However, there were some salient differences between 2e and non 2e students.

Further analyses investigated the academic success among 2e students who declared a major in line with their academic strength versus those who did not. Among students screened as 2e by the ACT, those who declared a major in line with their academic strength were more likely to be retained than those who did not. No statistical differences were observed in the six-year graduation rates between 2e students who declared a major in line with their academic strength and those who did not, although students screened as 2e by the SAT had a significantly lower mean number of years to graduation when they declared a major in line with their academic strength. Finally, though a statistically significant mean difference was not observed in final CGPA between 2e students who declared a major in line with their academic strength and those who did not, a small effect size was observed with 2e students who did declare a major in line with their academic strength achieving a slightly higher mean CGPA.

Recommendations for screening 2e students in the college population. Approximately four percent of the students in the current study were screened as twice-exceptional, which is similar to estimates of 2e students in the K-12 population (Assouline et al., 2006). The similarity in percentages of students identified provides support for the screening method described in this study. The methods described in this study can be used by college and universities looking to better serve the 2e student population. For example, students were screened as gifted in reading if they earned an ACT Reading score of 33 or higher OR an SAT Reading score of 680 or higher. Students were screened as gifted in math if they earned an ACT Math score of 31 or higher *or* an SAT Math score of 670 or higher. Students screened as gifted in reading were classified as potentially 2e if their ACT discrepancy score was 11 points or higher *or* if their SAT discrepancy score was 190 points or higher. Students screened as gifted in math were classified as potentially 2e if their ACT discrepancy score was 9 points of higher OR if their SAT discrepancy score was 180 points or higher. The generalizability of the cut scores presented in this study may be limited to large public universities with similar demographics, but the screening methods can be implemented at any school, assuming the institution uses data relevant to their institution (e.g., the institution's distribution of reading and math admissions scores). Using the screening methods described in the current study, a school with slightly lower test scores may yield a lower cut score when screening for giftedness, thus resulting in lower discrepancy cut scores as well.

The decision about which method is to be used when screening for 2e status depends on several factors. For example, some institutions require only one standardized, normally-distributed admissions test (e.g., either the SAT or the ACT). The same formula can be used with either admissions test, as demonstrated in the current study. Modifications can be made to the formula, yielding a smaller or larger percentage of students screened as potentially 2e (McCallum et al., 2013). For example, in the present study students were screened as gifted if their reading or math score was one standard deviation above the average reading or math score. Students were subsequently screened as 2e if their discrepancy score was two standard deviations above the mean discrepancy score. Adjusting the screening criteria will lead the institution to have more conservative or liberal population of potentially 2e students. In sum, 2e status may vary somewhat as a function of the institution's demographics and decisions.

Most public institutions have university sponsored services that assist students at increased risk for non-retention and thus, at risk for not graduating. Such services include tutoring, academic counseling, and academic/career counseling, among others (ACT, 2010). Twice-exceptional students can be readily screened for such services by the methods described in this study; however, 2e students will likely be missed by traditional screening methods, such as RTI, Achievement Discrepancy Model, and possibly even the Patterns of Strengths and Weaknesses, if there is a requirement that the weakness be significantly below the population averages. University officials who focus specifically on the 2e population may benefit from examining a possible Reading/Math discrepancy. This method will allow officials to screen for 2e students and other students with significant academic variability, but do not score high enough to be tentatively screened as gifted. Both sets of individuals would likely benefit from the unique university based services.

Finally, results of previous investigations (Hays, 2015), together with results of the current study, suggest that the ACT may be easier to use because it is more widely reported as the college entrance exam score by a majority of students. Additionally, as the ACT is more universally accepted by most universities, as evidenced by the database obtained for the present study, the ACT might be the more practical option for colleges and universities. And, of note the mean ACT was higher than the converted mean SAT score using the Concordance Table among students screened as twice-exceptional by both the ACT and the SAT, which adds to the utility of the ACT in screening for 2e status.

Limitations and Recommendations for Future Research

Several limitations are present in the current study. One limitation is that group assignment in this study was based on a screening procedure, not a full-blown psychoeducational assessment. In order to obtain diagnoses, individually administered academic skills and cognitive tests should be administered. Results of these two methodologies may result in differential characterizations of twice-exceptionality. More traditional and rigorous methods of identification are crucial to confirm 2e status

A second limitation of the current study is the specific nature of defining 2e by two academic areas- reading and math. Students can experience an SLD in many different categories: e.g., reading, math, written expression, listening comprehension, among others. Additionally, gifted with an SLD is only one form of twice-exceptionality; other disabilities (e.g., attention-deficit hyperactive disorder and autism spectrum disorder) can also be associated with giftedness. Therefore, future research should include demographic information regarding disability status to include students in these populations as well.

