

FOUNDATIONAL SCIENTIFIC KNOWLEDGE
IN ATHLETIC TRAINING CURRICULA

A Dissertation in Practice

presented to

the Faculty of the Graduate School
at the University of Missouri-Columbia

In Partial Fulfillment

of the Requirements for the Degree

Doctor of Education

by

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MAY 2017

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

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IN ATHLETIC TRAINING CURRICULA

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DEDICATION

This dissertation is dedicated to my intelligent, brave, compassionate, funny, and beautiful daughters, Haley C. Maxwell and Shelby E. Maxwell. You are my inspiration in life and my proudest, most honored accomplishment. Love you always.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

ACKNOWLEDGEMENTS

First and foremost, I would like to acknowledge my parents, Margaret and Bernard W. Wehring Ph.D., for their unwavering support throughout my education and life. Next, a heartfelt thank you to my dissertation committee members: Dr. Pilar Mendoza, Dr. Jeni Hart, Dr. Kathleen Quinn, and Dr. Beth Tankersley-Bankhead for your expertise, patience, and guidance through the dissertation process. I would like to acknowledge Dr. Dawn Emerson, my “unofficial” outside committee member, colleague, and friend. I could not have completed this dissertation without your support, laughs, and statistical knowledge.

Thank you to my daughters, Haley and Shelby, for being patient with me while I completed this endeavor. Haley, you won, you finished your degree first! Shelby and I are right behind you. Finally, I would like to thank Dr. Deidre Leaver-Dunn, Dr. Jeri Zemke, and Dr. Toni Torres-McGehee for their unwavering friendship, support, advice, and love over the past decade (DLD that’s two decades for you!). #innersanctum

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	ii
LIST OF TABLES	v
SECTION ONE: DISSERTATION IN PRACTICE	1
Introduction.....	2
Background of the Study	3
Statement of the Problem.....	5
Purpose of the Study	7
Research Questions.....	8
Theoretical Framework.....	9
Design of the Study.....	12
Setting, Sample and Data Collection	13
Data Analysis	14
Limitations, Assumptions, and Design Controls.....	16
Definitions of Key Terms	18
Significance of the Study	21
Summary.....	22
SECTION TWO: PRACTITIONER SETTING FOR THE STUDY	23
Introduction.....	24
Organizational Analysis.....	24
Organizational History of Athletic Training Education.....	24
Structural and Symbolic Organizational Context of AT Education	26
Political and Human Resource Organizational Context of AT Education	32
Leadership Analysis.....	35
Leadership Context for AT Education.....	35
Path-Goal Theory and Situational Leadership in AT Education	35
Trait and Skills Model Approach in AT Education.....	38
Implications for Research in AT Education.....	41
Summary.....	43
SECTION THREE: SCHOLARLY REVIEW FOR THE STUDY	45
Introduction.....	46
History of the Curriculum in Athletic Training Education.....	46
Curriculum Theory.....	50

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Foundational Knowledge	56
Foundational Knowledge in Health Professions and Education.....	57
Current Status of AT Curricula Literature	63
Summary	65
SECTION FOUR: CONTRIBUTION TO PRACTICE	67
Preface.....	68
Executive Summary:.....	70
Presentation.....	72
SECTION FIVE: CONTRIBUTION TO SCHOLARSHIP	86
Preface.....	87
Submission Ready Manuscript.....	88
SECTION SIX: SCHOLARLY PRACTITIONER REFLECTION.....	112
REFERENCES	115
APPENDIX.....	120
VITA.....	148

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

LIST OF TABLES

Table 1: 1959 Athletic Training Curriculum Model.....	47
Table 2: Mid 1970s Athletic Training Curriculum Course Requirements	48
Table 3: 1983 Athletic Training Curriculum Subject Matter Requirements	49
Table 1: 1959 Athletic Training Curriculum Model.....	104
Table 2: Mid 1970s Athletic Training Curriculum Course Requirements	105
Table 3: 1983 Athletic Training Curriculum Subject Matter Requirements	106
Table 4: Descriptive Statistics, Course Present (yes/no) Regression Analysis (Individual science courses regressed on BOC pass-rates), and Summary ANOVA.....	107
Table 5: Descriptive Statistics of BOC Pass Rate by Course Category	108
Table 6: Descriptive Statistics, Regression Analysis, and t-Test for BOC Pass-Rate by Course Categories (yes/no), Chemistry and Physics.....	109
Table 7: Descriptive Statistics, Multiple Regression Analysis and T-Test for BOC Pass Rate by Courses Category, Physics I and Physics II (yes/no).....	110

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

SECTION ONE:
DISSERTATION IN PRACTICE

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Introduction

The world of the Athletic Training (AT) academic program director is in the middle of a tumultuous time for a leader. The AT program director must abide by the Commission on Accreditation of Athletic Training Education (CAATE) accreditation standards, teach the competency content outlined by the National Athletic Trainers' Association (NATA), and prepare students to successfully complete the Board of Certification (BOC) examination. In addition, this young profession is currently transitioning from an undergraduate degree to a graduate degree and physically relocating the degree from the historic location in schools of education to schools of health professions within universities. These changes have been mandated by the CAATE, and communicated by each institution's AT program director to the university administration, clinically practicing athletic trainers, preceptors, students, parents, and the public.

These accreditation mandates have not been warmly embraced by the majority of clinically practicing ATs or educators across the nation because these new mandates represent change. Change customarily creates conflict as it generally benefits some individuals while negatively impacting others (Bolman & Deal, 2008). The CAATE's drive is to align the profession of AT with other similar health professions, including physical therapy and occupational therapy. The AT profession longs for recognition as capable health care providers, but it is caught between the history of the profession and the reality of health care practices today.

As a leader, the AT program director is charged with proposing the new graduate level degree. This involves an intentional evaluation of the curriculum and a decision-making process including: pre-requisite courses, degree requirements, ensuring that the

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

CAATE standards are encompassed and that the National Athletic Trainers' Association (NATA) Education Council's competencies are included in the curriculum. This study will focus on one aspect of curriculum development, the foundational *scientific knowledge* courses as pre-requisites for the graduate degree in AT.

Background of the Study

Athletic trainers are health care professionals who collaborate with physicians to provide preventative services, emergency care, clinical diagnosis, therapeutic intervention, and rehabilitation of injuries and medical conditions (Board of Certification, 2015; National Athletic Trainers Association, 2015). During 1990, the American Medical Association (AMA) first recognized AT as an allied health profession (Delforge & Behnke, 1999; Prentice, 2014). According to the Board of Certification (BOC), "Students engage in rigorous classroom study and clinical education in a variety of practice settings such as high schools, colleges/universities, hospitals, emergency rooms, physician offices, and healthcare clinics over the course of the degree program" (BOC, 2015, n.p.).

Over the past 20 years, the profession of AT has undergone many changes regarding the educational requirements leading to national certification and state licensure (NATA, 2014).

First, there were specific curricular requirements, and then a designated major. Currently, institutions of higher education must provide a Commission on Accreditation of Athletic Training (CAATE) which allows for an accredited stand-alone degree in athletic training (BOC, 2015; CAATE, 2015) if the outcome is to graduate eligible students for board certification and licensure.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

During 2014, the AT Strategic Alliance group was created representing the BOC, CAATE, National Athletic Trainers' Association (NATA) and the NATA Research and Education Foundation (NATA, 2015). This strategic group was charged with the task of researching the appropriate professional degree level for the profession of AT (NATA, 2015). During June, 2015, a mandate was announced to all programs stating that within a minimum of 7 years all AT programs must transition to a graduate level professional degree program (BOC, 2015; CAATE, 2015; NATA 2015).

With each academic change, there have been adjustments to what content must be included in an AT curriculum. According to Delforge and Behnke (1999), beginning in 1959, and then again in 1970, there was a defined list of courses all National Athletic Training Association (NATA) approved programs had to include in their AT curriculum. During the 1970s, the NATA Professional Education Committee (PEC) developed a list of required AT curriculum subject matter, a formalized list of behavioral objectives, and learning outcomes for the athletic training student (Delforge & Behnke, 1999). Furthermore, the PEC developed individual behavioral objectives for each course along with a skill competency checklist to evaluate the development of student clinical skills. As the PEC 1970 course list and behavioral objectives restricted the content taught in AT curricula, the PEC developed the 1983 Competencies in Athletic Training Education (Delforge & Behnke, 1999).

Today, programs gain accreditation through utilizing accreditation standards, which include a set of educational competencies developed by the NATA Education Council (NATA, 2015; CAATE 2015). The NATA educational competencies must be taught and evaluated in the AT degree coursework for the program to receive CAATE

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

accreditation. These competencies have replaced the set list of courses previously required in AT degree programs. The competencies include content in the following areas: evidence-based practice; prevention and health promotion; clinical examination and diagnosis; acute care of injuries and illness; therapeutic interventions; psychosocial strategies; referral, healthcare and administration; and professional development and responsibility (NATA, 2015; CAATE, 2015).

Upon graduation from a CAATE-accredited athletic training program, students are eligible to take the AT national board examination offered by the Board of Certification© (BOC). Successful completion of the BOC examination leads to the AT credential of Athletic Trainer, Certified (ATC) which allows the individual to apply for state licensure (BOC, 2015). Holding an AT state license allows ATs to legally practice under the direction of a physician.

The 2012 CAATE Standards require each accredited AT degree program to maintain a minimum of a 70% 3-year aggregate, first-attempt BOC pass rate. Each program must maintain this pass rate to be in compliance with the accreditation standards. Beginning in 2015, programs that do not have a 3-year aggregate pass rate above 70% are put on probation by the accrediting agency CAATE (CAATE Insight, 2015). To date, 25% (93/371) of programs are on probation (CAATE, 2016).

Statement of the Problem

The leaders in AT education have been charged with transitioning undergraduate AT programs to graduate level programs. Along with the degree change, the CAATE has published a statement and a *proposed* accreditation standard mandating inclusion of *foundational scientific knowledge* courses as pre-requisites for admission to the graduate

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

AT curriculum (CAATE, 2016). Currently, there are no published data regarding what foundational *scientific knowledge* courses are currently being taught in the accredited programs across the nation. Nor is there a published rationale for inclusion of the courses. This lack of information is a problem for program directors. How can the leaders in AT education make sound curricular decisions without having complete factual information?

As undergraduate AT programs transition to the graduate degree level, the educational competency curriculum model will remain in place. As previously stated, the competency curriculum model does not include a set list of courses. Instead, the pre-requisite coursework and required coursework for AT academic programs vary from program to program across the United States. One notable feature is that the NATA Educational Competencies do not include *foundational scientific knowledge* for athletic training students (CAATE, 2015; NATA, 2015). The lack of a requirement for *foundational scientific knowledge* in AT academic programs has resulted in a discrepancy across the 371 accredited programs regarding required foundational science courses as pre-requisites or program requirements (CAATE, 2016). For example, some programs require one chemistry course; others require two chemistry courses and two semesters of physics. Unlike other health professions, such as occupational therapy (OT), nursing, and medicine, from a thorough literature review, there appears to be no published research in the profession of AT that defines *foundational scientific knowledge* or discusses what *foundational scientific knowledge* courses are recommended for AT program admission or successful BOC pass rates.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

The CAATE (2015) summer newsletter, *Insight*, publicly identifies educational components that it believes will produce quality health care providers. According to CAATE (2015), the components include:

Periods of Full-time clinical engagement, strong *foundational scientific knowledge*, faculty with areas of specific expertise, the inclusion of the Institute of Medicine's core competencies, alignment with schools of health professions whenever possible and practitioners who function as mid-level (level II) providers (on par with PA, PT, OT, and NPs). (p. 2)

Given that the accrediting agency has identified the component of strong *foundational scientific knowledge* as a program component, educators and administrators have a need for research-based information on this topic to aid in making curricular decisions during this time of degree transition. Furthermore, during May of 2016, the CAATE electronically communicated with all Program Directors, sending a set of proposed accreditation standards for open comment. The proposed Standard 26 states, "The professional program requires prerequisite knowledge in biology, chemistry, physics, psychology, anatomy, and physiology" (CAATE, 2016). This proposed accreditation standard has no published evidence supporting the requirement, nor does it specify what content is expected to be taught or learned, to determine whether one or two chemistry or physics courses will be required.

Purpose of the Study

The purpose of this study is to provide AT educational leaders with evidence-based information to review and utilize during development of graduate AT curricula. This study addresses the gap in empirical knowledge related to the role of *foundational*

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

scientific knowledge in preparing AT professionals. In particular, the first step of this study was to identify which *foundational scientific knowledge* courses are currently being taught in all AT programs nationwide. Secondly, this study determined if student completion of chemistry and physics courses have an effect on successful first-time BOC pass rates. Also, this study will determine which of the *foundational scientific knowledge* courses/course combinations lead to the highest BOC first attempt pass rates. The data gathered from this study will give a research-based guide for *foundational scientific knowledge* during curricular development as academic programs transition from undergraduate to graduate level degrees.

Research Questions

The research questions guiding this study are:

Research Question 1: What *foundational scientific knowledge* courses are currently included in Athletic Training degree programs nationwide?

Research Question 2: Does inclusion of individual science courses have a correlation with Athletic Training programs 3-year aggregate first-time BOC pass rate?

Research Question 3: Does inclusion of individual chemistry and physics courses or combined have a correlation with Athletic Training programs' 3-year aggregate first-time BOC pass rate?

Research Question 4: What specific combination of physics and chemistry courses correspond to the highest first-time 3-year aggregate AT program BOC pass rates?

Theoretical Framework

The Curriculum Research Framework (CRF) phases developed by Clements (2007) were used as the lens to frame this study. Clements's (2007) CRF begins by describing and categorizing research for the development and evaluation of curriculum. The CAATE (2015) writes that it would like to see a strong *foundational scientific knowledge* within AT curriculums; however, as Clements (2007) claims, determining what specific courses or information should be included in the curriculum are generally not published and therefore not available for educators. In 2002, the National Research Council (as cited in Clements, 2007) stated, "Scientific knowledge is valued because it offers reliable documented and shared knowledge based on research" (p. 37). In particular, Clements (2007) suggests, "A valid scientific curriculum development program should address the basic issues of effect and conditions across the three domains of practice, policy, and theory" (p. 37). Clements's CRF outlines this evidence-based process focusing on the development, study, and evaluation of curricula (Clements, 2007). As such, this research study will utilize components of Clements's CRF to guide a research-based process to determine what science courses should be included in AT curriculum in relation to successful BOC outcomes.

The structure of CRF includes three categories: *a Priori Foundations*, *Learning Model*, and *Evaluation*. Within the three categories there are ten phases embedded. The *a priori foundations* category encompasses the following phases: (1) subject matter *a priori foundation*, (2) general *a priori foundation*, and (3) pedagogical *a priori foundation*. The *learning model* category contains phase (4) creating structure according to specific learning models. The *evaluation* category contains (5) market research, (6) formative

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

research, (7) formative research: single classroom, (8) formative research: multiple classrooms, (9) summative research: small scale, and (10) summative research: large scale (Clements, 2007). This study will only address the *a priori* subject matter phase (1), phase (4) learning models, and phases (6) formative research and (9) summative research: small scale.

Beginning with the first category, *a priori foundation*, includes establishing the process of “using scientific procedures to identify subject matter content that is valid within the discipline and makes substantive contribution to the development of the student” (Clements, 2007, p. 41). The NATA Educational Competencies are developed to guide curriculum content. However, there is no published research-based process utilized to develop these competencies. Remarkably, the profession of AT is aware of the concept of a research-based process because the BOC examination uses a research-based process to determine what will be included on the AT board examination. They developed this concept by conducting and publishing a role delineation (RD) study surveying clinically practicing ATs to determine the blueprint for content on the BOC exam. In particular, this survey includes the following content domains: injury and illness prevention and wellness protection, clinical evaluation, and diagnosis, immediate and emergency care, treatment, and rehabilitation, and organizational and professional health and well-being (BOC, 2010). The role delineation study is a research-based procedure to determine the subject matter content for the BOC examination; however, there is no research-based process to determine what science courses should be included in the AT curriculum.

The inclusion of specific science courses in an AT curriculum should be placed with a logical tie to the educational content. As Tyler (1949) specifies, the concept of the

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

a priori foundation category should play a role in the subject-matter domain, helping the students build from their past and present experiences and play a role in the development of future student understanding (as cited in Clements, 2007, p. 41). This relates to AT education. For example, a foundational science course in physics would contain subject matter in the area of light, sound, mechanics, heat, and electricity. For a student to understand complex content, how therapeutic modalities affect human tissue during the injury healing process, base science knowledge would be helpful prior to the therapeutic modalities course. A therapeutic modalities course is generally taught with a science course as a pre-requisite, but this is not always the case; therefore, students may go into a therapeutic modalities course without the basic science content one learns in a foundational scientific knowledge course.

Clements's (2007) second category of CRF is the *learning model*. The *learning model* involves the learning activities which are structured with domain-specific models of learning. For example, different teaching techniques/activities produce different ways of student learning. Learning activities can be grounded in empirically-based models of learning. In an AT curriculum, the learning may include: first, taking a science course to learn the basic scientific principles, then transferring the knowledge to understand the function of a therapeutic modality, and finally utilizing critical thinking to appropriately apply the modality to an injured athlete during a clinical course. In addition, per CAATE accreditation requirements, AT programs must electronically map the method or activity utilized to instruct and evaluate each educational competency. Further research would need to be done in athletic training to determine what learning model AT curriculum programs are utilized to decide on *foundational scientific knowledge* course inclusion into

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

their curriculum. To date, after an extensive review of the literature and relevant documentation, this study concludes that there is no set method for determining which science courses are currently being included in AT curricula. Without a method, there is no way to show evidence of deliberate thought toward a learning model or research based evidence.

