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A National Study on the Relationship Between Programmatic Factors and Athletic Training Education Board of Certification Pass Rates

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Abstract

In athletic training (AT) education, the first-time BOC pass rate is a significant marker of a program's success, and the Commission on Accreditation of Athletic Training Education (CAATE) requires programs to maintain a first-time 3-year aggregate BOC examination pass rate over 70%. There is limited published research on BOC pass rates on Professional Masters' (PM) programs. Therefore, it is essential to identify modifiable factors that have a relationship with first-time pass rates. This study aim was to investigate the relationships between programmatic factors and the first-time BOC pass rate for PM AT students while controlling for student and institutional factors. This study is necessary to fill the literature gap on PM programmatic factors, student outcomes, and identify factors that have been found significant in predicting student success in PM AT programs. A multiple regression analysis of program level data that captures student, programmatic and institutional factors obtained from the deidentified CAATE data was conducted on 77 PM AT programs. Independent variables included in the study were institutional type, admissions selectivity, cohort diversity, clinical immersion hours per week, students per core faculty member, students per lab faculty member, percent doctoral faculty, and total spending on professional development. The dependent variable was the programmatic 1-year first-time BOC pass rate. A significant positive relationship was found between admissions selectivity, clinical immersion hours per week, percentage of doctoral faculty and total amount spent on professional development and 1-year first-time BOC program pass rates. These results suggest that increased programmatic investments into development of faculty and the evaluation of the clinical immersive experience may help programs increase their first-time BOC pass rate.

Keywords: Student outcomes, Student Success, Clinical Immersive Experiences, Faculty Development, Faculty Composition

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List of Tables

Table 1: Descriptive Statistics for Categorical Variables 49

Table 2: Descriptive Statistics for Continuous Programmatic Variables..... 50

Table 3: Cross-tabulation for Categorical Independent Variables..... 51

Table 4: Correlation Data for Continuous Variables..... 52

Table 5: Variance Inflation Factor (VIF) Values for Independent Variables 53

Table 6: Multiple Regression Analysis: Outcome Variable First-time 1-year BOC Pass Rate 54

Table 7: Logistic Regression Analysis: Outcome Variable 100% First-time BOC Pass Rate 55

Table of Contents

Abstract i
Acknowledgements iii
List of Tables iv
Chapter 1: Introduction 1
Statement of The Problem 3
Statement of The Purpose 4
Significance of the Study 4
Research Question 4
Theories Used to Guide Research on Student Success 5
Definitions 7
Chapter 2: Review of The Literature 9
History of AT Education 9
History of AT Education Accreditation 11
History of AT Certification Examination 14
Factors Predicting Student Success in AT 16
Student Variables as Predictors of Success 16
Programmatic Variables as Predictors of Success 20
Factors Predicting Student Success in Healthcare Education 26
Student factors as predictors of success 28
Programmatic Factors as Predictors of Success 31
Institutional factors as predictors of success 34
Conclusion 35
Conceptual Model 36
Chapter 3: Study Design and Methods 39
Data Source 39
Variables 40
Dependent Variable 40
Independent Variables 40
Data Management 43
Data Analysis Method 44
Multiple Regression Analysis 44
Dichotomous Logistic Regression as a Sensitivity Test 46

Limitations 46
Chapter 4: Results 48
Descriptive Analysis 48
Cross Tabulation Analysis 50
Correlation Analysis 51
Multicollinearity Analysis 52
Multiple Linear Regression Analysis 53
Logistic Regression Analysis 54
Conclusion 55
Chapter 5: Discussion 56
Student Variables 57
Institutional Variables 58
Programmatic Variables 59
Core and Lab Faculty 60
Percentage of Doctoral Faculty 61
Professional Development Spending 62
Clinical Immersion Hours per Week 63
Implications and Future Research 66
Theoretical and Policy Implications 66
Practice Implications 67
Future Research 68
Conclusion 70
References 72
Appendix A 83
Appendix B 84

Chapter 1: Introduction

While undergraduate institutions have seen a decrease in enrollment, enrollment in graduate education has increased, with first-time graduate enrollment increasing 2.5% in the 2018–2019 academic year. Notably, the field of health sciences has seen a 3.5% increase over the past five years (Okahana et al., 2021). The health science field is composed mainly of professional degree programs. Graduate professional programs aim to prepare students for non-academic careers, and the knowledge and skills a student gains varies significantly between disciplines. Different professional programs are often required to meet different accreditors' standards and state regulators (Weidman et al., 2001). While similarities between disciplines exist and comparisons can be made, it is imperative to evaluate professional programs independently.

Athletic training (AT) programs are professional degree programs aimed at preparing students to practice as athletic trainers post-graduation. Athletic trainers are allied health professionals recognized by the American Medical Association that help prevent, diagnose, treat, and rehabilitate chronic or acute injuries (NATA, 2020). Athletic trainers have an important role in promoting safety, preventing injury and illness, recovery from injury, and supporting good health in patients across their lifespan (Thomas et al., 2017).

The AT profession regulation is complex and influenced by three different bodies: The National Athletic Training Association (NATA), the Commission on Accreditation of Athletic Training Education (CAATE), and the Board of Certification (BOC). Credentialing for an athletic trainer consists of graduation from a CAATE accredited program and successful completion of the BOC exam. The NATA is the professional association for AT whose goal is to "engage and foster the continued growth and development of the athletic training profession"

(NATA, 2020). CAATE is the regulatory agency for AT education, whose mission is to define, assess, and improve AT education (CAATE, n.d.a). The BOC is responsible for providing credentialing programs that support athletic trainers. Together these three agencies influence and govern the profession of AT and AT education.

Currently, the AT profession is undergoing a significant change to the education structure. The current minimum level of education required to qualify to take the BOC exam moves from the bachelor's to the professional master's (PM) as of 2022 (CAATE, 2015). In the 2018–2019 program year, there were 98 PM programs (CAATE, 2020), which is down from 111 in the 2017–2018 academic year (CAATE, 2019). Additionally, 298 bachelor's programs will need to PM or withdraw their accreditation (CAATE, n.d.b).

In 2013 CAATE enacted a new accreditation standard requiring all accredited programs to maintain a 3-year aggregate first-time BOC pass rate of 70% (Standard 6). The first-time pass rate is the percentage of test-takers at an institution for a testing year that successfully passed the BOC exam on the first attempt. Programs that are in noncompliance are placed on probation and risk losing accreditation if unable to become compliant in a subsequent year. Additionally, AT programs are required (Standard 25) to collect student outcome measures annually and post the information for three prior years on their programmatic webpage (CAATE, n.d.b). The increase in required transparency and accountability by CAATE has placed a greater emphasis on measurable student outcomes, such as a program's first-time BOC examination pass rate. In the 2017 to 2019 reporting years, 31% (n=66) of bachelor's degree programs and were non-compliant with Standard 6 compared to 16% (n=22) of PM programs (CAATE, 2019; CAATE 2020).

The BOC exam is a comprehensive computer-based test aimed to determine entry-level competence in the AT field. Currently, 49 states require completing the BOC exam to obtain mandatory state licensure to practice as an athletic trainer in those states. For a student to be eligible to sit for the BOC examination, they must graduate from a program accredited with CAATE (BOC, 2020a). The BOC first-time pass rate is a significant marker of a program's success, and determining predictors of BOC pass rates has been the focus of multiple studies within AT (Bruce et al., 2019; Gayford, 2018; Harrelson et al., 1997; Hickman, 2010; Middlemas et al., 2001; Murray, 2014; Parham, 2017; Searcy, 2006; Williams & Hadfield, 2003). However, prior research focuses mainly on undergraduate education and student factors.

Statement of The Problem

Over the past four years, the average first-time BOC examination pass rate for all programs has also steadily declined from 94% to 81% in the 2019 graduation year, and the average graduation rate for all PM programs has dropped from 85% to 74% for the same period (CAATE, 2019). With the recent decline in BOC pass rates, decline in graduation rates, and the enacting of a minimum 70% first-time 3-year aggregate pass rate, it is crucial to identify factors that may increase student success in PM AT programs.

Research in AT education has primarily focused on student factors and undergraduate programs (Bruce et al., 2019; Middlemas et al., 2001; Murray, 2014; Searcy, 2006). Studies that have focused on PM programs are cohort studies or limited by small sample sizes (Bruce et al., 2019; Murray, 2014; Walters, 2020). While some studies have focused on institutional factors and student variables as predictors of BOC exam scores (Parham, 2017), they did not include modifiable programmatic factors. There is literature in other allied health and medical fields that suggests a relationship between programmatic factors and exam pass rates in professional

programs (Asprey et al., 2004; C. Cook et al., 2015; Covington et al., 2016). Therefore, a relationship may exist between programmatic factors and PM program BOC pass rates. The limited research in programmatic factors and their relationship to BOC exam pass rates leaves programs with little information on which to base decisions to increase their BOC pass rates.

Statement of The Purpose

This study aims to identify whether there are relationships between programmatic factors and the first-time BOC pass rate for PM AT students while controlling for student and institutional factors. Program factors include faculty composition, clinical rotations, program length, and resource allocation. This study aims to fill the AT literature gap on the relationship between programmatic factors and first-time BOC pass rate in PM AT programs.

Significance of the Study

Due to the CAATE accreditation requirement for programs to maintain a 3-year aggregate BOC pass rate of 70%, it is essential to identify modifiable factors related to first-time BOC pass rates. Additionally, there is limited research on PM AT programs and factors on first-time BOC pass rates. Therefore, it is vital to identify factors that may have relationships with first-time BOC pass rates. Implications for this study's results are intended for use by programs seeking to increase their BOC pass rates to avoid probation and maintain a "good standing" accreditation status. Additionally, this study is necessary to fill the literature gap on PM programmatic factors and their relationship with student outcomes and identify factors that have been significant in predicting student success in PM AT programs.

Research Question

When controlling for student and institutional factors, what programmatic factors are significantly related to first-time BOC pass rates?

Theories Used to Guide Research on Student Success

Research on student success often uses the social capital theory, popularized in educational research by Pierre Bourdieu (1990) and evaluated by Dika and Singh (2002). The social capital theory suggests that the networks, made up of social obligations and connections in which students interact, are often converted into an economic gain (Bourdieu & Passeron, 1990; Dika & Singh, 2002). Therefore, attending a higher quality institution would allow students to increase their social networks and increase employment odds. Dika and Singh (2002) suggest that the increase of social capital directly relates to increased human capital. Schultz (1961) defined human capital as the knowledge and skills that a person acquires that can be used for personal gain, thereby providing them with more significant opportunities for successful graduation and employment.

Studies using human capital theory often assess the relationship between college quality, cost, and earning after graduation. The human capital theory has supported suggestions that labor markets will reward individuals for their investment in themselves (Becker, 2009). However, human capital and social capital focus on the outcomes of employment and monetary gains and do not explain the cognitive benefits that one might attain from attending a program (Zhang, 2005). The successful completion of the first attempt of the BOC examination for an AT student is an example of a non-monetary cognitive benefit from attending a program. Additionally, Gintis and Bowles (1975) criticized research using human capital theory for overlooking individual student factors, such as race and gender, that can often impact the attainment of or benefits from the capital increase.

The human capital theory does not consider how organizational policies and the environment impact student success. Researchers in academic institutions have used

organizational theory and its application to identify students' behaviors and their impacts (Bess et al., 2007). Berger (2001) suggests that there are different dimensions of an organization's behavior that make up a university's environment. For example, the governance structure, mission, and allocation of funding to resources within the entity all influence its environment. The different levels of different dimensions of organizational behaviors create varying institutional environments.

A simplified model used in the literature to conceptualize the interactions between student demographic variables, organizational behavior, and student outcomes is Astin's (1993) input-environment-output (I-E-O) model. The I-E-O model has been used as a theoretical, conceptual framework to assess student success in multiple healthcare disciplines (Murray, 2014; Prion, 2008). Murray (2014) used the I-E-O theory to study predictors of BOC examination pass rates in PM AT students. Prion (2008) used the approach to study student learning outcomes after simulation experiences in a nursing education program. In this model, Astin (1993) proposes three categories to measure student learning from attending an institution. Inputs are the student's demographic and academic factors. The environment is the institutional and programmatic factors that the student experiences while attending the program. Lastly, the outputs are the knowledge and skills that the student has gained from attendance. Use of Astin's I-E-O model allows for the conceptualization and identification of the different aspects of organizational behavior that may impact student success.

