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The Predictive Relationship Between Naturopathic Basic Science Curriculum and NPLEX I Performance

Tammy Marie Aragon
Walden University

Walden University

COLLEGE OF EDUCATION

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Tammy M. Aragon

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Review Committee
Dr. William McCook, Committee Chairperson, Education Faculty
Dr. Edward Garten, Committee Member, Education Faculty
Dr. Andrea Wilson, University Reviewer, Education Faculty

Chief Academic Officer

Eric Riedel, Ph.D.

Walden University
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Abstract

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MS, Walden University, 2011

MEd, Pennsylvania State University 2004

BS, University of Maryland University College, 2000

Doctoral Study Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Naturopathic medical schools are concerned with low first-time pass rates on the Naturopathic Physicians Licensing Exam Part I (NPLEX I) that may impact schools' accreditation with the Council on Naturopathic Medical Education (CNME). At a North American school of naturopathic medicine first-time pass rates have been a concern for 3 of the last 5 years. The purpose of this quantitative study was to determine whether students' naturopathic basic science content area scores predict NPLEX I scores at this this school. Grounded in general systems theory, a predictive correlational research design utilizing multiple logistic regression analyses was used. Archival data were obtained from the school for students who completed NPLEX I and all basic science courses. For the first model, microbiology, pathologyplus (including pathology and other content), and disease/dysfunction scores were obtained for N = 208 students. For the second model, anatomy, physiology, biochemistry, and structure/function scores were obtained for N = 256 students. For each model, students' groups of basic science content area final exam scores were analyzed against NPLEX I scores to determine predictive relationships. Results indicated pathologyplus, anatomy, and physiology scores were significant predictors of NPLEX I performance, microbiology and biochemistry were not significant predictors, and students who completed NPLEX I during the August 2015 administration were most likely to earn passing scores on NPLEX I. Based on the findings a position paper was developed recommending curriculum mapping to examine alignment and make all content areas predictive of NPLEX I performance. Positive social change may ensue by increasing the reputation of the schools and profession of naturopathic medicine.

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Introduction

Maintaining accreditation is a priority for institutions of higher education. Accreditation ensures academic programs maintain a particular level of quality, and validates to other institutions and employers that programs and their graduates are of quality (Western Interstate Commission for Higher Education [WICHE], 2010). In order to qualify for participation in federal financial aid programs accreditation is also required for institutions (WICHE, 2010). Furthermore, accreditation can promote continuous improvement, support learning, and increase social recognition and status (Cochrane, 2014; Taub, Birch, Auld, & Cottrell, 2011).

In the first section of this document I discuss the local problem. Next, I provide local evidence and evidence from the professional literature that informed the rationale for this study and contributed to the significance of this study. I then delineate the guiding research questions and theoretical framework on which this study is grounded, followed by a review of the literature that provides evidence which both validates and shows the significance of the problem defined in this study. Finally, I discuss the implications of this study, which may include a potential impact on the reputation of the schools and profession of naturopathic medicine. To ensure confidentiality, the college discussed in this study is referred to as South Valley College (SVC), a school of naturopathic medicine located in North America and accredited by the Council on Naturopathic Medical Education (CNME).

The Local Problem

The local problem that prompted this study was low first-time pass rates on the Naturopathic Physicians Licensing Exam Part I (NPLEX I) at SVC (North American Board of Naturopathic Examiners [NABNE], 2012, 2013a, 2013b, 2014a, 2014b, 2015c). Successful completion of NPLEX, which comprises two separate exams, NPLEX I and NPLEX II, is required for an individual to be licensed as a naturopathic physician in the United States and Canada (CNME, 2015; NABNE, 2015a). The first exam, NPLEX I, is designed to assess knowledge of biomedical science concepts or content areas including anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology (NABNE, 2015a). NPLEX I is taken after successful completion of all basic science courses related to these biomedical science content areas (NABNE, 2015a). The second exam, NPLEX II, is designed to assess knowledge of naturopathic clinical science concepts (NABNE, 2015a). NPLEX II is taken after successful completion of NPLEX I and graduation from a CNME accredited naturopathic medical school program (NABNE, 2015a). Successful completion of both NPLEX I and NPLEX II, and graduation from a CNME accredited naturopathic medical school program, is required for an individual to be licensed as a naturopathic physician in the United States and Canada (CNME, 2015).

NPLEX I and NPLEX II are each administered twice a year, once in February and once in August (NABNE, 2015a). NPLEX I is typically taken for the first time at the end of the second year of a CNME accredited naturopathic medical school program (Bastyr University, 2015; Boucher Institute of Naturopathic Medicine [BINM], 2015; Canadian College of Naturopathic Medicine [CCNM], 2015; National University of Health

Sciences [NUHS], 2015; National University of Natural Medicine [NUNM], 2016; Southwest College of Naturopathic Medicine [SCNM], 2015; University of Bridgeport, 2015). At SVC, students enter the program in two separate cohorts, but combine into one cohort at the beginning of their second year, before taking NPLEX I at the end of their second year (SVC chief academic officer, personal communication, June 4, 2015). Students at SVC are expected to take NPLEX I for the first time during the August administration since this occurs shortly after the students should have successfully completed the required basic science content areas (i.e. anatomy, physiology, etc.) (NABNE, 2015a; SVC dean, personal communication, February 4, 2016). However, for some students who encounter extenuating circumstances, the completion of the basic science content areas could occur before either the February or the August administration (SVC associate registrar, personal communication, September 19, 2014).

First-time pass rates on NPLEX I are based on the outcome of both the disease/dysfunction subscore area and the structure/function subscore area of NPLEX I (NABNE, 2014c). One overall score is reported on the NPLEX I score report; however, each subscore area applies directly to specific basic science content areas (NABNE, 2014c). Since the score for each subscore area, instead of an overall score could provide more insight into the relationships between variables, I used separate subscores for this study. The specific basic science content areas that apply to each NPLEX I subscore area of disease/dysfunction and structure/function are outlined in Table 1.

Table 1

Relationship of NPLEX I Subscore Areas and Basic Science Content Areas

NPLEX I Subscore Area	Basic Science Content Area
Disease/Dysfunction	Microbiology Immunology Pathology
Structure/Function	Anatomy Physiology Biochemistry Genetics

Note. Adapted from "Part I biomedical science examination: Blueprint and study guide," by North American Board of Naturopathic Examiners. Copyright 2015 by author.

The NPLEX I bulletin, or study guide, published by NABNE (2014c), refers to microbiology and immunology as one content area, and biochemistry and genetics as one content area. Similarly, it is common at many schools of naturopathic medicine for immunology to be covered in microbiology courses and for genetics to be covered in biochemistry courses (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). At SVC, immunology is covered in the microbiology courses, and genetics is covered in the biochemistry courses (SCNM, 2015). For the purpose of this study, I combined immunology and microbiology scores into one content area called microbiology, and combined biochemistry and genetics scores into one content area called biochemistry. Furthermore, pathology content could not be separated from the other content included in the General Medical Diagnosis I, II, and III courses (SVC Associate Professor, personal communication, March 18, 2015). Therefore, I refer to the pathology content as pathologyplus since it includes other content areas such as lab diagnosis, radiology, clinical diagnosis, and physical diagnosis.

Low first-time pass rates on both NPLEX I and NPLEX II can impact CNME accreditation at schools of naturopathic medicine (CNME, 2015). Schools of naturopathic medicine that are unable to maintain an average first-time pass rate of at least 70% over a 5-year period on NPLEX I or NPLEX II may lose accreditation (CNME, 2015). A loss of CNME accreditation would prevent graduates of that institution from obtaining medical licensure as naturopathic physicians in the United States and Canada, as graduation from a CNME accredited school of naturopathic medicine is required (NABNE, 2015a). Maintaining accreditation for schools of naturopathic medicine is also important because it can promote continuous improvement and support learning, as well as increase social recognition and status (Cochrane, 2014; Taub et al., 2011). Continuous improvement, learning, and social recognition and status may all impact graduates' ability to obtain licensure and be successful naturopathic physicians (Cochrane, 2014; Taub et al., 2011) That is, an impact on the reputation of the institution or on the profession of naturopathic medicine could impact the future success of graduates. Consequently, low first-time pass rates on NPLEX I and NPLEX II, continued accreditation with CNME, and naturopathic medical licensure are concerns for past, present, and future graduates of schools of naturopathic medicine, as well as the reputation of the profession of naturopathic medicine.

First-time pass rates on NPLEX I at many schools of naturopathic medicine are generally lower than first-time pass rates on NPLEX II, which has been the case at SVC for several years (NABNE, 2012, 2013a, 2013b, 2014a, 2014b, 2015c). The difference in pass rates between NPLEX I and NPLEX II are evident in the average first-time pass rates of all seven naturopathic schools accredited by the CNME. Following the August 2014 administration, the average first-time pass rates of all seven schools was 74% for NPLEX I, and 83% for NPLEX II (NABNE, 2014b). Therefore, the gap in practice on which I focused this study is first-time pass rates on NPLEX I. Specifically, I focused on the predictive relationship between students' naturopathic basic science content area final exam scores, and their performance on the first and second NPLEX I subscore areas on their first attempt.

Rationale

Evidence of the Problem at the Local Level

At the local level, the problem that prompted this study was low first-time pass rates on NPLEX I at SVC (NABNE, 2012, 2013a, 2013b, 2014a, 2014b, 2015c). The average first-time pass rate of all seven naturopathic schools accredited by the CNME following the August 2014 NPLEX I administration was 74% (NABNE, 2014b). For schools of naturopathic medicine to continue accreditation with the CNME, an average first-time pass rate of at least 70% on NPLEX I must be maintained over a 5-year period (CNME, 2015). To support students' preparations for NPLEX I, SVC offers students, upon matriculation, numerous resources (SVC associate registrar, personal communication, September 19, 2014). For instance, SVC offers basic science review courses, access to test anxiety counseling, resource books such as the *USMLE Step I Preparation Guide*, practice NPLEX I exams, and private and group tutoring (SVC Registrar's Office, n.d.). Additionally, SVC students taking NPLEX I are excused from courses and clerkships on the day of the examination, and quizzes and exams are not scheduled on the day before or day after the examination (SVC associate registrar, personal communication, September 9, 2014). Despite the resources provided at SVC to support students' preparations for NPLEX I, first-time pass rates on NPLEX I often fell below the minimum first-time pass rate of 70% required by CNME (2015). First-time pass rates have been below 70% for 3 of the last 5 years at SVC (NABNE, 2012, 2013a, 2013b, 2014a, 2014b, 2015c). In August 2014, SVC's first-time NPLEX I pass rate met the CNME (2015) required 70% minimum for the first time in 3 years (NABNE, 2014b).

Evidence of the Problem from the Professional Literature

Accreditation is critical to institutions of higher education because it is required for institutions to qualify for participation in federal financial aid programs (WICHE, 2010). Furthermore, accreditation, especially at the program level, can improve the educational foundation on which programs are based, which can also increase the strength of their given profession (Wolfman, 2014). Overall, accreditation helps increase the quality of educational programs by ensuring quality through the use of standards that are systematically reviewed (Wolfman, 2014). Systematic reviews allow accrediting bodies to determine whether programs meet the specified standards established by the profession (Wolfman, 2014). For instance, NABNE (2015a) established the eligibility requirements for taking NPLEX II, which included graduation from a CNME accredited program of naturopathic medicine. NABNE (2015a) also established the requirement of passing NPLEX II to become licensed as a naturopathic physician. Therefore, schools of naturopathic medicine are required to maintain program accreditation with CNME for graduates to be eligible to take NPLEX II, and to obtain medical licensure as naturopathic physicians in the United States and Canada (NABNE, 2015a).

Accreditation also compels programs to continuously improve the quality of their programs (El-Jardali et al., 2014). For example, despite acceptable exam scores, which may indicate a program is doing well, accreditation encourages programs to continuously improve these scores, helping to increase program quality and strengthen the profession with which these programs are associated (White, Paslawski, & Kearney, 2013). In support of continuous improvement, accreditation can require programs to merge activities to increase effectiveness at an institutional level (Dodd, 2004). In requiring documentation and reinforcing quality standards, which strengthens stakeholder relationships and improves staff and patient satisfaction, accreditation can also benefit programs and institutions (El-Jardali et al., 2014). Therefore, in identifying whether a predictive relationship exists between naturopathic basic science curriculum performance and NPLEX I performance, my intent was to help schools of naturopathic medicine identify potential strategies to increase first-time pass rates on NPLEX I and potentially help maintain the institution’s program accreditation with CNME.

Definitions

Definitions of special terms associated with the problem of this study are provided below.

Allopathic: Refers to a method of medical practice used by medical doctors (MDs) that focuses on treating disease using remedies designed to affect the body differently than the disease being treated (Johns Hopkins University, n.d.).

Biomedical science concepts: Concepts related to the subjects of anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology (NABNE, 2015a).

Clinical science concepts: Concepts related to the modalities of naturopathic medicine including diagnosis (physical, clinical, and lab), diagnostic imaging, botanical medicine, clinical nutrition, emergency medicine, homeopathy, physical medicine, mind body medicine, pharmacology, and medical procedures (NABNE, 2015a).

Continuous improvement: Continuously increasing the effectiveness and/or efficiency of an institution's products, services, or processes in order to realize its objectives (Chartered Quality Institute, 2015).

Didactic: A form of instruction that involves lectures and teaching activities which occur in the classroom versus practical demonstration in a laboratory or lineal setting (Richardson, 2008).

First-time pass rates: These refer to passing NPLEX I on the first attempt. Students are allowed to take NPLEX I up to 5 years after graduation; however only pass rates of students taking NPLEX I for the first time are reported to the CNME (NABNE, 2015b).

Graduate: A student who has successfully completed a naturopathic medical school program that is a candidate for accreditation or accredited by CNME (2015).

Practice NPLEX I exam: A series of questions that are similar in content and depth as the questions on NPLEX I (SVC associate registrar, personal communication, September 21, 2014).

Naturopathic: Refers to a method of medical practice used by naturopathic doctors (NDs) that focuses on prevention, treatment, and optimizing health by using therapeutic substances and methods that encourage self-healing (American Association of Naturopathic Physicians [AANP], 2011).

Osteopathic: Refers to a method of medical practice used by osteopathic doctors (DOs) that focuses on illness prevention, health maintenance, and removing barriers to treat the whole person (American Osteopathic Association [AOA], 2015).

Subscore area: NPLEX I scores are divided into two separate categories or subscore areas. The first subscore area is disease/dysfunction, which covers content related to microbiology, immunology, and pathology. The second subscore area is structure/function, which covers content related to anatomy, physiology, biochemistry, and genetics (NABNE, 2015a).

Significance

The relationships between various variables and student licensing exam performance within other healthcare professions, including allopathic, osteopathic, and chiropractic medicine, as well as nursing, and physical therapy, have been studied extensively (Aldridge, Keith, Sloas, & Mott-Murphree, 2010; Dillon, Swanson, McClintock, & Gravlee, 2013; Dong et al., 2012; Maring, Costello, Ulfers, & Zuber, 2013; McCall & Harvey, 2014; Romeo, 2013; Schutz, Dalton, & Tepe, 2015; Young, Rose, & Willson, 2013). However, these researchers have not specifically addressed the relationship between naturopathic professional licensing exam performance (NPLEX I) and naturopathic basic science curriculum performance. Therefore, my objective for this study was to investigate whether predictive relationships exist between performance in naturopathic basic science course final exam content areas and performance on the first and second subscore areas of NPLEX I on the first attempt. My intent, using the results from this study, was to help schools of naturopathic medicine develop potential strategies to assess the effectiveness of, and recommend potential changes to their basic science curricula that could help increase first-time pass rates on NPLEX I, and potentially help maintain the institution's program accreditation with CNME.

The potential strategies and potential recommended changes to increase NPLEX I performance, of which the results of this study might contribute, could benefit many institutional constituents. For instance, an increase in NPLEX I performance could help maintain CNME accreditation, which ensures schools of naturopathic medicine maintain high standards of education, as indicated in the 11 accreditation standards required by CNME (2015). An increase in NPLEX I performance could also benefit students and graduates by upholding the institutions' reputation and the reputation of the profession, which includes hundreds of newly licensed graduates from CNME-accredited schools of naturopathic medicine each year (NABNE, 2014b). If statistically significant predictive relationships were found between student performance on NPLEX I on the first attempt and student performance in naturopathic basic science final exam content areas, institutions could begin looking for ways to improve student performance in naturopathic basic science curricula and on NPLEX I. For instance, student performance might be improved by developing a strategy to assess the effectiveness of, and to make changes to, the basic science curricula. Indicators or targets for improvement might include low student scores in one or more basic science course content area, or low overall grade point averages (Gonsalves et al., 2014). If statistically significant relationships were not found, institutions could begin looking for other possible sources of the problem, such as possible mismatches between NPLEX I competencies and naturopathic basic science course outcomes (Geist & Catlette, 2014).

Research Questions and Hypotheses

The average first-time pass rate of all seven CNME accredited schools of naturopathic medicine, following the August 2014 NPLEX I administration, was 74% (NABNE, 2014b). At SVC, first-time pass rates have been below 70% for 3 of the last 5 years (NABNE, 2012, 2013a, 2013b, 2014a, 2014b, 2015c). Maintaining an average first-time pass rate of at least 70% on NPLEX I over a 5-year period is a concern for schools of naturopathic medicine because of the potential impact this may have on the institution’s program accreditation with CNME (2015). Therefore, to address the local problem of this study, I used a quantitative approach with a correlational focus, as described by Creswell (2012), to address the predictive relationship between students’ NPLEX I performance and students’ performance in naturopathic basic science course curricula at one North American school of naturopathic medicine, SVC. Identifying whether predictive relationships exist between naturopathic basic science content area final exam scores and first and second NPLEX I scores on the first attempt could help schools of naturopathic medicine develop potential strategies and recommend potential changes. For instance, a strategy to assess the effectiveness of, and to make changes to the basic science curricula could potentially help increase NPLEX I performance and help maintain the institution's program accreditation with CNME.

I used the guiding research questions for this study to explore the problem of low first-time NPLEX I pass rates at SVC. Specifically, I used the research questions to explore whether there is a predictive relationship between students' content area final exam scores in naturopathic basic science courses and their first and second NPLEX I subscores on the first attempt. Immediately following each guiding research question I included the null and alternative hypotheses. Each hypothesis is aligned with each guiding research question to help clarify the focus of this study (Fraenkel, Wallen, & Hyun, 2011).

RQ1: After controlling for NPLEX I administration, what is the predictive relationship between the students' group of microbiology content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC?

$H_0$1: After controlling for NPLEX I administration there is no statistically significant predictive relationship between the students' group of microbiology content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC.

$H_1$1: After controlling for NPLEX I administration there is a statistically significant predictive relationship between the students' group of microbiology content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC.

RQ2: After controlling for NPLEX I administration, what is the predictive relationship between the students' group of pathologyplus content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC?

$H_0$2: After controlling for NPLEX I administration there is no statistically significant predictive relationship between the students' group of pathologyplus content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC.

$H_1$2: After controlling for NPLEX I administration there is a statistically significant predictive relationship between the students' group of pathologyplus content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC.

RQ3: After controlling for NPLEX I administration, what is the predictive relationship between the students' group of anatomy content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC?

$H_0$3: After controlling for NPLEX I administration there is no statistically significant predictive relationship between the students' group of anatomy content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC.

$H_1$3: After controlling for NPLEX I administration there is a statistically significant predictive relationship between the students' group of anatomy content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC.

RQ4: After controlling for NPLEX I administration, what is the predictive relationship between the students' group of physiology content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC?

$H_0$4: After controlling for NPLEX I administration there is no statistically significant predictive relationship between the students' group of physiology content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC.

$H_1$4: After controlling for NPLEX I administration there is a statistically significant predictive relationship between the students' group of physiology content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC.

RQ5: After controlling for NPLEX I administration, what is the predictive relationship between the students' group of biochemistry content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC?

$H_0$5: After controlling for NPLEX I administration there is no statistically significant predictive relationship between the students' group of biochemistry content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC.

$H_1$5: After controlling for NPLEX I administration there is a statistically significant predictive relationship between the students' group of biochemistry content area final exam scores and the students' second NPLEX I subscore on the first attempt at SVC.

The dependent variables included in each aligned research question and hypothesis are dichotomous, categorical variables, consisting of binary data comprised of scores on each NPLEX I subscore area of disease/dysfunction and structure/function. My use of categorical binary data for the dependent variable was determined based on the fact that NABNE (2014a) only reports NPLEX I scores in terms of pass or fail for each subscore area. The NPLEX I score report does report an overall score; however, each subscore area applies directly to certain basic science content areas, which could provide more insight into the relationships between variables (NABNE, 2014a). Therefore, I used a score for each subscore area of disease/dysfunction and structure/function for this study (NABNE, 2014a).

The independent variables included in each aligned research question and hypothesis are continuous, consisting of students' naturopathic basic science final exam content area scores that correspond to each NPLEX I subscore area. The naturopathic basic science content areas of anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology are included in the following naturopathic basic science courses at SVC: Human Biology I, II, and III; and General Medical Diagnosis I, II, and III. Each aligned research question and hypothesis also includes a categorical independent control variable, referred to as "NPLEX I administration." The NPLEX I administration variable serves as a control variables consisting of the month and year in which NPLEX I was administered (e.g. Aug14).

Review of the Literature

In this literature review I included peer-reviewed and non-peer reviewed sources published within the past 5 years. I also examined peer reviewed and non-peer reviewed sources that were older than 5 years, but only included them if they were relevant to this study. I conducted my literature search using the Walden Online Library, Google Scholar, and outside online libraries. The specific databases I used for this study included Academic Search Complete, Business Source Complete, CINAHL Plus with Full Text, EBSCOhost, Education Research Complete, ERIC, MEDLINE with Full Text, Political Science Complete, ProQuest, PsycARTICLES, PsycBOOKS, Psyc INFO, SocioINDEX with full text, PsycTESTS, and the ProQuest Digital Dissertation database.

The key words I used in the literature review search included *National Council Licensure Examination performance, naturopathic medical school curriculum and naturopathic licensing exam performance, osteopathic licensing exam performance, United States Medical Licensing Examination Part I performance, Comprehensive Osteopathic Medical Licensing Examination performance, National Council Licensure Examination performance, National Board of Chiropractic Examiners Part I performance, National Physical Therapy Licensure Examination performance, licensing exam performance predictors, United States Medical Licensing Examination Part I eligibility requirements, National Board of Osteopathic Medical Examiners Part I eligibility requirements, National Council Licensure Examination eligibility requirements, National Board of Chiropractic Examiners Part I eligibility requirements, National Physical Therapy Licensure Examination eligibility requirements, naturopathic* *medicine education*, *medical education*, *osteopathic medical education*, *nursing education*, *chiropractic education,* and *physical therapy education.*

Theoretical Framework

This study is grounded in the theoretical framework of general systems theory proposed in the 1940s by Ludwig Von Bertalanffy (Watson, 2010). General systems theory grew out of systems theory, which applied specifically to biological systems (Weckowicz, 2000). Systems theory was developed in reaction to reductionism, as well as the desire to revive the idea that all sciences are part of a whole (Watson, 2010). Von Bertalanffy's beliefs that open systems should also apply to symbolic systems such as societies and cultures gave birth to general systems theory (Weckowicz, 2000).

General systems theory is concerned with the relationships of a system's organization and properties that interact with the outside environment and make up a whole system (Watson, 2010). According to general systems theory, a system is comprised of parts that communicate with and influence one another (Watson, 2010). General systems theory suggested that a system as a whole functions differently than the parts of that system, and considers the interaction between its parts when solving problems (Watson, 2010). This theory is based on the idea that all organizations have common principles that are true of all systems (Mizikaci, 2006). According to Minnaar (n.d.) these principles describe "the nature, structure, and functioning of a system" (p. 3), and involve the idea that all systems have goals, external inputs that help define these goals, outputs that achieve these goals, and external feedback about these outputs (Banathy, 2001).

General systems theory has been used in many different areas. According to general systems theory, higher education can be considered a system that includes subsystems, or individual institutions of higher education that have their own systems and subsystems (Mizikaci, 2006; Watson, 2010). According to Chen and Stroup (1993), general systems theory has been used in science and technology education because its multidisciplinary nature can help describe system dynamics and change, as well as denote relationships between different levels within the system. The growing emphasis on accountability that is placed on institutions of higher education by external accreditation bodies has renewed interest in general systems theory as a means of evaluating and assessing quality and effectiveness (Mizikaci, 2006). For example, general systems theory has been used by institutions of higher education to address program evaluations and problem solving (Mizikaci, 2006). It has also been employed by institutions of higher education to conduct more effective institutional research (Minnaar, n.d.). That is, by gaining further understanding of their goals, external inputs, outputs, and external feedback, institutions can use more effective institutional research to address problems (Banathy, 2001; Minnaar, n.d.).