The third category of the CRF includes formative and summative evaluation. Clements's (2007) example of curricula formative evaluation includes observing a small group of students' pilot testing a game or activity that is one component of a curriculum, to determine the effectiveness of the activity on learning. A classroom teacher may use pre- and post-test randomized experimental designs for measures of learning or standardized measures of curriculum goals. Another example, on a larger scale of formative evaluation, could be observing several classrooms for information about the effectiveness of the curriculum (Clements, 2007). This study used science course curriculum data accessed online as formative data. This formative data documents the specific *foundational science courses* required for each AT curriculum. Then this study compared the formative data with the summative data of 3-year aggregate program first-attempt BOC pass-rates, to determine whether the formative data was predictive of the summative data.

Design of the Study

This study addressed its research questions through a post-positivist, quantitative approach (Creswell, 2014). According to Creswell (2014), "Post-positivists hold a deterministic philosophy in which causes (probably) determine effects of outcomes" (p. 7) and defines quantitative research "as an approach for testing objective theories by

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

examining the relationship between variables” (p. 4). This study investigates the correlation between individual and combinations of foundational *scientific knowledge* courses within AT programs and the 3-year aggregate program first-attempt, BOC pass rate *outcomes*.

Setting, Sample and Data Collection

The setting for this research took place evaluating all CAATE-accredited AT programs in the United States. This study gathered all programs’ AT curricular requirements by electronically visiting each institution’s official website. The BOC 3-year, 2013-2015, aggregate first-time pass rates were retrieved from the publicly accessible CAATE website. The sample consists of the all CAATE accredited professional athletic training degree programs in the United States as of February 19, 2016 (N=371).

Three hundred forty-nine CAATE-accredited professional athletic training (AT) programs were included in this study. However, data were gathered on 371 professional AT programs. Twenty-two programs were excluded from this study for the following reasons: nine programs did not have their course degree completion requirements available on their institutional website, eight had a science course credit requirement without defining specific courses, and five were new programs which had not published the 3-year aggregate first-time BOC pass-rate.

This study retrieved the science course data by reviewing all CAATE accredited academic program’s degree requirements. Each accredited AT program has a published academic curriculum that must be available to faculty and students according to the 2012 CAATE accreditation standards (CAATE, 2012). The data gathered from the individual

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

program websites were first entered into an Excel spreadsheet. After completing the gathering of the science course information, the data were transferred into the Statistical Package for Social Sciences (SPSS) to obtain descriptive statistics. Next, the BOC 3-year (2013-2015) aggregate first-time pass rates for all AT Programs was accessed from the CAATE website and entered into SPSS.

Data Analysis

This study utilized quantitative analysis of collected categorical and continuous data to answer the research questions. All collected data were entered into SPSS version 20 to run the statistical analyses. This study set an alpha level of .05 for all comparisons of data, to determine if statistical significance was present. The eight independent/predictor variables are the *foundational scientific knowledge* courses. These categorical variables are the following science courses based on the different types of curricula of AT programs: anatomy, biology, chemistry I, chemistry II, physics I, physics II, physiology, and psychology. The continuous dependent/outcome variable was the BOC first-time pass rate for each AT degree program. The program BOC pass-rates are published as a 3-year aggregate percentage.

Research Question 1: What *foundational scientific knowledge* courses are currently included in Athletic Training degree programs nationwide?

First, each AT program/name of the institution was entered into SPSS. Next, the science courses in each program were individually coded “yes=0” or “no=1,” with the code of “yes” indicating the science course is a degree requirement for that AT program and “no” indicating the science course is not required. After all data were entered into SPSS, they were analyzed to obtain descriptive statistics utilizing frequencies.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Research Questions 2: Does inclusion of individual science courses have a correlation with Athletic Training programs' 3-year aggregate first-time BOC pass rates?

First, descriptive statistics were run on each individual science course as a predictor variable of BOC pass-rates. These statistics reported the number of programs that require each of the individual science courses, the mean BOC pass-rate, and the standard deviation of the BOC pass-rates. Next, a regression analysis was completed on each individual science course (independent variable) regressed on the BOC pass-rate (dependent variable).

Research Question 3: Does inclusion of individual chemistry and physics courses or combined have a correlation with Athletic Training programs' 3-year aggregate first-time BOC pass rate?

Chemistry and physics were chosen to create course categories because the current proposed CAATE accreditation Standard 26 lists both subject areas as required curriculum pre-requisite knowledge. However, the standard does not delineate how many courses/credit hours are required, does not list a specific level, or the actual content knowledge required of chemistry and physics. Each AT program was coded with a below category number, to designate which category matched their program requirements.

1. Chemistry I only
2. Chemistry I, II only
3. Physics I only
4. Physics I, II only
5. Chemistry I, physics I only
6. Chemistry I, II, physics I, physics II only
7. Chemistry I, II, physics I only
8. Physics I, II, chemistry I only

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

9. No chemistry, no physics only

After all categories of courses (1-9) were coded into SPSS, descriptive statistics were run, indicating that approximately half of all AT programs fit into Category 9 (no chemistry, no physics), with the other half coded into categories 1-8 (yes on chemistry and physics). Due to the finding that approximately half of the programs did not require chemistry or physics, the programs were re-coded as 0= chemistry and physics, 1= no chemistry, no physics. Next, a two-tailed *t*-test was run between the group with physics and chemistry and the group without these two courses. Then, a regression was run, using the new chemistry and physics categories as the independent variables regressed on BOC pass-rates as the dependent variable.

Research Question 4: What specific combination of physics and chemistry courses correspond to the highest first-time 3-year aggregate AT program BOC pass rates?

Descriptive statistics were completed for each chemistry and physics course category to determine the mean BOC pass-rates for each of the nine course categories. Next, these categories were ranked from highest BOC pass-rate mean to lowest.

Limitations, Assumptions, and Design Controls

There are many factors that determine AT program success. Program success can be measured through quality of instruction (didactic and clinical), quality of clinical experience (preceptor and clinical site), student learning (didactic and clinical), and overall program effectiveness (student exit surveys, BOC scores, student job placement). This study looked specifically at *foundational scientific knowledge* courses as predictors of BOC examination scores. This study cannot control for all other factors involved in AT programs.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

In regard to the *foundational scientific knowledge* courses, one limitation within this study was that the researcher did not have course syllabi for each of the courses. The assumption was made that content is similar in the courses (e.g., Chemistry I) at the university undergraduate level across the United States.

Within this study, there was no control in place for the quality of course delivery and instruction. There was no control to determine what content was taught in the individual program athletic training courses. For example, within a Therapeutic Modalities course the instructor may teach physics course content, therefore remediating any lack of knowledge a student has prior to taking the BOC examination. Likewise, an AT pharmacology instructor may re-teach basic chemistry within the upper level AT course.

This study does not have access to the information per individual student within programs and course substitutions. For example, a curriculum may have required a specific chemistry course, but allows a substitution with a higher-level chemistry course. It is also assumed that the published four-year plan for each institution is the actual course plan that the students successfully completed to obtain the AT degree.

The final reported limitation is represented by the 3-year aggregate BOC first-time pass rates for each AT program. The published pass-rates do not statistically adjust for the number of students in each cohort. For example, a program could have an annual pass-rate of 100%, which reflects a cohort of one student or a pass-rate of 100%, reflecting a cohort of 30 students.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Definitions of Key Terms

This study required the use of specific vocabulary. In order to clarify terminology, the following terms are defined.

A priori. Relating to what can be known through an understanding of how certain things work rather than by observation

Anatomy course. A basic human anatomy course, usually offered in the first or second year of college. This course may be offered in the Biology Department and may be the first of a two-course sequence covering anatomy and physiology. This course may have a pre-requisite of a general biology course. There may or may not be a laboratory component.

Athletic Trainer. Athletic trainers are health care professionals who collaborate with physicians to provide preventative services, emergency care, clinical diagnosis, therapeutic intervention and rehabilitation of injuries and medical conditions (BOC, 2015; NATA, 2015).

Athletic Training program/professional program. The athletic training (AT) program or professional program is a professional entry-level degree program leading to becoming a certified, licensed athletic trainer. Currently, professional AT programs can be at the undergraduate level or graduate level.

Biology course. A university first or second year general biology course with no pre-requisites required.

BOC. The National Athletic Trainers' Association Board of Certification, Inc. (BOC) is the recognized credentialing agency for the profession of athletic training. Originally a committee within the National Athletic Trainers' Association, Inc. (NATA), the BOC has

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

evolved into a stand-alone credentialing board. In 1982, the Board of Certification was granted administrative independence from the NATA and was accredited by the National Commission for Health Certifying Agencies (NCHCA). In 1989, the BOC became incorporated (NATABOC, Inc.), complete with its own constitution and by-laws, officers, and articles of incorporation. The move to become its own entity was essential to satisfy the credentialing accrediting agency. Today, the BOC is accredited by the National Organization for Competency (BOC, 2007).

BOC 3-year aggregate first-time pass-rate. The CAATE publishes individual program scores, received from the BOC, on their website. The individual program score is calculated by averaging the institutions' annual program pass-rate for the most recent three years. The annual program pass-rate is calculated by an average of individual student scores per year/cohort. There are no statistical adjustments in the pass rate, reflecting the number of students in each cohort.

CAATE. The Commission on Accreditation of Athletic Training Education was created on June 30, 2006 (CAATE, 2016). Incorporated in October 1991 as the Joint Review Committee on Education Programs in Athletic Training (JRC-AT) and the Committee on Accreditation under the Commission on Accreditation of Allied Health Education Programs (CAAHEP), CAATE is the accrediting agency for professional athletic training education programs. The American Academy of Family Physicians (AAFP), The American Academy of Pediatrics (AAP), the American Orthopedic Society for Sports Medicine (AOSSM), and the National Athletic Trainers' Association, Inc. (NATA), cooperate to sponsor the CAATE and to collaboratively develop the *Standards for Entry-Level Athletic Training Educational Programs* (CAATE, 2007; 2016).

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Chemistry I course. A basic university first or second year chemistry course that is one semester, three to five credits, and may or may not have an accompanying laboratory component.

Chemistry II course. A basic university first or second year level chemistry course taken the semester after Chemistry I. Generally, Chemistry I is a pre-requisite for this course and there is a laboratory component.

NATA. The National Athletic Trainers Association. The NATA is governed by a ten-member board of directors plus a president. The ten board members are chosen from each of ten districts dividing the United States. The president is elected bi-annually by the membership (NATA, 2016).

Physics I course. A basic university first or second year level physics course. Generally, this is a three to five credit course and there may or may not be a laboratory component.

Physics II course. A basic university first or second year level physics course taken the semester after Physics I. Generally, Physics I is a pre-requisite for this course and there is a laboratory component.

Physiology course. A university human physiology course that may be in a two-course sequence of anatomy and physiology. Generally, this course is three to five credits and there may or may not be a laboratory component.

Psychology course. A basic university first or second year level psychology course. Generally, this is a 3-credit course and the first course offered in the area of psychology.

RD. RD is the acronym for the role delineation study performed every five years by the BOC. The RD serves as the blueprint for the BOC Certification Examination for Athletic Trainers. It defines the roles of the certified athletic trainer.

Significance of the Study

An extensive literature search provided no published research in the area of AT and *foundational scientific knowledge*; thus, this study will contribute information critical to the AT program curricular planning during the transition from an undergraduate to a graduate degree. Research by Clements (2007) indicates that government agencies and educators are in support of research-based curricula. Without research, specific to AT programs, *foundational scientific knowledge* in relation to BOC outcomes, the AT program director has minimal direction when deciding what sciences courses to include in the degree curricula.

Through data collection of science courses, this study developed an empirically-driven definition of *foundational science knowledge* currently being taught within the health profession of Athletic Training curricula. This timely study will contribute to the profession by determining what *foundational scientific knowledge* courses are taught in AT programs, at the time of the study, which correlate to the highest BOC pass rates.

This research contributes to the practice of educational leaders, administrators, and program directors in the profession of athletic training by providing empirical evidence in regard to *foundational scientific knowledge* courses as predictors of the BOC pass-rate. Program directors and institutions are responsible to the CAATE for all curriculum accreditation standards. This study will provide descriptive data to the AT program directors and the CAATE, demonstrating the courses currently being required in degree programs across the United States, and will provide data explaining the significance of *foundational scientific knowledge* courses as predictors of BOC pass-rates. This study will also serve as a guide to programs transitioning from an

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

undergraduate degree to a graduate degree, giving evidence and direction to decide what pre-requisite science courses should be required for the professional graduate AT degree.

Summary

AT education programs have gone through many changes since the inception of the AT accredited academic degree program. With the latest mandate communicated during the spring of 2015, stating that all accredited AT programs must transition from an undergraduate to a graduate degree program, the profession faces yet another academic transition. Currently, a total of 371 AT programs exist. Of these, 336 are undergraduate AT programs that will be transitioning to a graduate level degree program by the year 2020.

Athletic Training academic leaders, program directors and administrators are in search of valid published research to guide their curricular decisions. The CAATE has publicly identified the educational component of “strong *foundational scientific knowledge*” to produce the best health care providers (CAATE Insight 2015, p.2). This educational component was introduced without a clear definition of exactly what the CAATE defines as strong *foundational scientific knowledge*. To date, there are no published studies showing whether *foundational scientific knowledge* courses have an effect on BOC examination first-time pass rates. Utilizing the Curriculum Research Framework, this study reviewed current academic 4-year degree plans of accredited AT programs to determine if there was a correlation between *foundational scientific knowledge* science courses and first-time BOC pass-rates.

SECTION TWO:

PRACTITIONER SETTING FOR THE STUDY

Introduction

This section will discuss the profession of Athletic Training (AT) education at the national level, beginning with the history of AT education. This history commences with the evolution of the academic requirements in the profession of AT and concludes with the current mandate of a professional entry-level master's AT degree. Next, the AT academic structure will be analyzed, including a review of the organization and leadership components, and closing with implications for research in the practitioner setting of AT.

Organizational Analysis

Organizational History of Athletic Training Education

The history of AT education began in the 1950s, with the first recommended academic model being developed in 1959 and approved by the National Athletic Trainers Association (NATA) Board of Directors (Delforge & Behnke, 1999). There were two distinct features to this educational model. Initially, the student would gain a teaching certificate, preparing the individual as a teacher in the area of health and physical education. The second component required students to take prerequisite coursework in preparation for application to physical therapy school, encouraging them to pursue further education and facilitate employability (Delforge & Behnke, 1999).

In 1969, the first NATA curriculum and evaluation process began, officially giving four universities NATA curriculum approval. Along with the formal recognition of academic programs, the first national certification examination was developed and administered in 1970 (Delforge & Behnke, 1999). During the 1970s, there was a steady growth of athletic training programs and, by 1982, there were 33 states that housed

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

NATA-approved athletic training curriculums. During 1980, the requirement of a teaching certificate was abandoned due to the limited health and physical education employment opportunities (Delforge & Behnke, 1999).

As curriculum content specialized for AT, the NATA Board of Directors called for all NATA approved undergraduate programs to offer an AT "major" by 1986. This endeavor took longer than planned and was revised to extend the deadline to July 1990. By 1990, one-third of the 73 NATA-approved undergraduate programs had not met the stand-alone "major" requirement. However, the rest of the programs met the requirement as a designated AT major, and some offered a bachelor's degree in AT (Delforge & Behnke, 1999).

After the 1990 American Medical Association (AMA) recognition of AT as an allied health profession, the NATA Board of Directors sought to gain accreditation by the AMA Committee on Allied Health Education and Accreditation (Delforge & Behnke, 1999). Through this process, the Joint Review Committee on Educational Programs in Athletic Training (JRC-AT) formed in 1990. Subsequently, during October of 1991, the JRC-AT incorporated in the state of Texas, becoming a Committee on Accreditation under the Commission on Accreditation of Allied Health Educational Programs (CAAHEP; CAATE, 2016). This committee eventually separated itself from CAAHEP on June 30, 2006, and changed its name to CAATE (CAATE, 2016).

Beginning on September 30, 2014, the Council of Higher Education (CHEA) recognized CAATE as the accrediting agency for AT programs (CAATE, 2016). To gain or maintain continued CAATE accreditation, AT programs must complete an electronic self-study and host an on-site visit every seven to ten years (CAATE, 2015). CAATE is a

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

501c non-profit organization located in Austin, TX (CAATE, 2016). Currently, a Board governs CAATE made up of 12 commissioners, including, six BOC-Certified Athletic Trainers, four sponsoring organizational representatives, one public member, and one institutional administrator. The CAATE board elects the following positions: President, Vice-President/ President-Elect, and Treasurer/Secretary, with the positions of President and Vice President holding an ATC credential (CAATE, 2013). To date, the Board of Commissioners oversees 371 accredited AT programs. Requiring compliance with 109 standards, the CAATE regulates AT programs in the areas of sponsorship, outcomes, personnel, program delivery, health and safety, financial resources, facilities, instructional resources, operational policies and fair practices, program description, and student records (CAATE, 2011).

Along with the mandated transition to a graduate degree, the CAATE has proposed a standard stating that all AT degree programs must be located in a School of Health Professions (CAATE, 2016). Thus, institutions of higher education must concurrently address curriculum changes and the physical location of their AT degree. Bolman and Deal (2008), recommend that an organization's goals and environment should be in line with the organizational structure. This is currently happening across the nation, as programs evaluate their current physical location within their institutions and transition to an environment that is best suited for housing a health care profession.