An additional limitation of this study is its focus on academics only. Research into the social/emotional characteristics of 2e college students is needed, and perhaps can help explain underperformance experienced by some 2e learners. Another limitation of the current study is the sample size. This study focused on exploration of screening techniques, the SAT and the ACT, for 2e students. The sample size was limited to those students who had submitted both admissions test scores to the University of Tennessee. More research needs to be conducted with both screening mechanisms, with increased sample sizes and use of various cut scores. Additionally, the validity of the screening mechanisms needs to be investigated.

An additional limitation of the current study could be attributed to the major declaration in line with academic strength component. Specifically, while most majors fit into the screening categories described above, some majors have wide variability in the form of concentrations. For example, a Marketing major has several different concentrations (e.g., Advertising and Finance). The Marketing major with a concentration in Advertising might most strongly align with giftedness in Reading, as advertising focuses more on the psychological aspect of Marketing. The Marketing major with a concentration in Finance would align most closely with giftedness in Math, as Finance involves ‘crunching’ numbers. The current study focused on majors specifically, but future research could take concentrations into consideration.

Finally, the results can only be generalized to samples with similar demographics and characteristics. These data were obtained from a large state-supported land-grant university in the southeast. So, future study needs to include more variation in states, university-size, areas, and regions.

Summary and Conclusions

In conclusion, screening for 2e status by either ACT or SAT will identify similar students within the conditions of this study. Results suggest that students screened as twice-exceptional, particularly those who declare a major in line with their academic strength, are more like to be retained after one year, to graduate within six years, and to achieve a higher mean exiting CGPA when compared to 2e students who did not declare a major in line with their academic strength. Additional results of the current study, as well as previous results (Hays, 2015), suggest that when compared to gifted peers and students in the general population, 2e students are less likely to be retained after their first year, less likely to graduate within six years, and obtain a lower exiting CGPA.

Given these results, several suggestions are made about future directions of research. As 2e research is limited, not only in the college setting but also in the K-12 setting, more research is crucial on the 2e population, specifically focusing on identification techniques and intervention strategies. More specifically, in the 2e college student population, future research should focus on whether academic advising, career counseling, and other strategies can be effective in assisting 2e students be more successful academically.

Finally, more information is needed to explore academic outcomes among different presentations of 2e status. The current study focused solely on students screened as gifted in one academic domain with an SLD in another academic domain. In this study, the academic domains were limited to reading and math. In future research, other types of SLD should be explored, as well as other types of exceptionalities, such as ADHD, physical disabilities, and ASD.

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APPENDIX

TABLES

Table 1

Establishing Cutoff Criteria Using Distributions from 2014 Cohort

Measure	*M*	*SD*	Formula to Establish Screening Cutoff Scores	Screening Cutoff
Reading ACT Superscore	28.05	4.90	Gifted in Reading if Reading ACT ≥ μ + 1 SD	≥ 33
Math ACT Superscore	26.71	4.28	Gifted in Math if Math ACT ≥ μ + 1 SD	≥ 31
[a]Discrepancy between Reading and Math	5.02	3.33	Twice-Exceptional if Screened as Gifted AND Discrepancy ≥ μ + 2 SD	≥ 11
[b]Discrepancy between Reading and Math	3.16	2.71	Twice-Exceptional if Screened as Gifted AND Discrepancy ≥ μ + 2 SD	≥ 9
Reading SAT Superscore	586.73	86.98	Gifted in Reading if Reading SAT ≥ μ + 1 SD	≥ 680**
Math SAT Superscore	582.06	85.64	Gifted in Math if Math SAT ≥ μ + 1 SD	≥ 670**
[a]Discrepancy between Reading and Math	76.15	57.95	Twice-Exceptional if Screened as Gifted AND Discrepancy ≥ μ + 2 SD	≥ 190**
[b]Discrepancy between Reading and Math	73.03	56.27	Twice-Exceptional if Screened as Gifted AND Discrepancy ≥ μ + 2 SD	≥ 180**

Note. [a]For students screened as gifted in reading. [b]For students screened as gifted in math. **Denotes SAT cut score rounded to the nearest 10 for screening purposes.

Table 2

Defining Groups in the Present Study

Group	Definition	*N*	Percentage of Sample
Screened as Gifted	Screened as potentially gifted in math and/or reading	2,043	36.90%
Screened as Twice-Exceptional with SLD in Reading	Screened as gifted AND as potentially having a SLD in reading	114	2.06%
Screened as Twice-Exceptional with SLD in Math	Screened as gifted AND as potentially having a SLD in math	100	1.81%
General Population	All remaining students	3,493	63.10%

Note. Students screened as twice-exceptional excluded from gifted group for all analyses.