Based on Watson's (2010) definition of general systems theory, naturopathic education could be considered a system in which the sum of each required component communicates with and impacts the whole system. Specifically, successful completion of the basic science courses is required to take NPLEX I, and NPLEX I and basic science courses are both required by CNME accredited naturopathic degree programs (NABNE, 2015a). Additionally, successful completion of all clinical science courses is required to take NPLEX II, and clinical science courses and NPLEX II are also required by CNME accredited naturopathic degree programs. Another component of naturopathic education is CNME accreditation, which, if lost, may impact the integrity and reputation of the profession of naturopathic medicine, which may impact the legitimacy of the credentials of past, present, and future graduates of schools of naturopathic medicine. Consequently, maintaining a minimum 70% first-time NPLEX I and NPLEX II pass rate is also a component of maintaining accreditation with the CNME (2015), as well as a component of CNME accredited naturopathic degree programs and the naturopathic education system. However, general systems theory also aligns with the philosophy of naturopathic medicine, which embraces the idea of whole person treatment and belief that the body, mind, and spirit are all connected and need to be considered when treating the whole person (SCNM, 2015).

The naturopathic education system is comprised of several different components, including CNME accreditation, basic science courses, clinical science courses, NPLEX I and NPLEX II, and licensure eligibility that communicate with and influence one another (Watson, 2010). These components, as suggested by Mizikaci (2006), comprise the structure and functioning of the naturopathic education system. Furthermore, the goals, external inputs, outputs, and external feedback within the naturopathic education system further comprise the structure and functioning of the system (Banathy, 2001). Therefore, being able to identify whether there is a predictive relationship between students' basic science content area final exam scores and the first and second subscore areas of NPLEX I on the first attempt could provide schools of naturopathic medicine a better understanding of how each component of the naturopathic education system communicates with and impacts one another. For instance, as illustrated in Figure 1, students' performance in basic science courses impact their eligibility to take NPLEX I, their performance on NPLEX I and in clinical science courses impact their eligibility to take NPLEX II. Their performance in basic science courses, NPLEX I, clinical science courses, and NPLEX II impact their eligibility for graduation. Furthermore, performance on NPLEX I and NPLEX II could impact the institution's accreditation with CNME, and CNME accreditation could impact the ability of graduates to become licensed naturopathic physicians (CNME, 2015). Therefore, this study and general systems theory could help schools of naturopathic medicine gain a better understanding of how basic and clinical science courses, NPLEX I, NPLEX II, accreditation, and licensure communicate with, and impact one another in order to address the problem of low first-time pass rates on NPLEX I.

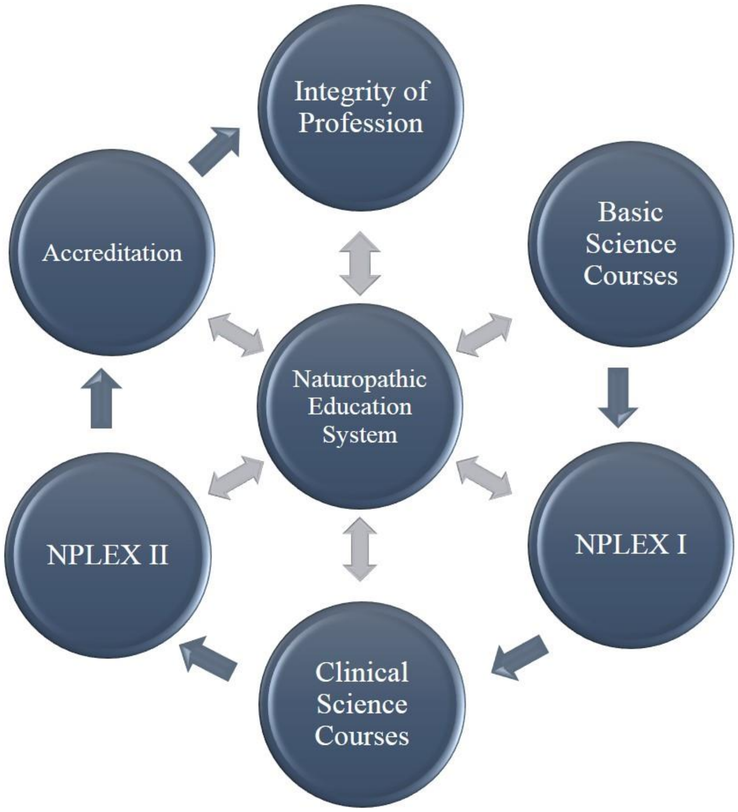

Figure 1. The naturopathic education system. This figure depicts how the different components of the naturopathic education system interface with one another.

Literature Review

A number of studies have examined the relationship between various variables and licensing exam performance within the healthcare fields of allopathic medicine, osteopathic medicine, chiropractic medicine, nursing, and physical therapy (Aldridge et al., 2010; Dillon et al., 2013; Dougherty, Walter, Schilling, Najibi, & Herkowitz, 2010; Glaros, Hanson, & Adkinson, 2014; Kenya, Kenya & Hart, 2013; Langford & Young, 2013; Liu, Basehore, & Fischer, 2014; Maring et al., 2013; Rowshan & Singh, 2014; Sefcik, Prozialeck, & O'Hare, 2003; Wolfenberger, 1999). However, my initial review of the literature revealed a gap in the research that specifically addressed naturopathic medical school curricula performance and licensing exam performance in the field of naturopathic medicine. Therefore, my purpose of conducting a literature review for this study was to identify and analyze the research associated with variables that may have a relationship with first-time licensing exam performance within other healthcare fields that are similar to naturopathic medicine. The secondary purpose of conducting this review involved gaining a better understanding of the extent of the problem of low first-time pass rates on the various licensing exams of other healthcare fields. The specific healthcare disciplines and licensing exams I identified as having similar concerns with low performance and low first-time pass rates included allopathic, osteopathic, and chiropractic medicine, as well as nursing and physical therapy.

I identified several corresponding licensing exams that are similar to NPLEX I. The licensing exam for allopathic medicine is the United States Medical Licensing Examination Part I (USMLE I), which consists of three separate examinations required to obtain medical licensure in the United States (USMLE, 2015). The USMLE I assesses knowledge of basic science concepts that are the basis of medical practice (USMLE, 2015). The Comprehensive Osteopathic Medicine Licensing Examination Part I (COMLEX I), the licensing exam for osteopathic medicine, consists of three separate exam levels designed to assess knowledge and skills of osteopathic medicine (National Board of Osteopathic Medical Examiners [NBOME], 2015). Specifically, COMLEX I assesses knowledge of the basic medical sciences needed for solving medical problems (NBOME, 2015). The National Board of Chiropractic Examiners Part I (NBCE I), the licensing exam for chiropractic medicine, consists of four separate examinations required for chiropractic licensure in the United States (NBCE, 2015). NBCE I assesses basic science knowledge, cognitive abilities, and problem-solving abilities. The National Council Licensure Examination (NCLEX), the licensing exam for registered nursing professionals, assesses the knowledge, abilities, and skills of entry-level nursing practice (NCLEX, 2015). The National Physical Therapy Licensure Examination (NPTE), the licensing exam for physical therapy professionals, assesses the knowledge required for entry-level physical therapy practitioners (Federation of State Boards of Physical Therapists [FSBPT], 2015).

In addition to having concerns with low first-time pass rates on their licensing exams the fields of allopathic, osteopathic, and chiropractic medicine, as well as nursing, and physical therapy education are also similar to the field of naturopathic medicine in other ways. The similarities between the educational programs of these fields can been seen through their respective accrediting bodies, who also require basic science courses to be included in their curricula (Commission on Accreditation in Physical Therapy Education [CAPTE], 2015; Commission on Collegiate Nursing Education [CCNE], 2015; Commission on Osteopathic College Accreditation [COCA], 2015; Council on Chiropractic Education [CCE], 2013; Liaison Committee on Medical Education [LCME], 2015). The curricula of schools of naturopathic medicine accredited by the CNME (2015) all include basic science courses, which are required by CNME (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). Likewise, the licensing exams for the fields of allopathic, osteopathic, and chiropractic medicine, as well as nursing, and physical therapy, like the NPLEX I for naturopathic medicine, also assess basic science knowledge (FSBPT, 2015; NABNE, 2015a; NBCE, 2015; NBOME, 2015; NCLEX, 2015; USMLE, 2015).

United States Medical Licensing Examination Part I (USMLE I)

During the literature review, I examined the relationships between USMLE I performance and performance on other exams. In many cases, correlations were found between performance on USMLE I and several other exams: the American Board of Anesthesiology Part I (ABA I) certification examination; the American Board of Orthopedic Surgery Part I (ABOS I) certifying exam; The National Board of Medical Examiners (NBME) subject examination; the USMLE I practice test, and the Comprehensive Basic Science Examination (CBSE) (Dillon et al., 2013; Dougherty et al., 2010; Gandy, 2008; Zahn et al., 2012). However, correlations were not found between USMLE I performance and performance on the second- and third-year Objective Structured Clinical Examinations (OSCE) (Dong et al., 2012). When comparing USMLE I performance to the American Board of Pathology (ABP) exam a two-digit USMLE I score of "90 or more and 80 or less were strong measures of ABP first-time pass/failure rates, whereas scores of 81 to 89 were less accurate measures" (Picarsic, Raval, & Macpherson, 2011, p. 1349). Although some relationships between USMLE I performance and performance on these other exams were seen, these relationships may not be generalizable across all other possible exams. However, as suggested by Dougherty et al. (2010), some of these relationships may be more usefulness for other purposes, such as guiding residency education.

During the literature review, I also examined the relationship between USMLE I performance and variables related to study strategies, curriculum content, assessment, and grade point average. Study strategies, such as techniques used to improve concentration skill were shown to help increase performance on USMLE I (West, Kurz, Smith, & Graham, 2014). On the other hand, USMLE performance was not impacted by a change in the grading system but had a negative impact on preclinical examinations (McDuff et al., 2014). Additionally, USMLE I performance and performance on second- and third-year OSCEs did not correlate with medical school grade point average (Dong et al., 2012). However, correlations were found between USMLE I performance and grade point averages of undergraduate science courses and MCAT scores (Basco, Way, Gilbert, & Hudson, 2002); as well as preclinical and clinical cumulative grade point averages of medical students (Zahn et al., 2012). Correlations between USMLE I performance and system-based curricular courses, such as Organ Systems and Human Structure at one medical school were also found to be good predictors of USMLE I performance, with the Organ Systems course being the better of the two predictors (Gandy, 2008). Similarly, medical school gross anatomy courses integrated with embryology and radiographic anatomy, and anatomy performance in general, were also found to be good predictors of USMLE I performance (Peterson & Tucker, 2005). Rank within specific courses and performance on lengthy multiple-choice examinations were also identified as predictive of USMLE I performance (Peterson & Tucker, 2005). Gohara et al. (2011) furthered the work of Gandy (2008) and analyzed several preadmission variables, such as gender, age, race, science and overall grade point average, undergraduate major, highest degree earned, the selectivity of the undergraduate institution attended, and MCAT scores. However, similar to Basco et al. (2002), the only preadmission variable found to be predictive of USMLE performance was MCAT scores. Although, performance in medical school was more predictive of USMLE I performance than were any of the preadmission variables (Gohara et al., 2011).

Performance on USMLE I has also been approached by assessing the completeness of the medical curriculum in regards to USMLE I topic coverage (Dexter, Koshland, Waer, & Anderson, 2012). An attempt to identify the relationship between USMLE I performance and curricular content resulted in a computer-based tool used to match curriculum content to the USMLE I content outline (Dexter et al., 2012). This approach did not specifically identify the relationship between performance on USMLE I and curricular content. However, this approach did allow faculty to see specific phenomenon, such as how the content was integrated across the first two years, how the curriculum covered all areas of the USMLE I content outline, and that their content-tracking capability had improved (Dexter et al., 2012).

Comprehensive Osteopathic Medical Licensing Examination Part I (COMLEX I)

During the literature review, I examined the relationships between COMLEX I performance and performance in medical school courses. Correlations were found between written exams in osteopathic manual medicine courses and performance on COMLEX I (Lewis, Johnson, & Finnerty, 2014). Correlations were also found between performance in preclinical courses such as pharmacology, physiology, behavioral medicine, microbiology, pathology, biochemistry, and COMLEX I performance (Liu et al., 2014; Sefcik et al., 2003). However, at one school, the strongest correlations were found between pharmacology and physiology and COMLEX I performance (Sefcik et al., 2003). The strongest correlation at another school were between COMLEX I performance and performance on the renal section of first-year medical school curriculum (Glaros et al., 2014). Biochemistry, physiology, and pathology were found to be strong predictors of performance on COMLEX at another school (Texas A&M University [TAMU], 2014).

During the literature review, I examined the relationships between performance on COMLEX I and variables such as osteopathic and preclinical courses, MCAT scores, and grade point average. Correlations were found between performance on COMLEX I and several academic preadmission variables. For instance, correlations were found between COMLEX I performance and MCAT, undergraduate grade point average, age, undergraduate major, and choice of undergraduate institutional (Dixon, 2012; Liu et al., 2014; Vora et al., 2013; Wong, Ramirez, & Helf, 2009). Higher overall grade point averages were also found to correlate with COMLEX I performance (Baker et al., 2000). Specifically, correlations were found between high medical school grade point averages during the first two years and COMLEX I performance (Vora et al., 2013). Similarly, students with grade point averages within the top 20% of their classes were more likely to pass COMLEX I (Baker et al., 2000). On the other hand, no correlations were found between performance on COMLEX I and the number of upper-level elective science courses taken prior to admission, or a student’s gender (Wong et al., 2009).

National Board of Chiropractic Examiners Part I (NBCE I)

During the literature review, I examined the relationships between performance on NBCE I and variables such as course grades, curriculum training, practice exams, and grade point average. Compared to other basic science subjects, anatomy and chemistry were found to be the most predictive of NBCE I performance (Kenya et al., 2013). Additionally, relationships were found between performance on NBCE I and various course grades, including Physiology I and II, Gross Anatomy I, Spinal Anatomy, Neuroanatomy, Pathology II (Wolfenberger, 1999). However, according to Wolfenberger (1999), no significant correlation were found between Research Methodology, Embryology, General Microbiology, Pathological Microbiology, Physiology III, and Public Health course grades, entering credit hours, and entering degree with NBCE I performance (Wolfenberger, 1999). In addition to course grades, chiropractic curriculum in general and practice exams were found to be strong predictors of success on NBCE I (McCall & Harvey, 2014). Relationships were also found between performance on all NBCE I sections and cumulative grade point average, and all NBCE I sections except Microbiology and Public Health and entering grade point average (Wolfenberger, 1999). Correlations between pre-chiropractic and in-program grade point averages and performance on NBCE I were also found (Cunningham, Percuoco, Marchiori, & Christianson, 2006). Study and learning strategies such as factors of self- regulated learning including, anxiety, selecting main ideas, concentration, and test strategies were found to be significant predictors of NBCE I performance (Schutz et al., 2015).

Although not directly related to NBCE I performance, the learning style preferences of chiropractic students, which were primarily multimodal learners and preferred kinesthetic learning, were found to be beneficial in structuring curricula (Whillier et al., 2014). However, additional research is needed to determine a relationship between teaching methods and learning style preferences (Whillier et al., 2014). Relationships between NBCE I performance and chiropractic curriculum in general, some course grades, such as Anatomy, Chemistry, Physiology I and II, Gross Anatomy I, Spinal Anatomy, Neuroanatomy, Pathology II and practice exams, study and learning strategies were also found. While, no significant correlations were found between other course grades, such as Research Methodology, Embryology, General Microbiology, Pathological Microbiology, Physiology III, and Public Health, entering credit hours, and entering degree. Additional research may also be needed to explore the effects of different variables on grade point average.

National Council Licensure Examination (NCLEX)

During the literature review, I examined the relationships between NCLEX performance and variables such as other exams, various courses, and student transfer status. Relationships were found between NCLEX performance and scores on several other exams, including the Health Education Systems Incorporated (HESI), the Mosby Assess Test, and the National League for Nursing (NLN) tests (Langford & Young, 2013; Rowshan & Singh, 2014; Young et al., 2013). In fact, one study (Young et al., 2013) found that higher HESI scores resulted in higher NCLEX scores. Similarly, standardized tests in community health, adult medical-surgical, and pharmacology standardized tests were found to be effective predictors of NCLEX success but were not effective in predicting first attempt failures (Yeom, 2013). Courses in advanced medical surgical nursing and pharmacology were also found to correlate with NCLEX performance (Trofino, 2013). Furthermore, scores on the introductory fundamentals portion of HESI, and grades in Pediatric Nursing, Medical and Surgical Nursing, and Maternity Nursing courses were found to predict NCLEX outcomes (Schooley & Dixon-Kuhn, 2013). However, Simon, McGinniss, and Krauss (2013) found that clinical and pre-clinical courses do not show a correlation with NCLEX performance, but did show a correlation between NCLEX I performance and student's with transfer credits. Still, Emory (2013) found that assessment scores in fundamentals, mental health, and pharmacology courses were predictive of failure on NCLEX with 73.7% accuracy.

During the literature review, I also examined the relationship between performance on NCLEX and variables such as critical thinking skills, grade point average, transfer status, and demographic data. Variables such as age, gender, student transfer status, grade point average, and scores on the reading subsections of American College Test (ACT), Scholastic Aptitude Test (SAT), and the Test of Essential Academic Skills (TEAS) were not found to be good predictors of NCLEX performance (Trofino, 2013). Though, for each point on the math subsection of the ACT, SAT, and TEAS scores "students were 2.364 times more likely to pass the NCLEX" (Trofino, 2013, p. 8). However, Truman (2012) found that predictors of success for NCLEX included performance on the verbal portion of the SAT. Specifically, for every point increase in the verbal SAT score, passing NCLEX increased by 1% and for every point increase in the grade point average of didactic nursing course, passing NCLEX increased by 35 times (Truman, 2012). Conversely, Romeo (2013) found that combined SAT scores were not shown to predict first-time pass rates on NCLEX, but critical thinking skills were shown to predict NCLEX first-time pass rates. Nursing grade point average has also been found to predict NCLEX first-time pass rates (Romeo, 2013; Truman, 2012). Although, bilingual nursing programs found entering grade point average to be the most predictive of NCLEX performance (Bosch, Dosher, & Gess-Newsome, 2012). Variables, such as scores on other exams and grade point average were shown to correlate with NCLEX performance, whereas other variables, such as gender and student transfer status were not shown to correlate with NCLEX performance (Simon, McGinniss, & Krauss, 2013). SAT and ACT were found to vary in their ability to predict NCLEX performance (Romeo, 2013).

National Physical Therapy Licensure Examination (NPTE)

During the literature review, I examined the relationship between performance on NPTE and variables such as curriculum, cohort, faculty, grade point average, and pass rates of other tests. Correlations were found between first-time NPTE success and the experience of the academic clinical coordinator of education programs, decreased graduation rates, and increased laboratory contact hours (Maring et al., 2013). Correlations between NPTE performance and the Nelson-Denny Reading Test (NDRT) performance, grade point average, and SAT scores were also found (Aldridge et al., 2010; Gallaher, Rundquist, Barker, & Chang, 2012; Luedtke-Hoffmann, Dillon, Utsey, & Tomaka, 2012; Taylor, 2012). Correlations were found between mock NPTE scores and

NPTE performance; students who achieved a score below 620 on the mock NPTE were identified as at risk of failing the NPTE (Sloas, Keith, & Whitehead, 2013). However, Sloas et al. (2013) found that core course grades and admission grade point average were not significant predictors of NPTE performance. Similarly, cognitive and non-cognitive predictors such as grade point average, conscientiousness, and task coping were not correlated with NPTE performance (Gallaher et al., 2012). The literature review revealed relationships between NPTE performance and experience of the ACCE, decreases in graduation rates, as well as increased laboratory contact hours, NDRT performance, grade point, mock NPTE exams and SAT scores. However, no significant correlations were found between core course grades, admission grade point average, conscientiousness, task coping, and NPTE performance.

Implications

The background literature for this study focused on a variety of relationships between a number of different variables and licensing exam performance in the fields of allopathic, osteopathic, and chiropractic medicine, as well as nursing, and physical therapy. However, the concern that remained was whether there is a predictive relationship between students' content area final exam scores in naturopathic basic science courses and their performance on the first and second subscore areas of NPLEX I on the first attempt. Therefore, my purpose for this quantitative study was to assess whether a predictive relationship exists between students' basic science content area final exam scores in naturopathic basic science courses and performance on the first and second NPLEX I subscore areas on the first attempt at SVC. In accordance with Mizikaci

(2006), being able to identify whether there is a predictive relationship between students' content area final exam scores in naturopathic basic science courses and their first and second NPLEX I subscores on the first attempt could have implications for positive social change. For instance, the results of this study could help schools of naturopathic medicine develop potential strategies to assess the effectiveness of their basic science curricula that may lead to curricular changes that could potentially increase NPLEX I performance, as well as have a positive impact on the reputation of the schools and profession of naturopathic medicine.

However, in addition to having implications for positive social change, this study, by identifying whether a predictive relationship exists between basic science content area final exam scores and NPLEX I scores could also provide directions for future research and development. That is, the potential strategies identified through this study may provide direction for future curricular development. This future curricular development could include recommending changes to the basic science curricula that could potentially be used to help increase NPLEX I performance. Consequently, there are a couple of directions for possible projects based on anticipated findings of the data collection and analysis that may be possible from this study. One potential project direction could involve recommending a change to the content of the curriculum of one or more basic science courses. For instance, the anatomy content could be changed by increasing the content, or the sequencing of content topics could be rearranged to build off of one another in a different order. Another potential project direction based on anticipated findings of the data collection and analysis of this study might involve recommending a change to the minimum performance standards required for one or more basic science courses. For instance, the minimum number of points or percentage needed to pass the anatomy content of a course could be increased. Furthermore, the results of this study may also provide directions for future research that could potentially build off of the results of this study. For example, this study's research may be extended to include the identification of the predictive relationship between each NPLEX I subscores and multiple basic science content areas, or between content areas of individual basic science courses.

Summary

In section one, I introduced and defined the problem of low first-time pass rates on NPLEX I at schools of naturopathic medicine. Next, I discussed the local evidence such as low first-time pass rates at one school of naturopathic medicine as well as low overall first-time pass rates on NPLEX I among all seven schools of naturopathic medicine. Next, I discussed evidence from the professional literature, which suggested that the problem of low first-time pass rates on NPLEX I could jeopardize accreditation. Furthermore, the professional literature reviewed for this study advocated for the importance of accreditation, which also fed into the rationale and significance of the problem of this study. Next, the guiding research questions and the theoretical framework provided a foundation on which to ground this study. Finally, a review of the literature provided evidence that validates the study's problem and shows the value of this study.

In section two I discuss the research methodology design for this study. I discuss information related to the research design, setting and sample, instrumentation, data collection and data analysis procedures, and ethical protection procedures of this study. I discuss the data analysis results, as well as assumptions and limitations of this study. In section three I describe the project goals and rationale, the project evaluation plan, and the project implications. In section four I provide reflections and closing words on the process that includes strengths and limitations, recommendations for alternative approaches, application of project development, evaluation, and leadership skills, the importance of the study, as well as implications, applications and directions for future research.

Section 2: The Methodology

Introduction

One purpose of this quantitative study was to assess whether a predictive relationship exists between students' content area final exam scores in naturopathic basic science courses and their performance on their first and second NPLEX I subscore areas on the first attempt. Identifying whether a predictive relationship exists between these variables could be used by schools of naturopathic medicine to help develop potential strategies to assess the effectiveness of, and recommend changes to their basic science curricula that could potentially increase NPLEX I performance. Furthermore, identifying whether a predictive relationship exists between students' content area final exam scores in naturopathic basic science courses and their first and second NPLEX I subscores on the first attempt could have implications for positive social change. For instance, the implications for positive social change of this study may include a positive impact on the reputation of the schools and profession of naturopathic medicine as well as a potential increase in student's NPLEX I performance

In this section, I introduce and describe the research design and approach of this study. Next, I discuss the research setting and sample method from which this study was drawn. I also describe the instrumentation and methods I used to collect and analyze the data for this study. Finally, I outline the assumptions and limitations of this study.

Research Design and Approach

My intent in this quantitative study was to identify the predictive relationship between naturopathic basic science content area final exam scores and first and second

NPLEX I subscores on the first attempt. A mixed methods approach was first considered for this study, but I ruled it out because of a potential conflict of interest in interviewing faculty at SVC and the unnecessary complexity of the mixed methods approach. Furthermore, I considered an explanatory research design since this approach focuses on identifying associations between variables (Creswell, 2012). Although an explanatory research design would allow “changes in one variable to be reflected in changes in the other,” this approach would have focused on testing prior hypotheses to measure the relationship between variables (Creswell, 2012, p. 340). Since there is a gap in research that specifically addresses the predictive relationship between naturopathic medical school curricula performance and naturopathic professional licensing exam performance (NPLEX I), prior hypotheses were not available. A causal-comparative research design was also considered since this approach is interested in comparing differences (Creswell, 2012). However, this approach was not chosen because I was interested in identifying predictive relationships rather than comparing differences (Creswell, 2012).