Structural and Symbolic Organizational Context of AT Education

Today, in the profession of AT education, many structures are in transition, beginning with a possible physical relocation of the degree program and the change from an undergraduate to a graduate degree. Historically, the structure of AT education

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

programs at institutions of higher education had a split foundation, with one foot in the athletics department and the other foot in the physical education department. The academic program directors in the 1990s were the head athletic trainers employed by athletics and adjunct instructors to the Department of Physical Education. There has been a rapid change in structure as programs transitioned from a concentration, to a major, a stand-alone degree in 2012, and they must offer a graduate degree in a school of health professions by 2022. Paralleling the academic changes were the clinical recognition changes in the profession of the clinically practicing AT. The recognition by the American Medical Association of AT as a health profession in 1991 led to state licensure and today, to third-party insurance reimbursement for health care services provided.

According to Bolman and Deal (2008), the core premise of viewing an organization from a structural perspective includes: reviewing the goals to be sure they are written clearly and are easily understood, that the roles and relationships are clearly outlined, and that they are coordinated for essential organizational performance. As the AT education has been transitioning, different goals appear to have been developed between the academic AT and the clinically practicing AT. The goals of the CAATE may be clearly outlined, but that does not mean they are easily understood by the clinical ATs. The clinical ATs have no responsibility to CAATE, thus leaving the sole responsibility on the academic program, whose students reside in the clinical settings through required academic coursework. There has been role confusion between the clinical and academic ATs, and this has therefore led to unsuccessful organizational performance.

Successful organizational performance in AT education can be defined as the production of quality health care professionals. Although the clinical ATs may have the

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

same goal of producing quality health care professionals, this goal is overshadowed, more often than not, by the athletic department viewing the AT student as a free work force.

The CAATE mandates the structure of the AT program, through standards, policies, and procedures required during student clinical placement. It does not guarantee the clinical AT agrees with these standards nor does it have any investment in following the standards. Part of the problem with the rapidly changing structure of academic AT is the fact that the CAATE standards challenge the belief system of the clinical ATs and the symbolic past of the hard-working AT student “owned” by athletics.

To produce quality health care professionals, the CAATE, as the accrediting agency, has outlined a new set of operational standards. As the standards mandate a transition to a graduate degree, the undergraduate AT programs will be discontinued and concurrent proposals for new professional AT Master’s degrees will be developed (CAATE, 2015). All ATs strive for the recognition of being competent health care providers, instead of the historic physical education major who provided water to athletes. Obtaining licensure was a symbol of professionalism and brought ATs in alignment with the other licensed health care providers, such as nurses, physical therapists (PTs), and occupational therapists (OTs). The graduate degree level mandate symbolically raises the profession to follow in the footsteps of other health professions like PT and OT which have also transitioned from undergraduate to graduate degrees.

Along with the structure perspective, the symbolic framework of the organization needs to be considered. According to Bolman and Deal (2008), “culture forms the superglue that bonds an organization, unites people, and helps an enterprise accomplish desired ends” (p. 253). The symbolic frame includes the way in which the culture and

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

behaviors of a group are specifically displayed at times of uncertainty (Bolman & Deal, 2008). There is current uncertainty within institutions while attempting to meet accreditation standards, maintain AT programs, and provide the students with the best possible AT curriculum. To support a successful AT degree transition within the institutional structure, the administrators must believe that the AT professional degree will survive at the graduate level and have a better cultural fit within the school of health professions, rather than having the degree remain in the historical placement of an education department.

The symbolic and cultural practices of academic health profession programs differ from the symbolic practices of teacher education, and the historic identity of the physical education teacher who is the athletic trainer. To meet the cultural expectations for a health care professional, the AT student is better situated in a school of health professions, with like-minded professions. The AT curriculum is similar to that of PT and OT programs, which contain comparable courses including clinical evaluation and rehabilitation of patients. These courses are not found within the education curricula. Resources provided by a school of health professions include clinical laboratory space and medical supplies that can all be shared within the health professions. Departments of education are not in the business of providing clinical laboratory space with medical supplies. Accrediting agencies for AT, PT, OT, and physician assistants now require inter-professional education across health professions. This requirement/standard can easily be met when students from differing health professions share coursework.

Symbolic practices in the health professions generally include a "pinning" ceremony at the beginning of a student's academic degree as well as a "white coat"

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

ceremony at the end of degree completion. These symbolic ceremonies are not present in a school of education. If an institution's vision is to produce quality health care providers, the "vision turns into the organization's core ideology, or a sense of purpose, into an image of the future" (Bolman & Deal, 2008, p. 255). The idealistic vision of the AT degree being housed in a school of health professions accompanies the reality of following the institution's structured academic degree proposal process.

The process for a new degree proposal at an institution of higher education requires many levels of approval, within an institution's structure. Initially, approval would begin with the AT faculty, then the department, school, college, provost's office, the board of regents and finally, the state board of education. This process is time consuming; however, it will give programs the opportunity to evaluate their current degree programs and create quality curriculum planning, with the aspiration that a quality curriculum would translate into successful program outcomes.

During the summer of 2015, as AT faculty and administrators were adjusting to the degree level change mandate, the Commission publicly identified the necessity for the inclusion of strong *foundational scientific knowledge* in curriculums which produces the best health care providers (CAATE, 2015). Next, the CAATE published and disseminated a draft of newly proposed 2016 standards mandating *foundational scientific knowledge* be included within professional AT degree prerequisites (CAATE, 2015; 2016). The newly proposed 2016 CAATE accreditation standards, if approved, will go into effect during the 2019-2020 academic year, followed by the MSAT degree requirement deadline of 2022. With the degree change mandate and the proposed new curriculum standards, each AT program will need to evaluate their current curriculum,

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

location of the program, and gain approval for a graduate level AT degree, if they choose to continue offering an accredited AT degree program.

Bolman and Deal (2008) refer to an organization's current problem or circumstance as part of the *structural framework*, which can be clearly seen in the profession of AT. The current circumstance develops and proposes a graduate degree while discontinuing the formal structure of the undergraduate degree. The standard process of a new degree includes discussion of the courses to be included in a curriculum, followed by a formal degree proposal. Within the structure of the degree, it must be decided which *foundational knowledge science* courses will be included in the prerequisites for the AT graduate degree program. The responsibility of curriculum development will be placed on the AT faculty within each institution, as they are the experts in this academic area.

Bolman and Deal (2008) indicate that the roles and relationships need to be clearly outlined for successful organizational performance to occur. The roles and relationships of administration can be challenged when an outside entity mandates a change in where a degree is housed leading to a structural dilemma (Bolman & Deal, 2008). If a university is operating as an organization with strict divisions between departments or schools, the mandate may not be received positively, because the university is being told what to do. In essence, an outside entity is telling one school within an institution that they must give up a degree program and telling another school they need to house the degree.

This situation not only challenges the structural organization of an institution but also may put "power and conflict at the center of organizational decision making,"

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

(Bolman & Deal, 2008, p. 209) causing the administration to feel they are being forced to make a change. In an attempt to facilitate structural change, the leader must clearly communicate with all constituents. Bolman and Deal (2008) suggest that as "work becomes more complex or the environment gets more turbulent, structure must also develop more multifaceted and lateral forms of communication and coordination" (p. 116). The communication and coordination can be accomplished through face-to-face meetings, with open-minded discussion, so that all involved have a clear understanding of the current and newly proposed CAATE standards.

Political and Human Resource Organizational Context of AT Education

The *political and human resource frameworks* came into play as soon as the CAATE announced that AT programs must transition to a graduate degree and proposed the degree should be housed in a School of Health Professions. According to Bolman and Deal (2008), the political frame views organizations, such as universities, as the arena with ongoing contests of individual and group interests (Bolman & Deal, 2008). This is apparent within a university as there is competition between schools and departments for student numbers, translating into tuition dollars. With the impending move of the AT degree program from schools of education to the schools of health professions, the administrators must evaluate the structural, financial, and human resource implications.

According to Bolman and Deal (2008), the human resource frame views "the relationship between people and the organizations" as need-based (p. 137). Employees need the organization for self-reward, and the organization needs the employees to function. There also needs to be a good fit between the organization and its employees. When there is a good fit both entities benefit: the employees find "meaningful and

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

satisfying” work and the organization gets the “talent and the energy” they need to be successful (Bolman & Deal, 2008, p. 137). The school of education is no longer a good fit for the profession of athletic training, as the AT program is now classified as a health profession. Schools of health professions are a better fit for the profession of AT because they can understand and provide for the needs of AT students and faculty. These needs include: having an understanding of a health profession’s culture, the laboratory space, and the equipment necessary to teach the required medical skills on human patients.

Another opportunity that a school of health professions can provide is inter-professional education with other student health care providers. The AT will benefit from a formalized educational component which includes working with other health professions such as nurses, physical therapists, and occupational therapists. These opportunities will be meaningful, satisfying, and applicable to the new AT graduate, and are currently not available for the AT student if the degree remains in a school of education.

Implementing the transition to a graduate degree and moving the location of the AT Program represents change, which is never easy as it threatens the history of the system (Grint, 2005). When there is role confusion, including which department gets to house the degree or power levels of unequal status among faculty and administrators, there may be mistrust and less communication which can further complicate the degree transition (Levi, 2013). It will take political shrewdness from the AT program faculty and support from administrators for programs to make the transition from a BSAT to an MSAT, closing out the initial degree, proposing a new graduate degree curriculum, and relocation into a School of Health Professions, (Levi, 2013).

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Bolman and Deal (2008) cite four key skills that must be in place for the manager to function as a politician. The first skill is *agenda setting* (Kotter, 1998; Pfeffer, 1992; Smith, 1988). Kotter (1988) describes the agenda as communicating the vision, considering the interests of key individuals, and figuring out how to achieve the vision while paying attention to internal and external conflicting forces. The second skill involves *mapping the political terrain* (Pfeffer, 1992; Pichault, 1993). Bolman and Deal (2008) suggest developing and drawing a political map, indicating the players, their individual levels of power, and their interest in change. From this map, the third skill of *networking and forming coalitions* can be evaluated (Kanter, 1983; Kotter, 1982, 1985, 1988; Pfeffer, 1992; Smith, 1988).

Kotter (1985) suggests three initial steps to exercise political influence: first, understand the relationships between the key players; then figure out who may not agree with you; and develop relationships with your potential opponents. These relationships can be utilized to improve communication, provide education, and negotiate. AT program directors often fail at this method because they rely on the CAATE Standards mandating policy and don't spend enough time developing relationships with the internal and external constituents. The fourth and final political skill is *bargaining and negotiating* (Bellow & Moulton, 1978; Fisher & Ury, 1981; Lax & Sebenius, 1986 as cited in Bolman & Deal, 2008, p. 214). Fisher and Ury (1981) indicate that during bargaining and negotiation the leader should insist on objective criteria and invent options for mutual gain while creating value by finding the best solution for all parties involved (as cited in Bolman & Deal, 2008). The political and human resource frameworks are complex areas

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

for the AT program director to demonstrate success, as not all constituents agree with the newly proposed 2016 and current published 2012 CAATE standards.

Leadership Analysis

Leadership Context for AT Education

Leadership is a vital skill for individuals serving in the position of an AT program director (PD). The PD must be an advocate for the AT profession and its students. Additionally, in today's climate, the PD must be willing to serve as a change agent, transitioning from an undergraduate to a graduate degree program as well as the responsibility of overseeing CAATE standard compliance (Ettling, 2012; CAATE, 2016). This analysis will review leadership types, approaches, and theory within the practitioner role of the PD in the setting of a CAATE-accredited AT program.

Path-Goal Theory and Situational Leadership in AT Education

During the process of degree transition, the PD must act as a leader, influencing a group of individuals to achieve a common goal to create a curriculum that meets CAATE standards (Northouse, 2013). Each institution will have the goal of transitioning their current undergraduate AT degree program to the graduate level. One focus during the development of the degree should be evaluating the curriculum to produce the best student outcomes. During this transition, faculty will evaluate and create courses to propose the graduate degree plan, including all CAATE mandated competencies. Due to the proposed 2016 CAATE Standards, the PD must also evaluate which *foundational scientific courses* to include within the degree requirements and logically attempt to consider what specific courses correlate with the outcome of high BOC pass rates. A professional graduate AT degree will include prerequisite coursework, and didactic, and

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

clinical coursework (CAATE, 2016). At the graduate level, the *foundational scientific knowledge* courses are included in the prerequisite course work needed for program application. The didactic coursework is knowledge-based, and the clinical course work includes applied content, comprising skills performed on real patients in real-time.

With the goal of a new curriculum, this places the PD in a position of "situational leadership." According to Goffee and Jones (2000), new leadership thinking is "dominated by contingency theory, which says that leadership is dependent on a particular situation" (p. 85). This goal places the PD in a situation to lead multiple individuals including administrators, faculty, and adjunct staff athletic trainers through the degree change. The situational leader can also view their task through the path-goal theory, in an attempt to motivate the constituents in goal accomplishment (Northouse, 2013).

Path-goal theory, described by Northouse (2013), focuses on "how leaders motivate subordinates to accomplish specific goals" (p. 137). This theory aims to enhance employee performance and satisfaction about their job by focusing on what motivates the employee (Northouse, 2013). When employees believe that their work behavior will contribute to a certain outcome and that their individual efforts are worthwhile, they are motivated to perform at the level necessary to reach the organization's goals (Northouse, 2013). Currently, in AT programs, the PD/leader attempts to meet a variety of goals. The first goal is getting the undergraduate AT program re-accredited and then following that with the graduate degree proposal. The PD must motivate the staff athletic trainer preceptors/ employees to maintain compliance with CAATE standards during their daily work performance, to achieve the goal of AT program re-accreditation. One motivation

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

for gaining re-accreditation for the AT staff employee is the continued daily help of their AT student workforce. Loss of program accreditation would result in no AT students; therefore, each AT staff employee would have an increased number of daily tasks to complete.

Path-goal theory resonates close to home with individuals who are attempting to gain the trust of constituents and make a shift within an organization, which is necessary, while making a change that affects a variety of constituents (Northouse, 2013). One downfall of path-goal leadership theory is that it fails to explain the relationship between leadership behavior and constituent behavior. The AT faculty need to navigate the degree change while remaining conscious of the effects on all involved (Northouse, 2013).

One model that addresses the relationship between leader and constituent/employee behavior is Hill's model of team leadership. Northouse (2013) explains that Hill's model of team leadership is based on the leader having a responsibility to understand team problems and take any action needed to guarantee team effectiveness. This model outlines a structure and process for the leader to follow when making decisions that affect all of the constituents of the team (Northouse, 2013). Hill's model begins by outlining the process of decision making by the leader. First, the leader needs to decide if they should continue to observe behavior or step in and take action. Secondly, the leader must decide if a team needs help accomplishing its tasks or if the team needs help working together. Finally, the leader must decide if they need to intervene within the team or intervene within the environment in which the team is working (Northouse, 2013).

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

All of the decisions outlined in Hill's model take into consideration the relationship between the leader and the employees. Additionally, Hill's model guides the leader by listing specific actions to be taken in the categories of tasks, relationships (internal), and environment (external), while moving toward the goal of overall team effectiveness (Northouse, 2013). Within the relational category, Hill explains, the applicable skills or actions of "coaching, managing power, and conflict, satisfying individual needs, and modeling ethical and consistent behavior" can be utilized to improve team relationships (Northouse, 2013, p.291). This model gives the PD applicable tools to implement into their day-to-day leadership behavior, while working with internal and external constituents of an AT academic program.

Trait and Skills Model Approach in AT Education

The AT PD must have appropriate traits and skills to become a successful leader and meet set goals. For success, the traits the leader embodies must be relevant to the situation or goal at hand (Stogdill, 1948). Stogdill (1948) lists eight traits of leaders: "intelligence, alertness, insight, responsibility, initiative, persistence, self-confidence, and sociability" (as cited in Northouse, p. 20). Throughout the literature, the most common trait cited for leadership is trustworthiness; therefore, to lead a successful program, the PD must establish trust with all constituents (Drucker, 2011; Goffee & Jones, 2000; Goleman, 2011; Judge, Bono, Ilies & Gerhardt, 2002). If there is an absence of trust, there will be dysfunction within the program; dysfunction can negatively affect all aspects of the AT degree program (Lencioni, 2002).

Characteristics and traits of an individual are important; however, the leader must also embody skills appropriate to the task. The skill-based model of leadership is

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

characterized as the *capability model* because it examines the relationship between a leader's knowledge, skills, and performance (Mumford, Zaccaro, Harding, Jacobs, & Fleishman, 2000, as cited in Northouse, 2013). According to Katz (1955), there are three components to the skills approach: technical, human, and conceptual (as cited in Northouse, 2013). The AT PD must embody technical skills to teach clinical skills and administratively run the program, human skills to develop relationships with constituents, and conceptual skills for curriculum development and to remain at the forefront of the profession. Mumford et al. (2000) states, "Career experience can positively affect the individual characteristics of leaders" (as cited in Northouse, 2013, p.54). If the PD was in the profession of AT when the change occurred from a "major" to a "degree," this knowledge of the process of degree proposal will positively affect their ability to propose the newly mandated graduate AT degree.

Additionally, the skills model includes "social judgment skills" which ties in the social relationship aspect of this model (Zaccaro, Mumford, Connelly, Marks, & Gilbert, 2000, p.46, as cited in Northouse, 2013, p.49). The AT PD must have social skills to communicate appropriately within the academic hierarchy, communicating up to administration and parallel to faculty and preceptors. The leader must be self-aware and understand that technical skills do not always accompany human skills, which may be necessary while communicating and gaining the trust of others.

Along with traits and skills, the PD must have some level of power. According to Levi (2014), "Power is the capacity or ability to change the beliefs, attitudes, or behaviors from others" (p.144). French and Raven (1959) explain that there are areas a leader must consider based on respect from the employees. These include the following:

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

- Does the employee like the PD/leader?
- Does the employee perceive the PD competence is legitimate?
- Does the PD have power associated with formal job authority for rewards to the employee?
- Does the PD have the coercive capacity to penalize or punish the employees? (as cited in Schein, 1977).