This study will use the CAATE accreditation database, which requires all accredited institutions to report annually to maintain accreditation. This study uses a multiple regression analysis due to the continuous outcome variable of first-time BOC pass rate. Student factors are

the inputs, and environmental student factors consist of programmatic and institutional factors. The outputs are the programmatic outcome of first-time BOC pass rate.

The following chapters in this study will cover the described information in the following order. First, this study examines the relevant literature on successful predictors of certification exam pass rates in AT education, allied health fields, and medical fields. Next, a detailed description of the data and analytical methods used in this study to answer the research questions. Lastly, this paper details the results and implications of the study.

Definitions

- Athletic Trainer (AT): Athletic Trainers are allied healthcare professionals, recognized by the American Medical Association, that specialize in the prevention, recognition, management, and rehabilitation of injuries resulting from physical activity.
- Board of Certification (BOC): A not-for-profit credentialing agency responsible for providing a certification program for the entry-level AT profession.
- Board of Certification Exam: The BOC exam is a 175-question computer-based test designed to determine entry-level knowledge of AT's five domains. Successful completion is required to obtain the AT credential.
- Commission on Accreditation of Athletic Training Education (CAATE): CAATE is a recognized accrediting agency by the Council for Higher Education. It is responsible for defining, assessing, and continually improving AT education.
- Core Faculty: Are full-time faculty employed by the institution whose primary responsibility is to teach in the AT program.

- National Athletic Trainers Association (NATA): Founded in 1950, the NATA is a professional membership association for certified athletic trainers whose mission is to represent, engage and foster the continued growth and development of the AT profession.
- Practice Analysis 7th Edition: Consists of 5 domains of specific tasks and is designed to define the current entry-level knowledge, skills, and abilities required for practice in the AT profession.
- Professional Master's Program (PM): a specialized degree program consisting of at least two years of study beyond a bachelor's degree.

Chapter 2: Review of The Literature

The purpose of this review of the literature is to synthesize the factors that may predict increased student success in PM AT programs' first-time BOC pass rates. This review was necessary to identify the literature gap on PM programmatic factors, student outcomes and identify factors that have been significant in predicting student success in AT programs.

This review will include a review of AT education's history and development, relevant theories used to guide studies on student success, and a literature review on what factors are significant in predicting student success in AT and similar healthcare fields. Lastly, in this chapter, a conceptual model is proposed for research that examines student success in PM AT programs.

History of AT Education

AT education is a relatively new field of study compared to other allied health fields like physical therapy (PT), which can trace their educational roots back to the early 1800s (Moffat, 2012). The profession of AT started with the need for medical coverage during college football seasons. However, the first athletic trainers did not obtain a degree or certification but instead were coaches with emergency medical training (Delforge & Behnke, 1999).

The development of an educational curriculum model in AT was, in part, a direct result of the establishment of NATA, which was established in 1950 to strengthen the profession, and approved the first educational curriculum in 1959. The educational curriculum's early focus was to educate athletic trainers and prepare them to teach in the secondary school setting or continue to a degree in. Under this model, athletic trainers obtained a teaching degree in health or physical education, and AT did not become an official undergraduate field of study until the mid-1980s.

After AT became an official undergraduate major, it was up to individual students to obtain teaching credentials along with the AT degree (Delforge & Behnke, 1999).

However, from the 1970s to the early 2000s, students did not need a degree in AT to obtain the AT certification. Students could be eligible to take the BOC examination if they had an undergraduate degree and had completed 1,800 clinical hours under a certified AT, which eventually reduced to 1,500 clinical hours. The second pathway to certification phased out in 2004 and required all students to complete formal didactic coursework in AT (Weidner & Henning, 2002). The elimination of the internship route made the only pathway to certification for students through a professional degree program. Students could obtain a bachelor's degree in AT or a master's level degree.

Lastly, in 2015, a strategic alliance of the BOC, NATA, NATA Research and Education Foundation, and CAATE announced the minimum level of a degree requirement to sit for the certification exam would be at the master's level. All accredited AT programs would need to transition the curriculum to the graduate level by 2022 and would no longer admit students into undergraduate degree programs after this date (CAATE, 2015). PM programs had demonstrated significantly higher retention, employment, and first-time BOC pass rates when compared to undergraduate AT programs (Bowman et al., 2015; Phegley, 2014). The increase in programmatic outcomes and the profession's push to be better aligned with their allied healthcare peer professions were primary reasons spurring the degree change (CAATE, 2015).

There are currently two types of graduate programs: professional master's level (PM), which are for students seeking to obtain the AT certification, and post-professional master's, for students who already possess the AT credential and wish to receive a graduate degree. The new

accreditation requirement is for CAATE accredited PM AT programs and that they must result in the granting of a master's degree after 2022 (CAATE, 2015).

History of AT Education Accreditation

Accreditation is defined by CAATE (n.d.b) as the voluntary peer review, quality assurance process for higher educational programs. CAATE, a recognized accrediting agency by the Council for Higher Education, is responsible for defining, assessing, and continually improving AT education. To accomplish this, CAATE has developed educational standards that provide a framework for AT educational program delivery. The newest version of the academic accreditation standards went into effect on July 1, 2020 (CAATE, n.d.b).

However, CAATE has not always been the accrediting body for AT education. The NATA was the first regulatory agency of AT education and officially recognized the early undergraduate curriculum in 1969 (Delforge & Behnke, 1999). The NATA remained the primary regulatory agency for AT curriculum until the 1990s. After the American Medical Association (AMA) officially recognized AT as an allied health profession in June of 1990, the NATA and AMA Committee on Allied Health Education Accreditation sought accreditation partners. The search for partners resulted in the Academy of Family Physicians and the American Academy of Pediatrics joining the AMA and NATA. Together they formed the Joint Review Committee on Education Programs in Athletic Training (JRC-AT) in 1991, which became the first AT accreditation committee housed under the Commission on Accreditation of Allied Health Educational Programs (CAAHEP) (Delforge & Behnke, 1999). The JRC-AT remained the accrediting agency until June of 2006 when the JRC-AT split with the CAAHEP and formed CAATE (CAATE, n.d.a).

A significant change CAATE imposed in AT education was the announcement of Standard 11 in 2013, which required all accredited programs to maintain a 3-year aggregate first-time pass rate of 70%. Programs that were not compliant were placed on probation, starting in 2016. Programs on probation that fail to comply with the 70% pass rate for a second year but have a pass rate above 50% remain on probation. If the pass rate is below 50% in the second year, the program has its accreditation withdrawn. (CAATE, 2016). Under the newest standards enacted on July 1, 2020, Standard 11 is now Standard 6 under Section 1: Program Quality and Design. CAATE has also added Standard 7, which requires programs that are non-compliant with Standard 6 to "develop and implement an action plan for the correction of BOC-examination pass-rate deficiency" (CAATE, n.d.b p. 2). Additionally, CAATE has maintained Standard 5, which requires all accredited programs to collect their graduation, retention, and employment rates, as well as first-time pass rate on the BOC examination on an annual basis. The need for increased accountability and transparency has placed a greater emphasis on measurable outcomes of student success.

Another addition to multiple standards is the requirement for program directors, clinical education coordinators, core faculty, and preceptors to develop and maintain contemporary expertise (CAATE, n.d.b). Contemporary expertise is defined as "knowledge and training of current concepts and best practices in routine areas of AT, which may include specialization in one or more of the identified areas of AT practice. An individual's role within the AT program should be directly related to the person's contemporary expertise" (CAATE, n.d.b p.52). The addition and focus on developing contemporary expertise places increased importance on faculty development related to enhancing the quality of education students receive.

CAATE has also expanded the required core competency content taught in professional programs. The new standards aimed to enhance and improve clinical decision-making, use evidence to inform practice and enhance patient-center care (CAATE, n.d.b). Programs are now required to educate students on practicing in interprofessional collaborative teams (Standard 61), use of evidence to inform practice (Standards 62), the use of a quality improvement to enhance patient care (Standard 63), and apply the practices of health informatics to the administration and delivery of patient care (Standard 64) (CAATE, n.d.b). The Institute of Medicine considers the areas of interprofessional practice, evidence-based practice, quality improvement, and health informatics to be core competencies in which all healthcare professionals should be educated (Greiner & Knebel, 2003). The addition of these core competencies by CAATE better aligns athletic trainers with other healthcare providers. However, these new core competencies may be new areas of instruction for faculty and preceptors, many of whom may have had no formal training in the areas due to the lack of inclusion in prior standards.

CAATE has also made changes in the new standards to the clinical education component of AT programs. Standard 16 now requires that the education program includes at least one four-week period of an immersive clinical experience. CAATE defines immersive clinical experiences as "practice-intensive experiences that allow the student to experience the totality of care provided by athletic trainers. Students must participate in the day-to-day and week-to-week role of an athletic trainer for a period of time identified by the program (but minimally one continuous four-week period)" (CAATE, n.d.b, p. 8).

CAATE has made strides in recent years to increase program accountability and transparency of student outcomes. With the transition to PM level instruction and the introduction of new accreditation core competencies, programs will need to adjust their

curriculum content to meet the requirements and adequately prepare students for the BOC certification exam.

History of AT Certification Examination

The route to becoming a certified athletic trainer, which today requires successful completion of the BOC exam and a degree in AT from a CAATE accredited institution, has undergone significant changes in the past 50 years. In 1969 the NATA outlined different pathways to certification, including having a degree, passing a certification exam, or having working experience as an athletic trainer beyond that of student AT experience (Grace, 1999). In 1970 the NATA started offering the first certification exam (Delforge & Behnke, 1999), which would later become the BOC exam. The BOC began as a not-for-profit agency in 1989 to provide the accrediting certification for the entry level AT profession (BOC, 2020a).

Today the BOC exam is a 175-question computer-based test designed to determine entry-level knowledge of the five AT domains, similar to other allied health entry-level master programs. For example, the occupational therapy (OT) certification exam is 170 questions in length (NBCOT, 2020). The five domains included in the Practice Analysis 7th Edition (BOC, 2015) "are designed to define the current entry-level knowledge, skills and abilities required for practice in the profession of AT" (p. 6). However, the test has gone through multiple changes in the past 13 years. The seventh edition of the practice analysis became effective for the April 2017 BOC examination and "serves as the blueprint for the BOC exam" (BOC, 2015, p.6). The current version of the BOC examination had derived the weights of the questions on the exam from the Practice Analysis 7th Edition.

The five domains of AT and weights for the current BOC exam are as follows:

- Domain 1: Injury prevention and wellness promotion, 19.8% of exam questions.

- Domain 2: Examination, Assessment, and Diagnosis, 24.3% of exam questions.
- Domain 3: Immediate and Emergency Care, 15.5% of exam questions.
- Domain 4: Therapeutic Intervention, 27.4 % of exam questions.
- Domain 5: Healthcare Administration and Professional responsibility, 13% of exam questions.

Domains 2 and 4 account for over 50% of all questions on the current BOC certification exam (BOC, 2015).

Until 2007, the BOC examination consisted of three components: simulation, written, and a practical section and required candidates to pass all three parts. The test had a first-time pass rate of 46% for all three components in the 2005–2006 year (BOC, 2007). A two-part combined test replaced the three-part exam in April of 2007. The two-part BOC examination format consisted of a 125 scored multiple-choice section, and two scored hybrid problems with 12 to 17 items in each.

The first-time pass rate for the two-part test in the 2007–2008 year was 39% (BOC, 2009). In 2009, the hybrid component was replaced by a comprehensive test of 125 scored items and 50 experimental items that consisted of multiple-choice, multi-select, and drag-and-drop items. The first-time pass rate for the 2010–2011 year was 60% (BOC, 2010). Currently, the BOC examination pass rate for all test takers for the 2018–2019 year was 66% (BOC, 2020b).

There have been multiple changes in the accreditation standards, exam format, and the Practice Analysis, which is currently in its seventh edition. These changes impact previous research's ability to be generalized to the current population of BOC exam test takers. Additionally, due to the accreditation standards by CAATE, AT education programs are placing more emphasis on maintaining and improving their BOC examination pass rates. Identifying

predictors of student success can aid programs in the ability to identify and adjust policies that may support an increase in their first-time BOC examination pass rate.

