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FACTORS ASSOCIATED WITH FIRST-TIME PASS RATES ON THE ATHLETIC TRAINERS' BOARD OF CERTIFICATION EXAMINATION

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Factors Associated with First-Time Pass Rates on the Athletic Trainers' Board of Certification Examination

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Abstract

Major changes have taken place in athletic training education over the past 15 years. With the changes came an increased expectation for reporting quality program outcomes. One important outcome places emphasis on first-time Board of Certification (BOC) exam pass rates. The purpose of this study was to examine the relationship between academic, pre-admission, and programmatic variables to first-time BOC exam pass rates. This retrospective study sampled 210 students from three Commission on Accreditation of Athletic training Education (CAATE) programs whose students attended an Amato-Cole Educational Services (ACES) Preparatory Workshop before taking the BOC examination. The research suggests that students with higher GPA, ACES Test scores, and distribution of the BOC Practice Analysis during the junior or senior year had higher first-time BOC exam pass rates. The logistic regression model was statistically significant, X^2 (3) = 57.92, $p < .001$. The model explained 39.3% (Nagelkerke R^2) of the variance for passing the BOC exam and correctly classified 83.3% of cases. This study revealed the final cumulative GPA, coupled with an ACES Test 2 evaluation, might provide valuable data when preparing students for the BOC exam and ensuring student success. Students with lower cumulative GPA and ACES Test 2 scores may need additional intervention and instruction. Ensuring program quality and student excellence are keys to the athletic training profession maintaining a valuable presence in today's healthcare system.

Keywords: Amato-Cole Educational Services, athletic training student, Board of Certification, athletic training education,

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Factors Associated with First-Time Pass Rates on the Athletic Trainers' Board of Certification Examination

Graduates from Commission on Accreditation of Athletic training Education (CAATE) athletic training programs are expected to be competent in injury and illness prevention; wellness promotion and education; emergent care; examination and clinical diagnosis; therapeutic intervention; and rehabilitation of injuries and medical conditions. To practice as an entry-level credentialed athletic trainer, students must pass the Board of Certification (BOC) examination (BOC, 2017). Each year, over 4,000 students graduate from CAATE programs and take the BOC examination (BOC, 2019). In 2018-2019, the first-time BOC exam pass rate was 73.2% (BOC, 2019). Failure to pass the BOC exam not only affects athletic training program outcomes and student recruitment but also adds a cost burden and delay of employment opportunities for the student (BOC, 2019).

Problem Statement

In 2012, CAATE implemented a standard (Standard 11) requiring all accredited athletic training programs to maintain a 70% three-year aggregate first-time BOC exam pass rate (CAATE, 2012). Athletic training programs were required to be compliant with Standard 11 by 2013, and professional programs not compliant by 2016 were placed on probation (CAATE, 2016a). In 2016, the 2015-2016 CAATE Analytics Report indicated 91 of 370 programs, over 25%, were non-compliant with the standard and in jeopardy of having accreditation withdrawn (CAATE, 2016b).

Since the introduction of Standard 11, athletic training program directors face the task of identifying metrics that can be used to predict students most likely to pass the BOC exam on the first attempt. Many programs have used metrics including: American College Testing (ACT) or

Scholastic Assessment Test (SAT) scores, athletic training program grade point average (GPA) (Bruce et al., 2016; Harrelson, Gallaspy, & Leaver-Dunn, 1997; Hobson, 2019; Lawrance & Lauber, 2015; Murray, 2014; Platt, Turocy, & McGlumphy, 2001), and other various academic variables to predict success. Program directors have also investigated strategies that could be used by students to improve their chances of passing the BOC exam on the first attempt (National Athletic Trainers Association [NATA], 2013). The Amato-Cole Educational Services (ACES) Preparatory Workshop is used by some athletic training programs to help athletic training students prepare for the BOC exam (H. K. Amato, Email correspondence, April 1, 2019). While many health professions have sought various tests in preparation for their respective board exams, evidence of their predictive value is limited. The profession of athletic training currently does not have a predictive metric for the BOC examination. While many athletic training programs use the ACES Preparatory Workshop to increase BOC pass rates, its effectiveness of improving BOC exam first-time pass rates has not been researched.

Study Purpose

The purpose of this study was to explore whether participation in an ACES Preparatory Workshop, undergraduate assessments, and institutional factors would have an impact on the first attempt pass rate of students who took the BOC exam. Specifically, this study sought to answer the following research question: For athletic training students who take the BOC exam, what factors are associated with first attempt pass rates? To determine if there was a statistically significant difference between students who passed the BOC exam on the first attempt and those who did not pass it on the first attempt, the following factors were tested:

1. Institutional factors (athletic training student enrollment, Carnegie classification, when the BOC Practice Analysis was distributed to students, number of core athletic training faculty, Standard 11 compliance, and study guide use).
2. Student characteristics (age, gender, and primary language).
3. Undergraduate assessments (first attempt BOC exam results, ACES Preparatory Workshop Test 2 scores, ACT/SAT scores, and final cumulative GPA).

Results from this study may help athletic training program directors and educators identify variables that may predict their students' first-time BOC exam pass rate. Insight into what factors forecast student success may drive policy, curriculum, and BOC study strategy changes needed to address potential student and program deficiencies.

Literature Review

Health professions are faced with examining entry-level degree requirements to secure a place in providing quality healthcare in today's marketplace. Athletic training is one of the allied health professions seeking to be part of the conversation. In 2012, the National Athletic Trainers' Association (NATA) Board of Directors accepted the recommendations of a report (Professional Education in Athletic Training: An Examination of the Professional Degree Level) on the future direction of athletic training education presented by the Executive Committee for Education (NATA, 2013). Among the initiatives in this report was the reexamination of the degree level appropriate for the preparation of athletic trainers. In 2013, the NATA's Executive Committee for Education formed a working group to examine the appropriate degree level to enter an athletic training program. The working group presented the findings to the Strategic Alliance (BOC, CAATE, NATA, and NATA Foundation). The Strategic Alliance then recommended to the NATA Board of Directors to change the entry-level degree in athletic training from a

bachelor's degree to a master's degree (NATA, 2013). In 2015, the NATA Board of Directors voted to accept the recommendation from the Strategic Alliance to move the professional degree in athletic training to the master's level (CAATE, 2015; NATA, 2013).

The investigation into the degree change in athletic training revealed several factors linked to successful performance on the BOC examination. These factors included academic aptitude, program quality, length of the program, student age, and completion of a master's degree (NATA, 2013). This information, in part, influenced the recommendation to change the degree level (NATA, 2013). Aggregate data from 2010-2013 athletic training master's degree-professional programs indicated program quality and student age as factors of BOC exam success. Master's degree programs demonstrated a 96% compliance with the CAATE first-time BOC exam pass rate standard. Whereas, in athletic training undergraduate programs, only 57% met the required 70% three-year first-time pass rate (NATA, 2013). Since the initial conversation and subsequent inception of the first-time BOC exam pass rate Standard 11 in 2012, there seems to be a concerted focus on the variables related to a successful outcome on the BOC exam. As a result of the concentration of Standard 11, the percentage of undergraduate programs not meeting the 70% pass rate decreased from 43% in 2010-2012 to 28% in 2011-2013 (NATA, 2013).

While the BOC first-time pass rate minimum percentage (Standard 11) was implemented before the decision to transition to the master's degree, the first-time BOC pass rate remains a crucial component of assessment to both undergraduate and master's level athletic training programs. As athletic training education programs strive to remain relevant in health care and prepare for a professional degree change, program directors must evaluate admissions criteria and other metrics of success to compete for students and ensure the delivery of quality healthcare from its graduates.

Driven by the competitive climate of healthcare and the Institute of Medicine's (IOM) initiative to transform the system to provide improved health outcomes, it is essential that allied health programs better prepare the workforce to create a more cost-effective, evidence-based patient-centered care delivery (IOM, 2001). In a climate of rising educational costs and the constant struggle for student recruitment and retention among colleges and universities, comes consumer scrutiny and the demand for successful outcomes. While the Higher Education Opportunity Act of 2008 requires institutions of higher education to publish program and student outcomes (National Postsecondary Education Cooperative, 2009), many health profession education accrediting agencies began to require the publication of available metrics to demonstrate program success. In athletic training, as with other health professions requiring standardized board exams, the most evident measure of student and program success is the first-attempt pass rate of national board exams.

The following literature review provides a history of the BOC, CAATE, and the ACES Preparatory Workshop. Moreover, it examines the available research concerning criteria used to ensure success on national board examination pass rates in the professions of athletic training, occupational therapy, physical therapy, nursing, and physician assistant (PA). While the quest for predictive variables affecting board exam outcomes has led to varied results, current literature may give valuable insight into the evaluative process for individual programs seeking to strengthen success rates on board exams and demonstrate their program's educational value.