Burns (1978) believes that the amount of power one has is in a direct correlation to the relationship and the common goals between the PD and the constituents (as cited in Kuhnert & Lewis, 1987). Mintzberg (1983) believes the basis of power lies within the individual who embodies technical skill, knowledge, and control of resources, without consideration for the political and moral influences of the leader. With the variety of beliefs regarding power, it can be overwhelming for the AT to successfully navigate the position of PD.

For the success of an academic program, there needs to be teamwork between the clinical staff/adjuncts and faculty. The success of a team depends on clear goals, social relations, organizational support, task characteristics, and leadership (Hackman, 1987; Levi & Slem, 1995; Larson & LaFasto, 1989). First, the leader should develop relationships and then move on to the work. According to Levi (2013), emotional ties among individuals, and good communication with understanding and trust lead to cohesiveness within a team. With the time demands placed on faculty members, including teaching, research, and service, and the limited hours of a workday, it is hard to find time to devote to developing emotional ties with co-workers. However, the AT PD should realize that such relationships must exist for overall program success.

Implications for Research in AT Education

When compared to nursing, physical therapy, and occupational therapy, athletic training is a young health profession. Since 1990, when the American Medical Association (AMA) first recognized AT as a health profession, there has been ongoing change to the academic requirements for a student to become a board certified, licensed athletic trainer. This ongoing change appears to be following the same progression as other health professions, such as physical therapy and occupational therapy, transitioning from an undergraduate degree to a graduate degree. With the ongoing transition of the educational preparation for the AT, the CAATE has been met with resistance from AT faculty, institutional administrators, and clinically practicing ATs. With this resistance, there are many unanswered questions. To answer such questions, there is a need for research.

As programs transition from an undergraduate to a graduate degree, the CAATE has published the requirement for strong *foundational scientific knowledge*, without any direction or evidence behind the statement, leaving program faculty at a loss for best practices in AT curriculum development (CAATE, 2015). After an extensive literature search, to date, there is no published literature communicating what courses in *foundational scientific knowledge* are currently being taught across the nation within the 371 AT degree programs. Additionally, no published literature was found tying *foundational scientific knowledge* coursework to BOC outcome data. Without published research specific to the curriculum of the AT profession, this leaves multiple areas open for necessary research. This study looks at one aspect of the curriculum, *foundational scientific knowledge*.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

In 2012, CAATE first mandated that two full-time faculty members must be allocated to each academic program as an accreditation standard (CAATE, 2011). Due to the administrative requirements of the program director and clinical education coordinator faculty positions, programs that only employ two faculty have minimum time to dedicate to scholarship. The newly proposed 2016 CAATE standards require all AT programs to have at least three dedicated faculty lines to each program, with each faculty member demonstrating involvement in scholarship (CAATE. 2016). This proposed standard demonstrates the CAATE's stance on the need for research in AT, by specifically creating a standard that delineates that all AT faculty must participate in scholarship.

With the academic changes that have occurred after the 2012 CAATE standards went into effect and the newly proposed 2016 CAATE standards, there are many areas within AT academic programs which demonstrate a need for research. These areas include curriculum, academic program content requirements, specified course requirements, types and location of clinical experiences, types of instructional delivery, the change in the degree level, and mandated program outcomes. Research studies could evaluate specific areas of the curriculum; including the total credit hours required for a graduate degree in AT, as there is currently a national discrepancy. There is also an implication for research in the area of content delivery; some programs teach content isolated into categories (e.g., individual courses in clinical injury evaluation, therapeutic modalities, and injury rehabilitation); however, in reality, that is not how the AT clinically practices. In clinical practice, an AT evaluates an injury, provides immediate care and develops a treatment plan. How would athletic training students respond to a

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

beginning level course that instead encompasses the first steps in injury evaluation, treatment, and rehabilitation? Does structure of course delivery affect program outcomes? There are many unanswered questions arising from the curriculum changes that the CAATE is mandating and proposing.

Academic leaders could benefit by having evidence-based information to make valid decisions regarding curricular change. Future studies utilizing all ten phases of Clements' CRF could produce in-depth knowledge of the factors contributing to program success. The AT program directors could benefit from published research to help guide decisions, while navigating multiple changes within the profession. As the profession of AT is transitioning from the current undergraduate degree programs to only offering professional AT graduate degree programs across the nation, there will be a lot of change. This change will present a variety of opportunities and implications for evaluation and research in the area of AT curriculum.

Summary

The practitioner within the national setting of CAATE-accredited AT education is dealing with multiple changes and a degree transition. Currently, the proposed 2016 CAATE standards are under review by the Commission. The CAATE announced the proposed standards will be re-opened for a second round of public comments and the standards are then projected to have CAATE approval by September 2017. Upon formal approval of the proposed 2016 CAATE standards, all AT programs must demonstrate compliance by the 2019- 2020 academic year (CAATE, 2016). By 2022, all CAATE AT degree programs will have implemented a new curriculum providing a graduate degree that leads to the profession of a board certified, licensed athletic trainer (CAATE, 2015).

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

To be a successful leader within the practitioner setting of an AT program amidst the current climate of change, the leader should be sensitive to the structural and political perspectives of all involved with the organization. Specifically, the first task a leader must accomplish is to build and establish trust with all constituents, as well as develop a common overall goal for the organization (Drucker, 2011; Goffee & Jones, 2000; Goleman, 2011; Judge, Bono, Ilies & Gerhardt, 2002). For continued success, the leader must demonstrate knowledge and skill, develop relationships, and effectively communicate with all team members (Hackman, 1987; Larson & LaFasto, 1989; Levi, 2013; Levi & Slem, 1995). Finally, the AT program director must stay current with all changes and transitions within the profession, by participating in ongoing analysis, conducting research, and using the continued application of leadership theory and practice to maintain effective leadership within the organizational structure.

SECTION THREE:

SCHOLARLY REVIEW FOR THE STUDY

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Introduction

The education of the Athletic Trainer (AT) has undergone many transitions since its inception in the 1950s. Through the decades, AT curricula have transformed from a model of required coursework to a specific list of subject matter, and currently utilizes a competency-based curriculum model. Along with curriculum model changes, there is an accreditation mandated change in the degree level for the profession of AT. The Commission on Accreditation of Athletic Training Education (CAATE) announced all undergraduate AT programs must transition to a graduate level professional degree program by 2022, (BOC, 2015; CAATE, 2015; NATA 2015). One requirement accompanying the degree level change is the inclusion of a strong *foundational scientific knowledge* component within the graduate degree, stating that "strong *foundational scientific knowledge* is an educational component to produce the best health care providers" (CAATE Insight, 2015, p.2). This review will explore the literature encompassing the history of the AT curriculum, curriculum theory, foundational knowledge, and foundational scientific knowledge in health professions and education.

History of the Curriculum in Athletic Training Education

Over the past 20 years, the health profession of AT has undergone many changes regarding the educational requirements leading to national certification and state licensure (NATA, 2014). First, there was a specific curricular requirement; then a designated major; and currently, institutions of higher education must provide a (CAATE) accredited stand-alone degree in athletic training (BOC, 2015; CAATE, 2015). During June, 2015, the CAATE mandated that all undergraduate programs transition to a

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

graduate level professional degree within a minimum of seven years (BOC, 2015; CAATE, 2015; NATA 2015).

According to Delforge and Behnke (1999), beginning in 1959, and then again in 1970, there was a defined list of courses that all National Athletic Training Association (NATA) approved programs had to include in their AT curriculum as shown in Table 1 and 2. Over the years, the transition has gone from a list of courses to subject matter and today, to educational competencies. The 1959 AT curriculum model includes a list of physical therapy school pre-requisites that encompass 24 semester hours of sciences. Next, this model lists courses that need to be included in the AT curriculum, including some sciences courses, but also introduces new content areas such as psychology, coaching, nutrition, organization and administration, hygiene, athletic training techniques, and laboratory sessions. The model concludes with four recommended courses that may have already been taken within the physical therapy prerequisites.

Table 1

1959 Athletic Training Curriculum Model

Physical therapy school prerequisites (minimum of 24 semester hours)
Biology/zoology (8 semester hours)
Physics and/or chemistry (6 semester hours)
Social sciences (10 semester hours)
Electives (e.g., hygiene, speech)
Specific course requirements (if not included above)
Anatomy
Physiology
Physiology of exercise
Applied anatomy and kinesiology
Laboratory physical science (6 semester hours, chemistry, and/or physics)
Psychology (6 semester hours)
Coaching techniques (9 semester hours)
First aid and safety
Nutrition and foods
Remedial exercise

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Organization and administration of health and physical education
Personal and community hygiene
Techniques of athletic training
Advanced techniques of athletic training
Laboratory practices (6 semester hours or equivalent)
Recommended courses
General physics
Pharmacology
Histology
Pathology

Note. Adapted from, “The History and Evolution of Athletic Training Education in the United States,” by G. Delforge and R. Behnke, *Journal of Athletic Training*, 34, p.54. Copyright 1999 by the National Athletic Trainers’ Association.

With the increase of NATA-approved programs during the 1970s, the AT profession determined that there was no longer a need to have the physical therapy pre-requisites included in AT curriculums. As you can see in Table 2, the physical therapy pre-requisites were no longer a requirement.

Table 2

Mid 1970s Athletic Training Curriculum Course Requirements

Anatomy (1 course)
Physiology (1 course)
Physiology of exercise (1 course)
Applied anatomy and kinesiology (1 course)
Psychology (2 courses)
First aid and safety (1 course)
Nutrition (1 course)
Remedial exercise (1 course)
Personal, community, and school health (1 course)
Basic athletic training (1 course)
Advanced athletic training (1 course)
Laboratory or practical experience in athletic training to include a minimum of 600 total clock hours under the direct supervision of an NATA-certified athletic trainer

Note. Adapted from, “The History and Evolution of Athletic Training Education in the United States,” by G. Delforge and R. Behnke, *Journal of Athletic Training*, 34 p. 56. Copyright 1999 by the National Athletic Trainers’ Association.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

During 1983, the NATA developed a list of required AT curriculum subject matter as shown in Table 3 (Delforge &, Behnke, 1999). With the shift from a course list to curriculum subject matter, the requirement for the *foundational scientific knowledge* courses of Biology, Chemistry, and Physics no longer existed.

Table 3

1983 Athletic Training Curriculum Subject Matter Requirements

Prevention of athletic injuries/illnesses
Evaluation of athletic training injuries/illnesses
First aid and emergency care
Therapeutic modalities
Therapeutic exercise
Administration of athletic training programs
Human anatomy
Human physiology
Exercise physiology
Kinesiology/biomechanics
Nutrition
Psychology
Personal/community health
Instructional methods

Note. Adapted from, “The History and Evolution of Athletic Training Education in the United States,” by G. Delforge and R. Behnke, *Journal of Athletic Training*, 34, p.58. Copyright 1999 by the National Athletic Trainers’ Association.

Today, programs gain accreditation through meeting the 109 CAATE accreditation standards, which includes a set of educational competencies developed by the NATA Education Council (NATA, 2015; CAATE 2015). Each program must demonstrate to CAATE the inclusion of the competencies in their curriculum by listing course objectives on a syllabus and completing the CAATE online competency matrix. The educational competencies include content in the following areas: evidence-based practice, prevention and health promotion, clinical examination and diagnosis, acute care

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

of injuries and illness, therapeutic interventions, psychosocial strategies, and referral, healthcare and administration, and professional development and responsibility (NATA, 2015; CAATE, 2015).

During 2014, the AT Strategic Alliance group was created representing the BOC, CAATE, NATA and the NATA Research and Education Foundation (NATA, 2015). This strategic alliance group was created to research and explore the appropriate professional degree level for the profession of AT (NATA, 2015). The AT Strategic Alliance determined that a graduate degree was appropriate for the profession of AT and published a statement during the spring of 2015, mandating that all undergraduate AT degree programs transition to a graduate degree level within 7 years (NATA, 2015). As the AT programs across the United States transition from an undergraduate to a graduate degree, a new curriculum will need to be proposed to meet graduate school requirements. During the development of a new curriculum, it may be helpful for the AT faculty to first review and explore curriculum theory, to further understand the curriculum development process.

Curriculum Theory

A variety of definitions exist for "curriculum" and "curriculum theory" depending on the context in which it is utilized (Beauchamp, 1968; Jackson, 1992; Pinar, Reynolds, Slattery, & Taubman, 1995; Walker, 2003; as cited in Clements, 2007). For example, MacDonald (1971) defines curriculum "as narrow as the 'subject matter' to be learned and as broad as 'all the experiences students have in school'" (p. 196). From this definition, it is easy to understand a list of subject matter, yet, it is difficult to conceptualize the broad definition of the curriculum, as "all student experiences" are so

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

individualized. Swanwick (2010) takes a structural approach in defining a curriculum by outlining specific steps to follow, beginning with written goals, written objectives, specific content to be included in individualized courses, written measurable outcomes, and a final systematic review of all processes of the academic program. Huebner's (1968) approach to curriculum theory is different from that of Swanwick and McDonald, as he utilizes an analysis approach, reviewing the categories of language used by curriculum theorists. To explain his view of curriculum theory, Huebner's theory involves analysis of the following categories of language: describing, exploring, controlling, and legitimizing (as cited in MacDonald, 1971). In understanding curriculum theory, one must look at the intentions of the individual theorists to determine the approach in which theorists develop or define curriculum (Macdonald, 1971).

With the variety of definitions and theories, it can be confusing, during curriculum development, for a researcher to understand the concept of what exactly constitutes the content to be included in a curriculum. A holistic approach to defining a curriculum could include all of the above-mentioned theories: a broad definition by McDonald (1971), a structural approach by Swanwick (2010), and a language analysis approach by Huebner (1968, as cited in McDonald, 1971). Such degree information is included in university publications, outlining requirements for degree completion. This leads the researcher to question how institutions decide on which courses are necessary for each degree. When developing a curriculum for an institution of higher education, it would be logical to have evidence behind the choice or process of course selection, to demonstrate the purpose or reasoning, for each course within a degree program. An evidence-based curriculum development process could start with the definition of

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

variables which, in turn, can be utilized for empirical validation of the curriculum in question (Clements, 2007; MacDonald, 1971).

To create a valid curriculum, Clements (2007) suggests that the three domains of practice, policy and theory must be addressed. According to Clements (2007), the first step of curriculum development begins with an evaluation, describing, and categorizing content. A different approach is provided by theorists Smith and Moss (1970) who focus on the role which the graduate is being trained to fill, as their first step in curriculum development (as cited in Clements, 2007). Smith and Moss (1970) then follow with nine more steps: (2) identifying the specific task that comprises the analyzing of each task, (3) selecting the tasks to be taught, (4) analyzing each of the tasks, (5) stating performance objectives, (6) specifying the instructional sequence, (7) identifying conditions of learning, (8) design and instructional strategy, (9) development of instructional events, and (10) creating student and curriculum evaluative procedures and devices (as cited in Clements, 2007). Whichever approach is utilized, the curriculum developer must begin with factual information to evaluate and analyze as well as to justify the curriculum.

Within the category of theory, Clements (2007) describes the meaning of his Curriculum Research Framework (CRF) as a curriculum that is written as an instructional blueprint, including the materials to guide students through “procedures, intellectual dispositions, and acquisition of culturally valued concepts” (p.36). Using the CRF as the blueprint for curriculum development gives structure and puts evidence behind the process. Currently, the development of an AT curriculum is left up to institutional autonomy, as long as the institution follows the CAATE Standards, to include the published competencies of skills, knowledge, and abilities. This opens the door to a wide

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

variety of curriculums in the United States as undergraduate AT programs transition to the graduate degree level (CAATE, 2015), including discrepancies in *foundational scientific knowledge* courses across AT programs. CRF provides a coherent structure for development and evaluation of AT curricula. In fact, this study proposes that CRF provides an ideal context for building a research-based curriculum development process. CRF includes the following three categories, *A Priori Foundations*, *Learning Model*, and *Evaluation*. These categories of the curriculum development research process would be necessary to warrant the claim that a curriculum is based on research (Clements, 2007).

Within the first category, the subject matter *a priori foundation* includes establishing educational goals. This phase is described as the process of “using scientific procedures to identify subject matter content that is valid within the discipline and makes substantive contribution to the development of the student” (Clements, 2007, p. 41). In this regard, the NATA Educational Competencies are developed to guide curriculum content by a committee. Unfortunately, there is no published scientific process utilized to develop these competencies. However, the BOC examination uses a scientific process to determine what will be on the examination and has published a study on role delineation (RD). The RD study surveys clinically practicing athletic trainers to determine the blueprint for content on the BOC exam within specific domains including: injury and illness prevention and wellness protection, clinical evaluation and diagnosis, immediate and emergency care, treatment and rehabilitation, and organizational and professional health and well-being (BOC, 2010).

Tyler (1949) specifies that the concept of the *a priori foundation* category should play a role in the subject-matter domain and in the development of future student

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

understanding by helping build from their past and present experiences (as cited in Clements, 2007, p. 41). This relates to AT education. For example, a foundational science course in physics would contain subject matter in the area of light, sound, and electricity. To understand how therapeutic modalities work within human tissue during the injury healing process, the AT student needs the base science knowledge. The therapeutic modalities content is contained in a therapeutic interventions course within an AT program curriculum and the *foundational scientific knowledge* is contained in the basic physics course. Another example is that students may or may not be required to take a human biology course within their degree program. However, they will need basic knowledge regarding the human cell to understand human tissue healing. These examples demonstrate the importance of the inclusion of *foundational scientific knowledge* within AT curriculums. If the curriculum does not require a physics or a biology course, the students are missing out on basic science knowledge needed to apply to the AT course content. This first category applies to AT education by emphasizing the inclusion of basic science courses, which sets a foundation for future understanding of upper level AT courses, as students utilize their past experiences and knowledge to further their overall understanding of program content.