I chose to use a correlational research design using statistical data because the variables would not be manipulated in order to determine the predictive relationship between basic science content area final exam scores and the first and second NPLEX I subscores (Creswell, 2012). Although a correlational research design may not prove causation, it can be useful for identifying data trends and patterns (Creswell & Plano-Clark, 2011). A correlational research design also allows data trends and patterns to emerge that could be used to identify whether any predictive relationships exist between the variables of this study (Creswell, 2012; Lodico, Spaulding & Voegtle, 2010). For these reasons, I chose the correlational research design method for this study (Renckly, 2013).

Setting and Sample

The sample of participants I initially proposed for this study included students from SVC and one other school. However, since data for a minimum of 90 student participants were not available for the other school, with approval from the Walden University IRB, I eliminated the proposed analysis related to the other school from this study. Furthermore, basic science data at SVC from 2010 were unavailable, which would have included students that took NPLEX I for the first time in August 2012. Therefore, with approval from the Walden University IRB, I obtained archival data for SVC students that took NPLEX I for the first time between August 2013 and August 2015, and took the corresponding basic science courses between 2011 and 2013.

In this study, I focused on a population with characteristics specifically tied to the research questions. Therefore, a purposive sample was used for this study (Lodico et al., 2010). Additionally, the sample of participants for this study were from a pre-specified group, SVC students that took NPLEX I for the first time between August 2013 and August 2015. Therefore, a homogenous purposive sampling method was used for this study (Lodico et al., 2010).

In addition to taking NPLEX I for the first time between August 2013 and August 2015, further criteria for eligibility were required in order for students to be included in this study. First, students had to pass all basic science courses related to anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology before taking NPLEX I—a requirement set by NABNE (2014c) which institutions must certify for students to take NPLEX I. However, NABNE (2014c) does not require students to pass all of those basic science courses at one institution, or the institution that is certifying them. An institution may issue transfer credit for these courses upon matriculation and still certify that student to take NPLEX I (SVC associate registrar, personal communication, October 23, 2015). According to the SVC associate registrar (personal communication, October 23, 2015), transfer students account for approximately 1% to 2% of participants per NPLEX I administration. Therefore, to help eliminate bias in the results, I excluded students who did not complete all of their basic science courses at SVC (i.e. transfer students) from this study.

NPLEX I examinees can also choose not to release their score reports to their institution, which means there is the potential for reports to be missing and data to be incomplete for some students (NABNE, 2015a). Following each NPLEX I administration, each institution receives anonymous score reports, indicating a score of pass or fail for each subscore area, for any of its students who chose not to release their score report to their institution (SVC associate registrar, personal communication, October 23, 2015). The anonymous NPLEX I reports, generally consisting of a mixture of passes and fails, prevent the institution from identifying the particular student to which each anonymous report belongs (SVC associate registrar, personal communication, October 23, 2015). According to the SVC associate registrar (personal communication, October 23, 2015), roughly 10% of students choose not to release their score reports to SVC during each NPLEX I administration. Therefore, students who chose not to release their NPLEX I score reports to SVC were excluded from this study. Consequently, to be included in this study an SVC student must have completed all of the required basic science courses at SVC (Human Biology I, II, and III, and General Medical Diagnosis I, II, and III), taken NPLEX I between August 2013 and August 2015 for the first time, and released their NPLEX I score report to SVC.

As I previously mentioned, the specific date range of August 2012 through August 2015 was originally proposed for this study. This date range was originally proposed since August 2012 was the first NPLEX I administration in which students enrolled in SVC's revised curriculum were eligible to take NPLEX I (SVC chief academic officer, personal communication, June 4, 2015). Furthermore, August 2015 included the last group of students from this version of SVC's revised curriculum who were eligible to take NPLEX I for the first-time (SVC chief academic officer, personal communication, June 4, 2015). However, basic science final exam data at SVC from the 2010 and previous academic years were unavailable, which would have included students who took NPLEX I for the first time in August 2012. Nonetheless, the NPLEX I administration range of August 2013 to August 2015 still included the most recent basic science final exam scores and the most recent NPLEX I scores associated with those basic science final exam scores. Therefore, with approval from the Walden University IRB, I changed the NPLEX I administration range to August 2013 through August 2015. The curriculum at SVC remained consistent during this time frame, with the exception of a few changes in faculty, and there were minimal changes to the basic science content area final exam coverage (SVC chief academic officer, personal communication, June 4, 2015).

Although I projected a maximum of 100 participants per NPLEX I exam administration (~400) for this study, an equal number of participants per exam could not be obtained. The differences in the number of eligible participants and the number of participants per exam resulted from a combination of factors, including unequal cohort numbers and the elimination of transfer students and students with incomplete data. Therefore, I included a controlled entry representing the specific administration month and year in which NPLEX I was taken, referred to as “NPLEX I administration”. The purpose of the controlled entry was to account for possible effects that an unequal number of participants per NPLEX I exam from administration to administration may have on the results (University of Colorado, Denver, n.d.). Although a controlled variable was not my primary interest, it was needed to control for the unequal number of participants per NPLEX I exam from administration to administration (Pole & Bondy, 2010). Therefore, I assigned dummy variables for each NPLEX I administration to control for differences in NPLEX I scores from each administration (Livingston, & Zieky, 1982; Stockburger, 1997).

When it comes to conducting regression analysis, there are several opinions regarding the recommended sample size. According to Hosmer and Lemeshow (2000), and Wilson-VanVoorhis and Morgan (2007), when conducting correlation analysis or regression analysis with five or less independent predictor variables, an adequate sample size should consist of no less than 50 participants. McDonald (2014) suggested a minimum of 10 to 20 participants per independent predictor variable. When performing regression analysis with six or more independent predictor variables, Wilson-VanVoorhis and Morgan (2007) suggested that a minimum of 10 participants per independent predictor variable is appropriate. However, Wilson-VanVoorhis and Morgan (2007) prefer 30 participants per independent predictor variable since it provides more opportunity to identify a small effect size. Furthermore, Soper (2015) recommended 15 participants per independent predictor variable when conducting hierarchical logistic regression. The independent variables of the study are referred to as independent predictor variables (Hosmer & Lemeshow, 2000).

In this study, the independent predictor variables are the final exam scores for each content area of anatomy, physiology, biochemistry (includes genetics), microbiology (includes immunology), and pathologyplus (includes pathology and other content). This study included two separate analyses, with a maximum of three independent predictor variables for each analysis. That is, the first analysis included two predictor variables: one variable for the microbiology score and one variable for the pathologyplus score. The second analysis included one variable for the anatomy score, one variable for the physiology score, and one variable for the biochemistry score. Table 2 outlines the independent variables (basic science final exam scores per content area) per dependent variable (NPLEX I subscore) per analysis at SVC.

Table 2

Independent Predictor Variables per Dependent Variable at SVC

Analysis	Dependent Variable (NPLEX I Subscore)	Independent Predictor Variable (Content Area Final Exam Scores)
1	1st (Disease/Dysfunction)	Microbiology Pathologyplus
2	2nd (Structure/Function)	Anatomy Physiology Biochemistry

Note. Adapted from “Part I biomedical science examination: Blueprint and study guide,” by North American Board of Naturopathic Examiners. Copyright 2015 by author.

As outlined in Table 2, the maximum number of predictors per analysis is three: one for the anatomy score, one for the physiology score, and one for the biochemistry score. Therefore, the maximum number of predictors for this study is three. Since a minimum of 50 participants was suggested by Hosmer and Lemeshow (2000), and Wilson-VanVoorhis and Morgan (2007), and the 10-20 limit recommended by McDonald (2014) results in 30-60 participants (3 predictors times 10 or 20 participants), this study required a bare minimum of 50 participants. However, since the use of 30 participants per predictor is the preferred recommendation by Wilson-VanVoorhis and Morgan (2007), a minimum of 90 participants (3 predictors, times 30 participants) was the required sample I used size for this study. The NPLEX I administration range of August 2013 through August 2015, the elimination of transfer students, and the elimination of participants with incomplete data provided the following sample sizes at SVC. The first analysis, with NPLEX I disease/dysfunction subscores and microbiology and pathologyplus scores was done with N = 208 student records. The second analysis, with the NPLEX I structure/function subscores with the anatomy, physiology, and biochemistry scores was done with *N* = 256 student records. The difference in sample size between the first and second analysis is 48 student records that did not have a microbiology and pathologyplus scores, and an NPLEX I score for the first analysis; therefore I eliminated these students from the sample. Nonetheless, the sample size for each analysis exceeded the recommended 10-20 participants per predictor by McDonald (2014), the 15 participants per predictor by Soper (2015), and the preferred 30 participants per predictor by Wilson-VanVoorhis and Morgan (2007).

Instrumentation and Materials

The sources of data I collected for this study included NPLEX I subscore data and basic science content area final exam score data. NPLEX I subscore data, obtained by the SVC dean, were from individual student score reports issued by NABNE (2015a), which were archived at SVC with student permission. The NPLEX I subscore data consisted of dichotomous, binary data that included a score of pass, which I coded as (1), or a score of fail, which I coded as (0) for the NPLEX I subscore area of disease/dysfunction and the subscore area of structure/function. Although an overall score was provided on the NPLEX I score reports, each subscore area applies directly to specific basic science content area courses, as previously outlined in Table 1, providing more insight into the predictive relationships between variables (NABNE, 2014c). Therefore, I used individual scores for each subscore area for this study instead of an overall score.

For each NPLEX I administration, the specific questions chosen for the exam were generated from a test bank of questions written and vetted by a minimum of six “biomedical science faculty and NDs in the United States and Canada” (NABNE, 2015a, p. 47). New questions may be added to the test bank before each administration of NPLEX I, and each administration of the exam may contain different questions (NABNE, 2015a). The chosen questions, as well as the percentage and number of questions from each basic science content area, are consistent for all students taking NPLEX I during a particular administration (NABNE, 2015a). However, NABNE (2014c) does not calibrate NPLEX I scores from administration to administration. Therefore, to control for differences between administrations, I added a controlled entry for the NPLEX I administration (i.e. month and year in which NPLEX I was administered) to the regression analyses (University of Colorado Denver, n.d.). Outlined in Table 3 are the dummy variables I coded for the categorical NPLEX I administration control variables, which consist of the particular academic year and NPLEX I administration month and year (Livingston & Zieky, 1982; Stockburger, 1997).

Table 3

Categorical Independent Control Variable, NPLEX I Administration Codes

NPLEX I Administration	Code
Academic Year 2014-2015 (Aug15)	001
Academic Year 2013-2014 (Aug14)	010
Academic Year 2012-2013 (Aug13)	100

The basic science course final exams at SVC were developed with NPLEX I in mind, which was developed using content validation principles (NABNE, 2015a; SVC dean, personal communication, July 15, 2015). At SVC, the basic science course final exams contain much of the same content outlined in the NPLEX I blueprint (NABNE, 2015a; SVC dean, personal communication, July 15, 2015). The NPLEX I blueprint outlined the content included on NPLEX I, which includes the specific percentage of each body system included on NPLEX I during each administration, which was the same for each administration (NABNE, 2015a). The NPLEX I blueprint also outlined the specific competencies for each body system students need to know to successfully pass NPLEX I (NABNE, 2015a). However, the blueprint did not specify the percentage or point distribution of each basic science content area included on NPLEX I during each administration, and this information was not available (NABNE, 2015a). Point distributions for each basic science content area were available for each basic science course final exam; however, the basic science course final exam point distributions for each body system specified within the NPLEX I blueprint were not available (SVC dean, personal communication, September 14, 2015). In other words, the distribution or percentage of each body system were available for NPLEX I, but not available for the basic science content area final exams; and the point distributions per basic science content area were available for the basic science content area final exams, but not available for NPLEX I. Given that the point distributions of each basic science content area on NPLEX I were unavailable, a direct analysis of the point distribution of each basic science content area final exam and each basic science content area included on each administration of NPLEX I were not possible (NABNE, 2015a). Therefore, potential differences in point distributions between the basic science content area final exams and NPLEX I scores were considered a limitation of this study (NABNE, 2015a).

One method that could address the point distribution issue involves applying a formula that provides an estimation of the weights (Kreuter & Olson, 2011). However, the weighting method requires an assumption that the point distributions on NPLEX I of the basic science content areas were equal to the point distributions on the basic science course final exams of each content area (Kreuter & Olson, 2011). For example, using the weighting method; if an SVC student's anatomy content area final exam scores were 90, 85, and 80 in Human Biology I, II, and III respectively; these scores would be multiplied by the difference between the total final exam points available for that content area in that course (182, 52, 102 respectively) by the overall anatomy final exam points available (336); 90*(182/336)+85*(52/336)+80*(102/336). Using the weighting method the weighted score for each basic science content area final exam score for each student at SVC could be calculated. The weighted basic science content area final exam scores could then be used in the regression analyses instead of the actual scores. Although I considered the method of weighting the point distributions, I chose not to implement it since documentation about the appropriateness of the assumption that point distributions on NPLEX I of the basic science content areas are equal to the point distributions on the basic science course final exams of each content area was not available (NABNE, 2015a). However, since the potential differences in point distributions were not controlled, this is considered a limitation of this study.

The basic science content area final exam scores, acquired by the SVC dean were from archived student records at SVC. The SVC dean collected basic science content area final exam score data from basic science courses taken in fall 2011 through spring 2013. Basic science content area final exam data were collected from this timeframe since fall 2011 through spring 2013 is the timeframe in which students who took NPLEX I between

August 2013 and August 2015 took these courses (NABNE, 2015a; SVC dean, personal communication, July 15, 2015). The basic science content area final exam score data consisted of continuous, interval level data that included basic science content area final exam scores from courses related to the content areas of anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology. The basic science courses at SVC included several content areas in one basic science course (SVC dean, personal communication, July 15, 2015). The overall course scores could not be separated by basic science content area, but the final exam scores could be separated by basic science content area. Therefore, I separated the final exam scores for the basic science content areas of anatomy, physiology, biochemistry, and microbiology from the overall final exam score in each basic science course at SVC. Each basic science content area included two to three final exam scores; one for each course that includes that content area. Anatomy, physiology, and biochemistry each had three final exam scores, one for each Human Biology I, II, and III course. Microbiology had two final exam scores, one for each Human Biology II and III course.

The pathology content final exam scores at SVC could not be separated from the scores of the other final exam content areas included in the General Medical Diagnosis I, II, and III courses (SVC Associate Professor, personal communication, March 18, 2015). Consequently, a majority of the CNME accredited schools of naturopathic medicine integrate pathology content with other content areas (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). For example, some of the other content areas included with the pathology content consisted of lab diagnosis, radiology, and clinical and physical diagnosis (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). Therefore, I did not collect separate pathology content data. Instead, I collected data for the entire course or courses at SVC that contain the pathology content for this study. Consequently, since the pathology content was integrated with other content areas the pathology content area for this study is referred to as “pathologyplus”. The pathologyplus content area had three final exam scores, one for each General Medical Diagnosis I, II, and III course.

Schools of naturopathic medicine accredited by the CNME typically have similar course measures, such as quizzes and cumulative final exams to assess performance as well as requiring grades of 70% or higher to pass assessments (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). SVC is accredited by the CNME and is required to follow its standards (CNME, 2015). However, exam characteristics may vary across CNME accredited institutions, and across courses. For example, differences in points per question and point distributions per basic science content area mean the exact numerical score could vary depending on the specific assessment or the specific course content area. For instance, 70% on one exam might result in a score of 70 points because the exam was worth 100 points. On the other hand, 70% on another exam might result in a score of 175 points because the exam was worth 250 points. Furthermore, Table 4 shows how SVC final exam characteristics vary across courses. For example, Table 4 shows that the basic science content area final exam characteristics are consistent across courses at SVC; they utilize only multiple choice questions and questions are consistently worth one point. However, questions and points per exam and content may vary (SVC dean, personal communication, July 2, 2015).

Table 4

Basic *Science Content Area Final Exam Characteristics at SVC*

Types of exam questions	Multiple choice
Questions per exam/content area	250 (16-192/content area)
Points per exam/content area	250 (16-192/content area)
Points per question	1

Note. Adapted from "personal communication, July 17, 2015" by SVC dean.

Differences in final exam point distributions per basic science content area is another example of how the exam characteristics may vary across courses. For example, Table 5 summarizes the differences in final exam point distributions per basic science content area final exam for each basic science course at SVC. The first column in Table 5 outlines the basic science content areas included within each NPLEX I subscore area. The remaining columns in Table 5 outline the number of final exam points that each NPLEX I subscore area is worth in each corresponding basic science course at SVC. For example, as outlined in Table 5, the differences in the points of each basic science final exam content area may range from approximately 16 points to 185 points depending on the course and content area (i.e. physiology content is 213, whereas anatomy content is 336). Nonetheless, these distributions remained consistent during the identified timeframe of fall 2011 through spring 2015 (SVC dean, personal communication, July 2, 2015).

Table 5

Basic Science Content Area Final Exam Point Distributions at SVC

	Human Biology I	Human Biology II	Human Biology III	Gen Med Diagnosis I	Gen Med Diagnosis II	Gen Med Diagnosis III
Anatomy	182	52	102	-	-	-
Physiology	54	100	59	-	-	-
Biochemistry	85	91	120	-	-	-
Microbiology	-	16	185	-	-	-
Pathologyplus	-	-	-	50	60	60

Note. Adapted from "personal communication July 17, 2015" by SVC dean.

Data Collection and Analysis

In this section I outline the data collection and data analysis strategies for this study. The data collection analysis strategy for this study involved the collection and preparation of archival data. I also outline the steps taken to prepare the data for analysis in this section. I also discuss the procedures for gaining access to the archival data and the changes to the initial study proposal, which included obtaining approval from the Institutional Review Boards (IRB) at SVC and the other school, as well as the IRB at Walden University. The Walden University IRB approval number for this study is 04-13-16-0196273.

Data Collection

Early in the data collection phase, the other school discovered they were unable to collect a sufficient number of participants, at least 90, to be included in this study (NVC associate dean, personal communication, June 2, 2016). Therefore, I obtained approval from the Walden University IRB and eliminated the proposed study analysis related to the other school from this study. Therefore, the data sources and findings of this study refer solely to SVC.

One source of archival data I collected for this study included individual student scores on the NPLEX I subscore area of disease/dysfunction and the subscore area of structure/function. I chose to include individual subscores instead of an overall score since each NPLEX I subscore area applied directly to specific basic science course content areas, as outlined earlier in Table 1 (NABNE, 2015a). Moreover, the individual subscore areas may provide more insight into the predictive relationships between variables. Therefore, with the help of the SVC dean I collected a passing or failing score on the disease/dysfunction subscore area and a passing or failing score on the structure/function subscore area for each eligible student at SVC (NABNE, 2014c).

An additional source of archival data I collected for this study, with help from the SVC dean, included individual content area scores from each basic science course final exam for each eligible student at SVC. The basic science final exam content area scores, contained in archived records at SVC, were exclusively from final exam scores of the lecture portion of each course. The courses from which these scores were collected consisted of courses related to anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology. The basic science courses at SVC included several content areas in one basic science course; however, the overall course score could not be separated by content area, but the final exam scores could be separated. Therefore, I collected final exam scores for each basic science content area for each eligible student at SVC (SVC Associate Professor, personal communication, March 18, 2015).

The one basic science content area at SVC in which final exam scores could not be separated from the other content was pathology (SVC Associate Professor, personal communication, March 18, 2015). Therefore, with help from the SVC dean, I collected an overall final exam score for the General Medical Diagnosis I, II, and II courses, which included the pathology content. For the purpose of this study, the pathology content is referred to as “pathologyplus” since these scores include more than just pathology content. Moreover, courses that have content combined with pathology is common at a majority of the CNME accredited schools of naturopathic medicine (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). Furthermore, since combining pathology with other content is common among the majority of schools of naturopathic medicine, I chose to analyze the pathologyplus score as a whole since it may provide beneficial insight into the predictive relationship of these courses and NPLEX I performance. The basic science content area relationships of each NPLEX I subscore area with the corresponding basic science courses at SVC are outlined in Table 6.

Table 6

Relationship of NPLEX I Subscore Areas and Basic Science Content Areas at SVC

NPLEX I Subscore Area	NPLEX I Basic Science Content Area	SVC Basic Science Courses
Disease/ Dysfunction	Microbiology/Immunology	Human Biology II, III
	Pathology	General Medical Diagnosis I, II, III
Structure/ Function	Anatomy	Human Biology I, II, III
	Physiology	Human Biology I, II, III
	Biochemistry/Genetics	Human Biology I, II, III

Note. Adapted from “Part I biomedical science examination: Blueprint and study guide,” by North American Board of Naturopathic Examiners. Copyright 2015 by author

To ensure confidentiality and anonymity of the data, I worked with the SVC dean and faculty to collect the necessary data for this study. The SVC dean, in collaboration with the faculty, began collecting the individual student basic science content area final exam data from archived files generated from the ExamView software for the academic years 2010 through 2013 (SVC dean, personal communication, June 2, 2016). During the data collection process, the SVC dean discovered that the basic science final exam data from the 2010 academic year, and previous, were not available (SVC dean, personal communication, June 2, 2016). The ExamView software was not in use during and prior to the 2010 academic year, and the physical exams and student scores were no longer available (SVC dean, personal communication, June 2, 2016).

Although the basic science final exam data from the 2011 - 2013 academic years were available, additional work was required for some of the exams to identify the individual student scores for each basic science content area. On two exams, the archived basic science final exam scores were not separated by content area (SVC dean, personal communication, June 2, 2016). In these cases, the SVC dean obtained the appropriate exams from the faculty and coded the questions to identify which questions fit into each basic science content area (SVC dean, personal communication, June 2, 2016). The SVC dean then separated the individual students' final exam scores by content area (SVC dean, personal communication, June 2, 2016). On another exam, only the microbiology and immunology scores needed to be separated (SVC dean, personal communication, June 2, 2016). The SVC dean indicated it was possible that the scores may have been combined on some exams and not others because different faculty may have scored the exams, and may have been focused on different academic needs at the time of scoring (SVC dean, personal communication, June 2, 2016). For instance, some faculty may have had a specific interest in immunology that quarter and some may have just combined the microbiology and immunology scores because these scores are combined on NPLEX I (NABNE, 2014c; SVC dean, personal communication, June 2, 2016). Regardless of the reasons, the SVC dean requested the exams so he could code the exam's questions to identify the specific microbiology questions and the specific immunology questions (SVC dean, personal communication, June 2, 2016). Unfortunately, the exams were no longer available, and therefore, could not be coded to obtain the individual microbiology and immunology scores (SVC dean, personal communication, June 2, 2016).

Next, the SVC dean collected the NPLEX I data from each individual student's NPLEX I score report from NABNE (2015a), which were archived at SVC with student permission (NABNE, 2013a, 2013b, 2014a, 2014b, 2015c; SVC dean, personal communication, June 2, 2016). The SVC dean then merged, or matched up each student's basic science content area final exam scores and NPLEX I scores (SVC dean, personal communication, June 2, 2016). To ensure anonymity and confidentiality all archived data, including NPLEX I score data and basic science final exam score data were manually coded for anonymity by the SVC dean before being released to me (Lodico et al., 2010; SVC dean, personal communication, June 2, 2016). That is, all identifying information such as students' names and IDs were replaced by an anonymous numerical identifier and the coded data were organized in an Excel spreadsheet and then emailed to me. All data released to me are secured in a password protected document (Lodico et al., 2010).

Since the 2010 basic science data were not available and the microbiology and immunology scores could not be separated for all courses, I requested additional approval from my doctoral committee and the Walden University IRB to amend the proposed data set. Upon receipt of approval to exclude the 2010 basic science data and combine the microbiology and immunology scores I was able to proceed with the analysis of the data. Combining the scores allowed me to keep the microbiology and immunology content areas in my study and prevented a potential loss of sample size. The first analysis, with the NPLEX I disease/dysfunction subscore, microbiology score, and pathologyplus score, was done with N = 208 student records. The second analysis, with the NPLEX I structure/function subscore and anatomy, physiology, and biochemistry scores was done with N = 256 student records. The difference in sample size between the first and second analysis was that 48 student records did not have a microbiology and pathologyplus score, and an NPLEX I score for the first analysis, and therefore were eliminated from the sample.