Historical Perspective of Athletic Training Education

Athletic training education has gone through many modifications since the formation of the NATA in 1950. Delforge and Behnke (1999) assembled an early timeline on the history and evolution of athletic training education. In the beginning, William E. Newell, ATC, PT. of

Purdue University was appointed as the National Secretary of the NATA, the position known today as the Executive Director. Perhaps the most significant act of Newell's tenure was the formation and appointment of a Committee on Gaining Recognition. The committee's charge was to focus on professional development and advancement of athletic training. In 1955, the NATA Board of Directors approved the committee to prioritize focus on the development of a model curriculum and a national certification examination. In response to the Board of Directors' vision, NATA Professional Education Committee (PEC) and NATA Certification Committee were formed, with individual attention to education and certification respectively. Delforge and Behnke (1999) also chronicled the development of the athletic training certification examination. In December 1968, the NATA Board of Certification (NATABOC) was formed. While the NATA PEC was developing educational programming throughout the 1950s and 1960s, the first national certification examination was simultaneously formed by the NATA Certification Committee. Before the administration of the first certification exam in August of 1970, it was declared that all active members of the NATA were eligible for automatic certification through a "grandfather clause". However, the grandfather clause closed after December 31, 1969 (BOC, 2007; Delforge & Behnke, 1999). There were five routes to certification:

1) graduate from an approved athletic training curriculum program; or
2) graduate from a 4-year college or university and proof of five years of experience; or
3) obtain a physical therapy degree with two years of athletic training experience; or
4) complete 1800 hours of on-the-job apprenticeship training; or
5) qualify for special consideration including state teaching licensure and NATA- approved workshop completion (BOC, 2007; Delforge & Behnke, 1999)

Grace (1999) further established a timeline of athletic training certification. The first NATABOC exam consisted of two sections. Section One contained questions of basic and clinical science, and Section Two focused on theory and application of athletic training knowledge and skills. In 1978, the National Commission for Health Certifying Agencies (NCHCA) was established by the U.S. Department of Health, Education, and Welfare. The purpose of this agency was to provide standards that healthcare education programs would follow to ensure the proper development of healthcare academic programs. In addition, the agency also ensured that certification credentials awarded by those programs were vetted using widely accepted testing, psychometric, and legal principles. Grace (1999) noted other milestones in athletic training credentialing. In 1983, the NATA was granted NCHCA approval and became its own credentialing body. In 1987, the NATA registered "ATC" as the designation of a fully-credentialed athletic trainer through the U.S. Patent Office. In 1989, the NATABOC became a separate organization with all rights to certify practitioners. It later changed its name to the Board of Certification (Delforge & Behnke, 1999).

In June 1990, the American Medical Association (AMA) formally recognized the profession of athletic training as an allied health profession (Delforge & Behnke, 1999). Once athletic training was recognized as an allied health profession, the process of accrediting programs began. Initially, the AMA's Committee on Allied Health Education and Accreditation (CAHEA) began developing requirements for entry-level athletic training programs. During this time, programs voluntarily seeking accreditation were required to follow the CAHEA accreditation process (Delforge & Behnke, 1999). The Commission on Accreditation of Allied Health Education Programs (CAAHEP) later replaced CAHEA and directed the accreditation process. The Joint Review Committee on Educational Programs in Athletic training (JRC-AT)

was incorporated in 1991 as a committee of CAAHEP (Delforge & Behnke, 1999). In 2006 the JRC-AT became an independent accrediting agency and officially changed its name to the Committee for Accreditation of Athletic training Education (CAATE, 2014). Commission on Accreditation of Athletic training Education is currently responsible for the accreditation of more than 390 education programs and collaboratively continues to develop professional standards for entry-level athletic training programs (CAATE, 2019a).

From 1970 through 2004, applicants wishing to take the BOC exam were required to either graduate from a NATA-approved curriculum program or graduate from an accredited college or university and complete internship requirements (BOC, 2007). Since 2004, athletic training certification can only be achieved by graduating from an athletic training program accredited by CAATE. The current electronic format of the BOC exam was introduced in June 2007 (BOC, 2007).

Historical Perspective of Amato-Cole Educational Services Preparatory Workshop

Board of Certification exam scores for athletic training programs in the early 1990s revealed low national first-time BOC pass rates. In 1992, Herb Amato, then program director at James Madison University, was developing ways for students in the university's athletic training program to be more successful on the BOC exam (H. K. Amato, Email correspondence, April 1, 2019). The result was a series of review sessions for students. (H. K. Amato, Email correspondence, April 1, 2019). H. K. Amato (Email correspondence, April 1, 2019) indicated the weekly review series was fostered over three years and aimed at providing students with a series of tests and study materials to identify areas of focus within the domains of the BOC Role Delineation Study (now called the BOC Practice Analysis) The first mock exam was created in

the fall of 1991 from an assignment in a doctoral course at Middle Tennessee State University (H. K. Amato, Email correspondence, April 1, 2019).

In the spring of 1995, Steve Cole, the athletic training program director, and head athletic trainer at the College of William and Mary (W&M) asked Dr. Amato to prepare his athletic training internship students for the upcoming BOC exam (H. K. Amato, Email correspondence, April 1, 2019). The weekly review sessions were combined and taught in a weekend course for W&M seniors. After this event, Dr. Amato and Mr. Cole decided the review session for the W&M students should be expanded and offered to others (H. K. Amato, Email correspondence, April 1, 2019). H. K. Amato (Email correspondence, April 1, 2019) noted that Steve Cole suggested the workshop be presented to other athletic training programs and athletic training students, and Amato-Cole Educational Services (ACES) was born. The goals of ACES are to identify areas of deficiency, develop a study plan of action based on identified deficiencies, reduce exam fears and test day anxiety, and expose students to questions similar to those on the BOC exam (H. K. Amato, Email correspondence, April 1, 2019). In 2008, ACES signed a contract with the NATA to administer two of the five available ACES exams on-line. The additional two ACES exams are given during the ground-based workshop, and a fifth exam is used in whatever manner a student or AT program director believes to be the most appropriate for future success (H. K. Amato, Email correspondence, April 1, 2019).

Nursing and Predicting First-Time Board Exam Pass Rate

Due to a potential nursing shortage and an increase in projected employment opportunities exceeding 3.3 million by 2026 (Unites States Department of Labor, 2018), nursing programs are faced with the task of increasing program enrollment, increasing nursing program student retention rates, and preparing more nursing school graduates (Herrera & Blair, 2015).

Research in the areas of nursing program retention and student preparation strategies has indicated minimum GPA and prerequisite course curriculum requirements as a plausible way to increase nursing school enrollment and identify students more likely to stay in nursing programs (Crouch, 2015; Herrera & Blair, 2015). Researchers also found the use of standardized tests could not only predict students more likely to stay in the program resulting in increased retention, but they also could be used to increase pass rates on the NCLEX-RN examination (Crouch, 2015; Herrera & Blair, 2015). Standardized tests found to be useful in nursing are the Health Education System Incorporated (HESI) admission assessment (A^2) test which helps predict academic readiness for nursing program admittance, and the HESI exit exam (E^2) to examine academic preparation and predict outcomes on the National Council Licensure Examination for Registered Nurses (NCLEX-RN) (Sosa & Sethares, 2015). While admission, subject matter, and mid-curricular exams exist for HESI, the focus appears to be on the ability of the E^2 to predict success on the NCLEX-RN (Sosa & Sethares, 2015).

A HESI validation study found the E^2 to not only be a reliable predictor of student success on the NCLEX-RN but also provide objective data when evaluating progress within the nursing curriculum when coupled with HESI specialty exams that contain critical thinking and problem-solving test questions (Zweighaft, 2013). Five component scores of the A^2: basic math, reading comprehension, grammar, vocabulary and general knowledge, and anatomy and physiology were investigated to determine whether the A^2 affected successful completion of three associate degree nursing courses (Chen &Voyles, 2013). Results indicated a positive correlation between all A^2 scores and nursing students successfully completing all three nursing courses. This study indicated that A^2 scores could be used to predict student success as determined by successful course completion in the first semester of a nursing curriculum (Chen

&Voyles, 2013). The same study found that A^2 scores can aid in student retention, which could result in lowering the cost associated with attrition (Chen &Voyles, 2013).

Other studies have compared the relationship of the HESI A^2, preadmission GPA, science GPA, and timely progression to passing the NCLEX-RN exam. Findings suggested preadmission GPA and science GPA had good predictability of timely program progression; however, the A^2 did not correlate with preadmission GPA or science GPA. Researchers reported that it was imprudent to relate success on the A^2 with passing the NCLEX-RN exam for registered nurses (Hinderer, Dibartolo, & Walsh, 2014). While nursing programs with high application rates and low seat availability are striving to see students successfully matriculate through the program, Hinder et al. (2014) suggested caution when considering preadmission GPA, science GPA, and the A^2 as indicators of success on the NCLEX-RN.

Nursing board councils occasionally field claims that the NCLEX exam is biased against candidates who list English as their second language (O'Neil, Marks, & Liu, 2006). O'Neil et al. (2006) investigated the impact of English as a second language on nursing students passing the NCLEX-RN and National Council Licensure Examination for Practical Nurses (NCLEX-PN) on their first attempt. The researchers found nursing students who listed English as a second language or that English and another language as their primary language had 10%- 15% lower pass rates compared to those students who listed English as their primary language (O'Neil et al., 2006).