Clements's (2007) second category of the CRF is the *learning model*. The *learning model* involves the learning activities that are structured with domain-specific models of learning. AT education uses this philosophy by utilizing the published NATA Educational Competencies that are divided by practice domains. These practice domains include: Evidence-Based Practice, Prevention and Health Promotion, Clinical Examination and Diagnosis, Acute Care of Injury and Illness, Therapeutic Interventions,

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Psychosocial Strategies and Referral, Healthcare Administration, Professional Development and Responsibility (NATA, 2012). Along with the domain-specific learning model, the BOC examination is developed by a role delineation study (RD)/practice analysis (PA) that surveys all practicing ATs to determine the blueprint of content to be included on the BOC examination. In other words, practice analysis drives curriculum content within set domains. The BOC outcome scores lead right into the third category of the CRF.

This final category of the CRF includes formative and summative curriculum evaluation. Clements's (2007) example of formative curricula evaluation notes observing a small group of students' pilot testing a game or activity as one component of a curriculum to determine the effectiveness of the activity on learning. A classroom teacher may use pre- and post-test randomized experimental designs for measures of learning or standardized measures of curriculum goals. Another example, on a larger scale of formative evaluation, could be observing several classrooms for information about the effectiveness of the curriculum (Clements, 2007).

Although Clements utilizes a math curriculum for examples throughout the framework, the phases are applicable to any curriculum. In fact, the CRT provides a framework for developing a research-based curriculum; thus, this researcher will use science course curriculum data accessed online as formative data to study the role of *foundational science courses* required for each AT curriculum. The summative evaluation will be the results of determining what *foundational scientific knowledge* courses affect successful BOC pass rates (Clements, 2007). In order to understand what is

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

considered *foundational scientific knowledge* within a curriculum, this study reviewed the literature to define the term.

Foundational Knowledge

McInnis (2002) defines foundational knowledge as “the basic building blocks needed for the sequential and cumulative development of understandings and skills in a specific discipline” (p. 34). It is common for health profession degree programs to require *foundational scientific knowledge* courses as prerequisites or as part of the curriculum. As the degrees in AT transition to the graduate level, it is appropriate to include prerequisites of *foundational scientific knowledge* to application requirements. Requiring the prerequisite coursework prepares the graduate student to understand concepts taught in AT courses such as therapeutic interventions, injury assessment, and general medical coursework.

According to Fink (2013), we must look at student learning in order to define *foundational knowledge*. During 2013, Fink developed the *taxonomy for significant learning*, (Fink, 2013). The researcher found that there are six kinds of learning within the cognitive domain of Bloom’s taxonomy, which was developed in 1956. The domains include: evaluation, synthesis, analysis, application, comprehension and knowledge (Fink, 2013). Within the domain of knowledge, Fink (2013) further defines foundational knowledge as “understanding and remembering of information and ideas” (p. 30). Fink goes on to explain that teachers use Bloom’s taxonomy both as a framework for formulating course objectives and as a basis for testing student learning (Fink, 2013). His *taxonomy of significant learning* is defined as foundational knowledge, the base knowledge that is needed for other kinds of learning to occur, the need to know

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

information, to understand, and recall specific ideas and information. Fink writes it is important for all people in the world to have valid knowledge about “science, history, literature and geography” (p. 30).

In summary, foundational knowledge is the basic knowledge first obtained by students. This basic knowledge is taught in order for individuals to have a foundation of information to build upon, and to apply when learning higher order information.

Foundational knowledge is found in all professions; however, this study will focus on understanding the foundational knowledge in health professions.

Foundational Knowledge in Health Professions and Education

All AT professional degree programs, undergraduate and graduate, contain the same educational competencies (CAATE 2015; NATA, 2015). Although the competencies and accreditation standards are consistent among all programs, there is not consistency throughout AT programs in regard to *foundational scientific knowledge* courses. Understanding the importance of *foundational scientific knowledge* courses within the curriculums in the profession of AT is critical as AT degree programs transition from an undergraduate to a graduate degree. It is this researcher’s belief that as AT programs are proposing the new graduate degree, it would be beneficial to have research to guide their curriculum planning, demonstrating reasoning behind course choices.

The CAATE summer newsletter *Insight* (2015) publicly identifies “educational components that we believe will produce the best health care providers, including; periods of full time clinical engagement, strong *foundational scientific knowledge*, faculty with areas of specific expertise, the inclusion of the Institute of Medicine’s core

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

competencies, alignment with schools of health professions whenever possible and practitioners who function as mid-level (level II) providers (on par with PA, PT, OT, and NPs)" (p. 2). As the accrediting agency has identified strong *foundational scientific knowledge* as a program component, educators and administrators have a need for research-based information on this topic to make curricular decisions during this time of degree transition.

Most health professions have set curricula for their respective degrees. Through the curricula/coursework, or pre-requisites, the students gain different types of knowledge. McGraw, Fox, and Weston (1978) completed a study reviewing health professions education and policy, and recommended a research agenda. The authors summarized that a process of research should be conducted to determine the basis for taking specific courses within schools of health professions. According to Henderson (1988), occupational therapy divides the knowledge needed for their profession into ordinary knowledge and specialized knowledge. Professional knowledge is gained in a liberal arts education and is considered to be an essential foundation for professional education. He further divides specialized knowledge into three categories: philosophy, technology, and science (Henderson, 1988). Henderson (1988) explains scientific knowledge as the knowledge in which professionals base their practice, and he includes in this definition the founding sciences such as anatomy, physiology, and psychology.

The medical education field has taken a different approach to their curriculum, transitioning from a traditional curriculum to a newer approach, including: replacing the teacher-centered focus to student-centered, gathering information through problem-based learning, hospital-based to community-based clinical experience, and standard programs

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

to one that includes elective courses (Hussain, 2011). Hussain (2011) explains the medical education curriculum design uses a discipline-based approach, first teaching basic sciences, including anatomy, physiology, and biochemistry.

As the medical students matriculate, they progress to pathology, microbiology, and epidemiology coursework and then apply to clinical practice, expanding upon the basic science knowledge. Medical education also uses an assessment of student needs, during the process of curriculum development, in an effort to close the gap between the students' knowledge and the competencies being taught (Sales & Schlaff, 2010). Hussain (2011) found that with the changes in health care, medical students need education outside of diagnosis and treatment. The physician of today must be able to understand health promotion, disease prevention, ethical practice, and research (Hussain, 2011). There are different approaches used to understand the needs of the students, including; discussions among supervising physicians, patients, care givers, and the government (Slavin, Wilkes, Usatine, & Hoffman, 2003; Walling & Merando, 2010). Once needs are addressed, learning outcomes are developed and integrated into the curriculum (Hussain, 2011).

McVicar, Andrew and Kemble (2015) completed an integrated literature review of prerequisite biosciences and curriculum interventions within the professional literature of nursing. In the United Kingdom, the path of a nursing student begins with a "pre-registration nurse education program" in which students are expected to meet competencies that include "a sound understanding of the biosciences, that is, anatomy, physiology, immunology, and biochemistry" (McVicar et al., 2014, p. 560) Once in a professional nursing program, the expectation is that the students have an understanding

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

of basic bioscience and are capable of transferring their basic knowledge into applied human bioscience, with expertise in “observational skills, analysis and problem-solving” (McVicar et al., 2015, p. 500) Within the 2015 study, they found that the focus of the curriculum interventions demonstrated perceived benefits to students rather than objective measures of actual student learning (McVicar et al., 2015).

In 2014, McVicar et al. conducted a review of published articles on the "bioscience problem," in an attempt to determine why nursing students were having on-going difficulty during their first year in the nursing curriculum, applying human bioscience information. This review found the admission criteria (pre-professional program course success) was the basis of screening students for success in grasping bioscience knowledge, as well as early academic support and quality of instruction (McVicar et al., 2014). This research demonstrated that prerequisite coursework success can be used as one indicator of professional program success. Furthermore, McVicar et al. (2014) concluded that health profession programs need to provide support to first-year students in the areas of study skills for student success.

Sesney, Neft, and Stringham (1977) took a different approach at Weber State University in Utah by including a year-long biomedical science core class for all introductory level allied health students. The core course was designed to “integrate the technical content of the sciences of physics, chemistry, anatomy, physiology, and microbiology to the human body” (Sesney et al., 1977, p. 34). The allied health students at Weber State were applying to programs including: nursing, respiratory therapy, medical technology, radiological technology, and dental hygiene (Sesney et al., 1977). The Weber State faculty who developed the core course felt that the “allied health is

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

students would learn the necessary scientific content in a more comprehensive, relevant, and economical manner than by taking the traditional curriculum sequence of 15-20 credit hours in separate science courses” (Sesney et. al., 1997, p.35). The core course success was evaluated by data collected, over a three and 3 ½ year period, in the areas of student learning, quality of instruction, and general operation of the course (Sesney et. al., 1997). Sesney et. al. (1997) reported that faculty in the School of Allied Health, “overwhelmingly endorsed the core and feel the course performs an outstanding service” claiming that “comprehensive data has been collected,” yet there is no documentation of statistical data reported within the article (Sesney et. al., 1997, p. 38). The core concept could be beneficial at an institution where students are applying to an undergraduate professional program. However, this concept would not work with stand-alone graduate level professional programs that outline specific required prerequisite science coursework.

Elder and Nick (1997) took a similar approach to that of Sesney et al. (1977) in which they researched creating a core curriculum for four degrees: laboratory sciences, health information management, occupational therapy, and physical therapy. They found that they needed to understand and meet each accrediting organization’s requirements to ensure students would be successful on credentialing examinations. They also found that there was relatively nothing published concerning desired skill beyond accreditation requirements and success on board examinations (Elder & Nick, 1997.) This study found that, “English composition was the most important course for the development of writing and reading skills,” and “computer science or computer applications courses were most important” (Elder & Nick, 1997, p .55).

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Humphrey, Mathews, Kaplan and Beeman (2002) reviewed 90 dental students' undergraduate transcripts, noting basic science course preparation. They then related their findings to the Dental Admission Test (DAT) performance, basic science course performance in dental school, and national board performance. The science courses analyzed included the number of credit hours in the following courses: anatomy, histology, biochemistry, microbiology, physiology, immunology, and basic biology. Using a t-test analysis correlation and Pearson correlation, they found that completing the undergraduate science courses did not significantly ($p < .05$) increase student scores on the dental national board examination (Humphrey et. al., 2002).

Historically, AT education originated as part of a physical education and health teaching degree; therefore, this study will explore literature in education regarding foundational knowledge. In the field of teacher education, there is a debate in the literature regarding the importance of inclusion or exclusion of foundational courses. Yuksel (2007) describes how, in 1997, the Higher Education Council (HEC) removed foundational courses, except psychology courses, from teacher education programs with no scientific data supporting the decision. This decision was then reversed in 2006 when the HEC brought foundational courses back into teacher education programs.

Yuksel (2007) believes the “foundational courses are the theoretical basis of educational practice by creating a bridge between the subject matter and teaching method courses, as well as helping teachers understand current social and psychological conditions and teach effectively” (p.1022). On the other hand, Conant (1963) believes foundational courses should be given as *pure*, not within the teacher education courses (Conant, as cited in Yuksel, 2007). Conant (1963) goes on to argue that courses including

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

foundational knowledge within teacher education courses are just bits of history, philosophy, political theory, sociology, and pedagogic ideology (as cited in Yuksel, 2007). He argued that instead of an educational philosophy course there should be philosophy course taught by an expert in philosophy (as cited in Yuksel, 2007). Yuksel (2007) presents the opposition to Conant's beliefs that foundational education courses are presented without referring to real teaching situations. Rather they refer to theory knowledge. Additionally, Yuksel (2007) believes that the foundation courses are taught by individuals with no formalized teacher training and no consensus across universities regarding content of the courses.

Current Status of AT Curricula Literature

Depending on the profession, there appears to be differing views on foundational knowledge requirements within the literature. Along with differing view, there is a lack of published literature. Clements (2007) found that foundational knowledge is seldom published or available to educators and the educational community, which makes one wonder how course decisions are made in curricula without supporting published evidence.

Unlike most health professions and education, the published research in the profession of AT that discusses the *foundational scientific knowledge* is limited. There is one published article on this topic written by Delforge and Behnke (1999) that lists specific science courses to be included in the AT curriculum from the years 1959 to the mid-1970s. The next item found was a newsletter, electronically published by CAATE in 2015, that publicly identifies educational components that they believe will produce quality health care providers. According to CAATE (2015), the components include:

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Periods of Full-time clinical engagement, strong *foundational scientific knowledge*, faculty with areas of specific expertise, the inclusion of the Institute of Medicine's core competencies, alignment with schools of health professions whenever possible and practitioners who function as mid-level (level II) providers (on par with PA, PT, OT, and NPs)". (p. 2)

Furthermore, during May 2016, the CAATE electronically communicated with all program directors, sending a set of proposed accreditation standards for open comment.

The proposed Standard 26 states, "The professional program requires prerequisite knowledge in biology, chemistry, physics, psychology, anatomy, and physiology" (CAATE, 2016, p.9). To date, an extensive literature review failed to produce findings demonstrating that inclusion of prerequisite science courses led to successful AT program outcomes. This standard does not specify what content is expected to be gained from the specified course, nor does it delineate whether one or two chemistry and physics courses are required.

Limited information is available in print and there is a mandate from the CAATE for inclusion of *foundational scientific knowledge*. These proposed standards listing specific *foundational scientific knowledge* courses for inclusion leave program directors in search of a basis for these mandated and proposed curricular changes. According to research conducted by Humphrey et. al. (2002) and Elder and Nick (1996), there are no significant findings that tie the inclusion of *foundational scientific knowledge* courses within curricula to objective program outcome data. These research findings do not indicate a need for *foundational scientific knowledge* inclusion within the curricula. With the information gained from these studies, it is imperative to answer the research

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

questions within this study, to determine whether there is valid data in support of the newly proposed CAATE standard.

Summary

In summary, this review began by analyzing the transformation of the AT curriculum over time. It was found that there have been specific content and course changes made without any data-driven research behind the curriculum decisions. With the change that has occurred within the academic history of the AT, and the mandate to transition all CAATE programs to the graduate level, requiring *strong foundational knowledge*, the AT practitioner is faced with creating a new curriculum. To develop a curriculum, the practitioner must first understand curriculum theory.

The curriculum theory reviewed in this document provided the general understanding that there is a broad range of theories and approaches to curriculum development. Through scholarly review and a need for evidence-based decision-making during curriculum development, Clements's (2007) Curriculum Research Framework was discovered. The steps outlined in the framework guide the practitioner through the development of an evidence-based curriculum. Due to the CAATE requirement of *foundational scientific knowledge* inclusion in AT curricula, the area of foundational knowledge was reviewed in health professions and education. This review ended with an overview of the current climate of AT education, demonstrated an accrediting body mandating inclusion of science courses into a curriculum, without a solid basis for the requirement. To date, there is no published evidence or data within the profession of AT to guide the practitioner in creating a curriculum that leads to demonstrated acquisition of *foundational scientific knowledge* or successful outcomes on the board of certification

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

examination. After discovery that evidence-based curriculum literature is needed in the profession of AT, it is the goal of this research study to determine if the requirement of *foundational scientific knowledge*, has a valid basis for being required in the AT curriculum.

SECTION FOUR:
CONTRIBUTION TO PRACTICE

Preface

The Athletic Training (AT) academic program director faces a tumultuous time as a leader, transitioning from an undergraduate degree to a graduate degree and physically relocating the degree from the historic location in schools of education to schools of health professions within universities. According to Bolman and Deal (2008), change customarily creates conflict. As the AT profession rapidly changes, conflict arises between historic roots of AT education and the newly proposed accreditation standards. As a profession, we yearn to be recognized on the same level as other health professions, such as physical and occupational therapy. Logically, to align with other health professions, we as ATs must accept that change is inevitable.

The AT program director, as a leader, is charged with proposing the new graduate level degree. A new degree proposal involves an intentional evaluation of the curriculum and a decision-making process including: pre-requisite courses, and degree requirements which encompass the Commission on Accreditation of Athletic Training Education (CAATE) standards and the National Athletic Trainers' Association (NATA) Education Council's competencies. Along with the degree change, the CAATE has published a statement and a *proposed* accreditation standard requiring inclusion of *foundational scientific knowledge* courses as prerequisites for admission to graduate level AT professional programs (CAATE, 2016). Currently, there is no published data regarding what *foundational scientific knowledge* courses are being taught in the accredited programs across the nation. Nor is there a published rationale for inclusion of the courses. This lack of factual information is a problem for program directors who seek to provide evidence behind their curricular decisions. The purpose of this executive summary is to

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

communicate the findings of this study, that was completed to determine what type of relationship, if any, exists between *foundational scientific knowledge* courses and 3-year aggregate first-attempt Board of Certification (BOC) pass-rates among CAATE accredited professional AT programs to the CAATE.

Executive Summary:

Foundational Scientific Knowledge in Athletic Training Curricula

Introduction & Purpose

The CAATE published a statement and a *proposed* accreditation Standard 26, requiring inclusion of *foundational scientific knowledge* as a pre-requisite for admission to professional graduate AT programs (CAATE, 2016). Currently, there is no published data regarding what *foundational scientific knowledge* courses are being taught in the accredited programs across the nation. Nor is there a published rationale for inclusion of the courses containing this knowledge. This lack of information creates a problem for program directors who would like to place evidence behind their curriculum design.

Key elements of Foundational Scientific Knowledge in AT Curricula

- a) The CAATE (2015) *Insight* summer newsletter publicly identifies educational components that it believes will produce quality health care providers, listing *strong foundational scientific knowledge*, as the second component (p.2)
- b) The proposed CAATE Standard 26 states, “The professional program requires prerequisite knowledge in biology, chemistry, physics, psychology, anatomy, and physiology” (CAATE, 2016).