Data Analysis Strategy

The data analysis strategy I used for this study involved utilizing the IBM Statistical Package for the Social Sciences (SPSS) version 21 program to analyze the Excel spreadsheet data. I analyzed each eligible individual students' basic science content area final exam scores against each of their respective NPLEX I subscores. That is, I analyzed each eligible individual student's basic science content area final exam scores obtained from archived records at SVC and each individual student's NPLEX I score report from NABNE (2015a), which were archived at SVC with student permission, against one another (NABNE, 2013a, 2013b, 2014a, 2014b, 2015c). Eligible students consisted of those who took NPLEX I between August 2013 and August 2015, released their score report to SVC, and completed all of their basic science courses at SVC. For the first analysis, students who did not have a microbiology and pathologyplus score, and an NPLEX I score for the subscore area of disease/dysfunction were considered ineligible students and were eliminated from the dataset. Therefore, the first analysis was done with N = 208 student records. Similarly, for analysis two, students who did not have an anatomy, physiology, and biochemistry score and an NPLEX I score for the subscore area of structure/function were considered ineligible students and were eliminated from the dataset. Therefore, the second analysis was done with N = 256 student records. Students who did not have a score for one or more of the basic science content areas were primarily indicative of dismissed, withdrawn, or transfer students since they would not have taken some or all of their basic science final exams at SVC (SVC dean, personal communication, June 2, 2016). The difference in sample size between the first and second analysis was that 48 student records did not have a microbiology and pathologyplus score, and an NPLEX I score for the first analysis, and were therefore eliminated from the sample. Therefore, for the first analysis, 48 students who did not have a score for microbiology were eliminated since their basic science final exams did not include this content area. Students without scores for both NPLEX I subscore areas were indicative of students who either did not take NPLEX I or chose not to release their scores to SVC (SVC dean, personal communication, June 2, 2016).

The data analysis strategy for this study involved the consideration of using a model of linear regression analysis or a model of logistic regression analysis. This consideration was due to opposing views among scholars regarding the use of linear regression versus logistic regression. Pohlman and Leitner (2003) suggested either linear regression or logistic regression could be used if looking specifically at relationships versus probabilities. Zhao, Chen, and Schaffner (2001) suggested logistic regression be used when the dependent variable is binary. However, Pohlman and Leitner (2003) suggested logistic regression should be used when working with binary dependent variables due to their ability "to produce more accurate estimates of the probability of belonging to the dependent category" (p.124). Hellevik (2009) suggested either linear regression or logistic regression could be used when working with binary variables, especially with large samples, as the use of one over the other will have little impact on the results. Due to the opposing views among scholars regarding the use of logistic regression versus linear regression, the assumptions and benefits of both models were considered in determining which approach to use for this study.

After careful consideration, the method of statistical analysis I used to analyze data for this study was logistic regression analysis, which uses maximum likelihood estimations (MLE) (McDonald, 2014). This study included separate regression analysis models for the first and second NPLEX I subscores at SVC (McDonald, 2014). The sample sizes for each model exceeded both the minimum of 50 participants and the preferred recommendation of 30 participants per predictor variable (e.g. 90) (Hosmer & Lemeshow, 2000; Wilson-VanVoorhis & Morgan, 2007). The first analysis, with the

NPLEX I disease/dysfunction subscore and microbiology and pathologyplus scores was done with N = 208 student records. The second analysis, with the NPLEX I structure/function subscore and the anatomy, physiology, and biochemistry scores was done with N = 256 student records. The difference in sample size between the first and second analysis was that 48 student records did not have a microbiology and pathologyplus score, and an NPLEX I score for the first analysis, and were therefore eliminated from the sample.

Although logistic regression requires a large sample size, it offers numerous benefits and lacks restrictive assumptions (McDonald, 2014). For example, logistic regression, unlike linear regression, allows for probability predictions in addition to identifying relationships (McDonald, 2014). Additionally, unlike linear regression, logistic regression does not assume the independent variable to be multivariate normal and residual errors are not assumed to follow a normal distribution (McDonald, 2014; Statistic Solutions, 2015). Also, unlike linear regression, the relationship between the independent and dependent variables in logistic regression is not assumed to be linear (McDonald, 2014). In logistic regression, a linear relationship between the independent and dependent variables is related to log odds, which increases the chance that the relationships will be rejected (McDonald, 2014). Logistic regression also does not assume homoscedasticity, or that differences in prediction errors will be the same for the predicted variables (McDonald, 2014). Although similar to linear regression, logistic regression also provides a value for the strength of the relationship, which includes the removal of confounding effects of other variables (McDonald 2014).

Due to the numerous benefits and unrestrictive assumptions that logistic regression provides, I used this method of statistical analysis for this study. Additionally, I used chi-square tests to test the association of variables and determine how well the model fit the data (McDonald, 2014; Statistic Solutions, 2015). Logistic regression analysis can also include either simple or multiple logistic regression analysis (McDonald, 2014). Simple logistic regression analysis, utilized when one measurable independent variable, such as an interval level variable, is used to determine the relationship between variations in the independent variable and variations in the categorical or binary dependent variable (McDonald, 2014). Multiple logistic regression analysis is used when two or more measurable independent variables are used to determine how the measurable independent variables will affect the categorical or binary dependent variable (McDonald, 2014). Since more than two independent variables were analyzed against the dependent variable, I used multiple logistic regression for this study.

The particular forms of logistic regression I used for this study included hierarchical and backward stepwise logistic regression analysis (Creswell, 2012; McDonald, 2014). Utilizing both forms of logistic regression analysis provided further insights into the predictive relationships between individual basic science content area final exam scores and NPLEX I subscore areas at SVC. Hierarchical logistic regression allows for a controlled entry of variables and is useful for capturing differences in variance between categorical independent control variables (Stockburger, 1997). Consequently, I used hierarchical logistic regression for this study since it allowed me to account for differences between variables by allowing a categorical independent control variable to be added to the regression equation (Stockburger, 1997). In this study, the categorical independent control variable, referred to as NPLEX I administration, consisted of the month and year in which NPLEX I was administered. Since the dependent variables in this study are from different NPLEX I administrations, entering a categorical independent control variable into the equation allowed me to account for any variance between NPLEX I scores from administration to administration.

Additionally, since the order of importance that the independent variables needed to be entered into the regression analysis in this study were unknown, I utilized stepwise logistic regression. In allowing the computer to select the order of importance of the variables, stepwise logistic regression identified the independent variables that were the best predictors of the dependent variable (Lewis, 2007). Furthermore, I used stepwise logistic regression for this study since it is useful when working with a large number of independent variables or when refining prior variable selections (Hosmer & Lemeshow, 2000). The forward approach is used when working with a large number of independent variables and involves adding each variable separately to see which variable provides the most improvement of the model until no more improvements are provided (McDonald, 2014). The backward approach is used when refining prior variable selections and involves deleting each variable one by one to improve the model until no more improvements are provided (McDonald, 2014). Since the variables for this study were already selected I used a backward approach (Hosmer & Lemeshow, 2000). That is, the basic science content areas associated with NPLEX I (anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology) were already predetermined by NABNE (2015a). Consequently, the basic science final exam course scores associated with those content areas were also already predetermined. Therefore, since this study focused on refining prior variable selections, I used the backward stepwise logistic regression approach (Hosmer & Lemeshow, 2000). Using a backward stepwise logistic regression approach allowed each independent variable to be deleted from the regression analysis model until no more improvements were provided (McDonald, 2014).

The dependent variable in this study, NPLEX I subscores, were dichotomous, categorical variables, consisting of binary data (McDonald, 2014). I used categorical binary data for the dependent variable based on the fact that NABNE (2014a) only reports NPLEX I scores in terms of pass or fail. Therefore, I assigned dummy variables to represent each NPLEX I subscore; a one (1) was assigned to scores of pass and a zero (0) was assigned to scores of fail (Agresti & Finlay, 1970). The independent variables in this study were continuous, consisting of interval level data; basic science content area final exam scores (McDonald, 2014). Furthermore, this study included a categorical independent control variable, NPLEX I administration, which identified the month and year in which NPLEX I was administered. As previously mentioned, the dummy variables I assigned to the categorical independent control variables are outlined in Table 3.

After controlling for the NPLEX I administration, I added the remaining independent variables to the regression equation using backward stepwise logistic regression. Specifically, I added the student’s actual basic science content area final exam scores to the regression equation using backward stepwise logistic regression. I used the student's actual scores because the point distributions for both the basic science content area final exam scores and each basic science content area on NPLEX I were not available (NABNE, 2015a). Distributions were available for the basic science content area final exam scores, but not for each basic science content area on NPLEX I (NABNE, 2015a). One method that could be used to address the point distribution issue was to use a formula that provided an estimation of the weights, under the assumption that the point distributions on NPLEX I of the basic science content areas were equal to the point distributions of each basic science course content area (Kreuter & Olson, 2011). Although I considered the method of weighting the point distributions, I chose not to implement it since documentation about the appropriateness of the assumption was not available. That is, the appropriateness of assuming that the NPLEX I point distributions were equal to the point distributions of each basic science course content area could not be determined and were not available (NABNE, 2015a). Therefore, I did not control for the potential differences in point distributions, which means it is considered a limitation of this study. Consequently, I added student's actual basic science content area final exam scores to the regression analysis model instead of weighted scores.

The data analysis strategy I used for this study, outlined in Table 7, utilized multiple logistic regression analysis to provide insights into the predictive relationships between basic science content areas and the corresponding NPLEX I subscore areas for SVC. Table 7 lists the multiple logistic regression analyses I conducted per basic science content area and the corresponding NPLEX I subscore area at SVC. For instance, I analyzed each student's second NPLEX I subscore against the group of anatomy content area final exam scores, group of physiology content area final exam scores, and group of biochemistry content area final exam scores from the Human Biology I, II, and III courses at SVC. The pathology content area scores could not be separated from the General Medical Diagnosis I, II, and III courses at SVC; therefore, I conducted the multiple logistic regression analysis for the first subscore area of NPLEX I using the final exam scores for each of these courses as a whole. These variables are referred to as pathologyplus since each of the courses include pathology as well as other content. As indicated in Table 7, the first analysis included two content areas (microbiology, pathologyplus) and the first NPLEX I subscore at SVC. The second analysis included three content areas (anatomy, physiology, biochemistry) and the second NPLEX I subscore at SVC.

Table 7

Multiple Logistic Regression per Analysis at SVC

Analysis #	NPLEX I Subscore	SVC Content Areas
1	1st (Disease/Dysfunction)	Microbiology Pathologyplus
2	2nd (Structure/Function)	Anatomy Physiology Biochemistry

Note. Adapted from "Part I biomedical science examination: Blueprint and study guide," by North American Board of Naturopathic Examiners. Copyright 2015 by author.

Ethical Protection of Participants

In this study I utilized several means of protecting participants. First, the procedure I used for gaining access to the archived data for this study involved obtaining approval from the Institutional Review Boards (IRB) at SVC as well as the other school. Although data were only collected from SVC, IRB approval was obtained from the other school before learning they were unable to collect sufficient data to be included in the study. The IRB process at both SVC and the other school required an application to be approved prior to collecting any data for this study. Each application required detailed descriptions of how participants would be protected (NVC Associate Professor, n.d.; SVC Professor, n.d.). Furthermore, a risk to benefit analysis was done by each IRB prior to approval to ensure the study meets ethical standards for protecting participants (NVC Associate Professor, n.d.; SVC Professor, n.d.).

Walden University (2015), the institution for which this study was submitted in partial fulfillment of the Doctor of Education degree, also required IRB approval. The Walden University (2015) IRB process involved a similar risk to benefit analysis prior to the approval of an application that explains the procedures the study will use to protect participants and uphold ethical standards for human participants. The Walden University IRB approval number for this study is 04-13-16-0196273. To ensure participants were being protected, I also obtained approval for each of the changes in procedure that were encountered throughout this study, including the exclusion of data from the other school, the exclusion of 2010 SVC basic science data and combining the microbiology and immunology scores for this study.

Private data, such as information which could be identifiable that is obtained from student records is one criterion the National Institutes of Health (NIH) (2014) use to classify a participant as a human subject. Being classified as a human subject requires researchers to protect participants from burdens and risks that might be associated with the study (NIH, 2014). Therefore, since the quantitative data for this study consisted of data from archived records, which contain private, identifiable data, I followed procedures to protect its participants from burdens and risks as outlined by the NIH (2014) for this study. For instance, data were coded by the institution prior to being released to me to ensure anonymity and confidentiality (Lodico et al., 2010). As a result, informed consent was not needed from each participant (Walden University, 2015). However, I made every effort to follow ethical guidelines to maintain participant confidentiality and protect them from harm throughout this study (NIH, 2014).

Assumptions, Limitations, Scope, and Delimitations

Several of the seven CNME accredited naturopathic schools of medicine may have low first-time NPLEX I pass rates, however, the results of this study are limited to one of the seven CNME accredited naturopathic schools of medicine located in North America. Therefore, the results of this study are specific to the institution outlined in this study and may not necessarily be generalized to all CNME accredited schools of naturopathic medicine. Furthermore, since the results of the hierarchical logistic regression analysis for NPEX I administration revealed a significant difference in scores between some NPLEX I administrations, the NPLEX I administration month and year in which the NPLEX I was taken was controlled for when conducting the logistic regression analyses. However, controlling for the NPLEX I administration month and year in which NPLEX I was taken when conducting the regressions means the results cannot be generalized from year to year and the differences in the administration in which NPLEX I was taken is also considered a limitation of this study. Additionally, since the pathology content area scores could not be separated from SVC's General Medical Diagnosis I, II, and III courses, the score for each General Medical Diagnosis course (pathologyplus variable), instead of only the pathology content were analyzed against student's first NPLEX I subscore. Therefore, the results of this study do not include data related to the relationship between specific basic science pathology content area final exam scores and NPLEX I scores. Instead, this study includes data related to the relationship between the specific courses that include the pathology content and NPLEX I scores. Furthermore, since information concerning whether the point distributions of each basic science content area included within each subscore area of NPLEX I were equal to the point distributions of each basic science course content area were not available the potential differences in point distributions are considered a limitation of this study (NPLEX, 2015a).

The variables included in this study were limited to archival data derived from academic student records. However, as discussed earlier in the review of literature section, it was assumed that various licensing exams, other variables, or a combination of other variables, such as entering grade point average, career grade point average, years out of school, age, ethnicity, and transfer status may also be predictive of first-time pass rates on NPLEX I. Furthermore, it was assumed that the archival data retrieved from the NPLEX I score reports and archived student records at SVC were accurate. Assumptions were also made regarding the validity and reliability of student achievement in the naturopathic basic science content area final exams at SVC. Moreover, assumptions were made regarding similarity in the way that NPLEX I and the naturopathic basic science content area final exams at SVC were administered to students each quarter and each year.

Data Analysis Results

In this section I describe the procedures I used for data analysis. I also describe the results of the data analysis for this study in this section. The data analysis procedures I used in this study involved data preparation, assumption testing, and several multiple logistic regression analyses. I obtained the results of the data analyses using the IBM Statistical Package for the Social Sciences (SPSS) version 21. All original data released to me, as well as analyzed data, are secured in a password protected document (Lodico et al., 2010). A summary of the findings from these analyses is included at the end of this section.

Data Preparation

Upon receipt of the archival data from SVC, I reviewed and filtered the dataset to help eliminate bias in the results. I filtered the SVC data set, contained in an Excel spreadsheet, to exclude the ineligible students. For data to be included in this study a basic science content area final exam score for each basic science content area of anatomy, physiology, biochemistry, microbiology, and pathologyplus and a score for the corresponding NPLEX I subscore area of disease/dysfunction and the subscore area structure/function were required for each student.

Since the microbiology and immunology scores could not be separated for all courses at SVC I needed to adjust these data. Furthermore, it was not completely clear from the recorded archival data whether the separate microbiology and immunology scores listed for each cohort were actually separate microbiology scores or possibly combined with immunology and just not listed as such. Some basic science courses included microbiology scores and immunology scores for some years, while others did not. For example, in fall 2011, the Human Biology II course final exam included immunology questions, but in winter 2012 it did not. My review of the data showed there were a total of 208 students who had any immunology and microbiology scores. There were 74 students who had immunology and microbiology in the Human Biology III course that were either already combined and could not be separated or could be combined (fall 2013 cohort, 48 students, and winter 2013 cohort, 26 students). For the remaining 134 students, some had immunology in the Human Biology II course (68 students), and some had immunology combined with microbiology in the Human Biology III course (65 students). Therefore, upon additional approval from my doctoral committee and the Walden University IRB, I manually combined each microbiology and immunology score for each coded student into one microbiology score; resulting in a sample size of $N = 208$ students for the first analysis.

For the first analysis, students who did not have a microbiology and pathologyplus score and an NPLEX I score for the subscore area of disease/dysfunction were considered ineligible students and were eliminated from the dataset. Therefore, the first analysis was done with $N = 208$ student records. Similarly, for the second analysis, students who did not have an anatomy, physiology, and biochemistry score and an NPLEX I score for the subscore area of structure/function were considered ineligible students and were eliminated from the dataset. Therefore, the analysis was done with N = 256 student. Students who did not have a score for one or more of the basic science content areas were primarily indicative of dismissed, withdrawn, or transfer students since they would not have taken some or all of their basic science final exams at SVC (SVC dean, personal communication, June 2, 2016). Students without scores for both NPLEX I subscore areas were indicative of students who either did not take NPLEX I or chose not to release their scores to SVC (SVC dean, personal communication, June 2, 2016). The difference in sample size between the first and second analysis resulted from the 48 student records that did not have a microbiology and pathologyplus score, and an NPLEX I score for the first analysis, and were therefore eliminated from the sample. The 48 students who were eliminated from the first analysis since their basic science final exams did not include this content area.

I also needed to manually combine some of the basic science content area final exam scores for each cohort. Some of the basic science content areas had been parsed out more than others. For example, the anatomy scores were separated into endocrinology, neuroanatomy, embryology, histology, vascular anatomy neurobiology, pelvic and abdominal anatomy scores. To streamline the content areas I combined all basic science content area related scores into one score for that content area. I combined all of the anatomy area scores into one anatomy score for each course. I combined all of the microbiology, immunology, and parasitology scores into one microbiology score for each course. I combined all the biochemistry and medical genetics scores into one biochemistry score for each course. Next, I combined the three anatomy scores into one anatomy score, the three physiology scores into one physiology score, the three biochemistry scores into one biochemistry score, the three microbiology scores into one microbiology score, and the three general medical diagnosis scores into one pathologyplus score.

Assumptions

Before running the logistic regression analyses, I verified several assumptions about the data. The first few assumptions involved the characteristics of the variables included in the study. Logistic regression requires the study to have one dependent and more than one independent variable, where the dependent variable has an independence of observations (McDonald, 2014). The dependent variable involved in this study included one dependent variable that had an independence of observations; each NPLEX I subscore observation could be either a pass or fail. For instance the disease/dysfunction subscore could not be both a pass and a fail. The independent variables included in the first analysis consisted of one microbiology and one pathologyplus content area score variable; a total of two independent variables. Additionally, the independent variables involved in the second analysis included one anatomy, one physiology, one biochemistry content area score variable; a total of three independent variables. An additional independent variable included in this study was a categorical control variable, NPLEX I administration.

For the first analysis, students who did not have a microbiology and pathologyplus score and an NPLEX I score for the subscore area of disease/dysfunction were considered ineligible students and were eliminated from the dataset. Similarly, for analysis two, students who did not have an anatomy, physiology, and biochemistry score and an NPLEX I score for the subscore area of structure/function were considered ineligible students and were eliminated from the dataset. Furthermore, a minimum sample size of 50-90 participants was required, of which the sample sizes of $N = 208$ for the first analysis and $N = 256$ for the second analysis, exceeded this minimum range (Hosmer & Lemeshow, 2000; McDonald, 2014; Soper, 2015; Wilson-VanVoorhis & Morgan, 2007).

The last few assumptions involved how well the data fit the model (McDonald, 2014). I assessed the linearity of the continuous variables in regards to the logit of the dependent variable via the Box-Tidwell (1962) procedure (Laerd Statistics, 2013). Since several dependent or independent statistical tests were simultaneously being performed on the dataset, I applied a Bonferroni correction, which produced a new level of statistical significance (Weisstein, 2016). For the first dependent variable, I calculated the new level of significance, or Bonferroni correction as follows, the original alpha level (p =0.05) was divided by the number of comparisons (6), which resulted in an adjusted alpha of p = 0.00833 (Weisstein, 2016). The continuous independent variables (microbiology, pathologyplus) related to the dependent variable SubScore1 (NPLEX I subscore disease/dysfunction) were linearly related to the logit of the dependent variable. This is evident in that both p-values (p = 0.645, p = 0.532, respectively) were above the new level of statistical significance (p = 0.00833).

The continuous independent variables (anatomy, physiology, biochemistry) related to the dependent variable, SubScore2 (NPLEX I subscore structure/function), were linearly related to the logit of the dependent variable. This is apparent in that the p-values (p = 0.103, p = 0.567, p = 0.301, respectively) were above the new level of statistical significance (p = 0.00714). In this case, I applied the Bonferroni correction to the original alpha level (p = 0.05) and divided by seven comparisons, which resulted in an adjusted alpha of p = 0.00714 (Weisstein, 2016). Therefore, the Box-Tidwell (1962) procedure using a Bonferroni correction showed that all continuous independent variables were found to be linearly related to the logit of the dependent variable.

To confirm that there were no significant outliers I used the outlier labeling rule, originally introduced by Tukey in 1977 and later revised and coined by Hoaglin, Iglewicz, and Tukey (1986). Tukey's original outlier test from 1977 utilized a 1.5 multiplier; however, later research by Hoaglin et al. (1986) posited that the use of a 2.2 multiplier instead of a 1.5 multiplier would result in more accurate results in situations where sample sizes were less than 1000. Since the sample sizes for this study were less than 1000, at N = 208 for the first analysis and N = 256 for the second analysis, I applied the outlier labeling rule using the 2.2 multiplier to each independent variable. In Table 8, the independent variables in column 1 are defined as follows, ANAT refers to the anatomy content area scores, PHYS refers to the physiology content area scores, BIOC refers to the biochemistry content area scores, MICR refers to the microbiology content area scores, and PATHPLUS refers to the pathologyplus scores. Columns 2 and 3 in Table 8 show the lower and upper limits for each independent variable listed in column 1. Columns 4 and 5 of Table 8 show the lowest and highest extreme value ranges for each independent variable. Column 6 of Table 8 shows that none of the lower and upper limits from columns 2 and 3 fell within the extreme value ranges from columns 4 and 5. There were no values lower than the respective lower limits in column two, or over the respective upper limit in column three, indicating that there are no outliers in the data.

Table 8

Significant Outlier Results for Each Independent Variable

Independent Variable	Lower	Upper	Lowest Extreme Value Range	Highest Extreme Value Range	#Outliers
ANAT	62.20	280.90	88-104	230-247	0
PHYS	5.95	230.05	59-71	166-179	0
BIOC	48.60	248.40	66-82	189-194	0
MICR	9.50	185.00	39-66	186-198	0
PATHPLUS	60.59	176.96	91.5 - 94.5	145.8-153.8	0

Next, I tested the data for multicollinearity by running correlation coefficients in SPSS and reviewing the variance inflation factor (VIF) values for each grouping of variables. According to Williams (2015), multicollinearity is significant when tolerance values are less than 0.1 or VIF values are higher than 10. Listed in Table 9 are the tolerance and VIF levels for each grouping of variables. All VIF values are lower than 2.000, with the highest level having a collinearity of 1.775; meaning that the data for this study does not show multicollinearity.

Table 9

Multicollinearity Results per Variable Grouping - Tolerance, and VIF Values

Model	Dependent Variable	Independent Variables	Tolerance	VIF
a	ANAT	PHYS	0.716	1.397
		BIOC	0.800	1.250
		MICR	0.953	1.050
		PATHPLUS	0.632	1.583
b	PHYS	BIOC	0.563	1.775
		MICR	0.850	1.176
		PATHPLUS	0.800	1.250
		ANAT	0.593	1.686
c	BIOC	MICR	0.820	1.219
		PATHPLUS	0.700	1.429
		ANAT	0.829	1.206
		PHYS	0.705	1.419
d	MICR	PATHPLUS	0.644	1.554
		ANAT	0.674	1.483
		PHYS	0.726	1.377
		BIOC	0.560	1.785
e	PATHPLUS	ANAT	0.574	1.743
		PHYS	0.877	1.140
		BIOC	0.613	1.630
		MICR	0.826	1.210

Multiple Logistic Regression Analyses

After confirming the data met the necessary assumptions, I conducted binary logistic regression analyses to investigate the predictive relationships between individual students’ content area final exam scores and students’ NPLEX I subscores on the first attempt. Specifically, the data analyses I used for this study involved hierarchical logistic regression as well as backward stepwise logistic regression analyses for two separate analyses. My intent of each analysis was to identify the predictive relationships between individual students’ groups of basic science content area final exam scores and corresponding NPLEX I subscore areas at SVC. Since the dependent variables in this study were from different NPLEX I administrations, I used hierarchical logistic regression to control for potential differences between NPLEX I administrations (NPLX_ADM). Using a hierarchical logistic regression allowed me to account for differences in variance between the different NPLEX I administrations (Stockburger, 1997). Since the order of importance that the independent variables needed to be entered into the regression analysis was unknown and I was interested in refining prior variable selections I used backward stepwise logistic regression (Hosmer & Lemeshow, 2000).