Predictors of First-Time Pass Rate on the National Physical Therapy Examination

In physical therapy, an increase in student applications and competition for students by physical therapy programs has increased the importance of predicting success on the National Physical Therapy Examination (NPTE) (Utzman, Riddle, & Jewell, 2007). Several researchers

have examined various factors that may contribute to success or failure on the NPTE. Utzman et al. (2007) examined pre-admission variables that had the potential to predict academic difficulties within physical therapy education programs. Variables included demographics (age and race or ethnicity) and pre-admissions data (undergraduate GPA, quantitative and verbal GRE [Graduate Record Exam] scores) (Utzman et al., 2007). Any student having to repeat a course or being placed on academic probation, suspension, or dismissed from the education program was considered as having academic difficulty (Utzman et al., 2007). The researchers concluded that the use of undergraduate GPA, GRE scores, as well as age and race or ethnicity, were useful in predicting student academic difficulty in physical therapy education programs (Utzman et al., 2007). Building on research correlating the GRE scores and undergraduate GPA to physical therapy program success (NPTE pass rate), a retrospective study was designed to investigate whether the Health Science Reasoning Test (HSRT) along with GRE scores and undergraduate GPA were related to first-time pass rate on the NPTE (Huhn & Parrot, 2017). The HSRT is a standardized test measuring clinical reasoning skills for students in healthcare professions. Researched as a part of an admissions decision tool, the authors recognized the validity of the HSRT in tracking changes in critical thinking (Huhn & Parrot, 2017). Huhn and Parrot (2017) also found the HRST added significantly to the performance of the predictive model when considering undergraduate GPA, final GPA, and GRE scores

A 2001 study found a link between physical therapy pre-admission factors and academic success with first-time pass rates on the NPTE (Dockter, 2001). Dockter (2001) found that the best predictor of academic success was the combination of total admission points on admission score criteria and age upon program admission. The best predictor of success on the NPTE was GPA following completion of the first year of physical therapy school (Dockter, 2001). In a

similar study, admission criteria consisting of GRE scores, overall and pre-requisite pre-admission GPA, and admissions committee evaluations were explored as predictors for acceptance into a physical therapy entry-level master's degree program (Thieman, Weddle, & Moore, 2003). The study examined the ability of admissions criteria to predict the final master's program GPA, applied skills using a physical therapy Clinical Performance Instrument (CPI), and NPTE scores (Thieman et al., 2003). Pre-admission GPA, when evaluated with age and GRE scores, accounted for 37% of the variability in prediction of the master's program final GPA (Thieman et al., 2003). The master's degree GPA was the best predictor of NPTE scores. However, when paired with previous grades and GRE scores, only 11% of the variability in NPTE scores was accounted for by the model (Thieman et al., 2003). In addition, the admissions variables did not predict CPI scores (Thieman et al., 2003).

A study by Riddle, Utzman, Jewell, Pearson, and Kong (2009) approached academic difficulty and program-level variables to determine performance on the NPTE. The results of this study suggested a significant relationship between academic difficulty and institutional and Carnegie classification as predictors of failure on the NPTE (Riddle et al., 2009). Failure on the NPTE was dependent on the schools Carnegie classification further noting that private master's degree programs had 2.78 times higher odds of NPTE failure than for students in a public master's degree program (Riddle et al., 2009). Awareness of academic difficulty and remediation factors may provide programs with an opportunity to develop an intervention strategy or curricular enhancement when concerned with retention and NPTE success (Riddle et al., 2009). In other research, Crawley, Greene, Brown-White, Simpson, and Karavatas (2015) surveyed study habits of physical therapy students to see if there was an effect on first-time pass rates for the NPTE. The authors found no significant relationship to first-time NPTE pass rate when

taking into consideration study materials, the number of hours a day spent studying, the number of days a week spent studying, and the number and type of practice tests taken (Crawley et al., 2015). Foundational courses, program GPA, and verbal, quantitative GRE scores were found to be the best predictors of first-time pass rates on the NPTE when including variables of the Clinical Performance Evaluation Instrument and academic difficulties (Bayliss, Thomas, & Eifert-Mangine, 2017).

Another study investigated the variables of age at graduation, professional-grade point average, overall exam score, and scores on a physical therapy clinical performance instrument (Kosmahl, 2005). Many allied health care education programs focus on various instruments to monitor a student's clinical progression and employ a comprehensive exam to track academic retention in an attempt to ensure professional competence and success on their respective board exams (Kosmahl, 2005). Similar to other studies (Dockter, 2001; Huhn & Parrot, 2017; Thieman et al., 2003), this study revealed a significant positive correlation with professional GPA and scores on the NPTE. However, there was no correlation between age and clinical performance scores on NPTE test scores (Kosmahl, 2005).

Comprehensive exams and research in curriculums have been compared to first-time board pass rates with mixed conclusions. Kosmahl (2005) found a significant correlation between comprehensive exams and scores on the NPTE and reinforced the notion of closely monitoring a student's academic performance as well as the use of a comprehensive exam to identify weaknesses in curricular content prior to taking the NPTE. A study comparing the volume of published research artifacts and pass rates on the NPTE revealed no significant association between the number of artifacts submitted and NPTE pass scores concluding that

other factors are likely better at predicting pass rates for the NPTE (Cook, Landry, Covington, McCallum, & Engelhard, 2015).

Clinical education is a crucial component of many healthcare education programs. Luedtke-Hoffmann, Dillon, Utsey, and Tomaka (2012) examined scores from the Physical Therapist Manual for the Assessment of Clinical skills (MACS), final physical therapy program GPA, compared to NPTE scores for first-time test takers. While results of this study did find a correlation between two skill sections of the MACS and NPTE exam, the coefficients were too low to infer any meaningful correlation. Luedtke-Hoffmann et al. (2012) did find a positive correlation between GPA and NPTE scores. This study reiterates the use of GPA as an indicator of standardized test scores and suggests using clinical assessment tools to ascertain clinical weaknesses for professional skill development (Luedtke-Hoffmann et al., 2012).

Occupational Therapy and Board Pass Rate Strategies

The Accreditation Council for Occupational Therapy Education (ACOTE) requires programs to possess a 3-year average pass rate of 80% or higher adding to the importance of examining variables which may predict success on the National Board for Certification in Occupational Therapy (NCBOT) (Novalis, Cyranowski, & Dolhi, 2017). Novalis et al. (2017) suggested that variables of gender, recommendation strength scores, program GPA, and fieldwork self-evaluation scores significantly predicted outcomes on the NBCOT examination. This model correctly predicted 82.9% of student success on the NBCOT exam (Novalis et al., 2017).

An online pilot course, with its primary purpose of successfully preparing occupational therapy students to complete the NBCOT examination was developed (Breen-Franklin, 2017). This pilot program provided materials, assignments, study plans, and practice tests for students

who were preparing for the NBCOT exam. A review of the pilot course and a two-day commercial course revealed high pass rates among both programs suggesting the use of similar programs when designing strategies to prepare for board examinations successfully (Breen-Franklin, 2017).

MacArther and Randall (2015) investigated the extent in which GRE scores, undergraduate GPA, prerequisite course grades, applicant essay scores, and occupational therapy school grades might predict occupational therapy fieldwork scores and first-time pass rates on the NBCOT exam. While regression models in this study provided little insight into variables that could increase the predictability of fieldwork scores, models were better at predicting NBCOT first time pass rates. The model indicated increased predictability when using GRE scores and occupational therapy school grades (MacArther & Randall, 2015). While all courses within the program were evaluated, only three (Gerontology, Biomechanical Treatment, and Adult Neurological Treatment) were found to predict first-time pass rates on the NBCOT exam. The inclusion of preadmission variables in the model as significant indicators of first-time NBCOT pass rates underscores the need for programs to evaluate preadmission criteria and program GPA when considering program admittance and types of remediation for board preparation (MacArther & Randall, 2015).

Physician Assistant and Board Pass Rates

Researchers have investigated various factors that may predict success on the Physician Assistant National Certifying Exam (PANCE) including GRE scores, program selection criteria, and other forms of measured student success. Hocking and Piepenbrock (2010) reviewed websites of physician assistant programs and found that 55% utilized the GRE as part of the admissions process. While the GRE is the most widely used standardized admissions test for

master's level PA programs, many (54%) do not require a minimum score, and only 40% of those programs use it according to published GRE guidelines (Hocking & Piepenbrock, 2010). It may be challenging to determine the usefulness of the GRE in an admissions process (Hocking & Piepenbrock, 2010). Other researchers examined and compared first-time pass rates on the PANCE with student success (PANCE pass/fail and score, and program GPA) and pre-admission criteria (undergraduate GPA, prerequisite course institution type, and prior healthcare experience) (Brown, Imel, Nelson, Hale, & Jansen, 2013). Brown et al. (2013) found no correlation between student success and pre-admission criteria. However, there was a strong or moderate association between pharmacology and anatomy grades and program GPA but not with PANCE pass rates. (Brown et al., 2013).

Athletic training and Factors Affecting First-Time Board Exam Pass Rates

Brown, Potteiger, Keeley, Lundgren, and David (2017) reviewed professional undergraduate athletic training programs (ATPs) and found the most common admissions decision process came in the form of a point system, criterion list, or committee perception among other methods of student selection. In this review, major GPA, overall GPA, or a combination of the two, as well as prerequisite courses, clinical hours, and personal attributes through the use of interview, resumes, letters of recommendation or other written forms of application materials were commonly used in the selection process (Brown et al., 2017)

Many athletic training programs have used admission application requirements as a method of ensuring program and ultimately national board exam success. Authors investigated minimum program GPA, grades on prerequisite coursework, student evaluations and documented direct observations, application essay, admittance exam, an interview process, and letters of recommendation as part of an entry-level master's athletic training program application

process. (Hawkins, McLoda, & Stanek, 2015). The authors found a decrease in program attrition, and an increase in students who took the BOC examination when using the multifaceted approach to admitting students into the master's program (Hawkins et al., 2015). The researchers also investigated data from nursing and physical therapy literature and found similar results and benefits of using a combined approach which included GPA, application essays, observation evaluations, prerequisite coursework grades, and interviews when considering criteria for program admission (Hawkins et al., 2015).