Methods of Investigation

This quantitative study investigates individual, and combinations of *foundational scientific knowledge* courses within AT programs as well as the correlation between these courses and the 3-year aggregate program first-attempt, BOC pass rate.

Findings

Physics I and II courses were statistically significant as predictors of BOC pass-rates, but the effect size was small, accounting for only 6% variance (physics I) and 1% variance (physics II). Inclusion of chemistry and physics in AT curricula demonstrated a significant difference between mean BOC pass-rates when compared to AT programs that do not require chemistry and physics; however, a small effect size was also found (1% of the variance).

Discussion

The intent of this study was to gain empirical evidence to assist leaders in AT education to make informed curricular decisions. Specifically, this study aimed to give leaders the evidence to demonstrate which *foundational scientific knowledge* courses are predictors of BOC pass-rates and which courses to include as prerequisites for the graduate AT curricula.

Within AT profession programs, there are multiple factors that lead to successful outcomes. Possible elements leading to the low predictive power of the foundational scientific knowledge courses could be reflective of the limitations within this study. There were no controls for quality of instruction (didactic and clinical), quality of clinical experience (preceptor and clinical site), student learning (didactic and clinical), and overall program effectiveness (student exit surveys, BOC scores, student job placement). With so many factors contributing to the BOC pass-rates, reviewing only one component

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

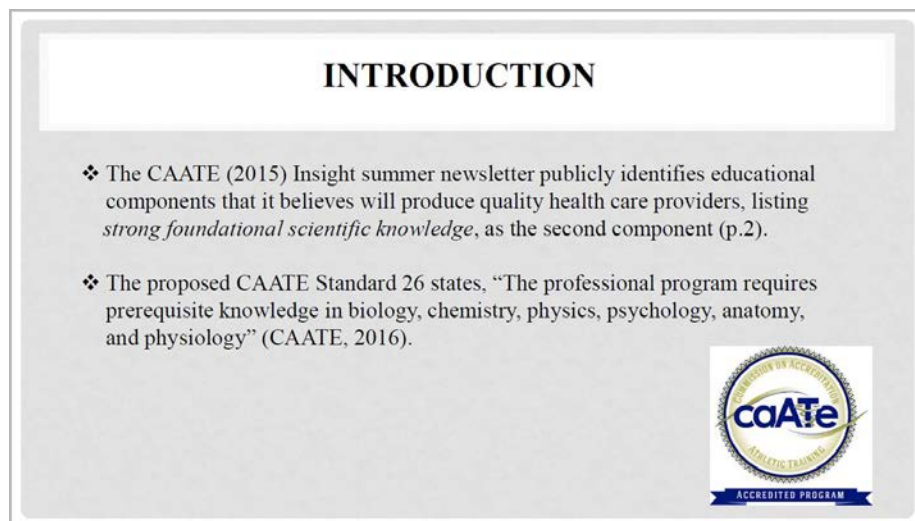
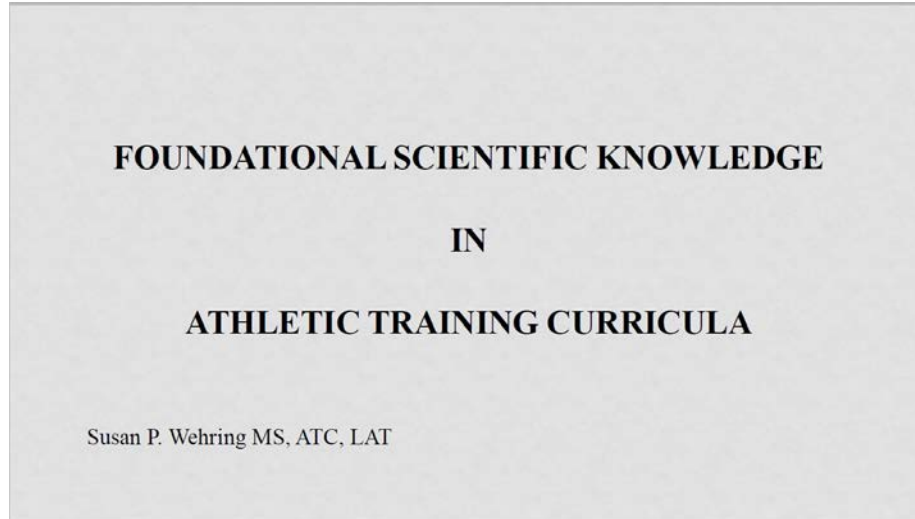
of the curriculum did not demonstrate high predictive power. However, the findings of this study were the first step in evaluating *foundational scientific knowledge* courses being taught in AT curricula across the nation and the correlation to BOC pass-rates. The overall results of this study call for the need for future studies.

Recommendations

A need for further research addressing the following areas:

- a. Evaluation of the quality of instruction within the *foundational scientific knowledge* courses.
- b. Investigation of *foundational scientific knowledge* course objectives, course content, and student outcomes to determine what content is actually being taught and learned in the courses.
- c. Student perception of what is being learned in the *foundational scientific knowledge* courses compared to the AT faculty perception of what students are learning in the courses.
- d. Do student outcomes (grades) in the *foundational scientific knowledge* courses correlate with success on BOC pass-rates?
- e. Student perception of knowledge gained in the undergraduate *foundational scientific knowledge* courses and application of that knowledge to AT graduate level course content.
- f. What specific *foundational scientific knowledge* content is being taught in AT courses? Are AT faculty teaching physics content within their therapeutic modalities course? Chemistry content within their AT pharmacology course?
- g. Case studies on specific institutions that utilize a biomedical core class, for all pre-allied health students that encompasses the technical content of the sciences (physics, chemistry, anatomy, physiology, and microbiology) to the human body and correlate to student success and program outcomes (e.g. allied health board exam success).

Presentation



The profession of Athletic Training (AT) is currently undergoing multiple changes, including: the transition to a graduate degree, the proposed standard of being housed in a school of health professions, and the proposed Standard 26 requiring graduate level academic programs to include the prerequisite *foundational scientific knowledge* in biology, chemistry, physics, psychology, anatomy and physiology (CAATE, 2016).

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

These new accreditation requirements can be challenging to AT program directors, as the leaders, implementing the change.

PURPOSE

- Provide AT educational leaders with evidence-based information to review and utilize during development of graduate AT curricula.
- This study addresses the gap in empirical knowledge related to the role of *foundational scientific knowledge* in preparing AT professionals.
- The data gathered from this study will give a research-based guide for *foundational scientific knowledge* during curricular development as academic programs transition from undergraduate to graduate degrees.

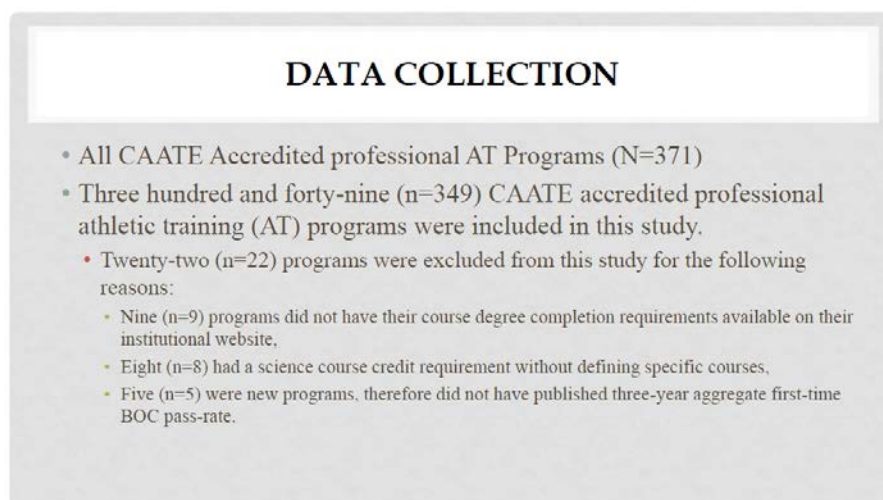
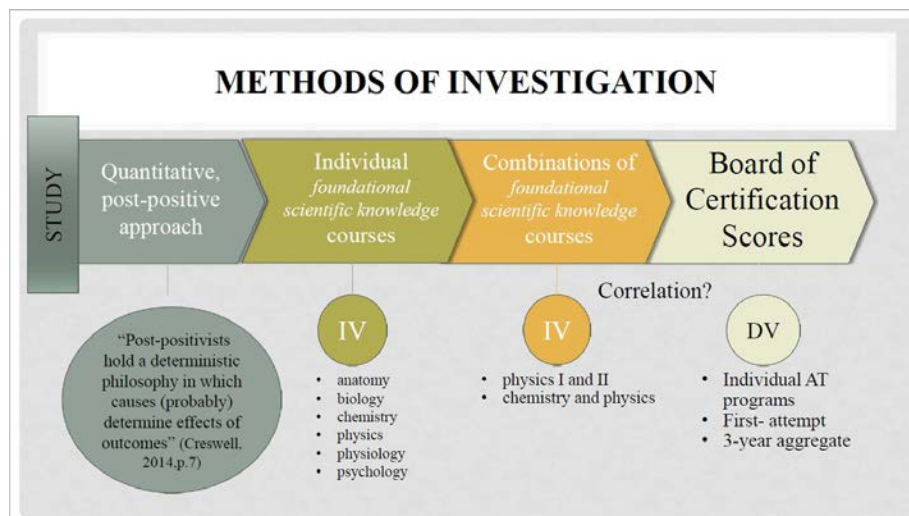
As a program director, I chose to focus my study on the newly proposed pre-requisite *foundational scientific knowledge* requirement. My curiosity about what other programs were currently requiring and seeking empirical evidence about why these specific areas of knowledge were chosen, led to the development of this study's research questions and an extensive literature search.

RESEARCH QUESTIONS

- **Research Question 1:** What *foundational scientific knowledge* courses are currently included in Athletic Training degree programs nationwide?
- **Research Question 2:** Does inclusion of individual science courses have correlation with Athletic Training programs 3-year aggregate first-time BOC pass rate?
- **Research Question 3:** Does inclusion of individual chemistry and physics courses or combined have a correlation with Athletic Training programs 3-year aggregate first-time BOC pass rate?
- **Research Question 4:** What specific combination of physics and chemistry courses correspond to the highest first-time 3-year aggregate AT program BOC pass rates?

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

To explore the *foundational scientific knowledge* content requirement, the undergraduate science courses (anatomy, biology, chemistry I, chemistry II, physics I, physics II, physiology and psychology) and combination of courses, were utilized to determine if there was a correlation with Board of Certification (BOC) scores. The individual AT program published 3-year aggregate, first-attempt, BOC pass-rate were used as the outcome measure, to determine if science course completion was predictive of BOC scores.



FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

During 2016, each professional AT program's institution website (N=371) was visited to determine which science courses were either part of the undergraduate curriculum or a prerequisite for the graduate curriculum. At the time the data was gathered there were 336 undergraduate programs and 35 graduate programs. Three-hundred and forty-nine (n=349) programs provided the data required for this study. The AT program BOC pass-rates were retrieved from the Commission on Accreditation of Athletic Training Education's (CAATE) website.

RESEARCH QUESTION 1

What *foundational scientific knowledge* courses are currently included in Athletic Training degree programs nationwide?

- Each AT program/name of the institution was entered into SPSS.
- The science courses in each program were individually coded "yes=0" or "no=1,"
- Code of "yes" indicating the science course is a degree requirement for that AT program and "no" indicating the science course is not required.
- After all data were entered into SPSS, they were analyzed to obtain descriptive statistics utilizing frequencies.

The data was entered into an Excel spreadsheet, listing the institution name, and columns for each science course. By individual program, science courses were coded 0=yes, a degree-requirement or 1=no, not a degree requirement. Next, the individual program BOC pass-rate percentages were entered into the Excel document. After all data was entered into Excel, it was transferred into SPSS. To answer research question one, descriptive statistics were completed determining the number of programs (and percent) that required each science course. Anatomy was not included in the results, because the science course was required by all (n=349) programs.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Course		n	%
Biology	Yes	169	48
	No	180	52
Chemistry I	Yes	145	41.5
	No	204	58.5
Chemistry II	Yes	32	9.2
	No	317	91
Physics I	Yes	97	28
	No	252	72
Physics II	Yes	17	5
	No	332	95
Physiology	Yes	329	94
	No	20	6
Psychology	Yes	247	71
	No	102	29

According to Delforge and Behnke (1999), beginning in 1959, and then again in 1970, there was a defined list of courses that all National Athletic Training Association (NATA) approved programs had to include in their AT curriculum. Over the years, the transition has gone from a list of courses to subject matter; and today, to educational competencies. The 1959 AT curriculum model included a list of physical therapy school prerequisites that encompasses 24 semester hours of sciences. Next, this model lists courses that need to be included in the AT curriculum, including some sciences courses, but it also introduces new content areas such as psychology, coaching, nutrition, organization and administration, hygiene, athletic training techniques, and laboratory sessions. The model concludes with four recommended courses that may have already been taken within the physical therapy pre-requisites.

With the increase of NATA-approved programs during the 1970s, the AT profession determined there was no longer a need to have the physical therapy prerequisites included in AT curriculums. During 1983, the NATA developed a list of required AT curriculum subject matter, shifting from a course list to curriculum subject matter, and the requirement for the *foundational scientific knowledge* courses of Biology,

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Chemistry, and Physics no longer existed. Today, programs follow a competency model.

The curriculum course requirement change implemented in 1983 has led to the current variety of science course requirements among AT programs.

RESEARCH QUESTION 2

Does inclusion of individual science courses have a correlation with Athletic Training programs 3-year aggregate first-time BOC pass rate?

- Descriptive statistics were run on each individual science course as a predictor variable of BOC pass-rates.
 - number of programs that require each of the individual science courses
 - mean BOC pass-rate, and the
 - standard deviation of the BOC pass-rates.
- A regression analysis was completed on each individual science course (independent variable) regressed on the BOC pass-rate (dependent variable).
- After the regressions analyses were completed on the individual science courses, it was determined that a multiple regression needed to be completed utilizing both physics I and II (IVs), regressed on the BOC pass-rates, given that these two courses were determined significant predictors of BOC pass-rates.

After determining what science course curricular requirements were currently in place across the United States, this study took a closer look at the individual course requirements and how they correlated with BOC pass-rates.

Descriptive Statistics, Course Present (yes/no), Regression Analysis (Individual science courses regressed on BOC pass-rates), and ANOVA							
Course		n	%	M ± SD	F	r ²	p-value
Biology	Yes	169	48	.80 ± .18	.13	0.00	.714
	No	180	52	.79 ± .18			
Chemistry I	Yes	145	41.5	.81 ± .10	1.56	.004	.212
	No	204	58.5	.78 ± .17			
Chemistry II	Yes	32	9.2	.84 ± .16	2.32	.007	.129
	No	79	91	.79 ± .18			
Physics I	Yes	97	28	.87 ± .15	22.41	.061	.000
	No	252	72	.77 ± .18			
Physics II	Yes	17	5	.89 ± .10	5.03	.014	.026
	No	332	95	.79 ± .18			
Physiology	Yes	329	94	.74 ± .18	1.69	.005	.195
	No	20	6	.80 ± .20			
Psychology	Yes	247	71	.79 ± .19	1.43	.004	.232
	No	102	29	.81 ± .16			

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

This table provides regression analysis for each individual course regressed on BOC pass rates. Again, no analysis is possible on the predictor variable anatomy as there was no naturally occurring variance in the vector. All AT programs included in this study required an anatomy course.

FINDINGS

- Physics I and II courses were statistical significant as predictors of BOC pass-rates
- Effect size was small,
 - accounting for only 6% variance (physics I)
 - 1% variance (physics II).

Physics I was most predictive of BOC pass-rates, but still only accounted for a six percent variance. The difference between the means was statistically significant ($t(204.85) = -5.103, p = .000$). The effect size of the difference between the means was statistically non-significant and the effect size was small ($r^2 = 0.06$) (i.e., the variance shared between Physics I as a pre-requisite and BOC completion rates was slightly over six percent).

For Physics II, the difference between the means remained statistically significant ($t(21.66) = -3.57, p = .001$). The effect size of the difference between the means was statistically significant and the effect size was small ($r^2 = 0.014$) (i.e., the variance shared between Physics II as a pre-requisite and BOC completion rates was slightly over one percent).

RESEARCH QUESTION 3

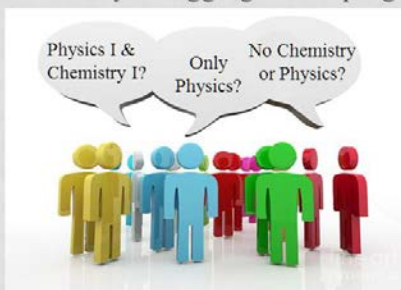
- Does inclusion of individual **chemistry** and **physics** courses or combined have a correlation with Athletic Training programs 3-year aggregate first-time BOC pass rate?



After looking at individual courses, course combinations were developed to determine the effect on BOC scores. Chemistry and physics were chosen to create course categories because the current proposed CAATE accreditation Standard 26 lists both subject areas as required curriculum prerequisite knowledge. However, the standard does not delineate how many courses/credit hours, a specific level, or the actual content knowledge required of chemistry and physics. Each AT program was coded with a below category number, to designate which category matched their program requirements.

RESEARCH QUESTION 4

What specific combination of physics and chemistry courses correspond to the highest first-time 3-year aggregate AT program BOC pass rates?



FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

CATEGORICAL GROUPS OF CHEMISTRY & PHYSICS

- 1. Chemistry I only
- 2. Chemistry I, II only
- 3. Physics I only
- 4. Physics I, II only
- 5. Chemistry I, physics I only
- 6. Chemistry I, II, physics I, physics II only
- 7. Chemistry I, II, physics I only
- 8. Physics I, II, chemistry I only
- 9. No chemistry, no physics only

- Descriptive statistics were completed for each course category to determine the mean BOC pass-rates for each of the nine course categories.
- The course categories were ranked from highest BOC pass-rate mean to lowest.



Next, descriptive statistics were completed of the chemistry and physics course categories including the means of BOC pass-rates.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Descriptive Statistics of BOC Pass Rate by Course Category

Course Category	n	M	SD
Chemistry I, Physics I, II only	2	0.96	0.06
Physics I, Chemistry I, II only	5	0.95	0.05
Physics I, II only	2	0.89	0.09
Physics I only	25	0.87	0.15
Chemistry I, Physics I only	50	0.85	0.17
Chemistry I, II, Physics I, II only	16	0.84	0.14
Chemistry I only	60	0.81	0.16
Chemistry I, II only	14	0.79	0.19
No Chemistry and no Physics	175	0.77	0.19
Total	349	0.79	0.18

The nominal categories were arranged so that no educational institution can belong to more than one mutually exclusive category. The categories were listed from highest to lowest mean BOC score. The most notable finding when analyzing the course category findings in this table demonstrates the number of AT programs (n=175) that include physics and chemistry courses as a requirement versus AT programs (n=174) that do not require physics or chemistry. Fifty percent of the AT programs do not require physics or chemistry and report the lowest mean BOC pass-rate at 77%. This difference in numbers of AT programs *requiring* or *not requiring* chemistry and physics, led to recoding programs into two groups, “0=chemistry and physics, yes,” and “1=chemistry and physics, no,” in order to gain a better understanding of relationships, descriptive statistics, regression analysis, and a two-tailed *t*- test were completed on the new course categories.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

FINDINGS

Descriptive Statistics, Regression Analysis and T-Test for BOC Pass Rate by Course Categories (yes/no).

Course Category	n	M ± SD	F	r ²	p-value
Chemistry and Physics					
Yes	175	.82±.17	4.75	.014	.030
No	174	.77±.19			

The difference between the means was found to be statistically significant ($t(347) = -2.179, p = .030$) with a small effect size ($r^2 = .014$). Only 1% of predictive power of BOC results was attributed to including chemistry and physics in an AT curriculum.

In reviewing the individual science course data as predictors of BOC pass-rates, it was determined that Physics I and Physics II were the only statistically significant *individual* course predictors. Therefore, this study combined the two courses into one *category* to investigate further significance.

Descriptive Statistics, Multiple Regression Analysis, T-Test on BOC Pass Rate by Courses Category, Physics I and Physics II (yes/no).

Course Category	n	M ± SD	F	r ²	p-value
Physics I and II					
Yes	17	.89±.10	11.38	.062	.000
No	332	.78±.18			

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

The difference between the means was statistically significant ($t(347) = -2.24$, $p = .000$), with a small effect size ($r^2 = .062$), accounting for only 6% variance, meaning that 94% of other factors accounted for prediction of AT program BOC pass-rate for success.

OVERALL FINDINGS

- Physics I and II courses were statistically significant as predictors of BOC pass-rates, but the effect size was small, accounting for only 6% variance (physics I) and 1% variance (physics II).
- Inclusion of chemistry and physics in AT curricula demonstrated a significant difference between mean BOC pass-rates when compared to AT programs that do not require chemistry and physics; however, a small effect size was also found (1% of the variance).

Within AT profession programs, there are multiple factors that lead to successful outcomes. Possible elements leading to the low predictive power of the foundational scientific knowledge courses could be reflective of the limitations within this study.

LIMITATIONS, ASSUMPTIONS, AND DESIGN CONTROLS

- Measures for AT Program success
 - quality of instruction (didactic and clinical),
 - quality of clinical experience (preceptor and clinical site),
 - student learning (didactic and clinical), and
 - overall program effectiveness (student exit surveys, BOC scores, student job placement).

This study is specifically looking at *foundational scientific knowledge* courses as predictors of BOC examination scores. This study cannot control for all other factors involved in AT programs.

Through assessment of AT programs, there are multiple areas that are evaluated. This study evaluated one area of curriculum design.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Possible elements contributing to the predictive power of the *foundational scientific knowledge* courses as predictors of BOC outcomes:

Limitations within this study.

- quality of instruction (didactic and clinical)
- quality of clinical experience (preceptor and clinical site)
- student learning (didactic and clinical)
- overall program effectiveness (student exit surveys, graduation rates, student job placement)

Findings within this study are the first-steps in evaluating *foundational scientific knowledge* courses being taught in AT curricula across the nation and the correlation to BOC pass-rates.

DISCUSSION

Intent of study

- Gain empirical evidence to assist leaders in AT education to make informed curricular decisions.
- Determine which *foundational scientific knowledge* courses or combination of courses are predictors of BOC pass-rates.

Predictive factors of AT program successful BOC examination outcomes

- Multiple components of AT programs
- BOC examination scores are only one measure of AT program success

Now that the empirical evidence has been gathered on the *foundational scientific knowledge* courses, as predictors of BOC pass-rates, it is clear that continued research needs to be completed, in order to gain more in-depth knowledge, outside the limitations found within this study.

RECOMMENDATIONS

A need for further research:

- Evaluation of the quality of instruction within the *foundational scientific knowledge* courses.
- Investigation of *foundational scientific knowledge* course objectives, course content, and student outcomes to determine what content is actually being taught and learned in the courses.
- Student perception of what is being learned in the *foundational scientific knowledge* courses compared to the AT faculty perception of what students are learning in the courses.

Recommendations, continued.

- What specific *foundational scientific knowledge* content is being taught in AT courses? Are AT faculty teaching physics content within their therapeutic modalities course? Chemistry content within their AT pharmacology course?
- **Case studies** on specific institutions that utilize a biomedical core class, for all pre-allied health students that encompasses the technical content of the sciences (physics, chemistry, anatomy, physiology, and microbiology) to the human body and correlate to student success and program outcomes (e.g. allied health board exam success)

QUESTIONS?

SECTION FIVE:
CONTRIBUTION TO SCHOLARSHIP

Preface

Athletic Training (AT) Education is currently in the midst of a culture of change. The accrediting agency, the Commission on Accreditation of Athletic Training Programs (CAATE), has mandated that all professional AT programs in the United States transition to a Master of Athletic Training degree by 2022 (BOC, 2015; CAATE, 2015; NATA 2015). CAATE followed the announcement of the degree level change with a published statement and a *proposed* accreditation standard mandating inclusion of *foundational scientific knowledge* courses as pre-requisites for admission to graduate AT curriculums (CAATE, 2016). The proposed standard delineates prerequisite knowledge in the following areas: biology, chemistry, physics, psychology, anatomy and physiology.

While programs transition to a graduate degree, the AT program director, as a leader, is charged with proposing the new degree. This involves an intentional evaluation of the curriculum and a decision-making process. My process began by wondering how and why the CAATE was requiring the delineated prerequisite knowledge. After an extensive literature search resulted in finding no published information on this topic specific to AT, my dissertation journey began. After my dissertation is approved I will submit a manuscript to the *Athletic Training Education Journal (ATEJ)*, the national journal for the profession of education in athletic training.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Foundational Scientific Knowledge in Athletic Training Curricula

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FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Foundational Scientific Knowledge in Athletic Training Curricula

ABSTRACT

Context: During 2015, the Commission on Accreditation of Athletic Training Education (CAATE) first publicly identified the fact that they believe strong *foundational scientific knowledge* produces the best health care providers. Next, in May 2016, a set of proposed accreditation standards were published. One standard delineated that all AT programs must include: anatomy, biology, chemistry, physics, physiology, and psychology as prerequisite knowledge. No studies to date have examined the relationship of *foundational scientific knowledge* course inclusion in AT curricula as a predictor of BOC pass-rates.

Objective: To determine if there is a significant relationship between *foundational scientific knowledge* courses and 3-year aggregate first-attempt Board of Certification (BOC) pass-rates among CAATE accredited professional Athletic Training (AT) programs.

Design: Original Research

Setting: All CAATE accredited professional programs in the United States.

Patients or other Participants: Three hundred and forty-nine (n=349) CAATE accredited professional AT programs.

Data Collection and Analysis: AT programs electronically published required science courses for degree completion and 3-year aggregate first-attempt program BOC pass-rates. Descriptive statistics, independent sample t-tests, and regression analyses were used to evaluate inclusion of science courses in AT curricula as predictors of BOC pass-rates.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Results: Physics I was most significant, compared to the other courses, when predicting BOC pass-rates, accounting for a 6% variance. The difference between the means was statistically significant ($t(204.85) = -5.103, r^2 = 0.06, p = .000$). AT programs that include physics and chemistry demonstrate a significant difference in BOC pass-rate means when compared to programs that do not. The difference between the means was found to be statistically significant with a small effect size ($t(347) = -2.179, r^2 = .014, p = .030$).

Conclusions: Overall foundational scientific knowledge courses individually, or in groups, are not significant predictors of BOC pass-rates, indicating that further research is needed.

Key Words: athletic training education, BOC success, predictors

Word Count: 298

Introduction

The education of the Athletic Trainer (AT) has undergone many transitions since its inception in the 1950s. Through the decades, AT curricula have transformed from a model of required coursework to a specific list of subject matter. The program currently utilizes a competency-based curriculum model. Along with curriculum model changes, there is an accreditation mandated change in the degree level for the profession of AT. The Commission on Accreditation of Athletic Training Education (CAATE) announced that all undergraduate AT programs must transition to a graduate level professional degree program by 2022 (BOC, 2015; CAATE, 2015; NATA 2015). One requirement accompanying the degree level change is the inclusion of a strong *foundational scientific knowledge* component as part of the graduate degree. The commission stated that "strong

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

foundational scientific knowledge is an educational component to produce the best health care providers” (CAATE Insight, 2015, p.2).

According to Delforge and Behnke (1999), beginning in 1959, and then again in 1970, there was a defined list of courses that all National Athletic Training Association (NATA)-approved programs had to include in their AT curriculum. Refer to Table 1 and Table 2 for the defined list of courses. Over the years, the transition has gone from a list of courses to subject matter, and today, to educational competencies. The 1959 AT curriculum model includes a list of physical therapy school prerequisites that encompass 24 semester hours of sciences. Refer to Table 1. Next, this model lists courses that need to be included in the AT curriculum, including some sciences courses, but also introduces new content areas such as psychology, coaching, nutrition, organization and administration, hygiene, athletic training techniques, and laboratory sessions. The model concludes with four recommended courses that may have already been taken within the physical therapy prerequisites. With the increase of NATA-approved programs during the 1970s, the AT profession determined that there was no longer a need to have the physical therapy pre-requisites included in AT curriculums. As shown in Table 2, the physical therapy pre-requisites were no longer a requirement. The next published information delineating AT curriculum requirements was in 1983, transitioning a course list to curriculum subject matter requirements (Delforge and Behnke 1999). Most recently, the CAATE Insight summer newsletter (2015) publicly identifies:

educational components that we believe will produce the best health care providers, including; periods of full time clinical engagement, strong *foundational scientific knowledge*, faculty with areas of specific expertise,

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

the inclusion of the Institute of Medicine's core competencies, alignment with schools of health professions whenever possible and practitioners who function as mid-level (level II) providers (on par with PA, PT, OT, and NPs (p. 2).

Furthermore, during May 2016, the CAATE electronically communicated with all program directors, sending a set of proposed accreditation standards for open comment. The proposed Standard 26 states, "The professional program requires prerequisite knowledge in biology, chemistry, physics, psychology, anatomy, and physiology" (CAATE, 2016, p. 9). As the accrediting agency has identified the component of strong *foundational scientific knowledge* as a program component, educators and administrators have a need for research-based information on this topic to make curricular decisions during this time of degree transition.

The purpose of this study was to provide AT program directors with empirical evidence to help guide curricular planning. To achieve the evidence, data was collected investigating the *foundational scientific knowledge* courses that are currently being taught within accredited programs across the United States. A study was made to determine whether the courses, or a combination of the courses, are significant predictors of AT program 3-year aggregate first-attempt BOC pass-rates. The Curriculum Research Framework (CRF) phases developed by Clements (2007) were used as the lens to frame this study. Clements's (2007) CRF begins by describing and categorizing research for the development and evaluation of curriculum. Through this framework, the following research questions were developed:

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Research Question 1: What *foundational scientific knowledge* courses are currently included in Athletic Training degree programs nationwide?

Research Question 2: Does inclusion of categorical groups of chemistry and physics courses within AT curricula correlate with Athletic Training programs 3-year aggregate first-time BOC pass rates?

Research Question 3: Does inclusion of individual chemistry and physics courses or combined have a correlation with Athletic Training programs' 3-year aggregate first-time BOC pass rate?

Research Question 4: What specific combination of physics and chemistry courses correspond to the highest first-time 3-year aggregate AT program BOC pass rates?

Methods

Participants

Three hundred and forty-nine (n=349) CAATE accredited professional athletic training (AT) programs were included in this study. Data was gathered on three-hundred and seventy-one (N=371) professional AT programs. Twenty-two (n=22) programs were excluded from this study for the following reasons: Nine (n=9) programs did not have their course degree completion requirements available on their institutional website, eight (n=8) had a science course credit requirement without defining specific courses, and five (n=5) were new programs, therefore they did not have published three-year aggregate first-time BOC pass-rates.

Procedures

Each AT program's degree requirements were verified on their institutional website and the following foundational scientific knowledge courses were documented:

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

anatomy, biology, chemistry I, chemistry II, physics I, physics II, physiology, and psychology. These foundational science courses were utilized as the independent/predictor variables for this study. The independent variables in this study are all binary categorical values with two possible values for degree requirement (e.g., biology was or was not). Next, the dependent/outcome variables of each AT professional program's three-year aggregate first-time BOC pass-rate, for the years 2013 to 2015, were retrieved from the CAATE website.

Data Analysis

This study utilized quantitative analysis of collected categorical and continuous data to answer the research questions. All collected data was entered into SPSS Version 20 to run the statistical analyses. This study set an alpha level of .05 for all comparisons of data, to determine if statistical significance was present. The eight independent/predictor variables are the *foundational scientific knowledge* courses: biology, chemistry I, chemistry II, physics I, physics II, physiology, and psychology. The continuous dependent/outcome variable was the BOC first-time pass rate for each AT degree program. The program BOC pass-rates are published as a 3-year aggregate percentage.

First, each AT institution program/name was entered into SPSS. Next, the science courses in each program were individually coded "yes=0" or "no=1," with the code of "yes" indicating the science course is a degree requirement for that AT program, and "no" indicating the science course is not required. After all data were entered into SPSS, they were analyzed to obtain descriptive statistics utilizing frequencies answering research question one. To answer research question two, descriptive statistics were run on each individual science course as a predictor variable of BOC pass-rates. These statistics

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

reported the number of programs that require each of the individual science courses, the mean BOC pass-rate, and the standard deviation of the BOC pass-rates. Next, a regression analysis was completed on each individual science course (independent variable) regressed on the BOC pass-rate (dependent variable).

Chemistry and physics were chosen to create course categories because the current proposed CAATE accreditation Standard 26 lists both subject areas as required curriculum pre-requisite knowledge. However, the standard does not delineate how many courses/credit hours, what specific level, or the actual content knowledge required of chemistry and physics. To answer research question three, each AT program was coded with a below category number, to designate which category matched their program requirements.

1. Chemistry I only
2. Chemistry I, II only
3. Physics I only
4. Physics I, II only
5. Chemistry I, physics I only
6. Chemistry I, II, physics I, physics II only
7. Chemistry I, II, physics I only
8. Physics I, II, chemistry I only
9. No chemistry, no physics only

After all categories of courses (1-9) were coded into SPSS, descriptive statistics were run. The results indicated approximately half of all AT programs fit into Category 9 (no chemistry, no physics), with the other half coded into categories 1-8 (yes chemistry and physics). Due to the finding that approximately half of the programs did not require chemistry or physics, the programs were re-coded as 0= chemistry and physics, 1= no

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

chemistry, no physics to answer research question four. Next, descriptive statistics, a two-tailed t -test, and a regression were completed, using the new chemistry and physics categories as the independent variables regressed on BOC pass-rates as the depended variable.

When the regressions analyses were completed on the individual science courses to answer research question one, it was determined that further investigation needed to be completed on physics I and II, given that these two courses had significant p -values. Finally, to answer question four, descriptive statistics, a multiple regression analysis and t -test for BOC Pass Rate by Courses Category, Physics I and Physics II (yes/no) were completed using the category of physics I and II as independent/predictor variables regressed on the BOC pass-rates as the dependent variable.

Results

Results for Research Question 1: *What foundational scientific knowledge courses are currently included in Athletic Training degree programs nationwide?*

This study sought to determine descriptive statistics for the science courses currently being taught in AT curricula and whether the use of one or more combinations of *foundational scientific knowledge* courses was predictive of the BOC pass-rate for the AT programs/ institutions sampled in this study. Table 4 reports the descriptive statistics for each individual science course (biology, chemistry I, chemistry II, physics I, physics II, physiology, and psychology) required within AT curricula. Next, Table 4 provides regression analysis for each individual course regressed on BOC pass rates. All AT programs, included in this study required an anatomy course. Therefore, no analysis is possible on the predictor variable anatomy, as there was no naturally occurring variance in the vector.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Results for Research Question 2: *Does inclusion of individual science courses have a correlation with Athletic Training programs' 3-year aggregate first-time BOC pass rates?*

Biology as an included course in AT program curricula accounted for no detectable shared variance with BOC pass-rates ($t(347) = -.367, r^2 = 0.00, p = .714$). The difference between the BOC pass-rate means of programs that required chemistry I was not statistically significant ($t(347) = -1.25, p = .212$). The effect size of the difference between the means was not statistically significant and the effect size was very small ($r^2 = 0.004$), accounting for less than one-half of one percent. Chemistry II demonstrated a difference between the means that was not statistically significant ($t(347) = -1.52, p = .129$). The effect size of the difference between the means was not statistically significant and the effect size was very small ($r^2 = 0.007$). Chemistry II accounted for seven tenths of one percent pass-rates (i.e., the variance shared between chemistry II as a pre-requisite and BOC completion rates was seven tenths of one percent).