Factors Predicting Student Success in AT

Research on factors predictive of student success on the BOC exam has primarily focused on undergraduate programs (Gayford, 2018; Harrelson et al., 1997; Hickman, 2010; Middlemas et al., 2001; Searcy, 2006; Williams & Hadfield, 2003). Until 2004 the internship route to certification was still possible, and many researchers were focusing on the differences between undergraduate and internship route BOC examination results. BOC candidates that had graduated from an AT curriculum program consistently outperformed internship route candidates, which was one reason supporting the elimination of the internship route in 2004 (Harrelson et al., 1997; Middlemas et al., 2001; Starkey & Henderson, 1995; Weidner & Henning, 2002). Additionally, the decision made in 2015 to transition to the PM level as a minimum degree requirement has limited the number of PM programs until recent years. While previous literature includes some PM program data in multiple studies, only three studies solely focus on predictors of PM program outcomes (Bruce et al., 2019; Murray, 2014: Walters, 2020). With the limited research on PM AT programs, it is important to consider previous research with a focus on undergraduate programs. Therefore, this review of the literature will focus on research done with both undergraduate and PM programs.

Student Variables as Predictors of Success

Research with AT programs has consistently found Grade Point Average (GPA) as a predictor of student success on the BOC exam (Bruce et al., 2019; Harrelson et al., 1997; Middlemas et al., 2001; Murray, 2014). Harrelson et al. (1997), in a cohort study, reviewed 53 students from one university between 1978 and 1992 to identify significant predictors of student

first-time pass on the BOC examination. Researchers used a multiple linear regression with the dependent variable of the number of attempts to pass the BOC examination's written and oral sections. The variables analyzed were predominantly related to GPA. They included overall, AT, and minor academic GPAs (all on a 4.0 scale), fraternity or sorority affiliation, ACT composite score, teaching or non-teaching degree track, and the number of semesters of enrollment. Of these variables, the composite of variables related to GPA and ACT score was a significant predictor of increased success of the first-time completion on the BOC exam. No single variable was a significant predictor. However, the small sample size, the lengthy timeline of the study, and the cohort design make the study's findings not generalizable to the PM AT population. Additionally, since the variables were found predictive in the composite, multiple variables included in the model do not apply to PM level students and therefore would not be generalizable to the population.

Middlemas et al. (2001) also found the continuous variable of GPA (4.0 scale) to be a significant predictor of student success in a sample of 270 first-time test-takers in 1998. Researchers solicited all BOC candidates from April and June of 1998. Respondents reported their gender, overall GPA at the time of exam application, number of clinical hours completed, and certification route type. Respondents approved the release of their exam scores on the exam's written, practical, and simulation portions. The researcher used a two-way analysis of variance (ANOVA) to determine differences in pass rates between internship and curriculum route candidates, a multiple linear regression analysis to identify any predictors of increased exam scores, and logistic regression to determine any predictors of increased odds of passing the exam. The study resulted in significant differences in exam pass rates between internship and curriculum route candidates, with curriculum route candidates having statistically higher pass

rates. Researchers found no interaction effects between variables. In the regression analysis, GPA was the only significant predictor of the high exam score. For every one-point increase in GPA, there was a 1.8 increase in the written exam score, a one-point increase in practical oral score, and a 17-point increase in simulation score. However, this was only a one-time sample, subjects were self-selected with a 19% response rate, and the results may not be representative. The limited response and self-selection design may have created some bias, with successful subjects on the exam more likely to respond.

A dissertation by Searcy (2006) reported similar results to Middlemas et al. (2001) in a survey of athletic trainers who had successfully passed the BOC exam on the first attempt in 2005. A 35-question survey obtained information on the program and clinical rotation characteristics of 212 randomly selected certified athletic trainers for predictors of success on the BOC examination. The logistic regression resulted in individuals having 1.4 higher odds of passing the BOC examination on the first attempt for every 1-unit increase in GPA (4.0 scale). The survey instrument underwent face validation and a pilot test. However, researchers did not report a validity or reliability analysis. Therefore, the instrumentation used in this study may not have accurately and precisely captured the constructs of interest.

Krieger (2014) studied the relationship between cognitive development, GPA, and BOC examination results. Using a convenience sample of 74 students in Illinois from 11 different institutions in a multiple regression analysis, the researcher found the continuous variable of GPA (4.0 scale) moderately positively correlated and the best predictor of successful first-time pass of the BOC exam. Results indicated that for every one-point increase in GPA, there was a 0.4 increase in BOC exam score with 18% of the variance in their model explained by GPA. However, the relatively small sample, limited geographic representation, and subject self-

reported data impact the findings' validity and generalizability. Additionally, the study population consisted of senior year students, and it is unclear if any PM program students were in the study. Therefore, the results of this and other previous research lack generalizability to PM students and programs.

Only two researchers have used PM programs solely in their analysis (Bruce et al., 2019; Murray, 2014). In a dissertation, Murray (2014) performed a retrospective analysis of 73 PM students from three different programs between 2007 and 2010. Multiple regression analyses determined the relationship between age, gender, admissions GPA (4.0 scale), final GPA (4.0 scale), and BOC examination results. The study resulted in both admissions GPA and final GPA having a weak significant relationship with a successful first-time pass of the BOC exam and did not find GPA to be a significant predictor of passing the exam on the first attempt. Gayford (2018) reported similar correlation and regression results regarding GPA in a multiple regression analysis of 295 undergraduate AT programs.

However, Bruce (2019) did find GPA to be a significant predictor of success on the BOC examination in a cohort study of 117 students at one PM AT program from 2004 to 2013. Researchers reported for every one-point increase in graduate GPA (4.0 scale), students had 12.32 higher odds of passing the BOC exam and 1.68 higher odds of the relative frequency of success.

A key difference in the variables used in the Murray (2014) study and Bruce (2019) is the use of Graduate Record Examination (GRE) scores. The GRE is a test commonly used as an admissions requirement for a graduate study designed to measure a student's verbal reasoning, quantitative reasoning, and analytical writing skills (ETS, n.d.). Murray did not include using the GRE scores into the model where Bruce used a receiver operating characteristic (ROC) curve

analysis in determining cutoffs for student demographic factors. Bruce et al. (2019) found the three most robust predictors were graduate GPA over 3.44, quantitative GRE score over 143, and verbal GRE score over 145. Students who had three factors had a 97% first-time pass rate on the BOC exam.

The literature has supported academic variables such as GPA and GRE scores as a predictor of student success on the BOC examination (Bruce et al., 2019; Harrelson et al., 1997; Krieger, 2014; Middlemas et al., 2001). Additional student demographic factors, such as age and gender, have been non-predictive of BOC results (Middlemas et al., 2001; Murray, 2014; Parham, 2017; Searcy, 2006; Turocy et al., 2000). However, in a survey of 346 PM AT programs, Parham (2017) concluded that males were 20% more likely to pass, although more recent research is needed to validate these results. Therefore, when using program-level data, variables related to admissions selectivity should be included in future research to control academic ability due to more selective institutions having higher GPA, SAT, and ACT score students admitted. However, institutional and programmatic factors can influence a student's academic performance, and it is essential to consider the additional variables of a student's environment.

Programmatic Variables as Predictors of Success

Historically, AT education has placed a significant emphasis on clinical experience and the number of hours a student spends working with a certified athletic trainer. In the new 2020 standards, CAATE requires that all clinical education requirements be met through two years of graduate coursework and address Standards 56 through 94 within the clinical education component, in addition to their curricular content. Additionally, CAATE will require students to participate in at least one clinical immersive experience as part of their professional education.

CAATE defines an immersive clinical experience as a practicing intensive day-to-day experience lasting at least four weeks (CAATE, n.d.b).

The most common programmatic factor considered in the research of undergraduate programs is clinical education (Hickman, 2010; Middlemas et al., 2001; Searcy, 2006; Turocy et al., 2000) with limited research in PM programs (Walters, 2020). However, clinical education and its ability to predict success on the BOC exam have been non-predictive (Middlemas et al., 2001; Searcy, 2006; Turocy et al., 2000). Clinical experience included in a study by Turocy et al. (2000) of 269 first-time test-takers over six months evaluated clinical rotations' characteristics as a predictor of success on the BOC examination. A linear regression analysis found the number of hours, sports assignments, and the rotation location to be non-predictive of success. While clinical experiences were non-predictive of overall success on the exam, researchers did find that students who completed 400 hours additional over their required number of hours for both the internship and curriculum routes did have higher BOC pass rates. However, completing over 400 additional hours did not have a relationship with higher BOC pass rates.

Additionally, Middlemas et al. (2001) found that the number of hours and GPA provided a significant slight increase in the prediction of success on the BOC exam. However, the model only explained 7% of the variance in scores. Hickman (2010) also found clinical hours non-predictive of BOC exam success. In a cohort study of 24 graduates from a National Collegiate Athletic Association (NCAA) Division I university from 2007 and 2010, Hickman found no significant relationships between total hours of clinical rotation and type of clinical rotation and passing the BOC exam. The small amount of variance explained by the model used by Middlemas et al. and Hickman's use of a cohort study impact the generalizability of both studies' results.

Other research in AT investigating the number of clinical rotations has resulted in a significant relationship with passing the BOC. Searcy (2006) found that more than three clinical rotations increased a student's likelihood to pass at least one section on the first attempt but did not have a significant relationship with the successful first-time completion of the entire exam. Additionally, Williams and Hadfield (2003), in a survey of program characteristics with 54 AT program directors, used multiple linear regression and found a significant positive correlation between the variety of clinical sites and exam pass rates. Students who received more than one type of site explained 6% of the variance in the scores. However, the small amount of variance explained by this model limits and the use of undergraduate programs in both studies limits the generalizability to the population of PM AT programs.

Previous research has focused on undergraduate programs' clinical experiences. More recently, Walters (2020) published a dissertation that included analyzing PM clinical education components of predicting student BOC examination first-time 3-year aggregate pass rate. This study evaluated 38 PM AT programs with multiple regression analysis. Walters selected the variables for the model using a backward selection of transformed data. Only three variables are included in the model: maximum required clinical hours per week, a clinical capstone course, and the number of dual-appointed faculty. This model's results indicated that the number of dual appointed faculty and maximum required clinical hours per week were both significant predictors of BOC 3-year aggregate first-time pass rates. However, the small sample size limited the number of variables in the model, and there were no variables included controlling for student or institutional factors. Therefore, the results of this study should be interpreted with caution, and more research is needed. With the new accreditation requirements for AT clinical

educational experiences, research needs to further evaluate the relationship between clinical education program components and student outcomes.

Besides clinical education, a few studies in AT investigated programmatic factors related to faculty and their relationship with BOC exam scores (Williams & Hadfield, 2003, Walters, 2020). Currently CAATE mandates that all programs have at minimum three core faculty members. Programs have until July 2023 to comply with this requirement. Additionally, CAATE only requires the program director have an earned doctoral degree (CAATE, 2020) and does not differentiate between an academic or clinical doctoral degree.

Williams and Hadfield (2003) found faculty highest degree attainment had a significant positive correlation with the BOC examination pass rate and explained 7% of the model's variance, and the results should be interpreted with caution. Faculty that were also practicing clinicians explained 7% variance, and faculty that had K-12 teaching experience resulted in 7% of the variance. Both variables negatively correlated with BOC examination pass rates. The results of Walters (2020) found similar results with the number of faculty with clinical responsibilities. The authors theorized that faculty with clinical responsibilities most likely devote less time to teaching, resulting in a negative relationship (Williams & Hadfield, 2003: Walters, 2020). However, Williams and Hadfield could not explain why K-12 teaching experience would have a negative relationship with BOC exam results. It is unclear if they included PM programs in their study, but at the time of the study there would have been very few PM programs in existence. Additionally, the BOC exam data used in both of the studies discussed included data from the three-part exam phased out in 2007 or the hybrid exam that replaced it in 2009. Therefore, further research on PM AT programs' faculty attributes related to first-time BOC examination pass rates is needed.

Parham (2017) investigated additional programmatic factors on cohort demographics using a secondary dataset that contained all records of candidates who sat for the BOC examination between February 2012 and June 2016. This study included 18,127 candidates from 346 different AT programs who met the criteria for inclusion in the analysis. The researcher used a multilevel logistic regression model to determine if there was a relationship between age, gender, race, and the odds of the first attempt to pass the BOC exam. There was a significant relationship between race and sex and passing the BOC exam. Persons of color had 52% lower, and males had 21% higher odds of passing on the first attempt. However, these results contained data from both undergraduate and PM programs and may not be generalizable PM population.

Most of the research done in AT education investigating the relationship between programmatic factors and BOC examination results focuses mainly on clinical educational components, such as type, length, and the number of clinical rotations (Middlemas et al., 2001; Searcy, 2006; Turocy et al., 2000). While type and length of clinical rotations were non-predictive of BOC exam success (Middlemas et al., 2001; Turocy et al., 2000), Searcy (2006) found more than three clinical rotations to increase the likelihood of first-time BOC exam success. Additionally, Middlemas et al. (2001), Searcy, and Walters (2020) have found relationships between the number of clinical hours and BOC pass rates. With the limited studies addressing clinical experiences in PM programs and more programs offering clinical immersion experiences due to the new requirements of the 2020 standards, more research is needed with PM AT programmatic factors and their relationship to first-time BOC pass rates.