Researchers also examined preadmission criteria as predictors of academic success determined by college GPA. Platt, Turocy, and McGlumphy (2001) investigated graduates from six allied health education programs from one private university. Programs included athletic training, occupational therapy, health management system, perfusion technology, physician assistant, and physical therapy (Platt et al., 2001). Platt and colleagues (2001) investigated student admission variables of high school GPA, SAT verbal scores, SAT mathematics scores, and SAT total scores, compared to college GPA. Results demonstrated that high school GPA and the verbal portion of the SAT were predictive of college GPA when compared to the allied health programs as a whole (Platt et al., 2001). However, this only accounted for a small portion of the variance of success when comparing college GPA (Platt et al., 2001). The athletic training program in the study found that high school GPA predicted more than a third of the program's success in college GPA (Platt et al., 2001). Harrelson et al. (1997) found a composite set of variables consisting of overall GPA, athletic training GPA, minor academic GPA, ACT composite score, and the number of semesters at the university predicted first-time BOC exam success. However, no single variable predicted first-time BOC exam pass rates (Harrelson et al.,

1997). Three of the variables were related to GPA, which may indicate the importance of GPA in predicting BOC exam pass rates (Harrelson et al., 1997).

Keskula, Sammarone, and Perrin (1995) examined five predictive variables used in the selection of students into a NATA-approved graduate athletic training education program. Among those variables were the quantitative scores and verbal scores of the GRE, preadmission GPA, preadmission clinical hours, and undergraduate education (curriculum or internship) as compared to the final graduate program GPA (Keskula et al., 1995). Contrary to the SAT findings by Platt et al. (2001), the verbal portion of the GRE was not found to have a significant effect on the final program GPA. Similarly, preadmission GPA was a significant factor in the prediction of the final program GPA (Platt et al., 2001). A study by Lawrance and Lauber (2015) compared high school academic performance (GPA, standardized test scores, number of college preparatory courses taken, and quality points) and professional athletic training program academic performance (undergraduate GPA, athletic training major GPA, end of sophomore year GPA, and select course GPA) with first-time pass rates on the BOC exam. The authors found that students who had a higher high school GPA and standardized test scores were more successful in the professional athletic training program (completed program without probationary status) (Lawrance & Lauber, 2015). Lawrance and Lauber (2015) found standardized test quantitative scores proved to be the best predictor of student's first-time BOC exam pass rates. While athletic training program coursework was a significant variable predicting BOC pass rates, it was only a small portion of the variance found in this study (Lawrance & Lauber, 2015)

Studies have sought to identify a predictive model for success in a professional master's degree in athletic training. One study identified three pre-admission criteria as predictors of success in a professional master's athletic training program where success was defined as

graduate program GPA (gGPA) after completing the first year of the curriculum (Bruce et al., 2016). The three-factor model for prediction of success was identified as undergraduate GPA (uGPA) ≥ 3.18; GRE scores ≥ 145.5, and completing calculus as an undergraduate student. The pre-admission criteria model found that students who had any two of the pre-admission predictors were 2.75 times more likely to be successful in the graduate program (Bruce et al., 2016). Additionally, Bruce et al. (2016) found a student having a gGPA of ≥ 3.45 at the end of the first year of graduate study was successful within the graduate program. Using the 3.45 gGPA as a cut point, it was determined that students who had a gGPA ≥ 3.45 were 8.3 times more likely to pass the BOC exam on the first attempt compared to those who had a gGPA ≤ 3.45 at the end of the first year of athletic training graduate studies (Bruce et al., 2016). This study suggests it is possible to create a model that may be beneficial for programs to predict student program success when measured by graduate program GPA and success on the BOC exam first-time pass rate (Bruce et al., 2016).

Completing clinical experiences are an essential component of health care education programs, and athletic training is no different. One study sought to determine if there was an association of student sex, overall program GPA, and the number of clinical hours completed with performance on the BOC examination (Middlemas, Manning, Gazzillo, & Young, 2001). During the time of this study, the BOC exam was a three-part exam consisting of written, practical, and simulation sections. Analysis indicated no significant difference regarding the sex of the participant and passing all three parts of the BOC exam (Middlemas et al., 2001). There was no significant correlation between the number of clinical hours and scores on all three portions of the BOC (Middlemas et al., 2001). However, when examining GPA, there was a significant association with scores on all portions of the BOC exam (Middlemas et al., 2001). A

similar study compared student age, sex, the route to certification, previous athletic training, and allied health experience, and clinical education experiences to scores on the BOC exam (Turocy, Comfort, Perrin, & Gieck, 2000). Age was found to have an association with the oral practical scores of the BOC exam (Turocy et al., 2000). Older candidates were more successful than younger candidates on the oral practical portion of the BOC exam, but it did not affect the written or written simulation scores of the BOC exam (Turocy et al., 2000). Turocy et al. (2000) reported that students who gained more clinical hours above the minimum hour requirement gained no more significant benefit in passing the BOC exam on the first-attempt than students who acquired fewer hours. While the clinical component of athletic training education is vital for professional practice, it would appear other variables may be more predictive of success on the BOC exam.

More recently, there has been increased attention to factors that may attribute to first-time BOC exam pass rates for students in professional master's degree athletic training programs. In one study, 11 athletic training programs were surveyed to obtain various program requirements, cohort characteristics, and outcome measures, including BOC exam pass rates. (Ostrowski & Marshall, 2015). The study considered the association between programs with structured research requirements to first-time BOC exam pass rates, and between programs that required students to take a program-specific comprehensive examination to first-time BOC exam pass rates (Ostrowski & Marshall, 2015). There was no correlation with programs that required a comprehensive exam and first-time pass rates on the BOC exam (Ostrowski & Marshall, 2015). However, there was a significant difference between programs that had a structured research component and first-time BOC pass rates (Ostrowski & Marshall, 2015). Programs that had a structured research component in the curriculum demonstrated significantly higher first-time

BOC exam pass rates than those programs that did not have a structured research component in the curriculum (Ostrowski & Marshall, 2015). One program that had no programmatic research requirements had the lowest BOC exam pass rate among programs studied (Ostrowski & Marshall, 2015). Another study investigated whether there was a relationship among admissions GPA, final GPA, gender, and age to first-attempt BOC pass rates (Murray, 2014). A relationship was determined to exist between student admission GPA and final program GPA with first-attempt BOC exam pass rates (Murray, 2014).

Students face many challenges while preparing for the BOC exam. A study by Breitbach, Downey, and Frager (2013) focused on students' academic worries, locus of control (perception of ability to control one's fate), and coping style (emotional focus versus problem-focused). The researchers hypothesized that coping style would negatively affect testing results if the student's coping mechanism focused on managing emotions associated with the stress of test preparation (emotion-focused) rather than a more step-by-step approach to changing the situation or altering the cause of the testing stress or anxiety (problem-focused) (Breitbach et al., 2013). Using a more problem-focused strategy to cope with test stress and anxiety when preparing for the BOC exam may help students counteract negative emotions tied to the testing experience (Breitbach et al., 2013). The researchers suggested that students who had high academic worry and utilized emotional focused coping skills did not do well on the BOC exam on the first attempt (Breitbach et al., 2013). Students who employed a problem-focused coping strategy were more successful in passing the BOC exam on the first attempt (Breitbach et al., 2013). One of the goals of the ACES Preparatory Workshop is to reduce exam and test day anxiety by offering students a step-by-step (problem-focused) blueprint to overcoming test anxiety (H. K. Amato, Email correspondence, April 1, 2019).

Lastly, a recent study scrutinized the accuracy of pre-professional athletic training program admission criteria and professional athletic training program metrics as predictors of first-time BOC exam pass rates (Hobson, 2019). Measures used in program admissions criteria were pre-professional phase program course GPA, cumulative GPA upon admission, average admissions interview evaluation scores, average scores from preceptor evaluations, and use of a single composite score generated inclusively of all previously mentioned pre-program admissions data (Hobson, 2019). The single composite score was weighted and given a value ranging from 0 to 10, and it was investigated to provide a comprehensive guide regarding the admissions process (Hobson, 2019). Additionally, the researchers compared variables within the professional athletic training program (final professional program GPA, combined math and reading SAT scores and clinical education hours) and first-time BOC exam pass rates (Hobson, 2019). Hobson (2019) found the most accurate predictor of first-time BOC exam pass rates within the pre-professional program metrics was the pre-professional phase course GPA. However, he also found that the highest accuracy rating of all examined variables was the combined math and reading SAT scores. The single composite score did show fair accuracy in predicting first-time BOC exam pass rates (Hobson, 2019). However, the accuracy of the single composite score was attributed to the GPA outcomes and suggested programs consider academic variables over subjective evaluations (interview and preceptor evaluations) when creating a single composite scoring metric (Hobson, 2019). Per the study authors, results of this study suggested that programs should consider math and reading SAT scores as well as pre-professional course GPA in the application process (Hobson, 2019). A study by Platt et al. (2001) revealed the verbal (reading) portion of the SAT was predictive of professional program GPA while other studies concluded that professional program GPA had a positive effect on first-

time BOC exam pass rates (Harrelson et al., 1997; Middlemas et al., 2001; Murray, 2014). The use of the reading portion of the SAT may deserve further investigation when admitting athletic training students or developing curricular changes.

Rationale

In athletic training, as well as other health professions with standardized board exams, the most evident measure of program success is the initial pass rate of national certifying board exams. Healthcare education programs have investigated many factors related to first-time board pass rates. These factors have ranged from pre-admissions criteria and pre-requisite coursework to the student's final program GPA and board review practice exams. Carnegie classification and student study habits have also been studied. While many variables have shown success in retention efforts and academic curricular success, data establishing definitive predictive criteria for first-time board exam pass rates has proven difficult. Only one study in nursing showed that a validated exit exam could be a reliable predictor of student success for the NCLEX-RN examination (Sosa & Sethares, 2015). Athletic training currently does not have a predictive metric for the BOC examination, and the relationship of the ACES Preparatory Workshop Test 2 examination has not been studied. Results from the current study may help athletic training program directors and educators identify variables that may play a role in predicting first-time BOC pass rates. Insight into what factors contribute to student success may drive policy, curriculum, and BOC exam study strategies needed to address student and program deficiencies.