Table 3

Shape of Distributions for Numeric Measures for All Twice-Exceptional Students

Measure	*M*	*SD*	Skewness	Kurtosis
Composite ACT Superscore	28.31	2.31	-0.40	0.96
Math ACT Superscore	27.34	5.56	0.04	-1.44
Reading ACT Superscore	29.31	5.88	-0.41	-1.38
Discrepancy	10.36	2.98	-0.70	0.65
Composite SAT Superscore	1220.79	103.16	0.07	0.14
Math SAT Superscore	615.00	107.70	-0.11	-1.04
Reading SAT Superscore	605.79	109.31	0.28	-1.20
Discrepancy	178.64	66.89	-0.15	0.36

Table 4

Shape of Distributions for Numeric Measures for All Students

Measure	*M*	*SD*	Skewness	Kurtosis
College GPA	3.12	0.71	-1.57	3.43
Composite ACT Superscore	27.38	3.75	-0.14	-0.33
Math ACT Superscore	26.70	4.18	-0.01	-0.24
Reading ACT Superscore	28.01	4.76	-0.38	-0.45
Discrepancy	3.80	2.87	0.94	0.69
Composite SAT Superscore	1,170.90	146.35	0.02	-0.14
Math SAT Superscore	583.11	83.19	0.09	-0.15
Reading SAT Superscore	587.70	83.03	0.01	-0.20
Discrepancy	61.98	48.83	1.18	1.89

Table 5

Classification of Majors to Major Types

[a]STEM	Bachelor of Arts and Education	Business and Communication	Agriculture
Aerospace Engineering	Agricultural Education	Accounting	Agriculture & Natural Resource Management
Animal Science	Architecture	Advertising	Agricultural Economics & Business
Biological Sciences	Art History	Business Administration	Agricultural Leadership Education & Communication
Biomedical Engineering	Child & Family Studies	Business Analytics	Food Science & Technology
Biosystems Engineering	Classics	Communication & Information	Forestry
Chemical Engineering	English	Communication Studies	Natural Resource & Environmental Economics
Civil Engineering	French	Economics	Plant Science & Landscape Systems
Clinical Laboratory Sciences	Graphic Design	Finance	Wildlife & Fisheries Science
Computer Engineering	Hotel Restaurant & Tourism	Human Resource Development	
Computer Science	Kinesiology, Recreation, & Human Sciences	Human Resource Management	
Electrical Engineering	Interdisciplinary Programs	Journalism	
Engineering Physics	Interior Design	Logistics Management	
Environmental & Soil Sciences	Italian	Marketing	
Geography	Music	Public Administration	
Geology	Philosophy	Sport Management	
Industrial Engineering	Political Science		
Materials Science & Engineering	Recreation		
Nuclear Engineering	Retail & Consumer Sciences		
Nursing	Social Work		
Nutrition	Spanish		
Physics	Special Education		
Pre-professional Programs	Social Work		
	Studio Art		
	Theater		

Note. [a]Science Technology Engineering Math

Table 6

Classification of Majors to Major Declaration in Line with Academic Strength

Gifted with [a]SLD in Reading	Gifted with [a]SLD in Math
Accounting	Agricultural Education
Advertising	Agricultural Leadership Education & Communication
Aerospace Engineering	Art History
Agriculture & Natural Resource Management	Child & Family Studies
Agricultural Economics & Business	Classics
Animal Science	Communication & Information
Architecture	Communication Studies
Biological Sciences	English
Biomedical Engineering	French
Biosystems Engineering	Hotel Restaurant & Tourism
Business Administration	Journalism
Business Analytics	Interdisciplinary Programs
Chemical Engineering	Interior Design
Civil Engineering	Italian
Clinical Laboratory Sciences	Music
Computer Engineering	Philosophy
Computer Science	Political Science
Electrical Engineering	Public Administration
Engineering Physics	Recreation
Environmental & Soil Sciences	Social Work
Food Science & Technology	Spanish
Forestry	Special Education
Geography	Sport Management
Geology	Social Work
Graphic Design	Studio Art
Economics	Theater
Finance	
Human Resource Development	
Human Resource Management	
Industrial Engineering	
Kinesiology, Recreation, & Human Sciences	
Logistics	
Management	
Marketing	
Materials Science & Engineering	
Natural Resource & Environmental Economics	
Nuclear Engineering	
Nursing	
Nutrition	
Physics	
Plant Science & Landscape Systems	
Pre-Professional Programs	
Retail & Consumer Sciences	
Wildlife & Fisheries Science	