In AT education, there has been limited research on didactic programmatic factors related to faculty. Both Williams and Hadfield (2003) and Walters (2020) have found negative relationships between BOC exam pass rates and faculty with clinical responsibilities.

Additionally, Williams and Hadfield found a positive relationship between the highest degree attained and BOC exam success (Williams & Hadfield, 2003).

Lastly, only one study of cohort demographics and has found significant relationships between gender, race and first-time BOC pass rates (Parham, 2017). Research suggests that clinical rotation numbers, faculty characteristics, and cohort demographics correlate with BOC exam results. No study has solely evaluated this in PM programs. The existing research lacks generalizability to both the PM population and the current structure of the BOC examination. There is a need for this study which looks at programmatic factors that pertain to faculty characteristics within PM AT programs.

Institutional Variables as Predictors of Success

Institutional variables often impact the behavior and operation of the institutional programs and are influenced by the university mission and governance structure (Berger, 2000). Standard institutional variables used in educational outcome research are funding type, Carnegie classification, and geographic location (Asprey et al., 2004; Cook, Engelhard, et al., 2015; Parham, 2017; Riddle et al., 2009). The funding type of institution refers to whether the funding is primarily by the state or privately funded and classified as either a public, private not-for-profit, or private for-profit (NCES, 2019). Carnegie classification assigns higher education institutions a categorical type based on the degrees granted from the institution and their research productivity obtained from data reported to the National Center for Education Statistics IPEDS survey (Carnegie Classifications, n.d.). In addition to programmatic factors, institutional variables are not frequently used in AT studies to predict success. A possible explanation for this is the heavy use of cohort studies and the inability to obtain a valid sample of institutions.

Parham (2017) investigated programmatic and institutional factors and their relationships to BOC exam results, used institutional aspects of funding type, Carnegie classification, and geographic locations in the multilevel logistic regression. Institutional factor results were significant for a relationship between both funding type and Carnegie classification. Private institutions had 40% lower odds and Historically Black Colleges and Universities (HBCUs) had 87% fewer odds of a first-time pass on the BOC exam. Parham is the first study published in AT that uses multiple years and a representative sample of AT programs. However, while this study's results included both undergraduate and PM programs, they were not reviewed independently from one another. This study suggests that there is a relationship between institutional factors and BOC pass rates. However, more research is needed to support these results further. Additionally, research is required to determine aspects of university behaviors, interactions with student demographics, and their relationship with BOC examination results.

Most of the literature on predictors of success on the BOC exam in the AT field used undergraduate programs, had small sample sizes, and relied on self-reported data (Hickman, 2010; Middlemas et al., 2001; Searcy, 2006; Turocy et al., 2000). Additionally, there is little research on the fully computerized version of the BOC exam currently in use (Bruce et al., 2019; Murray, 2014; Parham, 2017). Lastly, research on factors predicting success focuses on student demographic factors and fails to investigate the relationship between the programmatic and institutional behaviors that may affect student outcomes.

Factors Predicting Student Success in Healthcare Education

The lack of literature on master's level professional degree programs in AT education makes it essential to examine other healthcare fields with similar degree level requirements. Much allied healthcare, such as PT and OT, and medical fields like physician assistant (PA) and

nursing, have sought to identify institutional and programmatic relationships to exam pass rates (Andreeff, 2014; Asprey et al., 2004; Cook, Engelhard, et al., 2015; Cook, Landry, et al., 2015; Covington et al., 2016; Higgins et al., 2010; Kaddoura et al., 2017; Meiners & Rush, 2017; Novalis et al., 2017; Riddle et al., 2009). Physical therapists are allied health practitioners who specialize in managing patients' conditions through prescribed exercise, hands-on care, and patient education. The educational requirements to practice as a physical therapist are a clinical doctorate from an accredited program and successful completion of the National Physical Therapy Exam (NPTE) (CAPTE, n.d.). Researchers have examined institutional and programmatic predictors of success on NPTE due to the recent degree change in PT education. The PT minimal degree requirement is now at the clinical doctorate level (APTA, n.d.). Despite the minimal degree requirement, the similarity of the professions still makes this comparison important.

In addition to PT, it is crucial to include literature in other professional master's level programs. Like AT, OT also has a minimal educational degree requirement of a PM and has a national certification examination requirement. Studies of OT educational outcomes have found an undergraduate GPA to be predictive of increased success on certification examinations (Novalis et al., 2017). OT, a similar rehabilitative allied health field to PT and AT, focuses more on improving patients' daily living activities (AOTA, n.d.). Additionally, PAs are medical professionals that diagnose and treat illness alongside a patient's principal healthcare provider. The entry-level degree for licensure as a PA is also a master's degree from an accredited PA program and completing the Physician Assistant National Certification Examination (PANCE) (AAPA, 2020). The majority of literature on PA performance on the PANCE has focused on

student academic performance and has found similar results to the allied health fields (Andreeff, 2014; Ennulat et al., 2011; Higgins et al., 2010)

PT, OT, PA, and nursing professions are all fields with professional degree-granting programs that require a certification exam to practice. Therefore, reviewing the literature in these fields of study offers more insight into institutional and programmatic factors and predicting student success at the graduate level. This section of the review will discuss recent literature in other healthcare disciplines that include student, programmatic and institutional factors as predictors of licensure examination performance.

Student factors as predictors of success

Academic Variables. Other allied health fields such as PT, OT, PA, and nursing have commonly investigated student factors related to licensure exam pass rates. Like AT, GPA has been found predictive of success on the NPTE, which is the PT certification exam (Cook, Engelhard, et al., 2015). Cook, Engelhard, et al. (2015) used logistic regression on the Commission on Accreditation for Physical Therapy Education (CAPTE) institutional data, which included all 185 accredited PT programs in 2011, to look at modifiable programmatic variables that increased success on the program's 1-year and 3-year high pass rates. This study used the program pass rate as a dichotomous variable of high (> 99% pass rate, n=102), and low (< 99% pass rate, n=83). Researchers used a univariate logistic regression on all independent variables for both 1-year and 3-year pass rates. The analysis's student-level factors were a composite GPA variable of undergraduate and prerequisite GPA (4.0 scale), diversity, and age. The final multivariate analysis found the multivariate logistic regression model resulted in two significant predictors: a GPA of over 3.52 (*OR*=3.68) and the graduating cohort's age (*OR*=0.58) had higher 1-year pass rates. However, a GPA of over 3.52 (*OR*=5.43) was the only predictor of a higher 3-

year pass rate (Cook, Engelhard, et al., 2015). These studies suggest that the student-level factors are the most predictive of success on the NPTE certification exam. However, pass rates as a dichotomous variable to compensate for skewed data may lead to a less sensitive analysis of the interdependent relationship between the variables.

In PA programs, Higgins et al. (2010) studied admission variables as predictors of successful first-time completion of the PANCE in a retrospective analysis of 740 students from six different PA programs. A hierarchical multiple regression analysis found that GPA and GRE scores were predictive. Additionally, in a retrospective cohort study of 155 students from one university from 2006 to 2010, Andreeff (2014) found similar predictive results for admission GPA (4.0 scale). Results demonstrated that for every one-point increase in admission GPA, there was a 50-point increase, on an 800-point maximum, in the PANCE score.

Additionally, academic performance was a significant predictor of failure on the NPTE examination (Riddle et al., 2009). Riddle et al. (2009) found the students who had a failed course or received academic probation had 5.89 higher odds of failure on the NPTE examination. Novalis et al. (2017) reported similar results in OT. Students placed on academic probation were more likely to fail, with 23% of students who had been on probation failing the exam on the first attempt compared to 0% failing, which had not been on probation. The nursing literature has also reported similar results. Kuddauro et al. (2017) found that students with course grades under a C (*OR*=0.42) were a significant predictor of decreased odds of passing the National Council Licensure Examination-Registered Nurses (NCLEX-RN).

Most of the literature on predictors of exam pass success in professional degree programs focuses on predictors of individual student success using variables associated with students' academic abilities and has demonstrated similar predictive results to literature found in AT.

Therefore, it is crucial to include variables related to the student's academic abilities as control when considering programmatic relationships between programmatic factors and programmatic outcomes such as certification exam pass rate.

Demographic Variables. Multiple disciplines have investigated student demographic variables and their relationship to individual student success. While this study aims to look at student demographic information as a programmatic cohort variable, reviewing studies that looked at student demographics and success individually is still relevant and prudent. Asprey et al. (2004) studied the relationship between age, gender, and PANCE scores in a stepwise regression analysis of all PANCE test-takers in 1990, 1995, and 2000. The total number of subjects included in the analysis was 9,247. A significant weak negative correlation between age and score was found, like results in other allied health fields (Cook, Engelhard, et al., 2015). Scores also differed by age and gender, with females having higher average scores and lower failure rates than males. While scores did differ by age and gender, they were not predictive of success in both the Asprey & Dehn (2004) and the study by Andreef (2014), which also found age and PANCE score had a weak negative correlation.

However, a study of two different types of nursing programs found no relationship between age, gender, and student outcomes. Kaddoura et al. (2017) performed a multivariate logistic regression on 235 first-degree accelerated and second-degree accelerated Bachelor of Nursing students at one university to predict success on the NCLEX-RN. The study used demographic and academic characteristics. No demographic characteristics were significant predictors of increased odds of passing the licensure exam. However, they did not review programmatic factors and their relationship to the academic success of students. The research has

yielded inconsistent results in age and the relationship to student licensure exam scores, and therefore, other manipulative factors may have a superior ability to increase student outcomes.

While individual student demographics are mostly non-predictive of success on professional certification exams, it may be more relevant to look at the demographics within program cohorts to understand better the relationship between organizational behaviors and programmatic student outcomes.

Programmatic Factors as Predictors of Success

Programmatic levels' decisions often reflect aspects of organizational behaviors and may have a relationship with programmatic outcomes. Additionally, professional programs are often judged based on their outcomes, not only by their respective accreditation bodies but also by prospective students. Programmatic factors commonly examined in the literature are program spending, program length, credits, clinical education requirements, and faculty characteristics.

Faculty and Spending. One reflection of organizational behavior on the programmatic level is programmatic spending, with a large part of that being program faculty spending. In a study by Covington et al. (2016), program spending and faculty composition were two variables that were significant predictors of increased student success. Covington et al. investigated institutional expenditures and their impact on a 3-year pass rate. Dependent variables included were budget, teaching and research space, faculty factors, and clinical education sites. Researchers used an analysis of covariance (ANCOVA) between programs with a 100% first-time pass rate and a <100% first-time pass rate for both raw resources total and raw resources per student cohort. This study found that institutions that spent more per student and had higher faculty expenses per student had a significantly higher 3-year 100% pass rate on the certification exam, with a mean difference of $6,257 and $4,552 per student respectively. The mean core full-

time faculty per student, full-time faculty per student, and adjunct faculty per student were significantly higher in the programs with a 100% 3-year pass rate (Covington et al., 2016). Additionally, an earlier study by Mohr et al. (2005), who investigated programmatic factor and NPTE program pass rates in 132 out of a total of 175 accredited PT programs in 1999. A multiple regression analysis found a significant positive relationship (*OR*=1.12) between the number of Ph.D. and EDD faculty and higher pass rates.

While the increase in faculty numbers and highest degree attained by the faculty resulted in significant differences in 3-year pass rates, research suggests that the student to faculty ratio and skill level are more likely the result than faculty activities (Cook, Engelhard, et al., 2015). The publication by Cook, Engelhard, et al. (2015) found that the number of APTA faculty did have a relationship with increased NPTE pass rates. APTA credentialed faculty have done coursework and obtained credentials beyond the licensure's entry-level degree requirements (APTA, 2020). In a subsequent study, Cook, Landry, et al. (2015) investigated faculty's scholarly activity and their relationship with NPTE programmatic pass rates. Researchers used public/private status, cohort diversity, mean program GPA (4.0 scale), and the number of faculty as control variables. They performed a univariate logistic regression and found no statistically significant relationship between total scholarly productivity and pass rates. Additionally, a recent study using the CAPTE dataset by Dickson et al. (2020) found no significant relationship between faculty highest degree, scholarly activity, and NPTE pass rates. The lack of significant findings suggests that the programmatic behaviors that directly influence student learning are more relevant to examine.