Using SPSS, binary logistic regression using hierarchical logistic regression, and backward stepwise logistic regression, I conducted an analysis for each group of basic science content area final exam scores and the corresponding NPLEX I subscore at SVC. I entered the NPLEX I subscore as the dependent variable (e.g. SubScore1). I used a hierarchical logistic regression to control for the categorical independent variable (e.g. NPLX_ADM). I entered the categorical independent control variable (e.g. NPLX_ADM,) followed by the corresponding independent variables (e.g. microbiology and pathologyplus) for the first NPLEX I subscore into the analysis as covariates, or predictors. I coded the independent control variable as a categorical variable with three categories (Aug15, Aug14, and Aug13). I selected the first category (Aug15) as a reference category, which was used as a baseline to which the other categories were compared to determine significant differences (Grace-Martin, 2016). According to Grace-Martin (2016), the reference category usually defaults to the first or last reference category, alphabetically. However, according to both Grace-Martin (2016) and a Walden University Statistical Instructional Support Specialist (personal communication, June 11, 2016) the reference category chosen does not matter as long as you know which category is the reference. I chose the Aug15 category since it defaulted to the first category, was the last NPLEX I administration included in this study, and had the highest pass rate at 76%, compared to 60% and 71% respectively for Aug13 and Aug 14 (NABNE 2013a, 2014a, 2015c). I used a stepwise logistic regression since the variables were predetermined by NABNE (2015a) and the order of importance in which the variables need to be entered into the analysis was unknown (Hosmer & Lemeshow, 2000; Lewis, 2007). In stepwise logistic regression, the computer selects the order of importance of the variables, to identify the best predictors of the dependent variable (Lewis, 2007). Therefore, I used a backward stepwise logistic regression approach; the computer deleted each variable one by one to improve the model until no more improvements were provided (McDonald, 2014).

For example, I entered SubScore2 as the dependent variable and NPLX_ADM as the categorical control variable, and selected Aug15 as the reference category. I entered ANAT, PHYS, and BIOC as the independent predictor variables, and selected a backward stepwise method of entry. Specifically, I used the backward - Wald method since this method provides the most significant predictors to the least significant predictors (IBM Knowledge Center, n.d.). I designated the control variable, NPLX_ADM as a categorical variable using the first category, Aug15, as a reference category in which the other categories were compared to determine significant differences (Grace-Martin, 2016). According to Grace-Martin (2016), the reference category usually defaults to the first or last reference category, alphabetically. However, according to both Grace-Martin (2016) and a Walden University Statistical Instructional Support Specialist (personal communication, June 11, 2016) the reference category chosen does not matter as long as you know which category is the reference. Therefore, I chose Aug15 as the reference category since it defaulted to the first category, was the last NPLEX I administration included in this study, and had the highest pass rate at 76%, compared to 60% and 71% respectively for Aug13 and Aug 14 (NABNE 2013a, 2014a, 2015c). I followed this process for both NPLEX I subscore areas and their corresponding groups of basic science content area final exam scores outlined in Table 7.

The preliminary binary logistic regression run in SPSS included N = 259 cases. However, there were two categories amongst the categorical independent variables that had low counts; Aug12 had a count of one and Feb16 had a count of two. Due to the low count of these categories, which can impact the significance of the results, I removed these categories and the three cases contained within these categories from the dataset (Bewick, Cheek, & Ball, 2005). After removing the two control variable categories from the dataset, I reran the two binary logistic regression analyses. At this point, all eligible cases were included. For the first analysis, students who did not have a microbiology and pathologyplus score and an NPLEX I score for the subscore area of disease/dysfunction were considered ineligible and were eliminated from the dataset; resulting in a sample size of N = 208. Similarly, for analysis two, students who did not have an anatomy, physiology, and biochemistry score and an NPLEX I score for the subscore area of structure/function were considered ineligible and were eliminated from the dataset; resulting in a sample size of N = 256.

The binary logistic regression outcome of interest for the first analysis model was passing SubScore1 (NPLEX I subscore disease/dysfunction), which resulted in the following. The possible predictor variables included in the first analysis model were MICR and PATHPLUS (microbiology score and pathologyplus score). The Hosmer-Lemeshow goodness-of-fit, which is used to assess whether the data are a good fit for the chosen model, was not significant ($p > 0.05$) at $p = 0.939$ at step 1 and $p = 0.309$ at step 2, indicating that the model was correctly specified; the data were a good fit for the model (Bartlett, 2014). Additionally, the -2 log Likelihood $p = 229.769$ for step 1 and $p = 232.561$ for step 2 and the Nagelkerke R squared $p = 0.137$ for step 1 and $p = 0.121$ for step 2 were not significant ($p > 0.05$), indicating the data were a good fit for the model.

In the first analysis model, the outcome of the analysis for the control variable, NPLX_ADM, showed that the difference in scores between the Aug15 and Aug14 NPLEX I administrations and between the Aug15 and Aug13 NPLEX I administrations were significant. Students who took NPLEX I during the Aug15 administration had a 62.5% increase in the odds of passing the first NPLEX I subscore than students who took NPLEX I during the Aug14 administration. Students who took NPLEX I during the Aug15 administration had a 74% increase in the odds of passing the first NPLEX I subscore than students who took NPLEX I during the Aug13 administration. It is unknown to what the differences in NPLEX I scores between administrations may be attributed.

In the first analysis model, the independent variable, MICR was not significant ($p > 0.05$) at $p = 0.110$; however, the independent variable, PATHPLUS was significant at p

= 0.000. Controlling for NPLEX I administration, the predictor variable, PATHPLUS, in the logistic regression analysis was found to contribute to the model. The unstandardized B = 0.066, SE = 0.017, Wald = 15.623, $p < .05$ at $p = 0.000$. The estimated odds ratio favored a positive relationship, Exp(B) = 1.068, 95% CI =1.034, 1.104. For every one unit increase in combined PATHPLUS final exam scores the odds of passing SubScore1 increase by 1.068, or 10.68%. Table 10 shows the logistic regression output predicting the likelihood of passing the second NPLEX I subscore based on the basic science content areas of MICR and PATHPLUS, controlling for NPLX_ADM.

Table 10

Logistic Regression Output for MICRO and PATHPLUS

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
								Lower	Upper
Step 1*	NPLX_ADM			6.512	2	.039			
	NPLX_ADM(1)	-.982	.452	4.728	1	.030	.375	.155	.908
	NPLX_ADM(2)	-1.346	.557	5.846	1	.016	.260	.087	.775
	MICR	.012	.008	2.558	1	.110	1.012	.997	1.028
	PATHPLUS	.063	.017	13.624	1	.000	1.065	1.030	1.102
	Constant	-6.334	1.953	10.518	1	.001	.002		
Step 2	NPLX_ADM			10.594	2	.005			
	NPLX_ADM(1)	-1.089	.446	5.950	1	.015	.337	.140	.807
	NPLX_ADM(2)	-1.685	.523	10.356	1	.001	.186	.066	.518
	PATHPLUS	.066	.017	15.623	1	.000	1.068	1.034	1.104
	Constant	-5.320	1.782	8.910	1	.003	.005		

* *Note*. Variable(s) entered on step 1: NPLX_ADM, MICR, and PATHPLUS.

In the second analysis model, the outcome of the analysis for the control variable, NPLX_ADM, shows that the difference in scores between the Aug15 NPLEX I administration and the Aug14 NPLEX I administration were not significant. Students who took NPLEX I during the Aug15 NPLEX I administration had an equal likelihood of passing the second NPLEX I subscore as the students who took NPLEX I during the Aug14 administration. However, the differences in scores between the Aug15 NPLEX I administration and Aug13 NPLEX I administration were significant. Students who took NPLEX I during the Aug15 administration had an 88% increase in the odds of passing the second NPLEX I subscore than students who took NPLEX I during the Aug13 administration. It is unknown to what the differences in NPLEX I scores between administrations may be attributed.

The binary logistic regression outcome of interest for the second analysis model was passing SubScore2 (NPLEX I subscore structure/function), which resulted in the following. The possible predictor variables included in the second analysis model were ANAT, PHYS, and BIOC (anatomy, physiology, and biochemistry scores). The Hosmer-Lemeshow goodness-of-fit was not significant ($p > 0.05$) at $p = 0.921$ for step 1 and $p = 0.719$ for step 2, indicating the model was correctly specified; the data were a good fit for the model (Bartlett, 2014). Additionally, the -2 log Likelihood $p = 219.735$ for step 1 and $p =19.777$ for step 2 and the Nagelkerke R squared $p = 0.921$ for step 1 and $p = 0.719$ for step 2 were not significant ($p > .05$), indicating the data were a good fit for the model.

In the second analysis model, the independent variable BIOC was not significant at ($p > 0.05$) at $p = 0.838$; however, the independent variables ANAT and PHYS were significant at $p = 0.017$ and $p = 0.001$, respectively. Controlling for NPLEX I administration, the predictor variable, ANAT, in the logistic regression analysis was found to contribute to the model. The unstandardized B = 0.022, SE = 0.007, Wald = 9.178, $p < 0.05$ at $p = 0.002$. The estimated odds ratio favored a positive relationship for the odds of passing SubScore2, Exp(B) = 1.022, 95% CI = 1.008, 1.036. For every one unit increase in combined ANAT final exam scores the odds of passing SubScore2 increase by 1.022, or 10.22%. Controlling for NPLEX I administration, the predictor variable, PHYS, in the logistic regression analysis was also found to contribute to the model. The unstandardized B = 0.057, SE = 0.011, Wald = 25.825, $p < 0.05$ at $p = 0.000$. The estimated odds ratio favored a positive relationship for the odds of passing SubScore2, Exp(B) = 1.058, 95% CI = 1.035, 1.082. For every one unit increase in combined PHYS final exam scores, the odds of passing SubScore2 increase by 1.058, or 10.58%. Table 11 shows the logistic regression output predicting the likelihood of passing the second NPLEX I subscore based on the basic science content areas of ANAT, PHYS, and BIOC, controlling for NPLX_ADM.

Table 11

Logistic Regression Output for *ANAT, PHYS, and BIOC*

		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1*	NPLX_ADM			9.086	2	.011			
	NPLX_ADM(1)	-.140	.540	.067	1	.796	.869	.301	2.508
	NPLX_ADM(2)	-2.088	.724	8.321	1	.004	.124	.030	.512
	ANAT	.023	.010	5.734	1	.017	1.023	1.004	1.043
	PHYS	.057	.011	25.891	1	.000	1.058	1.035	1.082
	BIOC	-.002	.012	.042	1	.838	.998	.975	1.021
	Constant	-7.986	1.555	26.363	1	.000	.000		
Step 2	NPLX_ADM			14.960	2	.001			
	NPLX_ADM(1)	-.189	.486	.151	1	.698	.828	.320	2.145
	NPLX_ADM(2)	-2.181	.564	14.943	1	.000	.113	.037	.341
	ANAT	.022	.007	9.178	1	.002	1.022	1.008	1.036
	PHYS	.057	.011	25.825	1	.000	1.058	1.035	1.082
	Constant	-8.066	1.509	28.573	1	.000	.000		

**Note.* Variable(s) entered on step 1: NPLX_ADM, ANAT, PHYS, and BIOC

Summary of Findings

In section two, I introduced and described the research design, and approach of this study. I discussed the setting and sample method from which this study was drawn. Additionally, I discussed the instrumentation and materials, and data collection and analysis strategies used to collect data for this study. Finally, I discussed the assumptions and limitations of this study as well as the results of this study. A summary of the findings of this study is outlined in Tables 12 and 13. A summary of the answers to the research questions of this study, which are based on the findings of this study, are outlined in Table 14.

Table 12 outlines the odds ratios for each unit of increase in final exam scores for each basic science content area final exam that contributed to the analysis model. The fifth column in Table 12 provides the percent increase in the odds of passing the particular NPLEX I subscore for every one point or question increase in the particular combined basic science content area final exam scores; calculated by multiplying the odds ratio by 10 (Institute for Digital Research and Education, 2016). Therefore, for every unit of increase in the PATHPLUS group of content area final exam scores the odds of passing the first NPLEX I subscore (SubScore1) are multiplied by 1.068, or increase by 10.68%. For every unit of increase in the ANAT group of content area final exam scores the odds of passing the second NPLEX I subscore (SubScore2) are multiplied by 1.02 or increase by 10.20%. For every unit of increase in the PHYS group of content area final exam scores the odds of passing the second NPLEX I subscore (SubScore2) are multiplied by 1.058 or increase by 10.58%.

Table 12

Basic Science Content Areas that Contributed per Analysis Model

Analysis Model	Dependent Variable (NPLEX I Subscore)	Independent Variable (Basic Science Content Area)	Odds Ratio [Exp(B)]	% Increase
1	SubScore1 (disease/dysfunction)	PATHPLUS	1.068	10.68
2	SubScore2 (structure/function)	ANAT	1.022	10.22
		PHYS	1.058	10.58

Table 13 outlines the odds of passing the subscore area during each NPLEX I administration. I used the Aug15 administration as the reference category, to which the other administrations were compared. According to Grace-Martin (2016), the reference category usually defaults to the first or last reference category, alphabetically. However, according to both Grace-Martin (2016) and a Walden University Statistical Instructional Support Specialist (personal communication, June 11, 2016) the reference category chosen does not matter as long as you know which category is the reference. I chose the Aug15 category since it defaulted to the first category, was the last NPLEX I administration included in this study, and had the highest pass rate at 76%, compared to 60% and 71% respectively for Aug13 and Aug 14 (NABNE 2013a, 2014a, 2015c). The fourth column in Table 13 indicates the odds of passing the subscore area during each NPLEX I administration compared to the odds of passing during Aug15. For instance, in the first analysis, students who took NPLEX I during the Aug15 administration had a 62.5% increase in the odds of passing the first NPLEX I subscore than students who took NPLEX I during the Aug14 administration.

Table 13

Odds of Passing Each NPLEX I Administration Compared to Aug15

Analysis Model	NPLEX I Subscore Area	NPLX_ADM (ref. Aug15)	Odds of Passing Compared to Aug15
1	SubScore1 (disease/ dysfunction)	Aug14	62.5% increased odds of passing Aug15
		Aug13	74.0% increased odds of passing Aug15
2	SubScore2 (structure/ function)	Aug14	equal odds of passing Aug14 and Aug15
		Aug13	88.0% increased odds of passing Aug15

Research Questions Answered

Table 14 summarizes the answers to this study's research questions. The research questions and hypotheses listed in Table 14 are condensed for simplicity. Each null and alternative hypothesis refers to the absence of a statistically significant predictive relationship or the occurrence of a statistically significant predictive relationship between the respective independent variable (basic science content area) and dependent variable (NPLEX I subscore). For instance, the hypothesis and results of research question two would be stated as follows. I reject the null hypothesis that there is no statistically significant predictive relationship between the students' group of pathologyplus content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC. There is a statistically significant predictive relationship between the students' group of pathologyplus content area final exam scores and the students' first NPLEX I subscore on the first attempt at SVC; for each unit of increase in the pathologyplus group of final exam scores the odds of passing the first NPLEX I subscore increase by 10.68%.

Table 14

Summary of SVC Research Question Answers

After controlling for NPLEX I administration, what is the predictive relationship between the students' group of content area final exam scores and corresponding NPLEX I subscore area on the first attempt at SVC?

RQ #	Independent variable (content area grouped final exam scores)	Dependent variable (NPLEX I subscore)	Null Hypothesis	Alternative Hypothesis	Results	Details
1	MICR (Microbiology scores)	SubScore1 (first NPLEX I subscore [disease/ dysfunction])	no predictive relationship	is a predictive relationship	accept null	Microbiology group of final exam scores do not contribute to the model
2	PATHPLUS (Pathologyplus scores)	SubScore1 (first NPLEX I subscore [disease/ dysfunction])	no predictive relationship	is a predictive relationship	reject null	For each unit of increase in the pathologyplus group of final exam scores the odds of passing SubScore1 increase by 1.068 or 10.68%
3	ANAT (Anatomy scores)	SubScore2 (second NPLEX I subscore [structure/function])	no predictive relationship	is a predictive relationship	reject null	For each unit of increase in the anatomy group of final exam scores the odds of passing SubScore2 increase by 1.022 or 10.22%
4	PHYS (Physiology scores)	SubScore2 (second NPLEX I subscore [structure/ function])	no predictive relationship	is a predictive relationship	reject null	For each unit of increase in the physiology group of final exam scores the odds of passing SubScore2 increase by 1.058 or 10.58%
5	BIOC (Biochemistry scores)	SubScore2 (second NPLEX I subscore [structure/ function])	no predictive relationship	is a predictive relationship	accept null	Biochemistry group of final exam scores do not contribute to the model

The results of this study showed basic science content area final exam scores that were predictive of NPLEX I performance. Specifically, three of the five basic science content area final exam scores (PATHPLUS, ANAT, and PHYS) were found to have a statistically significant predictive relationship with NPLEX I performance. However, two of the five basic science content area final exam scores did not show a statistically significant predictive relationship with NPLEX I performance. Furthermore, a significant difference was found between NPLEX I scores during some of the administrations in which NPLEX I was taken. At this point, it is unknown to what the differences in NPLEX I scores between administrations may be attributed. I postulate that the differences may be attributed to differences in testing site conditions during the exam or differences in the number of questions related to each of the basic science content areas on NPLEX I during each administration. Since data concerning whether conditions were different during different NPLEX I administration were unknown and the distribution of questions per basic science content area on NPLEX I were unavailable, these potential factors could not be confirmed (NABNE, 2015a).

In regards to why some basic science content area final exam scores were predictors and others were not, I postulate that the differences in predictive relationships could be attributed to differences in the number of questions on the final exam of specific content areas. I also postulate that specific basic science content may have been emphasized during different years. I also postulate that there may be gaps in the course outcomes of the basic science courses that address the specific competencies outlined in the NPLEX I blueprint. Although a number of contributing factors for the results of this study have been postulated, further research is needed to confirm each of these factors.

Consequently, the results of this study support a position paper for policy recommendation as the project. The position paper, outlined in Appendix A, describes a curriculum mapping project designed to help SVC understand why only three of the five content areas were found to have a statistically significant predictive relationship with NPLEX I performance. The goal of the curriculum mapping project is to identify gaps between the basic science course outcomes and the NPLEX I competencies. The curriculum mapping project would provide a process by which SVC could examine and better align the naturopathic basic science course content to the NPLEX I blueprint in hopes of making all basic science course content areas better predictors of NPLEX I performance.

The project for this study is outlined in detail in section three. In this section I discuss information about the project goals and rationale. I identify and outline the project evaluation plan and the implications of the project. In section four I provide a reflective discussion and closing words on the process of this project study. I detail the strengths and limitations of the study. I discuss recommendations for alternative approaches and application, and an evaluation of my project development and leadership skills. Finally, I discuss and outline the importance of the study and implications, applications, and directions for future research.

Section 3: The Project

Introduction

CNME, the program accreditor for naturopathic medical programs, requires institutions to maintain an average first-time pass rate of at least 70% over a 5-year period on NPLEX I as part of their accreditation standards (CNME, 2015). In August 2014, SVC met this requirement for the first time in 3 years (NABNE, 2012, 2013b, 2014b). Following the August 2014 NPLEX I administration, the average first-time pass rates of all seven naturopathic schools of medicine was 74%, (NABNE, 2014b). Low first-time pass rates on NPLEX I may impact CNME accreditation for schools of naturopathic medicine, which could impact the reputation of the profession of naturopathic medicine, which could impact the reputation and future success of past, present, and future graduates. A loss of accreditation status with CNME would prevent graduates from obtaining licensure as naturopathic physicians (NABNE, 2015a). It could also impact the reputation of the institution, as well as the profession and perceived legitimacy of existing naturopathic physicians. Therefore, low first-time pass rates on NPLEX I at SVC and their impact on accreditation prompted me to explore ways to improve first-time NPLEX I pass rates.

Since NPLEX I was designed to assess knowledge of biomedical science content areas including anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology, I studied the basic science curriculum at SVC (NABNE, 2015c). I collected archived basic science content area final exam score data and first-time NPLEX I score data from individual student records, and analyzed them against one another for each student. Findings of this study show that some basic science content areas are better predictors of NPLEX I performance than others. However, since NPLEX I is designed to assess knowledge of biomedical science content areas, it is unclear to me why all basic science courses were not significant predictors of NPLEX I performance. To understand why only three of the five content areas were found to have a statistically significant predictive relationship with NPLEX I performance, additional research is needed.

Based on the findings of this study, I developed a position paper as the project deliverable for this study. In the position paper, I highlight the findings of this study and outline the recommendation to implement a curriculum mapping project within the Department of Basic Medical Sciences at SVC. I will use the position paper to encourage SVC to implement an ongoing curriculum mapping process within the Department of Basic Medical Sciences. The proposed curriculum mapping project includes mapping the basic science course outcomes to the NPLEX I competencies. The results of these curriculum mapping activities could help identify potential gaps between the basic science course outcomes at SVC and the NPLEX I competencies. If gaps are found, changes to the basic science course outcomes could be made that may help make all basic science course content areas better predictors of NPLEX I performance. Therefore, the objectives of the curriculum mapping project are twofold: (a) to ensure the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I, and (b) to improve the coverage of content taught in the naturopathic basic science curriculum at SVC. That is, depending on the results of the curriculum mapping process, improving the coverage of content might involve adding missing content to the curriculum, spending more time on specific content within the curriculum, or going into more detail on specific content within the curriculum.

Rationale

To address the problem of this study, low first-time pass rates on NPLEX I, I collected quantitative data. The findings in this study indicate that some basic science content areas are better predictors of NPLEX I performance than others. Specifically, anatomy, physiology, and pathologyplus were found to be significant predictors, and biochemistry and microbiology were not found to be significant predictors of NPLEX I performance. However, since NPLEX I is designed to assess knowledge of anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology, it is unclear to me why some basic science content areas were shown to be better predictors of NPLEX I performance than others. To gain a better understanding of the findings of this study, I recommend analyzing the course outcomes of each basic science course and the competencies listed in the NPLEX I blueprint together by using curriculum mapping.

Curriculum mapping is a process in which the relationships between courses, outcomes, and competencies are linked, resulting in a map of the relationships between each of these within the curriculum (Sarkisian & Taylor, 2013). Curriculum mapping has been used to audit curricula, improve curricular alignment, and increase student performance in program and institutional outcomes (Allen-Ramdial & Campbell, 2014; Lam & Tsui, 2014, Landry et al., 2011; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Zelenitsky, Vercaigne, Davies, Davis, Renaud, & Kristjanson, 2014). Curriculum mapping allows programs and institutions to demonstrate whether student learning outcomes, accreditation standards, and program competencies are being met (Lam & Tsui, 2014, Landry et al., 2011; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013). The implementation of a curriculum mapping process at SVC would allow the basic science course outcomes to be aligned, or matched, to the NPLEX I competencies, to help identify potential gaps in competency coverage of each content area. Identifying potential gaps through the use of curriculum mapping may provide insight into why some basic science content areas are better predictors of NPLEX I performance than others.

According to general systems theory upon which this study was grounded, a system as a whole functions differently than the parts of that system and those using the theory must consider the interaction between its parts when solving problems (Watson, 2010). Furthermore, general systems theory suggests all systems have their own goals, external inputs that help define the goals, outputs that achieve the goals, and external feedback about the outputs (Banathy, 2001). The goal of this study was to assess whether a predictive relationship exists between students' basic science content area final exam scores in naturopathic basic science courses and performance on the first and second NPLEX I subscore areas on the first attempt in order to help develop potential strategies that could increase NPLEX I performance. The external inputs I used to help define the goal of this study included NPLEX I performance requirements set by CNME (2015) and licensure requirements set by NABNE (2014c). The outputs related to achieving the goal of this study included knowledge gained from passing the course outcomes in the basic science courses. The external feedback related to the outputs of this study is NPLEX I performance, which represents passing the NPLEX I competencies. To address the problem of low first-time pass rates on NPLEX I, interaction between the parts of each basic science course, the course outcomes, and the parts of the NPLEX I exam, the exam competencies, need to be considered together. Mapping the course outcomes of the basic science courses at SVC to the NPLEX I competencies will allow SVC to consider these parts of the system as a whole. The curriculum mapping process will also provide faculty an opportunity to collaborate and gain a better understanding of how their courses fit into the overall basic science curriculum, as well as how their courses fit into and impact the naturopathic medicine education system as a whole.