Method

Study Design

This was a non-experimental study employing a retrospective cohort design to determine if first-time BOC exam pass rates of athletic training students could be predicted using

undergraduate assessments, institutional factors, and student characteristics. The study occurred between January and June 2019. Before data collection, the study was approved by the University of Indianapolis Human Research Protection Program, with a reliance agreement being established between them and the Central Methodist University Institutional Review Board.

Participants

A convenience sample of athletic training students admitted to one of six university CAATE professional undergraduate programs were included in the study. Program selection was based on differing Carnegie classifications and CAATE Standard 11 compliance (probation or non-probation status). Students from the selected programs must have participated in an ACES Preparatory Workshop and completed the athletic training BOC examination between 2014 and 2019. Students who were not candidates for the BOC examination and did not graduate were excluded.

To estimate the minimum sample size need to detect a statistically significant difference between students who passed and did not pass the BOC on the first attempt, an a priori sample size estimation was conducted using G*Power, version 3.1 (Faul, Erdfelder, Lang, & Buchner, 2009). The calculation was based on comparing means between two independent groups and the following parameters, two-tailed test, alpha of .05, power of .80, a moderate effect size of 0.50, and an allocation ratio of .20. From the calculation, it was estimated that a minimum of 228 participants was needed to power the study appropriately.

Data Collection

Program directors from six CAATE accredited professional ATPs who serve as host sites for the ACES Preparatory Workshop were contacted via phone and email correspondence regarding participation in the study. The primary researcher (W. W.) is the program director for

one of the participating undergraduate athletic training programs. Program directors were sent study information and instructions and when appropriate, an encrypted email containing a structured self-reported web-administered Excel spreadsheet to log all data (see Appendix A for Excel data spreadsheet). The following institutional factors were collected from each participating program: athletic training student enrollment, Carnegie classification, when the BOC Practice Analysis was distributed to students, the number of core athletic training faculty, and the use of a BOC study guide. The following data were collected from each program for students who completed the BOC exam: demographics (age, gender, and primary language), first attempt BOC exam results - pass or fail, ACES Preparatory Workshop Test 2 score, highest recorded ACT or SAT score, and final cumulative program GPA. For this study, since both ACT and SAT scores were utilized, SAT scores were converted to an ACT equivalent score using an SAT to ACT Concordance Table (ACT, 2019). The ACES test scores were taken from the second test given during the ACES Preparatory Workshop, and raw scores were used.

Program directors agreeing to participate were sent a blank Excel spreadsheet with data headings to complete and return to the primary investigator. Program directors were sent a follow-up email within one week of receiving the spreadsheet to see if there were any questions concerning data collection expectations. A second email was sent two weeks after the first reminder email. Program directors who provided data were then contacted by phone to answer any questions or discuss concerns.

As data were received from program directors, the primary researcher combined the de-identified data into one Excel spreadsheet. While the primary researcher had access to participant identifiable information at his site during data collection; no identifiers were recorded on the Excel spreadsheet. All data collected were stored on an external hard drive and secured in the

primary researcher's office. Files were backed-up using the University's mainframe system where the primary researcher was employed, the primary researcher's encrypted thumb and external hard drive, and University One Drive cloud storage system. A waiver of informed consent was obtained based on the study collecting retrospective de-identified data.

Data Analysis

Statistical analysis was conducted using the IBM SPSS Statistics for Windows, Version 24.0 (IBM Corp., Armonk, NY). All tests were two-tailed, and an alpha level of less than .05 was considered statistically significant. The Shapiro-Wilk test was used to determine if data were normally distributed and the Levene's test was used to assess equality of variance for interval and ratio data that were found to be normally distributed. Descriptive statistics were used to describe institutional program factors, student characteristics, and student undergraduate assessments. Nominal data are presented as frequencies and percentages, and interval and ratio data as means and standard deviations for data that were normally distributed or medians and interquartile ranges for data that were not normally distributed.

Program institutional factors (student enrollment, Carnegie classification, distribution of the BOC Practice Analysis, number of core athletic training faculty, Standard 11 non-compliance, and study guide use) were compared by programs using Fisher's exact tests and Mann-Whitney *U* tests. To determine if there were differences in student characteristics (age, gender, primary language) and undergraduate assessments (ACES Preparatory Workshop Test 2 scores, ACT/SAT scores, and final cumulative GPA) comparisons by participating programs, and by the two BOC groups (passers and non-passers of first-attempt BOC exam) were conducted using Fisher's exact test for nominal data and either an independent *t*-test or Mann-Whitney *U* test, as appropriate for interval and ratio data. To compare BOC groups by the

distribution of the BOC Practice Analysis, a Fisher's exact test with post hoc tests were conducted using the Bonferroni correction to reduce the chance of a type I error. Effect sizes were calculated using Cohen's *d* values for the significant variables in the bivariate comparisons and were interpreted based on the word by Cohen (1988).

Binomial logistic regression was used to identify significant predictors of passing the BOC examination on the first attempt. Predictor variables that demonstrated a significant difference between passers and non-passers on bivariate analyses were entered into the model simultaneously using the Enter method. Before and after conducting a logistical regression analysis, the following assumptions were tested using procedures outlined by Field (2017): linearity between continuous independent variables and the logit transformation of the dependent variable; no multicollinearity; and no significant outliers.

Results

A total of six program directors from CAATE accredited entry-level undergraduate ATPs were contacted regarding study participation. All six programs agreed to provide information. However, only three (50%) programs participated and provided data on 210 students. The description of institutional factors by program can be found in Table 1. Student characteristics by program are presented in Table 2. As can be seen in Table 2, there was a significant difference in first-attempt BOC exam pass rates by program with Program 2 having the highest pass rate. Because there were only four (2.0%) students in which English was not their primary language, their data were not compared by program. All four of the students in which English was not their primary language were from Program 1.

Outcomes were prepared for those who passed and failed the BOC on the first attempt. It was found that those programs that used a non-BOC study guide had a higher first-attempt BOC

exam failure rate percentage than those who used a BOC approved study guide. When comparing program student enrollment, Carnegie classification, and distribution of the BOC Practice Analysis, it was found that the timing of the BOC Practice Analysis was a stronger predictor of BOC success in the study model; therefore, only distribution of the BOC Practice Analysis was chosen for this study. Post-hoc tests were calculated for the BOC Practice Analysis and found students who had the BOC Practice Analysis distributed in the junior or senior year were over three times more likely to pass the BOC exam on the first attempt than students who received the BOC Practice Analysis in the sophomore year.

Further outcomes are presented in Table 3 and indicate a statistically significant difference in ACES Test 2 scores, final cumulative GPA, and timing of BOC Practice Analysis between the two BOC groups. Those who passed the BOC exam on the first attempt had higher ACES Test 2 scores and final cumulative GPA. Cohen's effect size was very large ($d = 1.20$) for ACES Test 2 scores compared to first-time BOC pass rates providing further indication of ACES Test 2 scores providing a meaningful clinical measure. The median and interquartile ranges for final cumulative GPA scores for students who passed the BOC exam on the first attempt was 3.74 (.367) and 3.42 (.477) for students who failed the BOC exam on the first attempt. The groups differed significantly at a .05 alpha ($p < .001$) and had a medium effect size ($d = 0.69$), both indicating a reasonable significance in this study.

Logistic Regression Analysis

Binomial logistic regression was performed to ascertain which institutional factors, student characteristics, and undergraduate student assessments could significantly predict students passing or failing the BOC on their first attempt. Results of bivariate analyses were used to identify potential predictors of the BOC exam pass rate with those in which there was a

statistically significant difference being entered into the model. The following seven variables were statistically significant and were entered simultaneously into the model: number of core faculty, Practice Analysis, use of a non-BOC study guide, ACT scores, final cumulative GPA, and ACES Test 2 scores. Linearity of the continuous variables concerning the logit of the dependent variable was assessed via the Box-Tidwell (1962) procedure. A Bonferroni correction was applied using all seven terms in the model resulting in a statistical significance being accepted when $p < .010$ (Tabachnick & Fidell, 2014). Based on this assessment, all continuous independent variables were found to be linearly related to the logit of the dependent variable. There were no studentized residuals greater than $\pm$ 3 standard deviations indicating no outliers were unduly affecting the results. The logistic regression model was statistically significant, $X^2 = (3)\ 57.92$, $p < .001$. The model explained 39.3% (Nagelkerke R^2) of the variance in passing the BOC exam on the first attempt and correctly classified 83.3% of cases. The sensitivity was 40.0%, specificity was 93.9%, positive predictive value was 61.5%, and the negative predictive value was 86.52%. Of the seven predictor variables, three were statistically significant in the final model, final cumulative GPA, ACES Test 2 score, and timing of distributing the BOC Practice Analysis (as shown in Table 4). Higher GPA, ACES Test 2 scores, and distribution of the BOC Practice Analysis in the junior or senior year were associated with an increased likelihood of passing the BOC exam on the first attempt.