Clinical Education. The clinical education component is another area where students gain valuable educational experience, and it is important for researchers to consider. Like AT,

PT has evaluated the relationship between clinical education program factors and student licensure examination scores. In PT, clinical educational factors are non-predictive of success on the NPTE (Cook, Engelhard, et al., 2015; Covington et al., 2016). Additionally, student clinical skill performance has also been non-predictive of NPTE success (Meiners & Rush, 2017). Researchers measured clinical skill performance on the 18-item ordinal scale and the validated Physical Therapy Clinical Performance Instrument (PT CPI) designed to assess student skills during clinical internships (Roach et al., 2012). Meiners and Rush (2017) used a hierarchical multiple regression on 134 students graduating from one mid-western university between 2012 and 2014. The model included student age, gender, undergraduate GPA (4.0 scale), verbal GRE score, quantitative GRE score, first-year PT school GPA (4.0 scale), and PT CPI score. While GPA and GRE variables were significant predictors of success in all models, the addition of PT clinical performance instrument scores in the fourth model did not increase its significance. Therefore, student clinical skill levels may not be as predictive as their academic performance for NPTE exam success.

Research suggests that while academic variables are the most predictive, there are relationships between programmatic variables and student outcomes. Additionally, faculty variables and resource allocation have a relationship with examination pass rates, and future research should include these aspects of institutional behaviors. While the literature in health fields offers additional insight into the programmatic relationship to licensure examination outcomes, longitudinal research in other fields is essential to review to strengthen the results' validity and generalizability.

Institutional factors as predictors of success

Institutional factors included were institutional type, geographic region, and institutional classification. Additional articles published using the same data set as Cook, Engelhard, et al. (2015) further investigate institutional behaviors (Covington et al., 2016). Similar to the previous study by Cook, Engelhard et al. and the AT literature (Parham, 2017), Covington et al. (2016) reported public universities had significantly higher pass rates with 50 out of a total of 78 universities with a 3-year 100% pass rate.

Moreover, Riddle et al. (2009) identified a significant relationship between institutional funding type, Carnegie classification, and failure. However, the authors cited a complicated relationship that made them unable to conclude from the results. These findings do suggest that there are interactions between institutional behaviors and student outcomes. However, researchers did not consider factors that differ between those students who had academic difficulty who passed and those who failed. More research is needed to identify possible specifics.

Additionally, Odom-Maryon et al. (2018) is the only recent study found in nursing that evaluated the relationships between institutional and programmatic characteristics on NCLEX-RN pass rates. A total of 832 nursing program directors completed the survey of program attributes, including characteristics related to institutional qualities, faculty characteristics, and admission criteria. Multivariable logistic model results using a binary pass rate of 80% or above and below 80% found public institutions (*OR*=1.65) to be significant predictors of higher odds of passing the NCLEX-RN on the first attempt. While this study is a nationally representative sample, it does not consider student factors other than the number of hours worked a week and non-English speaking that may interact with program factors.

The literature on licensure exam success in the allied health and medical fields has widely supported student academic variables as predictive of success on licensure examinations and yielded minimal programmatic predictive results. Some results suggest that institutions and programs should invest expenses into areas that directly impact student learning, such as faculty. The research results suggest a complicated relationship between student, programmatic, and university factors that warrants further investigation. While the literature in other allied health and medicine disciplines offers more recent studies on larger populations, with some studies spanning multiple years of data, there is still a need for the outcomes to be assessed within the PM AT population.

Conclusion

Within the relatively short period for AT education, there have been multiple transitions that have limited researchers' ability to obtain large samples of longitudinal data on which to base programmatic decisions when seeking to increase their first-time BOC pass rates. There is a heavy reliance on cohort studies that lack reproducibility to strengthen their validity. With the increased need for accountability and transparency, programs to improve and publish student outcomes are increasing. In AT education, the first-time BOC pass rate is a significant marker of a program's success. Additionally, there is a lack of literature that can be generalized to the PM-level population due to the recent degree change. Therefore, it is crucial to identify areas where programs invest resources to increase their student outcomes. Additionally, the resources needed may differ by the student and institutional demographics. Future research in programmatic factors and their relationship to student outcomes should focus on the differences in programs and control for the student and institutional differences.

Conceptual Model

Due to the AT degree's transitioning and the accreditation requirements to maintain a first-time 3-year aggregate BOC examination pass rate over 70%, it is crucial to identify factors that may affect student outcomes. Increasing the first-time BOC examination pass rate is essential for programs that are non-compliant with Standard 6 and need to develop a plan to address the deficit. Identifying programmatic factors that can be manipulated to increase student first-time BOC pass rate may help Standard 6 non-compliant programs identify areas for change. A conceptual model based on the current literature to assess programmatic factors and their relationship with first-time BOC pass rate should include the following variables listed below.

The academic ability of the student needs to be included in future research to control for university selectivity. The predictive results of GPA in multiple studies across multiple disciplines suggest it is a valid measure for predicting success on licensure exams (Andreeff, 2014; Bruce et al., 2019; Cook, Engelhard, et al., 2015; Higgins et al., 2010). Universities with a more selective admissions process would likely have higher examination pass rates, due to admission preference given to higher GPA students (Astin, 1971; Braxton, 1993). Therefore, controlling for student academic ability required using the program's admissions selectivity. The program's admissions selectivity will represent the students' academic ability within the separate cohorts, with more selective institutions having higher numbers of applicants and lower admittance rates, and admission preference given to higher GPA students.

A comprehensive model should include the diversity of the cohort because the literature showing race/ethnicity has had a relationship with examination pass rates and the decrease in pass rates among HBCUs (Cook et al., 2015; Honda et al., 2018; Parham, 2017). While most of the literature has found race and ethnicity to be non-predictive, this could result from the lower

levels of diversity within programs and the inability to obtain large enough sample sizes. If diversity rates vary between programs, this may be an important variable to consider.

With the new standards in AT now requiring a clinical immersion, it is unclear what impact this may have on examination scores. While the literature does not suggest that the type of rotation has a relationship with BOC pass rates, there has been literature in AT that suggests a relationship between the number of rotations (Searcy, 2006). Therefore, it is important to consider the number of immersions and length.

Faculty number per student, highest degree of core faculty members, and spending on professional development all need consideration as well. While literature in AT has not addressed the number of faculty, literature in PT suggests that programs with lower faculty to student ratios and increased expenses on faculty per student have a relationship with increased examination pass rates (Covington et al., 2016; Mohr et al., 2005). Additionally, the highest degree attained and clinical training of faculty members did have a relationship with BOC examination results in AT programs (Covington et al., 2016; Williams & Hadfield, 2003). Therefore, faculty variables warrant further examination in PM AT programs.

The inclusion of the institutional variables of funding type and selectivity is necessary. Evidence in both AT and other health professions consistently suggests that public universities have higher success rates (Cook, Engelhard, et al., 2015; Odom-Maryon et al., 2018; Parham, 2017). The program admissions selectivity used in place of institutional selectivity adequately represents institutional selectivity due to 64% of all PM AT programs using their own secondary admissions process instead of direct admission through the institution in 2017-2018 (CAATE, 2019).

The conceptual model for this study uses the student input factors of race and ethnicity and admissions selectivity. Modifiable programmatic environment factors include factors that pertain to faculty composition, faculty to student ratios, spending on professional development, and clinical immersion length. Institutional environment factors are the institutional type and admissions selectivity.

Chapter 3: Study Design and Methods

This retrospective quantitative study examines programmatic factors as predictors of first-time BOC pass rates in CAATE accredited PM AT programs. This study addressed the following research question: When controlling for institutional and student factors, what programmatic factors are significantly related to first-time BOC pass rates? The following chapter will cover the data source, variables, data cleaning procedures, and data analysis procedure. The input and environmental factors determine relationships between the outcome variable of the 1-year first-time BOC pass rate.

Data Source

Before submitting the data request, a Not for Human Subjects Research application was submitted to the Seton Hall University Institutional Review Board. This study was deemed "Not Human Subjects Research" and was therefore beyond the Institutional Review Board's purview. The data requested was from the CAATE accreditation database. CAATE collects data annually as part of accreditation requirements for all accredited AT programs to determine their accreditation standing. Programs are required to report program outcomes, cohort demographic information, program expenses, clinical immersion information, faculty degree and numbers, and faculty to student ratios as part of an annual review. In Fall 2020, an external data use request was sent to the CAATE Research Review Sub Committee for approval. Access to data for all PM AT programs that graduated a cohort in 2018–2019 was requested. The use of the 2018–2019 year was requested. Due to the interruption of the 2019–2020 testing period due to COVID-19, data has been affected both by the academic year being interrupted and the BOC testing dates. Therefore, data from the 2019–2020 year is not representative of a typical year and would

not be generalizable to future years. The 2018–2019 academic year data allows for the most extensive and most accurate sample of PM AT programs.

The use of the CAATE database allows for the inclusion of the entire population of accredited PM AT programs and provides consistency and accuracy of reporting for the variables used. Additionally, the use of the CAATE data allows for the inclusion of all PM programs that graduated a cohort in 2018–2019, and since all programs are required to submit the data yearly, this source is the most comprehensive source for AT program data.

Variables

Dependent Variable

The dependent variable is 1-year BOC first-time pass rate. The first-time pass rate is a standard measure of a program's success, and CAATE requires a minimum 3-year aggregate pass rate of 70%. The 1-year BOC first-time pass rate is being used instead of a 3-year aggregate because the sample size for the 1-year BOC first-time pass rate allows for a large sample. Additionally, the first-time pass rate is being evaluated as a continuous variable and a dichotomous variable of 100% first-time pass rate or not, due to the predominate use in the literature as a dichotomous variable. Therefore, the dependent variable of the 1-year BOC first-time pass rate is measured by two indicators in the study.

Independent Variables

The information for the independent variables requested for inclusion in the study collected by CAATE is the race and ethnicity of the cohort, number of students that applied, number of students offered admissions, core faculty number, core faculty highest degree, total students enrolled, student to faculty ratios, clinical immersive experience hours, professional

development expenses, and institution type. Further details on data management are provided in the next section.

The student factors consist of the race/ethnicity of students within each cohort and reported as the program cohort's diversity. The variable of cohort race/ethnicity is a dichotomous variable of low and high diversity based on the population mean, reported in the 2018–2019 CAATE analytic report, of 1:4 (.25) of non-white to white students (CAATE, 2020). High diversity represents programs with a diversity ratio above the population mean ratio of program diversity. In this study, the admissions selectivity ratio represents the academic ability of the cohorts. Unfortunately, CAATE does not collect information on cohort GPA or admission requirements.

Additionally, most PM programs used a secondary admissions process and did not use direct admission through the university. Therefore, the use of institutional-level data to represent undergraduate admission selectivity may not be accurate (CAATE, 2020). Admissions selectivity represents student academic ability and GPA. Typically, more selective institutions have lower admittance rates, with admission preference given to higher GPA students (Astin, 1971; Braxton, 1993).

Programmatic factors, including the students per one core faculty number and students per one laboratory faculty member, is continuous data. The inclusion of the number of students per core faculty member was important to conceptualize the number of core faculty to total student enrollment. Currently, CAATE only requires a minimum of three core faculty members, which are full-time faculty members whose primary responsibility is to teach within the AT program (CAATE, n.d.b). In this study, the number, or students per laboratory faculty ratio allowed for a more accurate measure of the student to faculty ratio across different course

formats. Laboratory faculty instruct the laboratory skills classes and consists of core, alternate full-time faculty within the university and adjunct faculty. Laboratory classes tend to have lower student to faculty ratios than lecture courses, which in large cohorts have very high student to faculty numbers. Therefore, the use of the laboratory faculty to student ratio is important to include.

Professional development expenses were reported as a continuous variable as the natural log, adjusting for the variable skewness and kurtosis which allowed for a for normal distribution. The use of expenses on professional development variables will allow for conceptualizing the institution's resource allocation related to investment in their PM AT programs. This study required the transformation of core faculty highest degrees into a percentage of faculty with an academic or clinical doctorate. CAATE does not stipulate a difference between required doctoral degrees; therefore, academic (Ph.D. & EdD) and clinical doctorates (DAT, DSc) were appropriate to include. Lastly, clinical immersive experience hours are the number of hours per week. Since CAATE only requires one four-week clinical immersive experience and does not regulate hours per week (CAATE, n.d.b), they only collect data on the number of immersive hours per week and not the number of immersive experiences provided.

The institutional factors considered are institutional type and program admission selectivity rate. Institutional type (public or private) is reported as a dichotomous variable. The program admission selectivity rate mentioned above represents institutional selectivity as well. All PM AT programs that graduated a cohort in the 2018–2019 graduation year data were included.