I did not choose an evaluation report as the project deliverable for this study since this study did not involve the evaluation of a particular program. My aim of this study was to investigate whether a predictive relationship exists between performance in naturopathic basic science course final exam content areas and performance on the first and second subscore areas of NPLEX I on the first attempt at SVC. My intent, using the results from this study, was to help schools of naturopathic medicine develop potential strategies to assess the effectiveness of, and recommend potential changes to, their basic science curricula that could help increase first-time pass rates on NPLEX I and potentially help maintain the institution's program accreditation with CNME. A curriculum plan and professional development plan were also considered for the project deliverable for this study; however I did not choose either of these project directions. A curriculum plan requires several components including learning goals, specific content, content sequences, instructional methods and resources as well as evaluation approaches

(Lattuca, & Stark, 2009). According to the doctoral checklist for this study, the professional development plan requires a minimum of three full days of training that includes learning outcomes, components and timelines, materials, implementation plan, and specific details of the trainings. Based on the data analysis and findings of this study, only three of the five basic science content areas were significant predictors of NPLEX I performance. However, to understand why only three of the five content areas were found to have a statistically significant predictive relationship with NPLEX I performance, additional research would be needed before a curriculum plan or professional development plan could be proposed. Therefore, I determined that a position paper outlining the recommendation to implement a curriculum mapping project within the Department of Basic Medical Sciences at SVC was the most appropriate project deliverable for this study.

Review of the Literature

To review the curriculum mapping literature, I conducted a search using the Walden Online Library, Google Scholar, and outside online libraries. The specific databases used for this search included Academic Search Complete, EBSCOhost, Education Research Complete, ERIC, MEDLINE with Full Text, Political Science Complete, PsycARTICLES, PsycBOOKS, Psyc INFO, and SocioINDEX with full text. The keywords I used in the literature review search included *curriculum mapping, curriculum mapping and academic performance, medical education curriculum mapping, curriculum mapping and academic progress, curriculum mapping and course development, curriculum mapping and licensing exam alignment.* To find additional research, I also used the following key words, *course outcomes alignment*, *student learning outcome alignment,* and *subject learning alignment.*

In this review, I found that curriculum mapping is considered a process in which the relationships between courses, activities, outcomes, objectives, and goals are linked, resulting in a map of the relationships between each of these within the curriculum (Sarkisian & Taylor, 2013). As suggested earlier, interest in general systems theory has been renewed by the growing emphasis on accountability that is placed on institutions of higher education (Mizikaci, 2006). That is, external accrediting bodies are calling for increased accountability by institutions of higher education as a means of evaluating and assessing program quality and effectiveness (Mizikaci, 2006). General systems theory could help institutions of higher education conduct more effective institutional research by gaining further understanding of their goals, external inputs, outputs, and external feedback to address problems (Banathy, 2001; Minnaar, n.d.). Being able to identify the relationships between courses, activities, outcomes, objectives, and goals within the curriculum could provide schools of naturopathic medicine a better understanding of how the basic science courses, NPLEX I, and accreditation impact one another, thereby helping them address the problem of low NPLEX I scores (Sarkisian & Taylor, 2013).

Curriculum mapping also allows programs to demonstrate whether student learning outcomes, accreditation standards, and program competencies are being met (Lam & Tsui, 2013; Lam & Tsui, 2014, Landry et al., 2011; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013). Duffy (2015) suggested a competency-based model of curriculum mapping for course development has many benefits including pedagogical faculty development, learning objective creation, learning assessment modifications, and curricular competency choices. Furthermore, curriculum mapping has been used to enhance curricular alignment, audit existing curricula, develop or redevelop courses, and increase student performance in program and institutional outcomes (Allen-Ramdial & Campbell, 2014; Lam & Tsui, 2013; Lam & Tsui, 2014, Landry et al., 2011; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Zelenitsky et al., 2014). Consequently, curriculum mapping, which is appropriate for the focus of the project for this study, has been used in various situations for a variety of purposes.

Demonstrate Standards, Outcomes, and Competencies

Curriculum mapping has been used to demonstrate curricular alignment of standards, outcomes, and competencies (Lam & Tsui, 2013; Lam & Tsui, 2014; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Wells, Benn, & Warber, 2015; Zelenitsky et al., 2014). One medical school used an existing curriculum map from a family medicine program to create separate preventative medicine competencies that would support a preventative medicine track within the integrative medicine competency-based curriculum (Wells et al., 2015). Another medical school created a curriculum mapping process to ensure that alignment of standards and outcomes were maintained as curricular changes were implemented (Steketee, 2015). In response to accreditor requests, another medical school established an in-house curriculum mapping system, called Prudentia to show where student outcomes were integrated into their courses (Steketee, 2015).

A graduate psychology program used curriculum mapping to assess how well their curriculum was addressing the required competencies to improve their program (Sarkisian & Taylor, 2013). The results included the identification of competencies that were lacking, but also created an increase in the transparency in the learning environment that helped teacher's better prepare students (Sarkisian & Taylor, 2013). Curriculum mapping was also used by an undergraduate psychology program to assess how well their curriculum was addressing their learning outcomes and performance requirements (Mancuso & Desmara, 2014). The intent of this curriculum mapping project was to transform the first-year curriculum, which involved gathering evidence, identifying gaps between expectations and experiences, demonstrating achievement of learning outcomes and performance requirements, as well as engaging faculty in curriculum innovation (Mancuso & Desmara, 2014).

The curriculum mapping process used by Lam and Tsui (2013) to compare coverage of student learning outcomes between two education programs found that aligning curriculum objectives with what is taught in each course enhanced the effectiveness of the curriculum. A year later, Lam and Tsui (2014) used curriculum mapping to investigate whether the program-level student learning outcomes in a teacher education program were reflected in each course in their department (Lam & Tsui, 2014). A pharmacy program used curriculum mapping to align the curriculum with national educational outcomes and licensing examination outcomes to support continuous analysis that resulted in evidence-based decisions (Zelenitsky et al., 2014). According to Zelenitsky et al. (2014), the curriculum mapping process within this pharmacy program reported “a number of positive outcomes for the school”, “reinforced key educational principles and introduced conceptual frameworks that provided a systematic approach and common language for discussing, analyzing, and modifying the curriculum” (p. 5).

Curriculum mapping has also been used to assess the completeness of curriculum to licensing exam coverage (Dexter et al., 2012; Geist & Catlette, 2014; Landry et al., 2011; Lawson et al., 2011; Mahboob & Evans, 2015; Miller, & Neyer, 2016; Steketee, 2015). Dexter et al. (2012) used curriculum mapping to assess whether a medical curriculum had sufficient USMLE I topic coverage. Nursing programs, much like medical programs, are also being pressured by accreditors and other stakeholders to increase first-time pass rates on their licensing exams; the NCLEX (Geist & Catlette, 2014; Mahboob & Evans, 2015; Steketee, 2015). In response to this, nursing programs have used curriculum mapping to audit nursing curriculums to ensure they cover professional standards as well as NCLEX activities and outcomes (Geist & Catlette, 2014; Landry et al., 2011; Lawson et al., 2011; Miller, & Neyer, 2016). Geist and Catlette (2014) suggested curriculum maps can help faculty identify NCLEX activities as well as standards and competencies that are not met in the curriculum. Furthermore, Geist and Catlette (2014) suggested aligning nursing curricula with NCLEX standards can help increase first-time pass rates on NCLEX. In response to demands to change nursing education, another nursing program implemented a curriculum mapping process to assess the content of the curriculum (Landry et al., 2011). The results of this curriculum mapping project revealed gaps in several topic areas required by professional nursing standards (Landry et al., 2011).

Curriculum mapping has also been used to identify where specific skills were covered within the curriculum (Kris-Etherton, et al., 2015; Mahboob & Evans, 2015; Miller and Neyer, 2016; Vaitsis, Nilsson, & Zary, 2014). For instance, curriculum mapping was used in a professional healthcare program to conduct analyses of, learning outcomes and teaching methods and examinations and learning outcomes, as well as conduct a gap analysis of teaching methods, learning outcomes, and examination results in order to promote analytical reasoning throughout the curriculum (Vaitsis et al., 2014). In a medical program, curriculum mapping was used to conduct a curriculum audit to identify where learning outcomes of professionalism were covered and map those to past and present professional guidelines (Mahboob & Evans, 2015). In this case, the audit showed that the outcome coverage met the past guidelines, but needed to be revised slightly to meet the new guidelines (Mahboob & Evans, 2015).

Another medical program used curriculum mapping to "effectively embed nutrition competencies within curricula and ensure that all medical graduates are 'nutritionally competent'" (Kris-Etherton, et al., 2015, p. 85). Miller and Neyer (2016) used curriculum mapping in an undergraduate nursing program to map information literacy outcomes and communication learning outcomes, which resulted in changes in frequency and timing of some classroom instruction. Curriculum mapping was used in three different pharmacy programs to identify where the concept of professionalism was covered (Schafheutle, Hassell, Ashcroft, & Harrison, 2013). In this case, the use of curriculum mapping allowed the overlap between the "intended," "taught" and "received" curriculum to be identified (Schafheutle et al., 2013).

Student Outcome Improvements

Curriculum mapping has been used in several areas to improve academic performance (Allen-Ramdial & Campbell, 2014; Geist & Catlette, 2014; Sarkisian & Taylor, 2013). A science, technology, engineering, and math (STEM) program used curriculum mapping to map undergraduate curriculum to graduate curriculum to improve student outcomes and the inconsistencies between undergraduate and graduate performance (Allen-Ramdial & Campbell, 2014). The curriculum mapping process within this program resulted in better curriculum alignment between the programs, improved outcomes, and reduced inconsistencies in performance (Allen-Ramdial & Campbell, 2014). A graduate psychology program used curriculum mapping to assess how well their curriculum was addressing the required competencies to improve their program (Sarkisian & Taylor, 2013). The results included the identification of competencies that were lacking, but also created an increase in the transparency in the learning environment that helped teacher's better prepare students (Sarkisian & Taylor, 2013). Geist and Catlette (2014) also suggested that aligning nursing curricula with NCLEX standards can help increase first-time pass rates on NCLEX.

Curricular Improvements

Curriculum mapping has also been used to make evidence based decisions regarding curricular changes (Arafeh, 2016; Komenda, Vita, Vaitsis, Schwarz, Pokorná, Zary, et al., 2015; Lam & Tsui, 2013; Lam & Tsui, 2014; Zelenitsky et al., 2014). For example, the results of a curriculum mapping project conducted by a doctor of education program provided useful policy, content, and instruction suggestions for improvements in courses and programs (Arafeh, 2016). A medical program used curriculum mapping to evaluate the medical curriculum, which resulted in the creation of automatic tasks that helped develop courses that are "both theoretically- focused and clinically-based" (Komenda et al., 2015, p. 3). Curriculum mapping used in three different pharmacy programs resulted in an increase in professionalism training in areas of the curriculum where professionalism training was most needed (Schafheutle et al., 2013). The curriculum mapping process used by Lam and Tsui (2013) to compare coverage of student learning outcomes between two education programs were found to be helpful when preparing for course development or re-development, and added meaning to the process of learning and teaching (Lam & Tsui, 2013). A year later, Lam and Tsui (2014) curriculum mapping process used in a teacher education program resulted in the establishment of more concise guidelines for conducting content analysis and course development (Lam & Tsui, 2014). According to Zelenitsky et al., (2014), the curriculum mapping process used within a pharmacy program "provided a systematic approach and common language for discussing, analyzing, and modifying the curriculum" (p. 5).

Curricular Maintenance

Curriculum mapping has also been used to maintain curricular alignment (Arafeh, 2016; Dexter et al., 2012; Mancuso & Desmara, 2014; Steketee, 2015). Steketee (2015) established a curriculum mapping system to provide an effective means of curricular maintenance which could ensure that continuous curricular improvements maintained alignment with necessary medical school standards and outcomes (Steketee, 2015). The curriculum mapping process used by an undergraduate psychology program also resulted in the creation of an overall process for which continuous curricular improvements could be maintained (Mancuso & Desmara, 2014). A doctor of education program used curriculum mapping to maintain a process of continuous curricular improvement (Arafeh, 2016). The results of a curriculum mapping process used by Dexter et al. (2012) to assess whether a medical curriculum had sufficient USMLE I topic coverage, resulted in a computer-based tool used to improve their content-tracking capability (Dexter et al., 2012).

Curriculum Mapping Processes

A review of the curriculum mapping literature also revealed insight into effective curriculum mapping processes, which include tips for development, implementation, and maintenance. The development stage of the curriculum mapping process should engage a diverse group of stakeholders such as faculty, students, staff and administrators, accreditors, or members of the public (Ellaway, Albright, Smothers, Camerson, & Willett, 2014; Lawson et al., 2011; Sarkisian & Taylor, 2013). Sarkisian and Taylor (2013) suggested that including students in the curriculum mapping process “contributed to a more complete understanding of how students learn what they learn” (p. 8). Faculty provide insight into the curriculum that is being taught and help clarify assumptions about what students are intended to learn and what they are actually learning (Sarkisian & Taylor, 2013). Collaboration and professional dialogue among participants have also been suggested for effective curriculum mapping (Lawson et al., 2011; Shilling, 2013). Materials and resources, such as course catalogs, syllabi, program level competencies, state and national guidelines, administrative directives, or program standards should also be provided to those involved in the curriculum mapping process (Curtis, 2014; Mancuso & Desmara, 2014; Buchanan, Webb, Houk & Tingelstad, 2015; Sarkisian & Taylor, 2013). Each person involved in the curriculum mapping process should also have a thorough understanding of the materials used for the project to make informed decisions (Ervin, Carter & Robinson, 2013).

Conducting a successful curriculum mapping project also means planning for possible limitations that may be encountered during the curriculum mapping process. The amount of time and resources involved in a curriculum mapping project should be accounted for and explained explicitly to the participants (Ervin et al., 2013). To ensure a successful curriculum mapping project knowing what needs to be identified, the time you have to do it, and the resources you have available must be considered when choosing how to approach your curriculum mapping project, as there are several variations (Ervin et al., 2013; Spencer, Riddle, & Knewstubb, 2012). For example, curriculum mapping can include outcomes together with specific content, tasks, and assessments (Arafeh, 2016). Buchanan et al. (2015), who had to rely on faculty responses about content integration in specific courses (not identified in outcomes), found that scheduling meetings with individual content experts was time-consuming and difficult to schedule; prolonging the results. In mapping course outcomes on syllabi to licensing exam competencies, Zelenitsky et al. (2014) had to invest less time to collect data, allowing more time for reflection analysis and problem-solving.

Depending on the institution, some previously described limitations may also be seen as both pros and cons. Often the success of a curriculum mapping project is directly related to faculty support and communication (Buchanan et al., 2015). For example, faculties often have to assess their own content, which can be good for content expertise, but bad if the faculty have time constraints (Ervin et al., 2013). However, another limitation is that inconsistent levels of cooperation, communication, buy-in, and commitment can be encountered during the curriculum mapping process (Buchanan et al., 2015). Therefore, engaging administration and staff to provide added support, communication, and help encourage buy-in to the curriculum mapping project can be beneficial (Buchanan et al., 2015; Shilling, 2013; Watts & Hodgson, 2015

A successful curriculum mapping project should integrate “critical thinking, judgement, moral development, creativity, reflective practice, social and emotional intelligence, problem solving, and communication” into the process (Watts & Hodgson, 2015, p.686-687). Furthermore, the resulting curriculum map should be holistic, collaborative, integrative, and maintainable (Lawson, et al., 2011). That is, when assessing the curriculum (program or department), the whole curriculum, progressive nature of the outcomes, integration and linkage of outcomes, competencies, and assessments, as well as the sustainability of maintaining the map must be considered (Lawson, et al., 2011). The ability to maintain the curriculum map often involves the assurance that the process does not rely on one person or resource for its maintenance (Ervin et al., 2013).

Shilling (2013) suggested that buy-in and contribution to the project are critical to successfully implementing the curriculum mapping project. Those who do not see the project as pertinent to their needs may be less likely to participate in the process (Shilling, 2013). Shilling (2013) offers some strategies to support a successful implementation of the curriculum mapping project including, consistent and adequate resources, support and leadership; appropriate curriculum mapping training; consistent communication and monitoring of the project, as well as incentives for participation.

The review of the curriculum mapping literature supports the implementation of a curriculum mapping process to gain further insight into the findings of this study, which show that some basic science content areas are better predictors of NPLEX I performance than others. However, since NPLEX I was designed to assess knowledge of biomedical science content areas it is unclear to me why all basic science courses were not predictors of NPLEX I performance. Therefore, to understand why only three of the five content areas were found to have a statistically significant predictive relationship with NPLEX I performance I recommend a curriculum mapping project within the Department of Basic Medical Sciences at SVC. The results of the curriculum mapping activities could help identify potential gaps between the basic science course outcomes at SVC and the NPLEX I competencies. If gaps are found, changes to the basic science course outcomes could be made that may help make all basic science courses better predictors of NPLEX I performance. A curriculum mapping process would also provide a systematic approach for identifying gaps between the basic science course outcomes and the NPLEX I competencies. It could also provide a means for monitoring whether the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. It could also improve the coverage of content taught in the naturopathic basic science curriculum at SVC that could help increase students' preparations for NPLEX I, such as adding missing content or going into more detail on specific content within the curriculum. Therefore, the findings from this study and the literature review support curriculum mapping as a viable project to begin addressing the problem of low first-time NPLEX I pass rates at SVC.

Project Description

The results of this study showed that three of the five basic science content areas analyzed for this study (pathologyplus, anatomy, and physiology) were predictive of NPLEX I performance. To understand why only three of the five content areas were found to have a statistically significant predictive relationship with NPLEX I performance I recommend a curriculum mapping project within the Department of Basic Medical Sciences at SVC. The result of the curriculum mapping activities could help identify potential gaps between the basic science course outcomes at SVC and the NPLEX I competencies. If gaps are found, changes to the basic science course outcomes could be made that may help make all basic science courses better predictors of NPLEX I performance. Therefore, the results of this study support a position paper recommending the implementation of a curriculum mapping project within the Department of Basic Medical Sciences at SVC (Purdue Online Writing Lab, 2015). The curriculum mapping project would fall under the purview of the Academic Affairs Department, and be developed, implemented, and maintained in collaboration with the members of the Academic Affairs Department and Department of Basic Medical Sciences at SVC.

In the position paper, delineated in Appendix A, I outline recommended guidelines for the development, implementation, and maintenance of the curriculum mapping project at SVC. The objective of the curriculum mapping project is to examine and align the naturopathic basic science course outcomes contained in each basic science course syllabus to the competencies contained in the NPLEX I blueprint. The purpose of this project is to identify gaps between the basic science course outcomes and the NPLEX I competencies. The curriculum mapping project would provide a systematic approach for identifying gaps between the basic science course outcomes and the NPLEX I competencies and aligning the curriculum to the NPLEX I blueprint. It would also provide a means for ensuring that the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. Additionally, it would provide a means for improving the coverage of content taught in the naturopathic basic science curriculum at SVC that could help increase students preparations for NPLEX I. That is, depending on the results of the curriculum mapping process, improving the coverage of content might involve adding missing content to the curriculum, spending more time on specific content within the curriculum, or going into more detail on specific content within the curriculum. Another purpose of identifying these gaps would be to revise or develop courses to incorporate the missing competencies into the appropriate basic science courses, which could also contribute to improving the coverage of basic science content within the curriculum. Furthermore, addressing the gaps between the basic science course outcomes and the NPLEX I competencies could potentially improve students preparations for NPLEX I. Incorporating missing competencies could increase the basic science final exam performance, which could potentially increase their predictability of NPLEX I performance. Identifying and incorporating missing competencies may also potentially make all basic science course content area final exams better predictors of NPLEX I performance with the overall intent of helping to address the problem of low fist-time pass rates on NPLEX I at SVC.

Roles and Responsibilities

The curriculum mapping project at SVC would engage a diverse group of stakeholders including faculty, students, and administrators (Ellaway et al., 2014; Lawson et al., 2011; Sarkisian & Taylor, 2013). Faculty would be included since they could provide insight into the curriculum that is being taught and help clarify assumptions about what students are intended to learn and what they are actually learning (Sarkisian & Taylor, 2013). All faculty from the Department of Basic Sciences would be invited to the initial meeting which would introduce the curriculum mapping project at SVC. Students, solicited via the student government association, would also be included in the curriculum mapping project since they may be able to contribute “a more complete understanding of how students learn what they learn” (Sarkisian & Taylor, 2013, p. 8). Students would be invited to all project meetings, but contribute mostly during the data follow-up and strategy building stages of the project. Administrators would also be included since they can provide added support and communication and help encourage buy-in to the curriculum mapping project (Buchanan et al., 2015; Shilling, 2013; Watts & Hodgson, 2015). Select members of the Academic Affairs Department, including the dean of academic affairs, and director of academic assessment and program development would be included in all project meetings and contribute support to the faculty and students as needed throughout the project.

Each participant involved in this project would hold a specific role. The curriculum mapping project would fall under the purview of the Academic Affairs Department, and be developed, implemented, and maintained in collaboration with members of the Academic Affairs Department and Department of Basic Medical Sciences at SVC. As the project manager I would be responsible for oversight of the project from start to finish, which would include providing resources and support, organizing and securing meetings spaces, and monitoring progress. I would provide appropriate resources to each participant, including copies of each basic science course syllabus that include course outcomes, copies of the NPLEX I competencies outlined in the most recent NPLEX I blueprint, a curriculum map template, and access to an online group page that could be used for collaboration. The dean of academic affairs would assist me in encouraging collaboration, commitment, and buy-in to the project. Faculty from the Department of Basic Medical Sciences would be responsible for completing the mapping of the course outcomes and NPLEX I competencies. Students would assist faculty in gathering follow-up information and engage in the strategy discussions after completion of the curriculum mapping by the faculty.

Potential Barriers

The most prominent potential impediment of this project could be faculty time. Mapping outcomes together with specific content, tasks, and assessments may provide insight into content coverage, but can be time consuming (Arafeh, 2016). Buchanan et al. (2015) cautioned that scheduling meetings with individual content experts can be time-consuming and difficult to schedule. Therefore, in mapping course outcomes solely from syllabi to licensing exam competencies, as suggested by Zelenitsky et al. (2014), less time would be required of faculty, allowing more time for faculty to focus on reflective analysis and problem-solving. The other potential barriers include acceptance, buy-in, and commitment to the project by those involved in the project (Buchanan et al., 2015; Shilling, 2013; Watts & Hodgson, 2015). Additionally, since the results of this study showed only three of the five basic science content area final exam scores were predictive of NPLEX I performance it is possible that the level of acceptance, buy-in, and commitment to the project may vary for faculty members who teach those content areas that were predictive versus those that were not predictive.

To address the potential barriers identified for this project such as the varying levels of acceptance, buy-in, and commitment to the project, the dean of academic affairs would be asked to assist me in encouraging and supporting commitment and buy-in to the project. According to several studies (Buchanan et al., 2015; Shilling, 2013; Watts & Hodgson, 2015), staff and administrators can provide added support, communication, and help encourage buy-in to curriculum mapping projects. As an incentive, with permission from the dean of academic affairs, faculty would be reminded that this project qualifies as service to the institution, which could be listed on their annual performance reviews. Also with permission from the dean of academic affairs, faculty would be allotted time in their workloads to complete the curriculum mapping project. Faculty would be reminded that this project is not intended to solely create more work for them, but that it is meant to support students by helping to address the problem of low fist-time pass rates on NPLEX I at SVC.

Implementation and Proposed Timeline

To facilitate the implementation of this curriculum mapping project, I propose the following timeline. The project would commence with a kick-off meeting to introduce the participants to the curriculum mapping project, the proposed process, the materials, and resources, as well as the timeline of the curriculum mapping project at SVC. The amount of time and resources involved in the curriculum mapping project would be explained explicitly to the participants who would be involved in the project (Ervin et al., 2013). Knowing what you want to identify, the time you have to do it, and the resources you have available are important to consider before beginning the curriculum mapping project (Ervin et al., 2013; Spencer et al., 2012). Therefore, the initial kick-off meeting would be held for participants to gain a thorough understanding of the time commitment involved in the curriculum mapping project, what needs to be identified, and the materials that would be used for the project so informed decisions could be made (Ervin et al., 2013). Additional meetings would be scheduled, as needed, throughout this process to allow a means of collaboration between participants and allow participants to report in on the status of their progress. The majority of the curriculum mapping activities will be done outside of the meetings, primarily by faculty.

To facilitate implementation of this project I suggest the proposed implementation timetable. I would obtain authorization from the dean of academic affairs with the expected launch date of mid-January 2017, with the project culminating in late-April 2017. I would hold the kick-off meeting, introducing the project, in mid-January 2017 and include an introduction to curriculum mapping, a discussion of the results of my doctoral study, and how these results relate to this project. I would discuss the timeline and project resources during this first meeting. Mid-January 2017 through mid-April 2017 faculty would work independently to map the basic science course outcomes to the NPLEX I competencies. I would schedule additional meetings as needed throughout this process should participants need additional support or guidance. I would reconvene the participants in mid-April to review the completed map, discuss the gaps, and develop strategies for curricular improvement. Between mid-April and late-April 2017 all participants would collaborate with other members of the college, as needed, to gather additional information that could be used to address or support the identified strategies. In late-April 2017 I would convene the participants again to create a proposal outlining the recommended curricular changes and an ongoing process for maintaining curricular alignment that would be presented to the dean of academic affairs in late-April 2017. Potential curricular changes could be developed during May 2017 through September 2017 and implemented in October 2017 at the beginning of the next academic year.