Discussion

The purpose of this study was to explore whether participation in an ACES Preparatory Workshop, institutional factors, student characteristics, and undergraduate student assessments would have an impact on the first-time pass rate of students who take the BOC exam. Results of the data analysis indicated a significant relationship between the final cumulative GPA and first-

time BOC exam pass rate, the timing of distributing the BOC Practice Analysis and first-time BOC exam pass rate, and a significant relationship between ACES Test 2 scores and first-time BOC exam pass rate. Other variables (student enrollment, Carnegie classification, number of core athletic training faculty, BOC study guide use, non- BOC study guide use, student age, gender, primary language, and ACT/SAT scores) were not significant factors for first-time BOC exam pass rate.

Amato-Cole Educational Services Preparatory Workshop

The current study is the first to investigate the relationship between ACES Test 2 scores and first-time BOC exam pass rates. The ACES Preparatory Workshop was designed for students to learn test-taking strategies specific to the BOC exam, to identify content weaknesses, and to help with test anxiety. In nursing education, the HESI exit exam has been widely used as a predictor of NCLEX-RN examination first-time pass rates. Eight HESI validity studies indicated for nursing students who scored 900 or higher, the HESI highly predicted passing the NCLEX-RN exam (96.36% to 99.16%) (Zweighaft, 2015). Given the vast research supporting the HESI examination for NCLEX-RN exam pass rates, there is some debate on the use of repeated testing to obtain the needed predictive score, and there is further debate on the second and third forms used and their predictive value on NCLEX-RN pass rates (Sosa & Sethares, 2015).

In the current study, the second of the two ACES Tests administered as part of the ACES Preparatory Workshop was utilized for analysis. Typically, most students see an increase in scores after the first exam due to testing strategies emphasized at the beginning of the ACES Preparatory Workshop and familiarity with the examination format. Follow-up testing and alternate test versions were not examined in the current study and may need to be considered when making BOC exam readiness decisions. While only three programs were sampled, the

current study finds similarities of the ACES Test 2 results to nursing's use of the HESI exit exam when providing program administrators and students direction when preparing for the BOC exam. While there is evidence to support ACES in attempting to reduce test anxiety (Breitbach et al., 2013), the current study provides program directors guidance to determine whether a student is ready to take the BOC exam, when examining scores from the ACES Preparatory Workshop.

College Readiness Metrics and Final Program Grades

Platt et al. (2001) found a correlation between the admissions metric of SAT scores with program academic success, finding SAT verbal scores had value in predicting academic success (college GPA) when coupled with high school GPA. While this study did not compare SAT metrics to first-time BOC exam pass rates, the findings were considered useful for admissions criteria in several healthcare programs: athletic training, physical therapy, occupational therapy, and physician assistant (Platt et al., 2001). Similarly, Hobson (2019) found that both verbal and math SAT scores were accurate in predicting first-time BOC exam pass rates. Harrelson et al. (1997) found ACT composite scores were able to predict BOC exam first-time pass rates; however, ACT composite scores were only able to predict BOC exam first-time pass rates when inclusive of overall academic, athletic training, and academic minor GPA.

In the current study, standardized admission test scores were reported as SAT and were converted to an ACT equivalent. Regarding relating ACT scores to BOC exam or program success, the current study found ACT scores between the groups to be statistically significant but had a small effect size indicating the ACT scores provided little clinical meaning in this study. Moreover, ACT composite scores were not significant in the overall prediction model and perhaps should be used with caution when used to predict BOC exam outcomes. While SAT

verbal and math scores were relevant for BOC exam success, it might be prudent to compare ACT sub-scores to determine if there are similarities to the findings regarding SAT scores.

While the current study focused on factors of success (first-time BOC exam pass rates) for undergraduate professional athletic training programs, it was noted that the GRE is used by many graduate athletic training programs for student admission. A review of several studies in athletic training and physical therapy found the GRE to produce mixed results in predicting academic success (GPA) or success on standardized board exams (first-time pass rates). Academic and or board exam success have been linked to GRE quantitative and or GRE verbal scores (Bayliss et al., 2017; Bruce et al., 2016;Thieman et al., 2003). Other studies did not find GRE scores (quantitative or verbal) to be significant factors regarding first-time exam pass rates on respective professional board exams (Keskula, 1995; Kuhn & Parrott, 2017; Riddle et al., 2009). As athletic training programs transition from bachelor's to master's degrees, GRE scores should be investigated more thoroughly as a measure to determine student admission.

Athletic training studies have correlated GPA with first-time BOC exam pass rates. Many of the studies were prior to the current BOC exam format; yet, these studies found GPA to be a predictor of BOC exam outcomes (Harrelson et al., 1997; Keskula, Sammarone, & Perrin, 1995). One study found that overall program GPA, athletic training GPA, and academic minor GPA were the strongest predictors of first-time BOC exam pass rates (Harrelson et al. 1997). When comparing clinical hours and program GPA, it was noted that the overall program GPA had the highest predictive value of first-time BOC exam pass rates. (Middlemas et al., 2001). In a study involving graduate athletic training students, it was noted that a student's admission GPA did not significantly predict BOC exam outcomes where the final master's program GPA did have a significant relationship with first-time BOC exam pass rates (Murray, 2014). A study

investigating graduate program GPA at the end of the first year of the athletic training program indicated students whose GPA was ≥ 3.45 had almost twice the probability of passing the BOC exam on the first attempt versus students with a GPA of < 3.45 (Bruce et al., 2016).

Similarly, a study involving undergraduate students attributed the final program GPA in undergraduate ATPs to be significant predictors of BOC exam first-time pass rates (Cripps et al., 2015). Other studies indicated athletic training pre-admission GPA was one of the best predictors of program success (Lawrance & Lauber, 2015) and success on BOC exam first-time pass rates (Platt et al., 2001). Investigation into GPA and first-time board pass rate success in other healthcare education programs (physical therapy, occupational therapy, physician assistant) found similar results when comparing first-time pass rates on their respective board examinations (Bayliss et al., 2017; Hocking & Piepenbrock, 2010; Huhn & Parrot, 2017; Luedtke-Hoffmann et al., 2012; MacArthur & Randall, 2015; Riddle et al., 2009).

In the current study, evidence points to the use of the final cumulative GPA when evaluating predictors of first-time BOC pass rates. Healthcare education programs may benefit by considering GPA as an admissions metric. However, it is perhaps more critical to evaluate the student's academic progress early and throughout the program. Being able to identify student's progress early in the program will help mitigate academic deficiencies before taking standardized board examinations.

Institutional Factors

When the BOC Practice Analysis was distributed to students in the junior or senior year, those students were 3.13 times more likely to pass the BOC exam on the first attempt than students who were introduced to the BOC Practice Analysis in their sophomore year. The gap in time between a student's sophomore year and the beginning of study preparation during their

senior year and increased maturity level between sophomores as compared to juniors and seniors may account for the increased likelihood of passing the BOC exam on the first attempt.

Students in programs with three faculty members did have a 3.5 times greater chance of passing the BOC exam on the first attempt than students with only two faculty members. A possible reason for this outcome might be the strain on faculty when faced with the task of administering the required competencies for the CAATE approved program. The 2020 standards for professional programs require a minimum of three full-time core faculty (CAATE, 2019c). This study supports the standard requiring three full-time core faculty members.

Age, Gender, and Primary Language

Students in this study had a median age of 23 years, with age ranging from 19-30 years. The median age of those who passed the BOC exam on the first attempt was 23 years and 22 years for those who did not pass the BOC exam on the first attempt. The comparison between age and first-time BOC exam pass rates indicated the difference was not statistically significant. It would be reasonable to expect that the nonsignificant findings in this study were the result of professional undergraduate ATPs typically enrolling a traditional high school age student, while professional master's programs would have more age disparity by attracting an older student consistent with post-graduates and non-traditional students. Age as a factor for success on the BOC exam was one of many factors identified when considering the transition of the professional degree in athletic training to the master's level. A comparison of undergraduate and master's programs in athletic training from 2010-2012 found BOC exam pass rates higher in those graduating from master's programs, even in institutions with both undergraduate and master's level athletic training programs (NATA, 2013). It is thought that graduate students tend to be more mature and more apt to be self-directed, independent learners, and better able to apply

critical thinking skills. Given the higher propensity for graduate students to possess these traits, age, and maturity would likely account for the increased first-time BOC exam pass rates (NATA, 2013).

There was no significant difference in gender between the two groups. While the BOC does not publish the gender of test-takers, data for this study indicated a higher number of females (64.3%) to males (35.7 %) compared to NATA gender membership data. National Athletic Trainers Association gender membership in 2018 was 56% for females and 44% for males (NATA, 2019). The primary language could not be compared between students who passed the BOC exam on the first attempt and with those who did not pass the BOC exam on the first attempt due to programs reporting that only four students spoke English as a second language. No research was found regarding the effect of primary language on first-time BOC exam pass rates. However, it was indicated as problematic in one study involving nursing students and the NCLEX exam where nursing students who spoke English as a second language passed the NCLEX exam at a lower rate than did those who spoke only English (O'Neil et al., 2006).

Board of Certification Study Materials

Athletic training programs typically utilize two forms of study guides when preparing students for the BOC exam. One is developed by the BOC for public consumption, and the other is a program developed study guide. Board exam preparation consisting of the number of hours, type of commercial study guide, and practice examinations found no correlation in first-time pass rates in physical therapy (Crawley et al., 2015). The current study comparing BOC exam first-time pass rates when using a program-specific (non-BOC) and a BOC approved study guide contradicted findings from occupational therapy (Breen-Franklin, 2017). Breen-Franklin (2017)

found no significant difference regarding types of study guides used; whereas, the current study suggested the use of a non-BOC approved study guide placed students at a higher risk of failing the BOC exam. Individual programs may need to carefully investigate the validity of commercially produced study guides within their respective professions and pay particular attention to individual student deficiencies when choosing to produce their study guide for BOC exam preparation.