Data Management

This research did not require individual universities' names, and the university name was removed and given a university code by CAATE before sending the data for analysis. The raw data set was received in an Excel format and downloaded, and electronic files loaded on a USB memory key for storage. Once downloaded, the Excel files were then loaded into SPSS for coding and analysis.

Next, I coded student diversity, institutional control type and programmatic 1-year first-time BOC pass rate variables into dichotomous categorical variables. The student demographics were received in a separate data file and required an additional step for inclusion. First, each student's race and ethnicity were coded into three levels; white coded as 0, non-white coded as 1, and race unknown coded as 2. Once coded, each level's frequency count was run and imputed as separate variables for each university in the final dataset. I calculated the percentage of diversity by dividing the number of non-white students by white and non-white students. There were four institutions missing race data; the population mean of .25 was imputed for these cases. Next, the cohort's final diversity was reported as a dichotomous variable of high and low diversity, high diversity ($\geq .25$) coded as 1 and low diversity ($\leq .24$) coded as 0.

Institutional type transformed into a dichotomous public or private variable, public coded as 0 and private coded as 1. Next, I calculated institutional selectivity by dividing the number of students who applied for admission by the number of admitted students. Two institutions were missing admissions data, the population mean for admissions selectivity was calculated from the 2018–2019 CAATE analytics report (CAATE, 2020) and the population mean of 1.45 was imputed.

The 1-year first-time BOC pass rate for the program was transformed into a dichotomous variable of 100% pass rate or not. I transformed this variable to be used in a logistic regression as a sensitivity test. The 100% first-time pass rate was selected due to the prevalence of its use in prior research (Riddle et al., 2009; Cook, Engelhard, et al., 2015, Covington et al., 2016; Kuddauro et al., 2017; Parham, 2017). Programs with 100% first-time BOC pass rate was coded as 1 and under 100% was coded as 0.

Programmatic variables are continuous variables. Clinical immersion hours were left unchanged, and the natural log (LN) of program costs on professional development was used to eliminate the variable's high variability. The number of laboratory faculty was left unchanged and expressed as the number of students per faculty. The core faculty number was created by dividing the total student enrollment by the number of core faculty. The highest faculty degree was received in a separate data file. First, I transformed each faculty member's degree into three levels: master's degree coded as 0, academic doctorate or clinical doctorate coded as 1, and degree unknown coded as 2. Each level's frequencies were inputted in the final data file for each university as separate variables. I calculated the percentage of faculty with a doctorate variable by dividing the number of doctoral degrees by the doctorate and master's degree.

Data Analysis Method

Multiple Regression Analysis

I performed a multiple regression analysis of student, programmatic and institutional factors obtained from the deidentified CAATE accreditation data. All 77 PM programs with a 1-year BOC first-time pass rate for the 2018–2019 academic year were included.

A power analysis run before the final selection of the number of variables with the G*Power 3.1.9.4 software determined the maximum number of independent variables to include

in the sample size model. G*Power allows for an a priori estimate of the required sample size based on desired significance level, statistical power, and desired population effect size (Faul et al. 2009). I used the exact test for multiple linear regression: random model. The random-effect model was used because this study's focus is programmatic factors that are not fixed and may change over time. The power analysis type was a priori to compute the given sample size with a given α, power, and effect size. Since the power analysis for sample size was run a priori, an effect size of 0.3 (large effect), the α error probability of 0.05, power (1- β error probability) of 0.95 and eight predictors. The effect size for G*Power, based off Cohen (1988) requires specification of the squared population correlation coefficient p^2 and serves as the effect size measure (Faul et al., 2009). The analysis included an effect size of 0.3 for the research hypothesis (H_1p^2) and an effect of 0 for the null hypothesis (H_0p^2). The G*Power result indicated a sample size of 74 would be required to detect the necessary power and effect size with eight predictors included in the model.

After the data were cleaned and coded, descriptive statistics and frequency data were conducted on all variables (Tables 1 and 2). For categorical variables, crosstabulation was performed (Table 3). Next, Pearson's correlations were run on all continuous programmatic variables (Table 4). The independent variables included in the final multiple regression model were institution type, diversity of cohort, admissions selectivity, percentage of core faculty with a doctorate, core faculty to student ratio, lab faculty to student ratio, immersive hours per week, and professional development expenses (Table 6). Additionally, a variance inflation factor (VIF) test for multicollinearity between predictors was conducted (Table 5).

Dichotomous Logistic Regression as a Sensitivity Test

Due to most of the literature using logistic regression with a binary outcome, I conducted a sensitivity test using logistic regression using 100% first-time BOC pass rate or not (Table 7). The threshold of 100% first-time pass rate was used based on the frequency of use in previous studies (Cook, Engelhard, et al., 2015, Covington et al., 2016; Dickson et al., 2020). The same eight predictors of institution type, diversity of cohort, admissions selectivity, percentage of core faculty with a doctorate, core faculty to student ratio, lab faculty to student ratio, immersive hours per week, and professional development expenses used in the multiple regression model were in the logistic regression model. The dependent variable was a dichotomous variable of 100% first-time BOC pass rate or not.

Limitations

This study's limitations include the small sample size; several PM programs were not included due to undergraduate data included in their reporting and inability to determine if they had graduated a PM cohort. The small sample size limits the model's ability to detect small effects. Therefore, there may be variables with a smaller effect on first-time BOC pass rates not captured in this study. There was missing data, for which the population mean was used for imputing the missing data, this may have increased bias within the sample. Also, the use of race as a dichotomous variable may have limited the sensitivity of this variable, and its ability to differentiate between different categories of race and ethnicity, therefore, the results should be interpreted with caution.

Additionally, this study evaluated data from one year of reporting and does not capture changes in the program over the time the cohort was in the program. However, typical PM programs are two years in length, and the variables may have changed very little in that time

which may have minimal impact on the results. Lastly, this study is limited to programmatic factors that are reported to and collected by CAATE. Therefore, additional programmatic factors, such as program GPA, have a significant relationship with first-time BOC pass rates not used in this study. Factors related to specific spending and budgeting areas beyond faculty cannot be assessed using this study's data set. Also, faculty qualifications, training, and experience beyond degree attainment, which has been shown to have a relationship with programmatic outcomes, could not be fully assessed by this study.

Chapter 4: Results

For the 2018–2019 academic year, 98 PM AT programs were accredited by CAATE (CAATE, 2020); however, only 77 PM AT programs graduated a PM cohort. Once programs transition from the bachelor's degree to the PM accreditation, they are labeled PM; however, 11 of the 98 programs labeled as PM did not enroll or graduate a PM cohort in 2019. Since all programs had only one profile in the accreditation system, the bachelor's degree data were listed under the PM program by default. Therefore, while CAATE reported a higher number of PM programs, only 77 PM programs qualified as having graduated a PM cohort and were included in this study. Therefore, the final sample for this study includes 77 PM programs.

The results of the G*Power analysis (version 3.1.9.4) determined with an effect size (H_1p^2) of 0.3 and (H_0p^2) of 0, an α error probability of 0.05 and Power (1 – β error probability) of 0.95, a sample size of 74 would be the minimal sample size for eight predictors. Therefore, with a sample of 77, all eight independent variables were included in the analysis.

Descriptive Analysis

Of the 77 programs included 51% (n = 39) were Private Institutions and 49% (n=38) were Public Institutions. The mean 1-year first-time BOC pass rate for all institutions was 79.48 (*SD* = 21.9). Most programs, 51% (*SD* = 0.50), were low diversity, with a ratio of non-white to white students of under 25%. Admissions selectivity ranged from 0 to 3.5, with a mean ratio of one student admitted per 1.44 (*SD* = 0.53) applications completed.

Programmatic factors of clinical immersion hours per week ranged from 0 to 60 hours per week with a mean of 30.9 (*SD* = 14.7). Institutions reported a mean of 3.6 (*SD* = 1.9) core faculty per program. Core faculty highest degree earned was on average 83% (*SD* = 27) Ph.D., EdD and Clinical Doctorate faculty. The number of students per core faculty member was on

average 7.4 (*SD* = 4.1). The number of students per lab faculty member was on average 8.6 (*SD* =3.9) students per faculty member. The mean program expense on professional development ranged from $0 to $25,000 per year with a mean yearly expense of $4,861 (*SD* = $4,047). All descriptive statistics for categorical variables are detailed in Table 1 and continuous variables in Table 2.

Table 1

Descriptive Statistics for Categorical Variables

Variable	Frequency Percentage	*SD*	*n*
Institutional Type			
Public	49%	0.503	38
Private	51%	0.503	39
Cohort Diversity			
High Diversity ≥ 0.25	49%	0.503	38
Low Diversity ≤ 0.24	51%	0.503	39
1 Year First-Time BOC Pass Rate			
100%	29%	0.455	22
Under 100%	71%	0.455	55

Table 2

Descriptive Statistics for Continuous Programmatic Variables

Variable	Mean	*SD*	Min	Max	Skewness	Kurtosis
Independent Variables						
Diversity of Cohort	.284	.254	0	1.0	.781	-.003
Admissions Selectivity	1.44	.527	0	3.5	1.66	4.64
Clinical Immersive Hours Per Week	30.87	14.66	0	60	-1.08	.451
Core Faculty to Students	7.4	4.1	1.3	16.5	.319	-.892
Lab Faculty to Students	8.60	3.90	1	25	1.18	3.07
Total Amount Spent on Professional Development ($)	4,861	4,047	0	25,000	2.2	7.7
Percent Doctoral Faculty	.830	.264	0	1	-1.57	1.94
1-Year First-Time BOC Pass Rate	.795	.219	.00	1.00	-1.60	3.19

Cross Tabulation Analysis

Public institutions were equally split with 50% low cohort diversity and 50% high cohort diversity. Private institutions had a slight majority (51%) of low diversity (Table 3). There was even distribution of percentage of cohort diversity by institutional control type.

Table 3

Cross-tabulation for Categorical Independent Variables

Variable	Public	Private
Cohort Diversity (*n*)		
Low Diversity	50%	51%
High Diversity	50%	49%

Correlation Analysis

Admission selectivity had a small positive correlation with the diversity of the cohort ($r^2 = 0.255$, $p < 0.05$), with more selective institutions having a higher percentage of cohort diversity. Students per core faculty member had a moderate positive correlation with students per lab faculty member ($r^2 = 0.546$, $p < 0.01$). Total professional development costs had a small positive correlation with the students per lab faculty member ($r^2 = 0.233$, $p < 0.05$).

Table 4

Correlation Data for Continuous Variables

Variable	1	2	3	4	5	6
1. Diversity of Cohort	1.00					
2. Admissions Selectivity	.255*	1.00				
3. Clinical Immersion Hours per Week	-.930	-.063	1.00			
4. Core Faculty to Students	.135	.008	-.034	1.00		
5. Lab Faculty to Students	.156	.104	-.024	.546**	1.00	
6. Total Spending on Professional Development	-.004	-.030	.159	.179	.233*	1.00
7. Percent of Doctoral Faculty	-.019	-.067	.066	.047	-.062	.097

Note. Pearson Correlation *($p < .05$), **($p < .01$), ***($p < .001$)

Multicollinearity Analysis

The VIF test for the multiple regression analysis resulted in VIF values between 1.08 and 1.58, under the threshold of 10 (Hair et al., 1995). Therefore, this model's predictors are not highly correlated, and no multicollinearity issues exist in this model (Table 5).

Table 5

Variance Inflation Factor (VIF) Values for Independent Variables

Variable	VIF
Institutional Type	1.08
High Cohort Diversity	1.15
Admission Selectivity	1.09
Clinical Immersion Hours Per Week	1.05
Core Faculty to Students	1.56
Lab Faculty to Students	1.51
Log Expenditures on Professional Development	1.25
Percentage of Doctoral Faculty	1.19

Multiple Linear Regression Analysis

The multiple regression model (N = 77) (Table 6) was significant in predicting 1-year first-time BOC pass rates, and 32% of the variance in scores was explained by this model (adjusted r^2 = .322, f = 5.06, p < .001). This model identified four significant predictors of 1-year first-time BOC pass rates. Admission selectivity resulted in a .23% increase 1-year first-time BOC pass rate for every 1-point increase in selectivity (β=0.230, p<0.05). Clinical immersive experience hours per week resulted in a 0.30% increase in 1-year first-time BOC pass rates for every 1 clinical immersive hour increase (β = 0.303, p < 0.01). Spending on professional development resulted in a 0.25% increase in the 1-year first-time BOC pass rate for every 1-unit increase in the natural log of professional development spending (β = 0.233, p < 0.05). Lastly, for every 1% increase in the percentage of doctorate faculty, there was a 0.25% increase in 1-year first-time BOC pass rate (β = 0.254, p < 0.05). Further results are detailed in Table 6.