Project Evaluation Plan

The type of evaluation I planned for this project is a formative assessment using a self-developed survey of program participants. I would manage the development and administration of the survey. Surveys are typically used as summative assessments to measure proficiency at the end of an instructional period (Carnegie Mellon University, n.d.). However, formative assessments are often used to obtain feedback that can be used to make improvements during the instructional period (Carnegie Mellon University, n.d.). Since one of the objectives of this project is to encourage SVC to implement an ongoing curriculum mapping process for continuous improvement within the Department of Basic Medical Sciences, I would administer a survey. However, I would use the survey as a formative assessment to obtain feedback at the end of the project from those who participated in the process. In developing the survey, I would solicit feedback from potential participants, administrators and faculty prior to finalizing and administering the survey (Frary, n.d.; University of Wisconsin Survey Center, 2010). I would administer the proposed sample survey (included in Appendix A), which would be updated based on feedback from participants, during the last project meeting. On the survey I would include a small number of questions designed to identify the strengths and weaknesses of the curriculum mapping project that could be used to improve the process (Frary, n.d.; University of Wisconsin Survey Center, 2010). According to Frary (n.d.), using open-ended questions is acceptable when used in "brief, informal questionnaires to small groups…fewer than 50 responders" (p. 169). Since the project would involve a small group of participants, approximately 7-10, I would also use open ended questions to capture unanticipated feedback.

Since specific NPLEX I pass rates are stipulated by CNME (2015) to maintain accreditation, monitoring NPLEX I pass rates will continue to be important for SVC, as such, maintaining a curriculum map will also be important. Therefore, the results of the survey could also be used to guide future curriculum mapping processes at SVC. To facilitate the use of the survey results to guide future curriculum mapping processes I would also include the survey results in the proposal submitted to the dean of academic affairs at the end of the project.

Project Implications

The potential implications the results of this project have for positive social change may include a potential increase in student's NPLEX I performance as well as a positive impact on the reputation of the schools and profession of naturopathic medicine. Low first-time pass rates on NPLEX I can impact accreditation with the CNME. Accreditation is beneficial to programs and institutions because it requires documentation of quality standards, can promote continuous improvement and support learning, as well as increase social recognition and status (Cochrane, 2014; El-Jardali et al., 2014; Taub et al., 2011). A loss of any of these benefits may impact the institution's reputation, the reputation of the profession, as well as the reputation of past and present graduates. For example, the loss of the institution's reputation and the loss of the profession's reputation could impact the success of past and present graduates (current physicians) by potentially impacting their reputation as naturopathic physicians. Furthermore, the loss of accreditation and potential impact on the reputation of the institution and profession may also impact future graduates' ability to obtain licensure, and be, successful naturopathic physicians (Cochrane, 2014; Taub et al., 2011).

A curriculum mapping project would provide a systematic approach for identifying gaps between the basic science course outcomes and the NPLEX I competencies. It would also provide a means for ensuring that the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. It would also provide a means for improving the coverage of content taught in the naturopathic basic science curriculum at SVC. For example, depending on the results of the curriculum mapping project, improving the coverage of content might involve adding missing content to the curriculum, spending more time on specific content within the curriculum, or going into more detail on specific content within the curriculum. Addressing any gaps between the basic science course outcomes and the NPLEX I competencies has the potential to better prepare students for NPLEX I and may potentially be used to make all basic science course content area final exams better predictors of NPLEX I performance. Increased basic science course performance and increased NPLEX I performance, of which the results of this project could contribute, have potential implications for positive social change that may include a positive impact on the reputation of the schools of naturopathic medicine, their graduates, and the profession of naturopathic medicine.

In a larger context, the results of this project could generate interest from other schools of naturopathic medicine. Specifically, if NPLEX I performance improves as a result of this project, other schools of naturopathic medicine could implement a similar process that might also increase NPLEX I performance at their schools. The results of other schools implementing similar process could have a significant impact on the number of competent physicians licensed to practice naturopathic medicine. An increased number of competent physicians licensed to practice naturopathic medicine could increase the number of patients that are treated by naturopathic physicians, which could also increase the exposure and reputation of the profession of naturopathic medicine.

Section 4: Reflections and Conclusions

Introduction

Throughout the process of completing this study's proposal, and collecting and analyzing data for this study, I encountered several challenges. However, these challenges also helped me identify and develop an appropriate project based the results of this study. In this section, I present the strengths and weaknesses of the proposed curriculum mapping project at SVC, which is presented in the form of a position paper for policy recommendation in Appendix A. I discuss the potential limitations of the proposed project and offer recommendations for alternative solutions. I also discuss personal insights and reflective analyses regarding my learning and growth as a scholar, project developer, and practitioner throughout the process of conducting this study. Finally, I offer reflections on the importance of the project's contributions to social change, as well as implications, applications, and directions for future research.

Project Strengths and Limitations

Based on the results of this study, the project deliverable I selected to address the problem of this study was a curriculum mapping project. As I demonstrated in the literature review, curriculum mapping has several strengths that may contribute to addressing the problem of low first-time pass rates on NPLEX I. Curriculum mapping provides a method in which institutions and programs can identify curricular gaps and demonstrate curricular alignment of standards, outcomes, and competencies, and licensing exam coverage (Dexter et al., 2012; Geist & Catlette, 2014; Lam & Tsui, 2013; Lam & Tsui, 2014; Landry et al., 2011; Lawson et al., 2011; Mahboob & Evans, 2015;

Mancuso & Desmara, 2014; Miller, & Neyer, 2016; Sarkisian & Taylor, 2013; Steketee, 2015; Wells et al., 2015; Zelenitsky et al., 2014). Curriculum mapping can provide a systematic approach to make evidence-based decisions regarding curricular changes, improve academic performance, and maintain curricular alignment (Allen-Ramdial & Campbell, 2014; Arafeh, 2016; Dexter et al., 2012; Komenda et al., 2015; Lam & Tsui, 2013; Lam & Tsui, 2014; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Schafheutle et al., 2013; Steketee, 2015; Zelenitsky et al., 2014).

Specifically, a curriculum mapping project within the Department of Basic Medical Sciences at SVC could provide a systematic approach for identifying gaps between the basic science course outcomes and the NPLEX I competencies. The results of this approach could then be used to make evidence-based decisions regarding curricular changes that could help improve academic and NPLEX I performance. According to Zelenitsky et al. (2014), the curriculum mapping process can provide a systematic approach for modifying the curriculum using evidence-based decisions to reinforce key principles, provide common language for discussion, while also providing positive outcomes for the institution. Therefore, a curriculum mapping process at SVC would provide a means for ensuring that the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I, and may potentially be used to make all basic science course content area final exams better predictors of NPLEX I performance. It would provide a means for improving the coverage of content taught in the naturopathic basic science curriculum to increase students' preparations for NPLEX I. According to Allen-Ramdial and Campbell (2014), the results of a curriculum mapping process can reduce inconsistencies in performance and improve program outcomes. Furthermore, a curriculum mapping process could provide an effective means for SVC to maintain continuous curricular alignment (Geist & Catlette, 2014; Landry et al., 2011; Lawson et al., 2011; Miller, & Neyer, 2016; Steketee, 2015).

Although curriculum mapping offers many potential strengths, it also has a few potential limitations. In fact, some of the strengths of curriculum mapping may also be considered limitations or weaknesses. For instance, there are multiple approaches to curriculum mapping that can each offer benefits, such as focusing on specific skills within a curriculum, or mapping course outcomes to licensing exam competencies, program outcomes, or accreditation standards (Arafeh, 2016; Buchanan et al., 2015; Zelenitsky et al., 2014). However, the time and resources available may limit and dictate the approach that needs to be taken for a particular project. Ervin et al. (2013) and Spencer et al. (2012) suggested that what you want to identify, the time you have to do it, and the resources you have available must be considered together when choosing which curriculum mapping approach to take.

The curriculum mapping project proposed as a result of this study involves mapping the course outcomes listed in the syllabi of the basic science courses at SVC to the NPLEX I competencies. Since faculty are the content experts, it may be imperative that faculty who teach each basic science course assess their own content, which can be good for content expertise, but bad if the faculty have time constraints (Ervin et al., 2013). Therefore, faculty time required to conduct the mapping activities may be a limitation to the curriculum mapping project at SVC. Additionally, because of the time requirements, faculty may also see less value in the project, which may reduce their cooperation, commitment, and buy-in to the project. Shilling (2013) found that those who did not see value in the process were less likely to commit to it. Buchanan et al. (2015) found that inconsistent levels of cooperation, communication, buy-in, and commitment can be encountered during the curriculum mapping process. Therefore, faculty who feel they are too busy, do not want to participate, or do not see how it impacts their work may also add to the limitations of this project.

Another limitation of the proposed curriculum mapping project involves the approach chosen for this project. The project proposed involves mapping only the course outcomes listed in the syllabi of the basic science courses to the NPLEX I competencies. Therefore, the limitation of this approach is that it is possible that specific content that is covered in the basic science courses may not be captured. According to Arafeh (2016), depending on the project, mapping outcomes without including specific content, tasks, or assessments may limit the institution’s ability to assess whether the coverage is appropriate. However, Zelenitsky et al. (2014) suggested that choosing to map course outcomes to licensing exam competencies without including specific content, tasks, or assessments requires less time to collect data, allowing more time for reflection analysis, and problem-solving. Since faculty time may also be a limitation of this project, and faculty would be doing most of the mapping activities, I considered the amount of time that would be required of faculty to complete this project. Although this approach creates limitations, I chose to start with a less time-consuming approach in hopes that it may contribute to the success of the project and elicit more faculty buy-in and commitment to the project.

Recommendations for Alternative Approaches

The curriculum mapping process recommended as the project for this study includes mapping the basic science course outcomes to the NPLEX I blueprint competencies, which could address the problem of this study: low first-time pass rates on NPLEX I at SVC. However, the problem could also be defined and approached differently, providing alternative definitions of the problem, as well alternative solutions to the problem of this study. For example, an alternative definition of the problem could include the idea that students are not learning the necessary skills in the basic science curriculum to sufficiently prepare them for NPLEX I. In this case, an alternative approach could involve the development of an NPLEX I prep program to address the problem of low first-time pass rates on NPLEX I at SVC. The NPLEX I prep program could incorporate specific questions related to each NPLEX I competency that could assist in content mastery. Since NPLEX I is designed to assess knowledge of the basic science content areas, each element of this NPLEX I prep program could potentially help improve basic science content area final exam scores and increase NPLEX I performance (NABNE, 2015a). Although the NPLEX I prep program could be beneficial, I believe that identifying and addressing gaps in the existing curriculum could more thoroughly address the potential root of the problem of low first-time pass rates on NPLEX I.

An alternative approach that could build upon the recommended project for this study includes expanding the curriculum mapping process to include specific content, tasks, and assessments within each basic science course (Arafeh, 2016). However, Buchanan et al. (2015) cautioned that scheduling meetings with individual content experts can be time-consuming and difficult to schedule. Therefore, expanding the curriculum mapping process proposed for this study may eliminate the possibility that specific content covered in the basic science courses may not be captured. Expanding the project could also increase the amount of time required of faculty, which may reduce faculty cooperation, commitment, and buy-in to the project, and prolong the project timeline.

Scholarship, Project Development and Evaluation, and Leadership and Change

Throughout the process of completing this study, I have learned how to begin thinking like a scholar, and gained a better understanding of what it takes to develop a scholarly study. I have learned that scholarship often starts with a "gut feeling" or a "hunch" about something. Through research, discovery, analysis, reflection, and application, those gut feelings or hunches can be transformed into scholarly works, and scholars can be born. I have also learned that a scholar must be curious, diligent, objective, ethical, honest, and have the ability to critically dissect facts, data, and interpretations to discover new ideas. Through my engagement with this process, I have learned that I possess each of these characteristics, which were imperative to developing this scholarly study.

The findings from this study and the curriculum mapping literature both provided me resources for developing the curriculum mapping project to address the findings of this study. The findings from this study showed three of the five basic science content areas were predictive of NPLEX I performance. This means two of the five were not indicated as predictors of NPLEX I performance. Since NPLEX I is designed to assess knowledge of the basic science content areas, it was not clear to me why all five areas were not predictive of NPLEX I performance (NABNE, 2015a). To identify why only three of the five basic science content areas were predictive of NPLEX I performance, I recommended the curriculum mapping project as the first step in addressing the problem of low first-time pass rates on NPLEX I at SVC. Although, it was tempting to include specific content not listed in the course outcomes into the curriculum mapping project for this study, I chose to start with a less time consuming process. I chose to map the basic science course outcomes listed on the syllabi to the competencies listed on the NPLEX I blueprint because doing so should require less time. Identifying content not listed in the course outcomes of syllabi may require the collaboration of multiple faculty content experts, which could be time consuming (Buchanan et al., 2015). The time saved using the less time consuming mapping approach would allow more time for reflection and problem solving to determine content integration into specific courses or the creation of new courses (Buchanan et al., 2015; Zelenitsky et al., 2014). Furthermore, since faculty would be doing most of the mapping activities, I considered the amount of time that would be required of faculty to complete this project. I chose to start with a less time-consuming approach in hopes that it may contribute to the success of the project and elicit more faculty buy-in and commitment to the project.

From a project development standpoint, because the objective of the curriculum mapping process is to create an ongoing process, gathering feedback will be important for continuous improvement of the process. Therefore, a curriculum mapping project evaluation survey would be administered to those who participated in each curriculum mapping project. The surveys would include questions designed to identify the strengths and weaknesses of the curriculum mapping project. The results of the survey could then be used to guide future curriculum mapping processes at SVC.

In reviewing the literature for this project I was reminded of how important appropriate leadership is to supporting the successful implementation of a project, including the curriculum mapping project at SVC. The curriculum mapping project at SVC may likely be seen by faculty as a top-down decision that is being imposed on them that simply serves to add to their existing workload. In developing this project I recognized that the inclusion of faculty at every stage of this process would be important for gaining support, buy-in, and commitment to the project.

Additionally, I have also learned how important it is to provide inclusive and supportive leadership on projects, of which will also be important to the success of this project Therefore, as the project manager, I would personally meet with each faculty member to discuss the benefits of this project. The project would be presented as an opportunity to help solve a problem that has been troubling the institution for years. The fact that their help as content experts would be imperative to the success of this project and to improving student success would also be expressed. Since curriculum mapping may be new to many faculty, training on the purpose, benefits, and approaches to curriculum mapping would be provided. Reassurance that I and others within the

Academic Affairs Department would be available for guidance and support throughout the curriculum mapping process would also be communicated.

Reflection on Importance of the Work

An increase in NPLEX I performance, of which the results of this study and the curriculum mapping project might contribute, could benefit many institutional constituents. The work of this study is beneficial to the reputation of SVC as a school of naturopathic medicine. It is beneficial to past, present, and future naturopathic medical students. It is also beneficial to the profession of naturopathic medicine. An increase in NPLEX I performance could help maintain CNME accreditation, which ensures that schools of naturopathic medicine maintain high standards of education (CNME, 2015). Maintaining accreditation for schools of naturopathic medicine is important because it promotes continuous improvement and supports learning (Cochrane, 2014). Maintaining accreditation can also increase social recognition and status (Taub et al., 2011). Continuous improvement, learning, and social recognition and status may all impact the reputation of schools and profession of naturopathic medicine, which could impact the reputation and future success of past, present, and future graduates (Cochrane, 2014; Taub et al., 2011). First-time pass rates on NPLEX I may impact CNME accreditation for schools of naturopathic medicine, which could impact graduates' ability to obtain licensure as naturopathic physicians. It could also impact the reputation of the profession of naturopathic medicine, which could consequently impact the reputation and future success of past, present, and future graduates. An increase in NPLEX I performance could benefit students and graduates by upholding the institution's reputation and the reputation of the profession. The fact that the results of this study showed three of the five basic science content areas were predictive of NPLEX I performance might indicate there are curricular deficiencies within the basic science courses at SVC. The curriculum mapping project could provide a systematic approach for identifying gaps between the basic science course outcomes and the NPLEX I competencies. It could also provide a means for monitoring whether the basic science curriculum is consistently teaching students to achieve the appropriate competencies needed to pass NPLEX I, as well as offering an appropriate coverage of naturopathic basic science curriculum content at SVC. Moreover, addressing any gaps between the basic science course outcomes and the NPLEX I competencies could better prepare students for NPLEX I and may potentially be used to make all basic science course content area final exams better predictors of NPLEX I performance. Therefore, the implementation of a curriculum mapping process and the possible increase in NPLEX I performance it may provide have potential positive social change implications that could benefit schools of naturopathic medicine. It could improve academic and NPLEX I performance of naturopathic medical students, which may have a positive impact on the reputation of the schools and profession of naturopathic medicine.

In a larger context, the results of this project could generate interest from other schools of naturopathic medicine. Specifically, if NPLEX I performance improves as a result of this project, other schools of naturopathic medicine could implement similar processes that might also increase NPLEX I performance at their schools. The results of other schools implementing similar process could have a significant impact on the number of competent physicians licensed to practice naturopathic medicine. An increased number of competent physicians could also increase the number of patients who are treated by naturopathic physicians. Furthermore, the increased number of patients could also increase the exposure and reputation of the profession of naturopathic medicine.

Implications, Applications, and Directions for Future Research

Implications of the curriculum mapping project I chose as the project deliverable to address the results of this study could include future curricular developments at SVC. Future curricular developments could include changes to the content of one or more basic science courses that could potentially help increase performance in basic science courses as well as NPLEX I performance. For instance, the anatomy content could be changed by increasing the amount of delivered content, or adding additional delivered content. Another potential implication of this project might involve recommending a change to the minimum performance standards required for one or more basic science courses. For instance, the minimum number of points or percentage needed to pass the anatomy content of a course could be increased.

There is a gap in the research related to naturopathic curriculum and licensing exam performance and this study focused solely on one portion of this gap; the relationship between groups of basic science content area final exam scores and NPLEX I performance. This study also focused on one of the seven CNME accredited schools of naturopathic medicine. Therefore, this study may provide several directions for future research that could expand or complement this study. For example, this study could be conducted at each of the other six CNME accredited schools of naturopathic medicine.

This study's research may also be expanded to identify the relationship between each NPLEX I subscore and multiple basic science content areas or individual basic science courses. This research could be expanded to other departments within the institution to identify the relationship between each NPLEX I subscore and other courses within the first and second year curriculum. This study's research could also be expanded to include the identification of the predictive relationship between each NPLEX II subscore and multiple clinical science courses, individual clinical science courses, or individual or multiple clinical science content areas. Furthermore, this study's research could also be expanded to include the identification of the relationships between each NPLEX I subscore and multiple factors such as entering grade point average, career grade point average, years out of school, age, ethnicity, and transfer status.

Conclusion

In this final section, I presented the strengths and weaknesses of the proposed curriculum mapping project at SVC. I presented recommendations for alternative solutions as well as personal insights and reflective analyses about my learning and growth throughout the process of this study. I presented reflections on the importance of the project's contributions; personal learning and growth as a scholar and project developer; as well as reflections on the importance of leading change. Finally, I presented implications, applications, and directions for possible future research as a result of this study.

The fact that the results of this study showed only three of the five basic science content area final exams were predictors of NPLEX I performance was a surprise to me.

The results of this study offer important information that could potentially contribute to increased NPLEX I performance for SVC students. Low first-time pass rates on NPLEX I have an immediate impact on current students who do not pass the exam. However, first-time NPLEX I pass rates also have an impact on the institution's accreditation status with CNME (2015), which can impact past, present and future naturopathic medical students, the reputation of the institution, and the profession of naturopathic medicine. Each school of naturopathic medicine, its faculty, and its administration have a responsibility to the naturopathic profession, to its students, and to its graduates, to do all they can to help student's successfully pass NPLEX I.

Appendix A includes the position paper for policy recommendation that outlines the recommended curriculum mapping project at SVC Appendix A also includes the invitation email to participants, the proposed kick-off meeting agenda and project presentation, as well as the proposed timeline, and evaluation I created for the curriculum mapping project at SVC.

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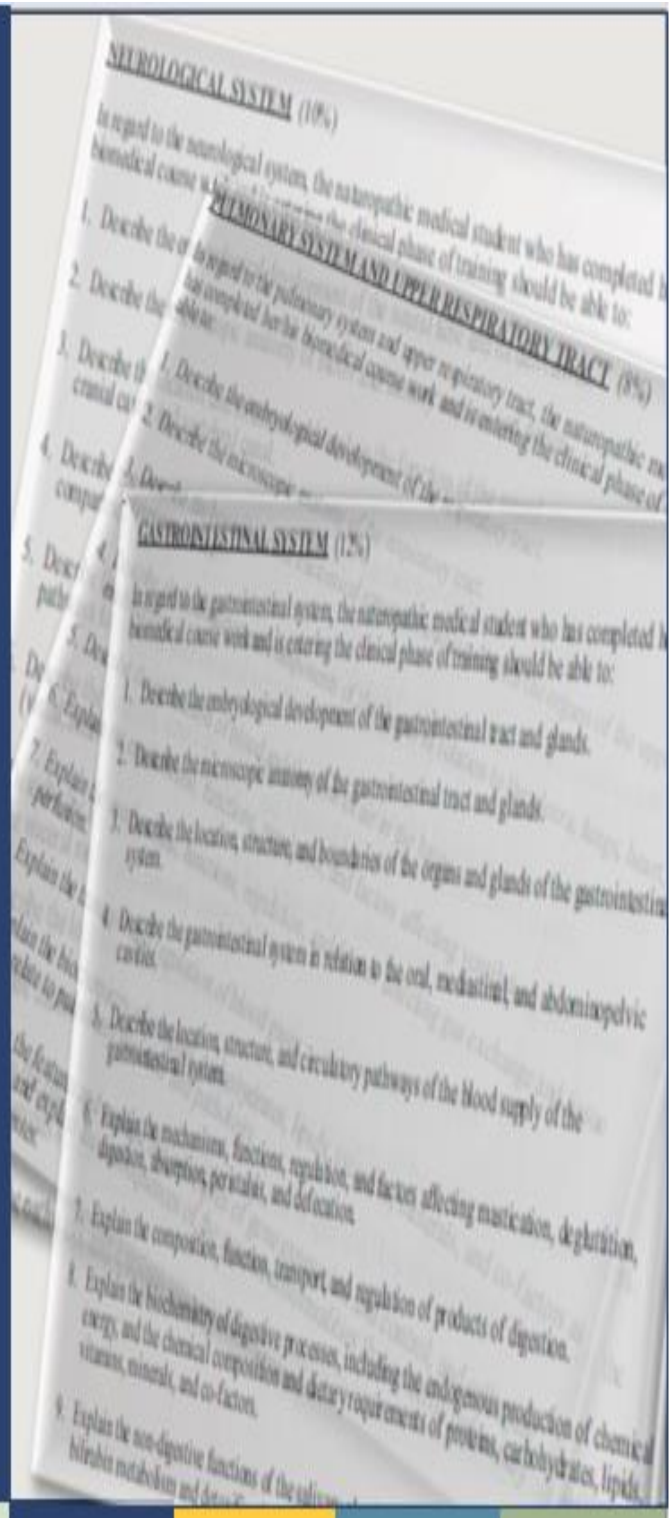
Appendix A: Position Paper

Curriculum Mapping to Address Low First-Time Pass Rates on NPLEX I

A Position Paper by
Tammy M. Aragon



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Executive Summary

The purpose of this position paper is to communicate the results of my doctoral study and present a project to help address the problem of low fist-time pass rates on the Naturopathic Physicians Licensing Exam I (NPLEX I) to the administration at South Valley College (SVC). Low first-time pass rates on NPLEX I can impact accreditation with the program accreditor for naturopathic medical programs, the Council on Naturopathic Medical Education (CNME). The recommendation outlined in this position paper is a policy change for SVC in the form of a curriculum mapping process designed to identify gaps between the basic science course outcomes and NPLEX I competencies. A curriculum mapping process would provide a systematic approach for identifying gaps between the basic science course outcomes at SVC and the NPLEX I competencies. It would also provide a means for ensuring the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. Furthrmore, it would also provide a means for improving the coverage of content taught in the naturopathic basic science curriculum at SVC to increase students' preparations for NPLEX I, such as adding missing content or going into more detail on specific content within the curriculum. Addressing any gaps between the basic science course outcomes and the NPLEX I competencies could help better prepare students for NPLEX I, and may potentially be used to make all basic science course content area final exams better predictors of NPLEX I performance.