Limitations and Barriers of Study

A low program response rate limits this study. Initial contact was made through phone or email by the investigator for all six schools chosen for the study, and repeated follow-up was performed using the same medium. However, while data gathered was ample ($N = 210$), only three of the six programs contacted provided information for the study. A likely cause of the low program response rate is study timing. The data collection took place in the spring semester, a busy time of the year for many program directors as they prepare for year-end academic obligations. Many program directors are also currently engaged in the transition from bachelor's degrees to CAATE mandated master's degree in athletic training. In response to the mandated transition, many program directors have been required to return to the classroom to pursue terminal degrees to meet the requirements of both regional accreditation and CAATE. Because only three schools participated, it was noted that the geographical and Carnegie classification was limited in scope and may not represent athletic training programs as a whole.

It was also noted that many program directors have not kept adequate student records or have limited access to this data. One program was able to complete much of the Excel datasheet; however, it was unable to provide an age for their student population and another program that agreed to participate later realized access to data was unobtainable. While CAATE requires

program directors to log program and student information into an e-accreditation portal, it does not require the documentation of age, ACT/SAT scores, cumulative GPA, or other specific programmatic indicators. Tracking this information in this portal may be helpful for those institutions which do not have access to other forms of data gathering and dissemination.

This study was also limited in the composition of the participants. Undergraduate ATPs by nature admit students within the same age demographic. This study revealed a median age of 23 years ($N = 87$), a typical age for a student graduating from an undergraduate program. This information may not be generalizable to the master's program demographics, which tend to attract a more diverse age group. English as a student's secondary language was limited in this study to four students from one program; therefore, conclusions about the effect students' primary language could have on first-time BOC exam pass rates could not be made.

Recommendations for Future Research

The significance mentioned above in this study concerning English as a second language, and students who passed the BOC exam on the first attempt would suggest further examination. The recommendation would be to conduct a similar study where a broad range of programs can be sampled to get a better picture of whether English as a second language has an effect on first-time BOC exam pass rates. While evidence in this current study does not suggest an internal problem with the BOC exam, it may give program directors valuable information regarding study strategies to employ, and it may raise the awareness of BOC officials when considering methods of test administration. Statistics on ethnic diversity are recorded by the NATA; however, data on English as a second language and BOC exam pass rates could not be found. As the NATA expands its international reach, programs may face more first-time BOC exam pass rate complications with an anticipated increase in an international student population who speak

English as a second language. More research in this area may provide valuable insight into the factors related to success and failure on the BOC exam in this population.

Program directors in this study were surveyed to see whether they used BOC approved study materials or if they manufactured their own BOC study materials. The sample size was small, and all three programs indicated they used both forms of study materials for students before taking the BOC exam. A qualitative study identifying what study strategies students perceive as the most beneficial for first-time BOC pass rates may help program directors identify additional study strategies for the BOC examination preparation.

This study revealed a significant positive correlation between ACES Test 2 scores and passing the BOC exam on the first attempt. In light of the results, an opportunity exists to expand this study to include a broader sample of programs. Perhaps demographics and ACES Test 2 scores data could be collected in a collaborative effort between ACES and the BOC at the beginning of the ACES Preparatory Workshop with follow-up gaining access from the BOC on matching BOC exam pass and fail rates. Collecting data in this manner would be beneficial in accessing samples from over 25 ACES testing sites in all geographical regions of the U.S. Information gained from a larger sample size may give program directors a better picture of how to best use the ACES Preparatory Workshop scores for assessment data and student's preparation in advance of taking the BOC exam.

Conclusion

This study examined variables of ACES Preparatory Workshop Test 2 scores, ACT scores, final cumulative GPA, BOC study guide use, and non-BOC study guide use, program student enrollment, Carnegie classification, BOC Practice Analysis, number of core athletic training faculty, age, gender, and English as a second language and found final program GPA,

timing of distributing the BOC Practice Analysis, and ACES Test 2 scores to be significant factors in passing the BOC exam on the first attempt. Age and gender were not found to be significant factors for success on the BOC exam on the first attempt.

The timing of the BOC Practice Analysis did reveal a significance in the logistic regression predictive model. Students presented with the BOC Practice Analysis in their junior or senior year were over 3 times more likely to pass the BOC exam as compared to sophomore year distribution. The ACES Preparatory Workshop was designed to be administered in a student's senior year to allow enough time to remediate before taking the BOC exam. However, several schools have the ACES Preparatory Workshop administered in the junior year. In this study, two programs hosted the ACES Preparatory Workshop in the student's junior year while the third program did so in the student's senior year. Amato-Cole Educational Services distributed the BOC Practice Analysis during the workshop to identify student areas of weakness within the domains of the BOC exam. Programs may want to be aware of students who are presented with the BOC Practice Analysis before taking the ACES Preparatory Workshop and may want to re-emphasize the importance of reviewing the BOC Practice Analysis when beginning to prepare for the BOC exam in the senior year. Relying on the early distribution of the BOC Practice Analysis for the primary mode of BOC exam study may give a false sense of security if not utilized closer to taking the BOC exam.

It is imperative that program directors utilize assessment data to demonstrate a level of program and student success and attract students in a competitive market. Passing the BOC exam on the first attempt is one of the significant indicators of success. As master's programs become the norm, program directors in all programs are looking to admit students with the best chance of succeeding on the BOC examination. Some programs serve a student who enters as a first-

generation college student eager to succeed. For those institutions, ensuring success is key to program survival, especially when student selectivity is not always an option. Programs of this nature need to review their program data and consider many factors such as admission and program GPA, and board preparation assessment examinations when devising a comprehensive plan to BOC examination preparation. Some program directors have begun to utilize the services of the ACES Preparatory Workshop to help identify areas of remediation before taking the BOC exam. This study revealed that the final cumulative GPA, coupled with an ACES Test 2 score, may provide valuable data when preparing for the BOC exam and ensuring program success. Students with lower program GPA and ACES Test 2 scores may need additional intervention and instruction. As the profession of athletic training increases in demand (23% between 2016 -2026) (Bureau of Labor Statistics, 2019), ensuring program and student success is one of the keys to maintaining a presence in today's healthcare system.

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Table 1

Description of Athletic training Programs

	Program 1	Program 2	Program 3
Program student enrollment	26	34	30
Carnegie classification	Bachelor	Doctoral	Masters
BOC Practice Analysis	Junior	Senior	Sophomore
Core athletic training faculty	3	3	2
Standard 11 non-compliance	2013-2014	NA	2016-2019
BOC study guide	Yes	Yes	Yes
Non-BOC study guide	Yes	No	Yes

Note. BOC = Board of Certification, NA = Not applicable due to being compliant

Table 2

Student Characteristics by Program

	Program 1 (*N* = 76)	Program 2 (*N* = 98)	Program 3 (*N* = 36)	
Median (IQR) age (years)	23.00 (1.00)		22..00 (1.0)	
	N (%)	*N* (%)	*N* (%)	*p*
BOC				<.001
Pass	58 (76.3%)	89 (90.8%)	22 (61.1%)	
Fail	18 (23.7%)	9 (9.2%)	14 (38.9%)	
Gender				.890
Male	26 (34.2%)	35 (35.7%)	14 (38.9%)	
Female	50 (65.8%)	63 (64.3%)	22 (61.1%)	
Primary language				
English	72 (94.7%)	98 (100%)	36(100%)	
Non-English	4 (5.3%)	0 (0%)	0 (0%)	

Note. IQR = interquartile range, BOC = Board of Certification

Table 3

Outcomes by Students who Passed and Failed the Board of Certification

	BOC Passed ($N = 159$)	BOC Failed ($N = 40$)	
	Mdn (IQR)	*Mdn* (IQR)	*p*
ACT Scores	24.00 (4.00)	22.00 (2.00)	.004
Final cumulative GPA	3.73	3.42	< .001
ACES[a]	81.04 (9.19)	72.07 (7.95)	< .001
	N (%)	N (%)	
Non-BOC Guide			< .001
No	89 (90.8%)	9(9.2%)	
Yes	80(80.4%)	32(28.6%)	
BOC Practice Analysis			< .001
Sophomore	22 (61.1%)	14(38.9%)	
Junior	58(76.3%)	18(23.7%)	
Senior	89(90.8%)	9(9.2%)	
Core Faculty			< .001
2	22(61.1%)	14(38.9%)	
3	147(87.5%)	27(15.5%)	

Note. IQR = interquartile range, BOC = Board of Certification, ACT =American college testing, SAT = scholastic aptitude test, GPA = grade point average, ACES = Amato-Coles educational services

[a]Means and standard deviations reported.