Table 6

Multiple Regression Analysis: Outcome Variable First-time 1-year BOC Pass Rate

Variable	(*b)*	Standard Error
Public Institution	-.096	.043
High Cohort Diversity	-.140	.044
Admission Selectivity	.230*	.041
Clinical Immersion Hours per Week	.303**	.001
Core Faculty to Students	.063	.006
Lab Faculty to Students	.079	.007
Percentage of Doctoral Faculty	.233*	.086
Log Expenditure on Professional Development	.254*	.013

Note. $N = 77$. Adjusted $R^2 = .322$***, *$P < .05$, **$P < .01$, ***$P < .001$

Logistic Regression Analysis

The logistic regression analysis (Table 7) was significant in predicting whether the pass rate is 100% or not, with an overall prediction accuracy of 81%. This model identified two significant predictors of 100% 1-year first-time BOC pass rates. An odds ratio of greater than 1 indicates a positive relationship and an odds ratio lower than 1 indicates a negative relationship (Portney & Watkins, 2009). For every 1 hour increase in clinical immersion hours per week there was a 6% increase in the odds of 100% 1-year first-time BOC pass rate ($OR = 1.06$, $p < 0.05$). Admission selectivity was also predictive, the range of selectivity scores were 0 to 3.5 applications received per every 1 student admitted. For every 1-unit increase in admissions selectivity there was a 471% increase in the odds of 100% 1-year first-time BOC pass rate (*OR* =

5.71, $p < 0.01$). Percentage of doctoral faculty and expenditures on professional development were not significant predictors in this model.

Table 7

Logistic Regression Analysis: Outcome Variable 100% First-Time BOC Pass Rate

Variable	*OR*	Significance	*SE*
Public Institutional Control	.497		.628
High Cohort Diversity	.300		3.57
Admission Selectivity	5.71	**	.701
Clinical Immersion Hours per Week	1.06	*	.029
Core Faculty to Students	1.05		.084
Lab Faculty to Students	.905		.095
Percentage of Doctoral Faculty	6.32		1.38
Log Expenditure on Professional Development	1.27		.380

Note. $N = 77$. $*P < .05$, $**P < .01$, $***P < .001$

Conclusion

This study sought to answer the following question: When controlling for student and institutional factors, what programmatic factors are significantly related to first-time BOC pass rates? This study suggests that there is a relationship between programmatic factors and 1-year first-time BOC pass rates. The percentage of academic and clinical doctorate faculty, total spending on professional development, clinical immersion hours, and admissions selectivity all had a significant positive relationship with 1-year first-time BOC pass rates. The next chapter will discuss these results as they relate to previous literature, implications, and future research.

Chapter 5: Discussion

This study aimed to investigate programmatic factors of PM AT programs and their relationship with BOC pass rates. This study was necessary to fill the literature gap on PM AT programs. Additionally, with the recent changes to the educational structure and the 7th Edition of the Practice Analysis, prior research on this topic is outdated. As discussed previously in Chapter 2, the 7th Edition of the Practice Analysis, which determines the content areas and weights for the BOC exam, was released in April 2017 (BOC, 2015). Therefore, research prior to this date does not use the current format of the BOC exam that is being administered today.

Currently, this is the only study that uses the CAATE accreditation data. While this was a small sample, this study included all accredited PM AT programs that graduated a cohort in the 2018–2019 academic year. Additionally, this sample represented the population and met the appropriate power to include all eight variables in the model.

This study used the entire sample of PM AT programs accredited by CAATE. However, only 77 programs had graduated a PM cohort, and a large majority of undergraduate programs (364) had yet to transition to the PM level. Undergraduate programs will not be allowed to enroll students after 2022 and will need to transition to the PM level or withdraw their accreditation. The large proportion of programs that have yet to transition to the PM level limited this study's sample size.

Sensitivity Test

This study utilized a logistic regression with the binary outcome of 100% 1-year first-time BOC pass rate or not as a sensitivity test. The results of the logistic regression analysis identified clinical immersion hours per week and admissions selectivity as significant predictors of increased odds of 100% 1YR BOC pass rate. The difference in the number of significant

predictors between the multiple and logistic regression models suggests that the multiple linear regression model was more precise in prediction of higher 1-year first-time BOC pass rates. Therefore, methods that use a continuous outcome should be adopted over a dichotomous outcome when the data permits, due to the increased precision and sensitivity of the multiple linear regression model.

Student Variables

Within this sample, student variables such as race and academic ability were included to control for student differences within each program and only admissions selectivity significant predictors of 1-year first-time BOC pass rates. The study had a mean cohort diversity of 28% non-white students, and CAATE reports a cohort diversity for all accredited programs of 25% non-white students (CAATE, 2020). Therefore, this sample was representative of the cohort diversity of the entire population of accredited AT programs.

In my study, diversity of the cohort was non-predictive of success on the BOC exam, which is different from previous studies. However, in prior studies that found race predictive, student factors were predictive when reviewed individually, but as a cohort variable in this study, they were not predictive (Honda et al., 2018; Parham, 2017). The study of PT exam pass rates by Cook, Engelhard, et al. (2015) has a similar result to my study, with the result that the mean racial diversity of under or over 15% was not a significant predictor of a high first-time programmatic certification exam pass rate. Therefore, while it may be a predictor of individual student performance, race may not be a significant predictor of programmatic performance. The lack of cohort diversity as a significant predictor could be due to low racial diversity within these programs; in PT, mean cohort diversity was 15%, and AT, the mean cohort diversity was 25% of minority students.

Lastly, research has demonstrated student factors as significant predictors of success on certification exams (Andreeff, 2014; Bruce et al., 2019; Cook, Engelhard, et al., 2015; Higgins et al., 2010). The use of GPA as a predictor was beyond this study's capabilities, and the use of admissions selectivity was used to capture the relationship between academic ability and programmatic outcomes. The results of my study support the theory that universities with a more selective admissions process would likely have higher examination pass rates, due to admission preference given to higher GPA students (Astin, 1971; Braxton, 1993). The sensitivity test further supports that student factors, such as academic ability, are predictive of increased odds of success.

However, with the decline in application for AT programs in the past few years (Dearie et al., 2021) programs will likely need to be less selective in their admissions to increase student enrollment. The possible decrease in selectivity of admissions places greater importance on modifiable program characteristics. Programs will need to identify ways in which they can increase and maintain student success.

Institutional Variables

The frequency of institutional type in this study was similar in proportions, 51% private and 49% public, to the population of all accredited AT programs (CAATE, 2020). Therefore, the institutional control type variable in my study was representative of the population of AT programs. In my study, the institutional type was not predictive of increased success on the BOC exam. However, institutional type factors in both AT and other health professions suggest that public universities have higher success rates (Cook, Engelhard, et al., 2015; Odom-Maryon et al., 2018; Parham, 2017).

Parham (2017) reported private institutions having 40% lower odds of a first-time pass on the BOC exam. However, in this current study of programmatic BOC pass rates, institutional control type was not a significant predictor of higher first-time BOC pass rates. In the study by Parham, undergraduate and PM students' results were reviewed with their success on the BOC exam and were not considered as a program average pass rate, resulting in the difference in results. Additionally, BOC results were analyzed with a logistic regression using a dichotomous outcome of pass/fail. Covington et al. (2016) also used logistic regression and reported public universities having significantly higher 3-year 100% pass rates in PT. However, the results of my study do not support a relationship between institutional control type and student outcomes. Neither the multiple linear or logistic regression models found institutional control type as a predictor of increased 1-year first-time BOC pass rates. There may be a complex relationship between student factors, programmatic and institutional control type that was unable to be assessed by the methods and data used in my study. Future research is needed to further assess institutional control type as it relates to organizational behavior and its relationship to programmatic outcomes. Additionally, methods that use a continuous outcome should be adopted over a dichotomous outcome due to the increased precision and sensitivity of the multiple linear regression model.

Programmatic Variables

The aim of this study was to investigate modifiable programmatic factors and their relationship with 1-year first-time BOC pass rates. The model used was significant in predicting 1-year first-time BOC scores and explained a moderate proportion of the variance between scores. Additionally, three of the model's five programmatic variables were significant predictors of 1-year first-time BOC first-time programmatic pass rates.

Core and Lab Faculty

In this study, student to faculty ratios for core faculty and lab faculty were non-predictive of success on the BOC exam. The mean number of students per core faculty member was 7.4 and 8.6 students per laboratory faculty member. Additionally, these variables were significantly moderately positively correlated, which suggests that there are similar faculty to student ratios between lecture and laboratory classes. Typically, laboratory classes have smaller faculty to student ratios. A mean of 8.6 students per laboratory faculty member, which is larger than the mean 7.4 students per core faculty member, suggests smaller class sizes. As previously discussed in Chapter 3, the number of students per core faculty member was calculated using total program enrollment. Currently, CAATE requires a minimum of three core faculty members. However, programs have until July 2023 to become compliant with this standard for accreditation (CAATE, n.d.b). Therefore, because CAATE is mandating a minimum core faculty number, there may be smaller programs with low total enrollment already meeting the core faculty number requirement that are contributing to the low number of students per core faculty number.

There was no literature found on core faculty and lab faculty numbers in AT. However, the lack of predictability of core and lab faculty variables are different from previous literature in PT, which found faculty-to-student ratios predictive of increased success on certification examinations. Findings in PT using logistic regression analysis of the mean core full-time faculty per student and adjunct faculty per student were significantly higher in the programs with a 100% 3-year pass rate (Covington et al., 2016). The difference in the methods may explain the different results.

Percentage of Doctoral Faculty

While the number of faculty to students was not a significant predictor in this study, the degree level of faculty members was predictive. Higher proportions of Ph.D., EdD, and clinical doctorate faculty members had a positive relationship with BOC pass rates in the multiple regression analysis. However, the percent of doctoral faculty being a non-significant predictor in the logistic regression analysis suggests that the proportion of variance in the outcome variable explained by percentage of doctoral faculty is small.

The significant predictive result of percentage of doctoral faculty is like results found by Williams and Hatfield (2003), with a sample of 54 AT programs, which found that programs with higher numbers of Ph.D and EdD faculty had higher first-time BOC pass rates. Additionally, Mohr et al. (2005), who investigated programmatic factors and NPTE program pass rates in 132 accredited PT programs in 1999, found a significant positive relationship between the number of Ph.D/EdD faculty and higher pass rates.

However, none of these previous studies looked at clinical doctorates beyond an EdD. Since the AT profession is moving to the PM level, clinical doctorates in AT (DAT) have gained popularity for practitioners looking to advance their skills. The inclusion of clinical doctorates as a terminal degree in this study was to capture faculty members with advanced practice skills and its relationship with programmatic outcomes. A study published by Cook, Landry, et al. (2015) found that the number of DPT faculty with an APTA credential did have a relationship with increased NPTE pass rates, and scholarly activity did not have a significant relationship with NPTE pass rates. APTA credentialed faculty have done coursework and obtained credentials beyond the DPT licensure's entry-level degree requirements (APTA, 2020).

In both the study by Dickson et al. (2020) and Cook et al. (2015), the number of Ph.D and EdD faculty were not significant predictors of NPTE exam pass rates. However, the minimal degree requirement to sit for the NPTE exam is at the clinical doctorate level. Therefore, the faculty of DPT programs would likely already possess a clinical doctorate. Whereas, in AT, the clinical doctorate is a relatively new degree and indicates advanced training in AT. The degree-level difference between AT and PT programs may explain the difference between AT and PT results. Therefore, the number of academic and clinical doctorate faculty may have a relationship with higher pass rates due to the advanced skills of the faculty members instructing the students.

Professional Development Spending

Another area related to faculty characteristics investigated in this study was the amount of spending on faculty development. There is currently no research on PM AT programs and their professional development spending related to student outcomes. This study suggests that there was a relationship between the two, with program pass rates increasing as professional development spending increased. However, the non-significant predictive results of expenditure on professional development in the logistic regression model suggests that this variable explains only a small amount of variance in the outcome variable. Other disciplines have documented the relationship between faculty and advanced clinical training (Cook, Landry, et al., 2015) and increased spending on faculty (Covington et al., 2016). However, these studies do not look at the program resources devoted to the professional development of faculty.