Note. [a]Specific Learning Disability

Table 7

Statistical Analyses Used to Address Research Questions

Research Question	Outcome Measure(s)	Analyses
1. Percentage of Overlap – [a]2e students ACT and SAT	Percentage 2e status	Nonparametic chi-square
2. Retention rates of [a]2e students – ACT vs. SAT	Retention rates	Chi-square
3. Graduation rates of [a]2e students – ACT vs. SAT	Graduation,	Chi-square
4. Years to graduation of [a]2e students – ACT vs. SAT	Years to Graduation	Independent samples *t* test
5. CUM GPA of [a]2e students – ACT vs. SAT	CUM GPA	Independent samples *t* test
6. [a]2e students who declare major in line with strength likely to be retained	Major Declaration, Retention	Chi-square
7. [a]2e students who declare major in line with strength likely to graduate w/in 6 yrs	Major Declaration, Graduation	Chi-square
8. [a]2e students who declare major in line with strength likely to graduate sooner	Major Declaration, Years to Graduation	Independent samples *t* test
9. [a]2e students who declare major in line with strength likely to have statistically higher exiting GPA	Major Declaration, College GPA	Independent Samples *t*-test

Note. [a]2e denotes twice-exceptional

Table 8

Average Composite ACT and SAT Scores across Groups

Group	Number of Students in Group	Average ACT Composite Score	Average SAT Composite Score
General Population	3,493	25.40 (2.84)	1096.28 (108.00)
Screened as Gifted	2,043	30.71 (2.46)	1298.83 (107.44)
Screened as [b]2e	214 (154[a])	28.27 (2.50)	972.92 (285.20)
Screened as [b]2e – SAT	61	27.51 (4.68)	652.62 (120.59)
Screened as [b]2e – ACT	93	27.90 (1.66)	1183.01 (114.65)

Note. [a]Total number of 2e students included in all analyses. Excludes all 2e students identified by both the ACT and the SAT. [b]2e denotes twice-exceptional.

Table 9

Percentage of Students Retained by Group

Group	Number of Students in Group	Number of Students Retained	Percent Retained
General Population	3,493	3,025	86.6%
Screened as Gifted	2,043	1,877	91.9%
Screened as [a]2e	154	139	90.3%
Screened as [a]2e – SAT	61	57	93.4%
Screened as [a]2e – ACT	93	82	88.2&

Note. [a]2e denotes twice-exceptional.

Table 10

Six-Year Graduation Rate by Group (2007 Cohort and 2008 Cohort)

Group	Number of Students in Group	Number of Students who Graduated	Percent of Students who Graduated
General Population	1,500	1,237	82.5%
Screened as Gifted	750	673	89.7%
Screened as [a]2e	64	48	75.0%
Screened as [a]2e – SAT	27	19	70.4%
Screened as [a]2e – ACT	37	29	78.4%

Note. [a]2e denotes twice-exceptional.

Table 11

Major Classification by Each Group

Group	Declaration of Specific Major	Declaration of Intent to Pursue Major	Undecided
General Population	1,331	1,277	885
Screened as Gifted	903	730	410
Screened as [a]2e	69	54	31
Screened as [a]2e – SAT	27	18	16
Screened as [a]2e – ACT	42	36	15

Note. [a]2e denotes twice-exceptional.

Table 12

Comparisons of Years to Graduation and Cumulative GPA across Groups

Group	Number of Students in Group	Mean Years to Graduation (SD)	Mean CGPA(SD)
General Population	1,237	4.31 (0.77)	3.12 (0.49)
Screened as [a]2e	48	4.58 (0.82)	3.41 (0.34)
Screened as Gifted	668	4.29 (0.77)	3.39 (0.52)
Screened as [a]2e – SAT	19	4.74 (0.81)	3.43 (0.33)
Screened as [a]2e – ACT	29	4.48 (0.83)	3.39 (0.36)

Note. [a]2e denotes twice-exceptional.

Table 13

Major Declaration in Line with Academic Strength among Twice-Exceptional Students

Group	Number of Students in Group	Number of Students who Declared Major in Line with Academic Strength	Percent of Students who Declared Major in Line with Academic Strength
Screened as [a]2e	154	75	51.3%
Screened as [a]2e – SAT	61	12	19.7%
Screened as [a]2e – ACT	93	63	67.7%

Note. [a]2e denotes twice-exceptional.

Table 14

Final GPA by Group (2007 Cohort and 2008 Cohort)

Group	Number of Students in Group	Number of Students who Graduated	Mean GPA (SD)
Screened as [a]2e	64	48	3.41 (0.34)
Screened as [a]2e – SAT	27	19	3.43 (0.32)
Screened as [a]2e – ACT	37	29	3.39 (0.36)

Note. [a]2e denotes twice-exceptional.

Table 15

National Score Distributions – 2015 Senior Cohort

Test	*N* of Test-Takers	Reading (*SD*)	Mathematics (*SD*)
ACT	1,924, 436	21.4 (6.2)	20.8 (5.3)
SAT	1,698,521	495 (116)	511 (120)

VITA

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