Table 4

Logistic Regression Predicting Likelihood of Passing the BOC based on Institutional Factors, Undergraduate Assessments, and Student Characteristics

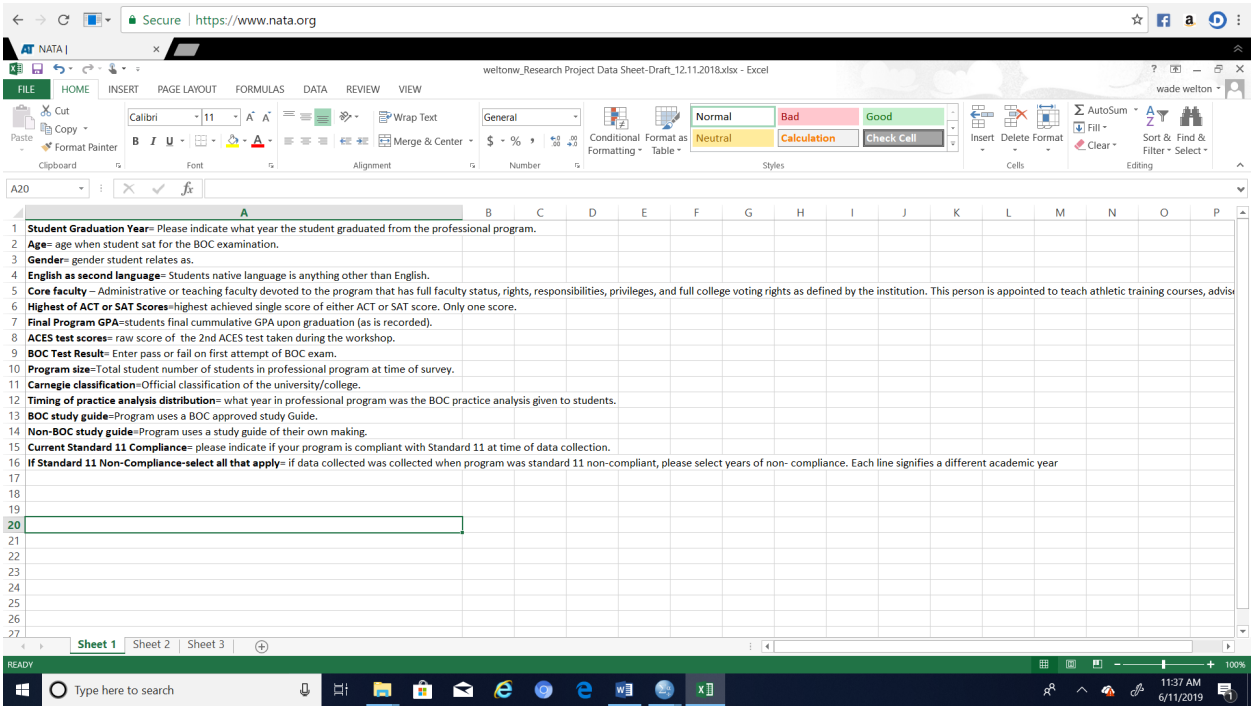
	β	SE	Wald	*p*	Odds Ratio	95% CI	
						Lower	Upper
Final cumulative GPA	-2.66	0.77	11.88	.001	14.29	3.15	66.67
ACES Test score	-.116	0.03	15.76	< .001	1.12	1.06	1.19
BOC Practice Analysis	1.14	0.49	5.45	.020	3.13	1.2	8.13
Constant	16.62	3.16	27.76	< .001			

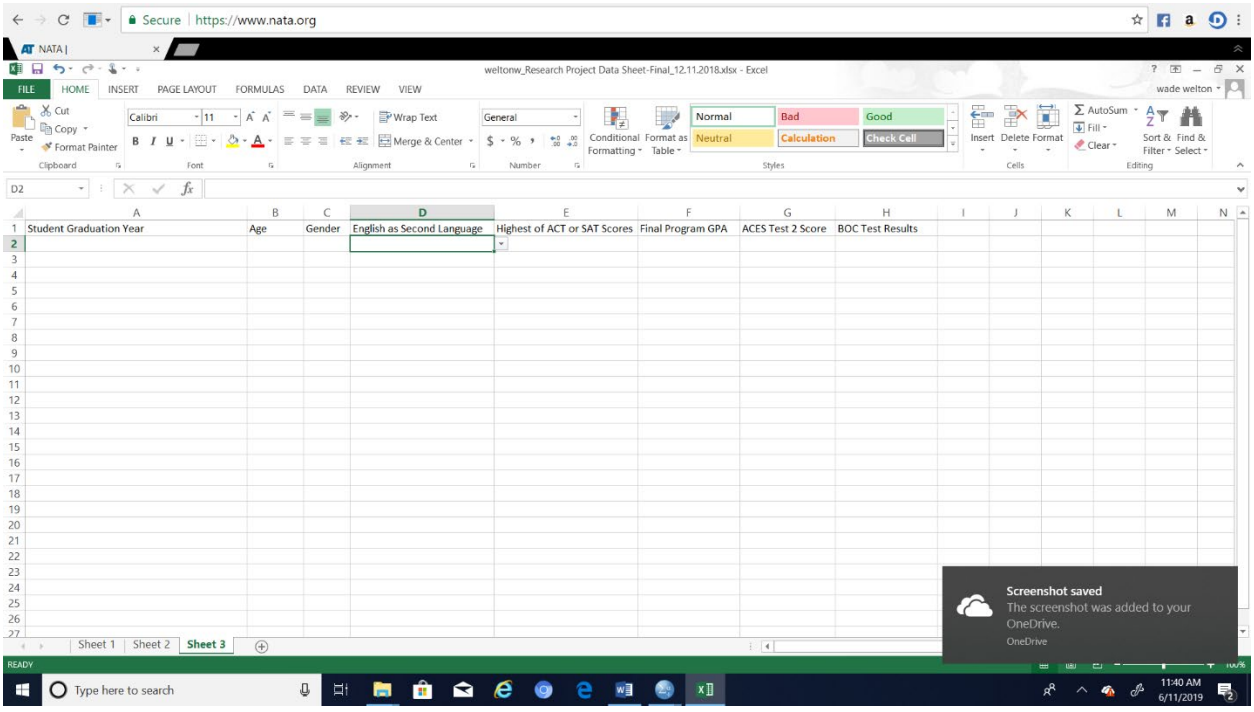
Note. ACES = Amato-Cole educational services; BOC = Board of Certification;

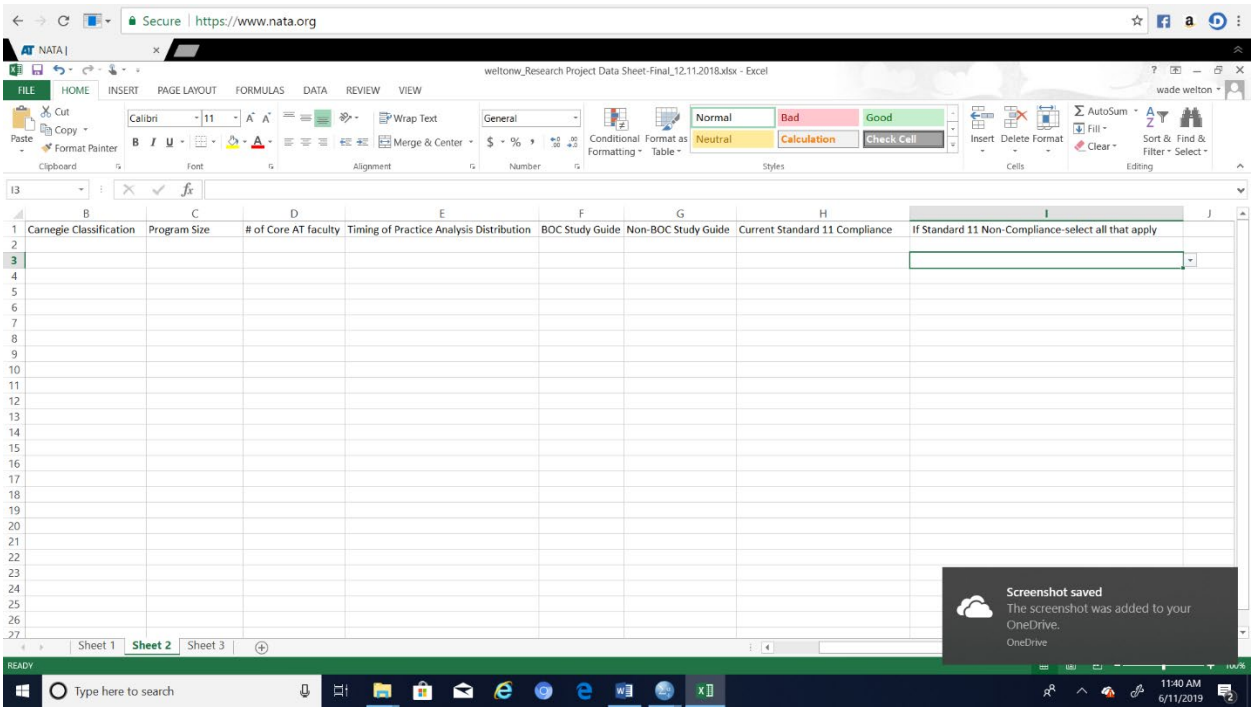
[a] BOC Practice Analysis is for sophomore compared to junior and senior.

Appendix A

Excel Data Spread Sheet






Secure https://www.nata.org
NATA |
weltonw_Research Project Data Sheet-Final_12.11.2018.xlsx - Excel
wade welton
FILE HOME INSERT PAGE LAYOUT FORMULAS DATA REVIEW VIEW
Paste Cut Copy Format Painter
Calibri 11
Wrap Text
Merge & Center
General
Conditional Formatting
Format as Table
Normal
Bad
Good
Neutral
Calculation
Check Cell
Insert Delete Format
AutoSum Fill Clear
Sort & Filter Find & Select
Clipboard Font Alignment Number Styles Cells Editing
I3
Carnegie Classification
Program Size
# of Core AT faculty
Timing of Practice Analysis Distribution
BOC Study Guide
Non-BOC Study Guide
Current Standard 11 Compliance
If Standard 11 Non-Compliance-select all that apply
Sheet 1 Sheet 2 Sheet 3
READY
Screenshot saved
The screenshot was added to your OneDrive.
OneDrive
Type here to search
11:40 AM
6/11/2019