The development and continued education of faculty have become a priority for CAATE. CAATE has now included developing contemporary expertise within the new accreditation standards, which requires programs to document their faculty and preceptors' attainment and maintenance of contemporary expertise (CAATE, n.d.b). Additionally, many standards now need

to be addressed both clinically and didactically in which faculty and preceptors may have no formal education. As discussed previously in the literature review, standards relating to working in interdisciplinary teams, using evidence to inform practice, quality improvement, and the use of healthcare informatics have all been added to the 2020 core competencies effective July 1, 2020 (CAATE, n.d.b). These are all areas where athletic trainers certified before the new standards may not have received formal training in the new content area.

Overall total spending on faculty development had a positive relationship with the 1YR BOC first-time pass rate; however, the more faculty institutions had, the less the institutions spent per faculty member. Therefore, professional development expenses focused on increasing teaching faculty members in their course area of expertise may be most beneficial. Additionally, faculty transitioning to a PM will need additional support in developing the research component, supporting faculty and student scholarly activity (Cavallario et al., 2021), and meeting the instructional demand of new 2020 accreditation competencies (Eberman, 2019). Therefore, targeting professional development spending in faculty's teaching areas assists in the required maintenance and development of contemporary expertise, but it may also bridge the knowledge gap between faculty and the new core competencies.

Clinical Immersion Hours per Week

While the type of rotation and hours may not be significant (Middlemas et al., 2001; Hickman, 2010; Searcy, 2006), the number of rotations has resulted in a significant relationship with passing the BOC (Searcy, 2006). However, CAATE now requires students to complete four clinical rotations over two years. Therefore, most of a student's clinical rotations are standardized. At the time of data collection for this study, clinical immersive experiences were not required. However, immersive clinical experience has become required in addition to the

traditional clinical experience in the 2020 accreditation standards effective July 1, 2020. CAATE defines immersive clinical experiences as "practice-intensive experiences that allow the student to experience the totality of care provided by athletic trainers. Students must participate in the day-to-day and week-to-week role of an athletic trainer for a period of time identified by the program (but minimally one continuous four-week period)" (CAATE, n.d.b, p.2).

Since the clinical education component is such a large part of AT education, it was necessary to include immersive clinical hours due to the lack of research. This study indicates that the number of immersive clinical hours had a significant positive relationship with BOC exam pass rates. Additionally, the results of the logistic regression suggest that the clinical immersion hours per week explains a large proportion of variance in the outcome variable.

Multiple disciplines have adopted immersive experiences to provide students with an in-depth understanding of their profession's full scope (Harris et al., 2020). AT program directors have reported that immersive clinical experiences increase the exposure that gives the student more time with administrative tasks and day-to-day patient care and fosters stronger relationships with those they interact with within their rotation (Harris et al., 2020). As previously mentioned in Chapter 2, over 50% of the current version of the BOC exam relates to Domain 2: Examination, Assessment and Diagnosis and Domain 4: Therapeutic Intervention, which are most skills involved in day-to-day patient care (BOC, 2015).

The clinical immersive experience is designed to give students an intensive practice experience without disrupting their didactic coursework. The ability of immersive clinical hours to strengthen student knowledge and skills in AT in the domains representing half of the BOC examination questions explains the predictive result of immersive clinical hours per week. Therefore, increasing their knowledge and experience through increased clinical immersion time

increased the 1YR BOC exam pass rate. However, there may be a large variation in this variable due to CAATE not requiring a clinical immersive experience until July 1, 2020. Therefore, the number of hours may be significant due to some programs reporting no immersive clinical hours per week.

While immersive clinical hours per week resulted in an increase in 1YR BOC program pass rates in this sample, further research is needed to validate these results. Additionally, the interpretation of these results should be made with caution. The clinical immersion hours ranged from 0 to 60 hours per week with a mean of 30 hours per week (*SD* = 14.66). The concern is that if hours increased too high, students would experience a negative impact. In a study by Turocy (2000), undergraduate AT students who gained precisely 400 hours of experience beyond their required clinical hours had higher BOC pass rates. However, students who had more than 400 hours over the required amount saw no improvement in scores. Additionally, Walters (2020) found a negative relationship between maximum clinical hours and 3-year aggregate first-time BOC pass rates. Therefore, it may be wise for programs to limit maximum clinical immersion hours to avoid burnout and provide for a positive work-life balance.

This study sought to evaluate PM AT programs' programmatic factors and their relationship with BOC pass rates and fill the literature gap on PM AT programs. In conclusion, there was a relationship between programmatic factors and 1YR BOC pass rates. The percentage of academic and clinical doctorate faculty, total spending on professional development, clinical immersion hours all had a significant positive relationship with 1YR BOC pass rates. However, due to the sample size was small in this study only large effect sizes were detected. There may be alternate factors that may also contribute not captured in this study.

Implications and Future Research

Theoretical and Policy Implications

The focus of this study was on modifiable programmatic factors and their relationship with first-time BOC pass rates. While student and institutional factors were included, only admissions selectivity had a significant relationship with first-time BOC pass rates. Therefore, the results of this study support the theory that the environment for which the student is exposed has a relationship with the programs first-time BOC pass rates. The identification of modifiable programmatic factors aids programs in the decision-making processes for resource allocation or program delivery to improve their programmatic outcomes.

The significant positive relationship between expenditures on professional development found in this study supports the efforts by CAATE to require the maintenance and development of contemporary expertise for faculty (Standard 37). Standard 37 mandates that programs document professional development activities for faculty. Programs are now required to document faculty development activity category, date, and rationale for how the activity relates to their area of expertise (CAATE, n.d.b).

Additionally, these results support CAATE's addition of immersive clinical experience into the 2020 accreditation standards. The positive predictive relationship between the number of hours and first-time BOC pass rates, in both the multiple regression and logistic regression analysis, highlights the effectiveness of this experience for students. However, at the time of this study's data collection, clinical immersive experiences were not required, and these results may be different in the future once all accredited programs have clinical immersive experiences.

Practice Implications

BOC pass rates are typically a marker of programmatic success, and students often use the marker in their decision to attend. While attendance rates in the healthcare field are increasing, the overall number of applications in PM AT programs are decreasing (Dearie et al., 2020). The maintaining of good accreditation status and high BOC pass rates are two areas of importance to perspective graduate students (Dearie et al., 2020). Therefore, increasing the BOC pass rate may improve a program's sustainability due to the increased competition for students and by maintaining good accreditation status. Additionally, the decrease in number of applications received will force institutions to be less selective in their admissions. The less selective admissions process places much greater importance on programs to modify the student's environment to increase their potential for a successful outcome.

Programs with a lower selective admissions process, that are non-complaint with Standard 6, or are at risk of becoming non-compliant, should evaluate their clinical immersive experiences. Increasing the hours per week for students in their immersive experiences may increase their knowledge and skills highly weighted on the BOC exam. However, programs with already high clinical immersive hours per week requirements should be cautious about raising their hour requirements. Requiring too many clinical immersive hours per week may increase the risk of student burnout.

The results of this study support the programmatic investments into faculty development both through professional education and higher degree attainment. With the transition to PM level education, programs will need to offer more research components to their programs to fulfill the requirement of the master's level degree. Therefore, faculty with higher level research

degrees and more advanced research skills will be able to assist students in the fulfillment of master level degree requirements.

With the addition of new education standards focusing on practicing in interprofessional collaborative teams (Standard 61), use of evidence to inform practice, (Standards 62), the use of quality improvement to enhance patient care (Standard 63) and apply the practices of health informatics to the administration and delivery of patient care (Standard 64) (CAATE, n.d.b), faculty may need increased support in these areas to properly disseminate knowledge and skills to students. The finding from this study demonstrated that the development and degree level of the faculty member has a positive relationship with BOC pass rates, whereas the number of faculty per students did not. Faculty with a DAT, which is a clinical practice degree, will have increased knowledge and skills in these areas and may help programs meet the educational demands of the new required curricular content.

Programs that are transitioning to the PM level from a bachelor's degree, may benefit from both academic doctoral (PhD/EdD) and clinical doctoral (DAT) faculty to meet the demands of both the research component and the new curricular content. Additionally, programs that want to increase their 1-year first-time BOC pass rate should evaluate their professional development expenses and clinical immersion experiences as possible areas to modify to increase programmatic outcomes.

Future Research

This study focused on programmatic factors and their relationship with BOC pass rates, utilizing student factors at the programmatic level as a control. Therefore, students were considered as a whole cohort and their relationship with the outcome variable was considered at the programmatic level. Further investigation into individual student factors and their

relationship to individual outcomes is necessary to further identify how modifiable programmatic factors impact the individual student.

With the enactment of the 2020 accreditation standard, there will be changes within the educational content and structure of PM AT programs. The requirement of clinical immersive experiences and the development and maintenance of faculty contemporary expertise are two additions to the standards that warrant further investigation based on the findings of this study. Since this study uses data from before the enactment of the standards, future research is needed to assess if these changes result in a change in their relationship with BOC pass rates.

Currently, CAATE does not have hour requirements for clinical immersive experiences and only requires one 4-week rotation. Clinical immersive experience hours requirements should be investigated to determine if high maximum hours have a negative relationship with BOC pass rates. The number of clinical immersive experiences and the length of experiences should also be considered in future research.

Additionally, the documentation of contemporary expertise will allow for a more in-depth analysis of the relationship between faculty development and student outcomes. CAATE is requiring programs to document the type, frequency, content area of professional development. These factors should be considered for future research to further investigate the relationship between professional development and BOC pass rates.

While this study used the largest possible sample of PM AT programs available, the sample was still small and limited the strength of the analysis. Additional research is needed in the future, when there is a large available population of PM programs to validate these findings further. A larger sample of PM AT programs will allow for increased selectivity of the analysis, the detection of smaller effect sizes, and more variables to be included in the model. Future

models should include a more accurate measure of academic ability, due to the lack of a significant relationship between admissions selectivity and BOC pass rates. Additional studies should also include the use of 3 years of programmatic data and the 3-year aggregate BOC pass rate once more BA/BS programs have completed the transition to PM and have graduated 3 years of cohorts.

Future research conducted using the CAATE accreditation data for PM programs should not use the public data released by CAATE. The public data published by CAATE contains both undergraduate and graduate data in the PM category. Institutions that have PM accreditation status and have not enrolled cohorts or are still teaching a bachelor's degree to committed students will be included as PM in the public data. Therefore, using the public data will not be an accurate representation of the PM level data until all bachelor level programs are phased out.

Conclusion

This study was necessary to fill the gap in the literature on the relationship between programmatic factors and student outcomes. Currently, the entry level degree requirement is transitioning from the bachelors to the master's level, and most programs have yet to complete the transition (CAATE, 2020). Therefore, there is little literature that pertains to first-time BOC pass rates of PM programs. The AT program first-time BOC pass rates have become more important in recent years, with CAATE requiring programs to have a minimal pass rate of 70% to maintain good accreditation standing (CAATE, n.d.b). Additionally, accreditation status and first-time BOC pass rates often factor into students' decisions to attend a particular program. Therefore, with the declining rates of undergraduate students (Okahana et al., 2021) and the declining program enrollments within AT programs (Dearie et al., 2020) it is imperative

programs maintain high first-time BOC pass rates. Maintaining high programmatic first-time BOC pass rates benefits the program, students, and the AT profession.

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Appendix A

Seton Hall University IRB Non-Human Subjects Research Letter

June 16, 2020

Leslie Rippon

Seton Hall University

Re: 2020-101

Dear Ms. Rippon,

The IRB is in receipt of the application for your study entitled "Programmatic factors and relationship to athletic training education program outcomes." After reviewing the inclusive content, the proposed study was deemed to be "Not Human Subjects Research" and is therefore beyond the purview of the Institutional Review Board. Therefore, you are under no obligation to submit any further correspondence to the Seton Hall University Institutional Review Board regarding this effort, unless of course there are any modifications made to the design or intent of your study that may otherwise change the designation to human subject's research. If you plan to create any future correspondence with the Institutional Review Board about this study, please reference the ID# listed above.

Sincerely,

Director, Institutional Review Board

Seton Hall University

Office of the Institutional Review Board

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Appendix B

CAATE Data Request Approval Letter

CAATE
Commission on Accreditation of Athletic Training Education

November 18, 2020

Leslie Rippon MS, ATC
Assistant Professor for Department of Athletic Training Seton Hall University
[redacted]

Dear Ms. Rippon

The Commission on Accreditation of Athletic Training Education (CAATE) has reviewed the data request, *Programmatic Factors and Relationship to Athletic Training Education Program Outcomes.* At their most recent meeting, the Commission voted to **approve** the data request.

Please do not hesitate to contact the CAATE Office (512-733-9700) if we can be of further assistance.

Kind Regards,

Christine Murphy Peck

CAATE Interim Executive Director

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