Physics I was most predictive of BOC pass-rates, but still only accounted for a six percent variance. Physics II accounted for slightly less than one and one half percent of shared variance. The difference between the means of Physics I failed to satisfy Levene's test for the equality of variances and was small enough not to alter the degrees of freedom significantly. The difference between the means was statistically significant ($t(204.85) = -5.103, p = .000$). The effect size of the difference between the means was statistically non-significant and the effect size was small ($r^2 = 0.06$) (i.e., the variance shared between physics I as a pre-requisite and BOC completion rates was slightly over six percent). The physics II difference between the means failed to satisfy Levene's test for the equality of

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

variances and the violation was large, resulting in a dramatic adjustment in the degrees of freedom. However, the difference between the means remained statistically significant ($t(21.66) = -3.57, p = .001$). The effect size of the difference between the means was statistically significant and the effect size was small ($r^2 = 0.014$) (i.e., the variance shared between physics II as a pre-requisite and BOC completion rates was slightly over one percent).

When evaluating inclusion of a physiology course, the difference between the means was not statistically significant ($t(347) = -1.300, p = .195$). The effect size of the difference between the means was statistically non-significant and effect size was very small ($r^2 = 0.005$). Specifically, the shared variance between physiology as a pre-requisite and BOC pass rates was only one half of one percent. Psychology accounted for less than one half of one percent of shared variance with BOC pass-rates. The difference between the means was not statistically significant ($t(347) = -1.97, p = .232$). The effect size of the difference between the means was not statistically significant and the effect size was very small ($r^2 = 0.004$) (i.e., the variance shared between psychology as a pre-requisite and BOC completion rates was four tenths of one percent).

Results for Research Question 3: *Does inclusion of individual chemistry and physics courses or combined have a correlation with Athletic Training programs' 3-year aggregate first-time BOC pass rate?*

Table 5 reports course categories of physics and chemistry as predictors of BOC pass-rates. The nominal categories are arranged so that no educational institution can belong to more than one mutually exclusive category. The categories are listed from highest to lowest mean BOC score. The sample sizes in the top mean BOC score

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

categories are small at 2, 5, and 2 programs. Table 5 also reflects what was already found in research question 1, demonstrating that physics I is a predictor of BOC score success.

The most notable finding when analyzing the course category findings in Table 5 demonstrates the number of AT programs (n=175) that include physics and chemistry courses as a requirement versus AT programs (n=174) that do not require physics or chemistry. Fifty percent of the AT programs do not require physics or chemistry and report the lowest mean BOC pass-rate at 77%. Table 6 reports all AT programs that require chemistry and physics, compared to programs that do not. The difference between the means was found to be statistically significant ($t(347) = -2.179, p = .030$) with a small effect size ($r^2 = .014$). Demonstrating that including chemistry and physics in the AT curriculum leads to higher BOC mean pass-rates than not including chemistry and physics courses. However the effect size only accounts for 1% of the variance of scores.

Results for Research Question 4: *What specific combination of physics and chemistry courses correspond to the highest first-time 3-year aggregate AT program BOC pass rates?*

Physics I and physics II were the only statistically significant individual course predictors of the BOC pass-rate as shown in Table 4. With this finding, a closer look was taken at the combination of the two predictor variables, physics I and physics II, by completing a 2-tailed t -test and multiple regression between the programs that require physics I and physics II (yes or no) as the independent variable regressed on the dependent variable of BOC scores.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

The difference between the means is statistically significant ($t(347) = -2.24, p = .000$), with a small effect size ($r^2 = .062$), only accounting for 6% variance, meaning that 94% of other factors account for prediction of AT program BOC pass-rates.

To answer research question four, Table 6 and 7 were reviewed. It was determined that the combination of physics and chemistry lead to a significant mean BOC score (with a small effect size) when compared to AT programs that do not include physics and chemistry. However, the most significant finding in this study was that the combination of physics I and physics II have the most significant correlation with higher BOC scores.

Discussion

The intent of this study was to gain empirical evidence to assist leaders in AT education to make informed curricular decisions. Specifically, the study reviewed methods to give leaders the evidence to demonstrate which *foundational scientific knowledge* courses are predictors of BOC pass-rates and which courses to include as pre-requisites for the graduate AT curricula.

When evaluating the predictive power, we must consider the science knowledge students are gaining while in their AT courses. Specifically, the more generalized knowledge structures being built into *foundational scientific knowledge* courses are likely being remediated inside of AT program courses, thereby diminishing the ultimate predictive power they might have on BOC completion rates. For example, physics course content may be taught inside a therapeutic modalities course to ensure student understanding of how the machines work, what type of energy is transferred (sound waves, electrical current), and the physiological effects on human tissue.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Other factors leading to the low predictive power of the foundational scientific knowledge courses could be reflective of the limitations within this study. There were no controls for quality of instruction (didactic and clinical), quality of clinical experience (preceptor and clinical site), student learning (didactic and clinical), and overall program effectiveness (student exit surveys, BOC scores, student job placement). With so many factors contributing to the BOC pass-rates, reviewing only one component of the curriculum did not demonstrate high predictive power.

Based on the research results, it would be difficult to defend unequivocally that there is a natural ranking of the *foundational scientific knowledge* course categories as predictors of BOC pass-rates. These course categories were derived from inferential statistics on the differences between means which seems ill advised, especially since some of the categories have extremely small sample sizes. At the descriptive level, we can discern that, in general, a greater total number of science courses are associated with slightly higher BOC pass-rates. However, attributing causation to the presence or absence of certain courses remains troublesome.

The findings of this study were the first step in evaluating *foundational scientific knowledge* courses being taught in AT curricula across the nation. The overall results of this study direct a variety of future studies. A more in-depth look at the individual science courses would evaluate the actual content taught, course objectives, and student outcomes. Evaluating quality of instruction, quality of clinical experience, and student learning should be studied utilizing a qualitative approach to determine the AT student, faculty, and preceptor perceptions for each area and the contribution to BOC pass-rates. Case studies can be conducted, evaluating AT programs with 100% BOC pass-rates,

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

evaluating multiple program factors as predictors of BOC pass-rates. Future studies utilizing Clements's CRF framework, addressing all ten phases, would provide a comprehensive evaluation of an AT curriculum. Although the results of this study demonstrate that the *foundational scientific knowledge* courses statistically lack predictive power for BOC pass-rates, future studies need to address the limitations that were mentioned in this study.

Summary

AT education programs have gone through many changes since the inception of the AT-accredited academic degree program. With the latest mandate communicated during the spring of 2015, stating that all accredited AT programs must transition from an undergraduate to a graduate degree program, the profession faces yet another academic transition. Currently, a total of 371 AT programs exist, among which are 336 undergraduate AT programs that will be transitioning to a graduate level degree program by the year 2022.

Athletic Training academic leaders, program directors and administrators are in search of valid published research to guide their curricular decisions. The CAATE has publicly identified the educational component of “strong *foundational scientific knowledge*” to produce the best health care providers (CAATE Insight 2015, p.2). This educational component was introduced without a clear definition of exactly what the CAATE defines as strong *foundational scientific knowledge*. To date, there are no published studies showing if *foundational scientific knowledge* courses have an effect on BOC examination first-time pass rates. Utilizing the Curriculum Research Framework, this study reviewed current academic 4-year degree plans of accredited AT programs to

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

determine whether there was a correlation between *foundational scientific knowledge* science courses and first-time BOC pass-rates.

The findings in this study conclude that overall the *foundational scientific knowledge* courses are not powerful predictors of BOC pass-rates. There was a statistical significance found for physics I and II as predictors of BOC pass-rates, but the effect size was minimal, accounting for only 6% variance (physics I) and 1% variance (physics II) of BOC pass-rates. Inclusion of chemistry and physics in AT curricula demonstrated a significant difference between mean BOC pass-rates when compared to AT programs that do not require chemistry and physics; however, a small effect size was reported. These results can be explained by other factors that impact the prediction of BOC pass-rates such as quality of instruction, quality of clinical experience, and student learning. Therefore, future studies need to evaluate quality of instruction, quality of clinical education, and student learning to understand how the role of foundational scientific knowledge impacts the BOC exam as predictors.

This study produced empirical evidence for the leaders in AT education to review and consider when planning AT curricula. The findings will also inform the CAATE of the current practice of AT curricula across the nation and provide statistical data, for their review, as they finalize the proposed Standard 26, mandating all programs include individual *foundational scientific knowledge* courses as program prerequisites.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table Legend

Table 1

1959 Athletic Training Curriculum Model

Physical therapy school prerequisites (minimum of 24 semester hours)
Biology/zoology (8 semester hours)
Physics and/or chemistry (6 semester hours)
Social sciences (10 semester hours)
Electives (e.g. hygiene, speech)
Specific course requirements (if not included above)
Anatomy
Physiology
Physiology of exercise
Applied anatomy and kinesiology
Laboratory physical science (6 semester hours, chemistry, and/or physics)
Psychology (6 semester hours)
Coaching techniques (9 semester hours)
First aid and safety
Nutrition and foods
Remedial exercise
Organization and administration of health and physical education
Personal and community hygiene
Techniques of athletic training
Advanced techniques of athletic training
Laboratory practices (6 semester hours or equivalent)
Recommended courses
General physics
Pharmacology
Histology
Pathology

Note. Adapted from, “The History and Evolution of Athletic Training Education in the United States”, by G. Delforge and R. Behnke, *Journal of Athletic Training*, 34, p.54. Copyright 1999 by the National Athletic Trainers’ Association.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table 2

Mid 1970s Athletic Training Curriculum Course Requirements

Anatomy (1 course)
Physiology (1 course)
Physiology of exercise (1 course)
Applied anatomy and kinesiology (1 course)
Psychology (2 courses)
First aid and safety (1 course)
Nutrition (1 course)
Remedial exercise (1 course)
Personal, community, and school health (1 course)
Basic athletic training (1 course)
Advanced athletic training (1 course)
Laboratory or practical experience in athletic training to include a minimum of 600 total clock hours under the direct supervision of an NATA-certified athletic trainer

Note. Adapted from, “The History and Evolution of Athletic Training Education in the United States”, by G. Delforge and R. Behnke, *Journal of Athletic Training*, 34 p. 56. Copyright 1999 by the National Athletic Trainers’ Association.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table 3

1983 Athletic Training Curriculum Subject Matter Requirements

Prevention of athletic injuries/illnesses
Evaluation of athletic training injuries/illnesses
First aid and emergency care
Therapeutic modalities
Therapeutic exercise
Administration of athletic training programs
Human anatomy
Human physiology
Exercise physiology
Kinesiology/biomechanics
Nutrition
Psychology
Personal/community health
Instructional methods

Note. Adapted from, “The History and Evolution of Athletic Training Education in the United States”, by G. Delforge and R. Behnke, *Journal of Athletic Training*, 34, p.58. Copyright 1999 by the National Athletic Trainers’ Association.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table 4

Descriptive Statistics, Course Present (yes/no) Regression Analysis (Individual science courses regressed on BOC pass-rates), and Summary ANOVA

Course	<i>n</i>	%	<i>M</i> ± <i>SD</i>	<i>F</i>	<i>r</i> ²	<i>P</i> -value
Biology						
Yes	169	48	.80 ± .18	.13	0.00	.714
No	180	52	.79 ± .18			
Chemistry I						
Yes	145	41.5	.81±.10	1.56	.004	.212
No	204	58.5	.78±.17			
Chemistry II						
Yes	32	9.2	.84±.16	2.32	.007	.129
No	317	91	.79±.18			
Physics I						
Yes	97	28	.87±.15	22.41	0.061	.000
No	252	72	.77±.18			
Physics II						
Yes	17	5	.89±.10	5.03	.014	.026
No	332	95	.79±.18			
Physiology						
Yes	329	94	.74 ± .18	1.69	.005	.195
No	20	6	.80± .20			
Psychology						

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Yes	247	71	.79±.19	1.43	.004	.232
No	102	29	.81±.16			

Note. BOC=Board of Certification

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table 5

Descriptive Statistics of BOC Pass Rate by Course Category

Course Category	<i>n</i>	<i>M</i>	<i>SD</i>
Chemistry I, Physics I, II only	2	0.96	0.06
Physics I, Chemistry I, II only	5	0.95	0.05
Physics I, II only	2	0.89	0.09
Physics I only	25	0.87	0.15
Chemistry I, Physics I only	50	0.85	0.17
Chemistry I, II, Physics I, II only	16	0.84	0.14
Chemistry I only	60	0.81	0.16
Chemistry I, II only	14	0.79	0.19
No Chemistry and no Physics	175	0.77	0.19
Total	349	0.79	0.18

Note. BOC=Board of Certification

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table 6

Descriptive Statistics, Regression Analysis, and t-Test for BOC Pass-Rate by Course Categories (yes/no), Chemistry and Physics

Course Category	<i>n</i>	<i>M ± SD</i>	<i>F</i>	<i>r</i> ²	<i>P-value</i>	
Chemistry and Physics	Yes	175	.82 _{±.17}	4.75	.014	.030
	No	174	.77 _{±.19}			

Note. BOC=Board of Certification

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Table 7

Descriptive Statistics, Multiple Regression Analysis and T-Test for BOC Pass Rate by Courses Category, Physics I and Physics II (yes/no).

Course Category	<i>n</i>	<i>M ± SD</i>	<i>F</i>	<i>r²</i>	<i>P-value</i>
Physics I and II					
Yes	2	.89±.08	11.38	.062	.000
No	347	.78±.18			

Note. BOC=Board of Certification

SECTION SIX:

SCHOLARLY PRACTITIONER REFLECTION

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

The dissertation has influenced me as an educational leader and scholar in a multitude of ways. The process of research and writing the dissertation opened my mind to developing an inquisitive approach to my profession. This gave me the skills to develop applicable questions in my leadership role as an Athletic Training (AT) program director and actually put them on paper, gather evidence, and put the information in a proper format in which to share with my peers.

My strengths include the themes of activator and deliberative researcher (GALLUP, 2013). The dissertation process taught me how to apply the themes to scholarship. As an activator, I now have the tools to ask the questions and understand how to frame them within a research format. Writing the dissertation has ignited my interest in scholarship and I can now approach scholarship in a deliberative manner. I completed my master's degree in 1988, so my experience of research was quite outdated. This dissertation has opened my thought process and made it applicable to the current research process in today's higher education climate. Prior to my dissertation, the thought of publishing was overwhelming. Now that I understand the process and have the ability, I am excited to pursue a research agenda in AT education. The academic program also gave me the tools to conduct both quantitative and qualitative research. Although my dissertation was a quantitative study, the research triggered my thought process of how I could have incorporated a qualitative component and made me envision future mixed-method and qualitative studies.

I have found a new appreciation for reading research studies. This appreciation stems from the knowledge I have acquired through writing this dissertation and the program. I now have a better understanding of the statistics within research, and this

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

ability is invaluable as a program director with the ability to pass this information on to my students. The knowledge gained from the program and writing the dissertation will be an asset to my leadership role as a practitioner.

The dissertation also allowed me to apply theory to practice. Within my dissertation I included the four frames of Bolman and Deal (2008). This experience gave me the perspective and experience to apply the frames to a real problem of practice. In my current new position as a program director, I naturally began analyzing this new institution through the four frames: the structural framework, political framework, human resource framework, and the symbolic framework (Bolman & Deal, 2008, p.314). The dissertation gave me practice in the application of the frames and that knowledge has carried over to my new position. This knowledge also helps me comprehend the information in an organized manner and reminds me to pay attention to all aspects of the frames as I process information, understand, and contribute to my new organization.

The process of writing the dissertation has been an invaluable and necessary experience which will contribute to my new position as a tenure track faculty member. I look forward to applying all that I have learned from this experience into my future as both a scholar and a leader.

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FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

VITA

Susan Patricia Wehring was born in Urbana, Illinois while her father was a professor of nuclear engineering at the University of Illinois. She graduated from Champaign Central High School and started college at Illinois State University, majoring in physical education teaching with a concentration in athletic training. When her family relocated to North Carolina she finished her Bachelor of Science degree in physical education and health teaching with a concentration in athletic training at East Carolina University. Ms. Wehring then received her teaching certification (K-12) in the state of North Carolina and Ohio while completing a Master of Science degree in physical education and athletic training at Ohio University.

Susan has clinically practiced athletic training in a variety of settings, including; two out-patient orthopedic clinics, high schools, Division I and III universities, USTA men's professional tennis circuit, and on a movie set. While clinically practicing, she lived in the states of South Carolina and Kansas. She has held the role of Program Director in CAATE-accredited programs since 2002, taking Loras College through initial and renewal accreditation of their Athletic Training Education Program. Ms. Wehring also served as a Division Chair at Loras College as a tenured, associate professor. Susan has served as the athletic training program director at Georgia Southern University, Southeast Missouri State University, and presently at Gannon University. She served as the accreditation compliance coordinator for the newly developed athletic training degree at the University of Missouri while enrolled in the Doctorate of Education, Education, Leadership, and Policy Analysis program.

FOUNDATIONAL SCIENTIFIC KNOWLEDGE IN AT CURRICULA

Ms. Wehring has served as a site visitor for the Commission on Accreditation of Athletic Training Education over the past 15 years. Her research interests include athletic training program curriculum and administration. Susan enjoys spending her free time with her two daughters, and spending time on the beach.