The information contained in this position paper may be particularly useful to administrators and faculty responsible for improving student performance. In this position paper I begin with an overview of the problem of low first-time pass rates on NPLEX I at SVC. I follow with an overview of my doctoral study and results of the predictive relationships between naturopathic basic science courses and NPLEX I performance. Next, I discuss evidence from the literature outlining the benefits of curriculum mapping, recommendations for implementation of the project, and descriptions of the purpose of this curriculum mapping project.

Overview of the Problem

Low first-time pass rates on NPLEX I can impact accreditation with the program accreditor for naturopathic medical programs, the Council on Naturopathic Medical Education (CNME). Schools of naturopathic medicine that are unable to maintain an average first-time pass rate of at least 70% over a 5-year period on NPLEX I may lose CNME (2015) accreditation. Maintaining accreditation for schools of naturopathic medicine is important because it promotes continuous improvement and supports learning, as well as increases social recognition and status (Cochrane, 2014; Taub et al., 2011). A loss of CNME accreditation would prevent graduates of the institution from obtaining medical licensure as naturopathic physicians in the United States and Canada, as graduation from a CNME accredited school of naturopathic medicine is required (North American Board of Naturopathic Examiners [NABNE], 2015a). A loss of accreditation with CNME would also impact the reputation of the institution, the profession, and the integrity of existing naturopathic physicians. Therefore, low first-time pass rates on NPLEX I, continued accreditation with CNME, and naturopathic medical licensure are concerns that could impact the success and reputation of the schools and profession of naturopathic medicine, as well as the legitimacy of the credentials of past and present, graduates of schools of naturopathic medicine.

To support students' preparations for NPLEX I, SVC offers matriculated students, numerous resources (SVC associate registrar, personal communication, September 19, 2014). Resources include basic science review courses, access to test anxiety counseling, resource books such as the *USMLE Step I Preparation Guide*, practice NPLEX I exams, and private and group tutoring (SVC registrar's office, n.d.). Additionally, students taking NPLEX I are excused from courses and clerkships on the day of the examination (SVC registrar, personal communication, September 9, 2014) Furthermore, quizzes and exams are not scheduled on the day before or day after the examination (SVC registrar, personal communication, September 9, 2014).

Despite the resources provided at SVC to support students' preparations for NPLEX I, first-time pass rates on NPLEX I have been below 70% for 3 of the last 5 years (NABNE, 2012, 2013a, 2013b, 2014a, 2014b, 2015c). Following the August 2014 administration, the average first-time pass rate of all seven schools was 74% for NPLEX I (NABNE, 2014b). However, in August 2014 SVC met the CNME (2015) required 70% minimum for the first-time in 3 years with a 71%. Although the first-time pass rate increased to 86% in August 2015, this is still below the goal of 90% outlined in SVC's strategic plan (NABNE, 2015b; SVC Strategic Plan, 2015). Therefore, low first-time pass rates on NPLEX I at SVC and their impact on accreditation prompted me to explore ways to improve first-time NPLEX I pass rates.

Study Overview

The primary purpose of this quantitative study was to assess whether there is a predictive relationship between students' content area final exam scores in naturopathic basic science courses and performance on their first and second NPLEX I subscore areas on the first attempt at SVC. The secondary purpose was to help schools of naturopathic medicine develop potential strategies to assess the effectiveness of, and recommend changes to their basic science curricula that could potentially increase NPLEX I performance. Additionally, the results of this study offer potential implications for positive social change that could benefit schools of naturopathic medicine and the academic performance of naturopathic medical students, which may include a positive impact on the reputation of the schools and profession of naturopathic medicine.

Sample Size

This study consisted of two separate analyses. The sample of participants N = 208 for the first analysis and N = 256 for the second analysis for this study consisted of SVC students and utilized archived student data. The first analysis, which included the NPLEX I disease/dysfunction subscore and microbiology and pathologyplus scores was done with 208 student records. The second analysis, which included the NPLEX I structure/function subscore and the anatomy, physiology, and biochemistry scores was done with 256 student records. The difference in sample size between the first and second analysis was that 48 student records did not have a microbiology and pathologyplus score and an NPLEX I score for the first analysis, and were therefore eliminated from the sample.

A homogenous purposive sampling method was used for this study since the sample population was from a pre-specified group with characteristics specifically tied to my research questions (Lodico, Spaulding & Voegtle, 2010). The archival student data obtained for this study included first-time NPLEX I scores from August 2013, August 2014, and August 2015, and basic science content area final exam scores from basic courses taken at SVC between 2011 and 2013. In addition to taking NPLEX I for the first-time between August 2013 and August 2015, students were required to have the appropriate basic science content area final exam scores and a score for each corresponding NPLEX I subscore area for each separate analysis to be included in this study.

For each analysis, students who were missing any of the required scores were considered ineligible and were eliminated from the dataset. Specifically, for the first analysis, students who did not have a microbiology and pathologyplus score and an NPLEX I score for the subscore area of disease/dysfunction were considered ineligible and were eliminated from the dataset. Therefore, the analysis was done with $N = 208$ student records. Similarly, for analysis two, students who did not have an anatomy, physiology, and biochemistry score and an NPLEX I score for the subscore area of structure/function were considered ineligible and were eliminated from the dataset. Therefore, the analysis was done with $N = 256$ student records. Students who did not have a score for one or more of the basic science content areas were primarily indicative of dismissed, withdrawn, or transfer students since they would not have taken some or all of their basic science final exams at SVC (SVC dean, personal communication, June 2, 2016). The difference in sample size between the first and second analysis was that 48 student records did not have a microbiology and pathologyplus score and an NPLEX I score for the first analysis, and were therefore eliminated from the sample. Therefore, for the first analysis, 48 students who did not have a score for microbiology were eliminated since their basic science final exams did not include this content area.

Research Questions

To investigate whether there were predictive relationships between basic science course final exam content area performance and NPLEX I performance I explored questions that focused on the five basic science content areas covered on NPLEX I. Since the number of students who took NPLEX I at each administration differed due to entry cohort size, transfer students, and students who chose not to release their scores to SVC the NPLEX I administration was controlled for in each analysis. The questions explored are outlined as follows.

After controlling for NPLEX I administration, what is the predictive relationship between the students' group of:

- microbiology content area final exam scores and the students' first NPLEX I subscore on the first attempt?
- pathologyplus content area final exam scores and the students' first NPLEX I subscore on the first attempt?
- anatomy content area final exam scores and the students' second NPLEX I subscore on the first attempt?

- physiology content area final exam scores and the students' second NPLEX I subscore on the first attempt?
- biochemistry content area final exam scores and the students' second NPLEX I subscore on the first attempt?

Data Analysis

I used a correlational research design to detect data trends and patterns that could be used to identify whether predictive relationships existed between basic science content area final exam scores and first and second NPLEX I subscores (Creswell, 2012; Creswell & Plano-Clark, 2011; Lodico et al., 2010). I analyzed individual student's basic science content area final exam scores against their respective NPLEX I subscores. I used a hierarchical logistic regression analysis to account for the unequal number of participants per NPLEX I exam, which allowed possible effects that an unequal number of participants per NPLEX I exam may have on the results (Pole & Bondy, 2010; University of Colorado Denver, n.d.). I used backward stepwise logistic regression; each content area was deleted one by one to improve the model until no more improvements were provided. I conducted a total of two analyses. The first analysis included the microbiology score and the pathologyplus score and the NPLEX I subscore related to the disease/dysfunction subscore area. The pathology content could not be separated from the General Medical Diagnosis courses. Therefore, in order to obtain data on this content area I used the entire final exam score from the General Medical Diagnosis courses in place of the pathology content scores, and refer to them as pathologyplus. I decided to do this since the pathology content was also integrated with other content areas at a majority of the CNME accredited schools of naturopathic medicine (Bastyr University, 2015; BINM, 2015; CCNM, 2015; NUHS, 2015; NUNM, 2016; SCNM, 2015; University of Bridgeport, 2015). The second analysis included the anatomy score, physiology score, and biochemistry score and NPLEX I subscore related to the structure/function subscore area.

Findings

The results of the first analysis, which compared the microbiology score and the pathologyplus score to the disease/dysfunction NPLEX I subscore, while controlling for NPLEX I administration, were as follows. First, differences in NPLEX I administration were indicated. Students who took NPLEX I during the August 2015 administration had a 62.5% increase in the odds of passing the first NPLEX I subscore than students who took NPLEX I during the August 2014 administration. Students who took NPLEX I during the August 2015 administration had a 74% increase in the odds of passing the first NPLEX I subscore than students who took NPLEX I during the August 2013 administration. It is unknown to what the differences in NPLEX I scores between administrations may be attributed. The results also indicated that the microbiology content area final exam scores were not significant predictors of performance on the disease/dysfunction subscore area of NPLEX I. However, the pathologyplus content area final exam scores were indicated as significant predictors of performance on the disease/dysfunction subscore area of NPLEX I. Favoring a positive relationship, for every one unit increase in pathologyplus final exam scores the odds of passing the disease/dysfunction subscore area of NPLEX I increases by 10.68%.

The results of the second analysis, which compared the anatomy score, physiology score, and biochemistry score to the structure/function NPLEX I subscore, while controlling for NPLEX I administration, were as follows. First, differences were not indicated between the August 2015 and August 2014 NPLEX I administrations. Students who took NPLEX I during the August 2015 NPLEX I administration had an equal likelihood of passing the structure/function NPLEX I subscore as the students who took NPLEX I during the August 2014 administration. However, differences were indicated between the August 2015 and August 2013 NPLEX I administrations. Students who took NPLEX I during the August 2015 administration had an 88% increase in the odds of passing the second NPLEX I subscore than students who took NPLEX I during the August 2013 administration. It is unknown to what the differences in NPLEX I scores between administrations may be attributed. The results also indicate that the biochemistry content area final exam scores were not significant predictors of performance on the structure/function subscore area of NPLEX I. However, anatomy and physiology were indicated as significant predictors of performance on the structure/function subscore area of NPLEX I. Favoring a positive relationship for anatomy; for every one unit increase in anatomy final exam scores the odds of passing the structure/function subscore area of NPLEX I increase by 10.22%. Also, favoring a positive relationship, for every one unit increase in physiology final exam scores, the odds of passing the structure/function subscore area of NPLEX I increase by 10.58%.

Curriculum Mapping Literature

The literature on curriculum mapping provided evidence of the benefits that curriculum mapping can bring to institutions and programs. Curriculum mapping has been used by a diverse number of institutions and fields to develop, implement, and maintain continuous curricular improvement for program improvement; resulting in positive and beneficial impacts to institutions and professions (Lam & Tsui, 2013; Lam & Tsui, 2014, Landry et al., 2011; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Zelenitsky, Vercaigne, Davies, Davis, Renaud, & Kristjanson, 2014). For instance, curriculum mapping has been used to:

- demonstrate and maintain curricular alignment (Arafeh, 2016; Dexter et al., 2012; Lam & Tsui, 2013; Lam & Tsui, 2014; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Wells, Benn, & Warber, 2015; Zelenitsky et al., 2014).
- assess the completeness of curriculum to licensing exam coverage (Dexter et al., 2012; Geist & Catlette, 2014; Landry et al., 2011; Lawson et al., 2011; Mahboob & Evans, 2015; Miller, & Neyer, 2016; Steketee, 2015).
- identify where specific skills are covered within the curriculum, including “intended,” “taught” and “received” outcomes (Kris-Etherton, et al., 2015; Mahboob & Evans, 2015; Miller and Neyer, 2016; Schafheutle, Hassell, Ashcroft, & Harrison, 2013; Vaitsis, Nilsson, & Zary, 2014).

- make evidence based decisions regarding curricular changes (Arafeh, 2016; Komenda, Vita, Vaitsis, Schwarz, Pokorná, Zary, et al., 2015; Lam & Tsui, 2013; Lam & Tsui, 2014; Zelenitsky et al., 2014).
- improve academic performance (Allen-Ramdial & Campbell, 2014; Geist & Catlette, 2014; Sarkisian & Taylor, 2013).

Specifically, useful policy, content, and instruction suggestions for improvements in courses and programs, and a process of continuous curricular improvement in a doctor of education program resulted from curriculum mapping (Arafeh, 2016). The results of a curriculum mapping process used by Dexter et al. (2012) to assess whether a medical curriculum had sufficient USMLE I topic coverage resulted in a computer-based tool used to improve their content-tracking capability (Dexter et al., 2012). The alignment of curriculum objectives between two education programs enhanced the effectiveness of the overall curriculum (Lam & Tsui, 2013). Curriculum mapping was also used by an undergraduate psychology program to transform the first-year curriculum by identifying gaps between expectations and experiences, demonstrating achievement of learning outcomes and performance requirements, as well as engaging faculty in curriculum innovation (Mancuso & Desmara, 2014). Additionally, in response to accreditor requests, and as a result of curriculum mapping, a medical program created an in-house system to demonstrate how and when their student outcomes were integrated into their medical curriculum (Steketee, 2015). Furthermore, mapping in a number of curriculum mapping projects resulted in the creation of an overall process for which continuous curricular improvements could be maintained (Arafeh, 2016; Dexter et al., 2012; Lam & Tsui, 2013; Lam & Tsui, 2014; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Wells et al., 2015; Zelenitsky et al., 2014).

Curriculum mapping has been used to identify where specific learning outcomes related to professionalism were covered and where they needed to be revised (Mahboob & Evans, 2015). Curriculum mapping has also been used to identify and promote analytical reasoning throughout the curriculum (Vaitsis et al., 2014). Another program used curriculum mapping to embed nutrition competencies within the program curricula to ensure all medical graduates were “nutritionally competent” (Kris-Etherton, et al., 2015, p. 85). A graduate psychology program’s increased transparency in the learning environment that helped teacher’s better prepare students also resulted from a curriculum mapping project (Sarkisian & Taylor, 2013). The curriculum mapping process used by Lam and Tsui (2013) to compare coverage of student learning outcomes between two education programs was found to be helpful when preparing for course development or re-development, and added meaning to the process of learning and teaching (Lam & Tsui, 2013). A year later, Lam and Tsui (2014) used curriculum mapping to establish more concise guidelines for conducting content analysis and course development process in a teacher education program (Lam & Tsui, 2014). According to Zelenitsky et al. (2014), the curriculum mapping process used within a pharmacy program “provided a systematic approach and common language for discussing, analyzing, and modifying the curriculum” (p. 5).

Geist and Catlette (2014) suggested that curriculum maps can help faculty identify licensing exam activities and standards and competencies that are not met in the curriculum. Geist and Catlette (2014) also suggested aligning curricula with licensing standards can help increase first-time pass rates on licensing exams. Curriculum mapping has also provided a means for competencies to be effectively embed into the curricula to ensure medical school graduates are "competent" (Kris-Etherton, et al., 2015). Curriculum mapping has resulted in the revision of courses to incorporate missing standards, which have improved the program and helped teacher's better prepare students (Landry et al., 2011; Sarkisian & Taylor, 2013). Based on the literature, curriculum mapping usually involves some form of evidence gathering, demonstration of achievement of learning outcomes and performance requirements, the identification of gaps between expectations and experiences, faculty engagement, and creating a process used to maintain an overall process of continuous curricular improvement. Therefore, I recommend SVC implement a curriculum mapping process within the Department of Basic Medical Sciences. A curriculum mapping process would provide a systematic approach for identifying gaps between the basic science course objectives and the NPLEX I competencies. It would also provide a means for monitoring whether the basic science curriculum is teaching to achieve the appropriate competencies needed to pass NPLEX I, and improve the coverage of content taught in the naturopathic basic science curriculum at SVC to increase students' preparation for NPLEX I.

Recommendation and Purpose

The results of this study showed three of the five basic science content areas (pathologyplus, anatomy and physiology) were predictive of NPLEX I performance. However, since NPLEX I is designed to assess knowledge of anatomy, physiology, biochemistry, genetics, microbiology, immunology, and pathology it is unclear to me why some basic science content areas were shown to be predictors of NPLEX I performance and other were not. To gain a better understanding of the findings in this study I suggest implementing a curriculum mapping process with the Department of Basic Medical Sciences to analyze the course outcomes of each basic science course and the competencies listed in the NPLEX I blueprint.

A curriculum mapping project would provide a systematic approach for identifying gaps between the basic science course outcomes and the NPLEX I competencies at SVC. It would also provide a means for monitoring whether the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. It could provide a means for improving the coverage of content taught in the naturopathic basic science curriculum at SVC, such as adding missing content or going into more detail on specific content within the curriculum. Furthermore, addressing any gaps between the basic science course outcomes and the NPLEX I competencies may better prepare students for NPLEX I and may potentially be used to make all basic science course content area final exams better predictors of NPLEX I performance. I recommend the curriculum mapping process fall under the purview of the Academic Affairs Department, and be developed, implemented, and maintained in collaboration with the members of the Academic Affairs Department and Department of Basic Medical Sciences at SVC.

The objective of the curriculum mapping process is to examine and align the naturopathic basic science course outcomes contained in each syllabus to the competencies contained in the NPLEX I blueprint. The purpose of this objective is to identify gaps between the basic science course outcomes and the NPLEX I competencies. The objective of identifying these gaps is to revise or develop courses in order to incorporate the missing competencies into the appropriate basic science courses. The objective of incorporating the missing competencies is to improve student preparations or competencies in basic science courses to increase student's performance on NPLEX I and help address the problem of low fist-time pass rates on NPLEX I. What follows are recommended guidelines for the development, implementation, and maintenance of the curriculum mapping process at SVC.

Proposed Project Guidelines

Development

The proposed guidelines for planning the curriculum mapping process involve engaging a diverse group of participants including faculty, students, and administrators (Ellaway, Albright, Smothers, Camerson, & Willett, 2014; Lawson et al., 2011; Sarkisian & Taylor, 2013). Faculty can provide insight into the curriculum that is being taught and help clarify assumptions about what students are intended to learn and what they are actually learning (Sarkisian & Taylor, 2013). Students can contribute "a more complete understanding of how students learn what they learn" to the curriculum mapping process (Sarkisian & Taylor, 2013, p. 8). Administrators can provide added support, communication, and help encourage buy-in to the curriculum mapping process (Buchanan, Webb, Houk & Tingelstad, 2015; Shilling, 2013; Watts & Hodgson, 2015). Furthermore, the process should be collaborative and all participants should be reminded to maintain a professional dialogue throughout the process (Lawson et al., 2011; Shilling, 2013).

Prior to beginning the curriculum mapping process, the amount of time and resources involved in the process should be explained to the participants (Ervin, Carter & Robinson, 2013). Participants should have a thorough understanding of the intended process and purpose of the curriculum mapping project, and the materials used for the process so that informed decisions can be made (Ervin et al., 2013; Spencer, Riddle, & Knewstubb, 2012). The project proposed for SVC would involve approximately forty to fifty hours for faculty to complete the mapping activities plus roughly eight to ten hours for meetings over a nine month period. The amount of time required by each participant, depending on their role, and the resources required for the process would be explained during the initial kick-off meeting. Students would not participate in the mapping activities, therefore their time requirements would be limited to the eight to ten hours for meetings. However, the time requirements of the administrators and project manager may vary depending on the support that is needed by each participant. The participants would be introduced to the purpose and materials used for the curriculum mapping process as well as provided training on how to construct a curriculum map during the kick-off meeting,. Additional meetings and support would also be provided to participants as needed throughout the curriculum mapping process so they continue to have a thorough understanding of what the process is and why it’s important.

The proposed curriculum mapping project includes several meetings, including a two-hour kick-off meeting, a four-hour strategy meeting, a two-hour proposal meeting, follow-up meetings as needed and a thirty-minute proposal presentation. In addition to the time allotted for the mapping activities, the project also includes a two-week period for participants to gather additional information to address or support the proposed curricular changes that result from this project. Furthermore, the proposed timeline also allows time for the proposed curricular changes to be developed during May 2017 through September 2017 so potential changes could be implemented in October 2017 at the beginning of the next academic year.

Implementation

I recommend approaching the curriculum mapping project by mapping the basic science course outcomes to the NPLEX I blueprint competencies. Since the faculty will only be mapping the outcomes listed on the syllabi and not mapping every content item covered in the course I anticipate the curriculum mapping process will be less time-consuming. Although, this approach may not capture all content items covered in courses I chose to start with a less time-consuming approach in hopes that it may contribute to the success of the project and elicit more faculty buy-in and commitment to the project. The process used for this portion could eventually be expanded to include specific content, tasks, and assessments or expanded to other departments or the entire curriculum. To identify content not listed in the course outcomes of syllabi may require multiple faculty content experts to collaborate, which can be time consuming (Buchanan et al., 2015). Since mapping the basic science course outcomes listed on syllabi to the NPLEX I competencies listed on the blueprint should not require collaboration by multiple faculty less time may be required, which could allow more time for reflection, problem solving, and strategies for content integration (Buchanan et al., 2015; Zelenitsky et al., 2014). Either way, faculty support, communication, and buy-in to the project will be key to the curriculum mapping process (Buchanan et al., 2015; Shilling, 2013; Watts & Hodgson, 2015). It is not uncommon to encounter inconsistent levels of cooperation, communication, buy-in, and commitment or time constraints from participants during the curriculum mapping process (Buchanan et al., 2015; Ervin et al., 2013). However, in choosing to start with a less time-consuming approach and soliciting Academic Affairs administrators to assist me in encouraging and supporting commitment and buy-in to the project it is my hope that inconsistent levels of cooperation, communication, buy-in, and commitment from participants would be minimal.

To facilitate the implementation of the curriculum mapping project participants would be provided consistent and adequate resources, support and leadership, consistent communication and monitoring throughout the project (Shilling, 2013). Curriculum mapping materials and training on how to construct a curriculum map would be provided during the kick-off meeting. Specifically, links to the materials and resources, such as the basic science course syllabi, program level outcomes, administrative directives (strategic plan), and licensing exam (NPLEX I) competencies needed to complete the curriculum mapping process would be provided to each participant during the kick-off meeting (Curtis, 2014; Mancuso & Desmara, 2014; Buchanan et al., 2015; Sarkisian & Taylor, 2013). These resources would be posted on the internal project page of which all participants would have access.

Maintenance

The resulting curriculum map for this project would cover the basic science course outcomes listed in the syllabi and the NPLEX I competencies listed in the blueprint (Lawson et al., 2011). When assessing the completed map, participants should utilize "critical thinking, judgement, moral development, creativity, reflective practice, social and emotional intelligence, problem solving, and communication" to identify and develop potential strategies for curricular change (Watts & Hodgson, 2015, p.686-687) Participants should also consider the linkage of outcomes, the progressive nature of the outcomes as well as the sustainability of maintaining the map (Lawson, et al., 2011). Sustainability of maintaining the map involves assuring that the process does not rely on one person or resource for its maintenance (Ervin et al., 2013). Maintaining the map also means maintaining alignment with the NPLEX I blueprint. Therefore, maintaining the map means creating a process from which continuous curricular improvements could be maintained (Arafeh, 2016; Dexter et al., 2012; Lam & Tsui, 2013; Lam & Tsui, 2014; Mancuso & Desmara, 2014; Sarkisian & Taylor, 2013; Steketee, 2015; Wells et al., 2015; Zelenitsky et al., 2014). The proposal created at the end of the curriculum mapping project would include recommendations for curricular changes and an ongoing process for maintaining curricular alignment.

Conclusion

The research outlined within this position paper supports the recommendation to implement an ongoing curriculum mapping process at SVC to monitor whether the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. The literature review included ideas for best practices for the curriculum mapping process that have been recommended as guidelines. The objective of the guidelines proposed in this position paper are intended to help SVC develop a curriculum mapping process that could provide a means for ensuring the basic science curriculum is teaching students to achieve the appropriate competencies needed to pass NPLEX I. An additional objective of these guidelines is to help improve the coverage of content taught in the naturopathic basic science curriculum, which could better prepare students for NPLEX I and may potentially be used to make all basic science course content area final exams better predictors of NPLEX I performance. Furthermore, the implementation of a curriculum mapping process and potential increase in NPLEX I performance have the potential for positive social change implications that could benefit schools of naturopathic medicine and the academic performance of naturopathic medical students, which may include a positive impact on the reputation of the schools and profession of naturopathic medicine.

From a larger context, the results of this project could also generate interest from other schools of naturopathic medicine. Specifically, if NPLEX I performance improves as a result of this project, other schools of naturopathic medicine could implement similar processes that might also increase NPLEX I performance at their schools. The results of other schools implementing similar process could have a significant impact on the number of competent physicians licensed to practice naturopathic medicine. An increased number of competent physicians licensed to practice naturopathic medicine could also increase the number of patients who are treated by naturopathic physicians. The increased number of patients could also increase the exposure and reputation of the profession of naturopathic medicine. Therefore, the implementation of the curriculum mapping process within the Department of Basic Medical Sciences is recommended to help address the problem of low first-time pass rates on NPLEX I at SVC.

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Curriculum Mapping Project Materials

Invitation Email to Participants (Proposed)

January 3, 2017

Dear __________,

We hope this email finds you well. We would like to invite you to participate in an opportunity to help solve a problem that has been troubling the institution for years. The opportunity is a curriculum mapping project that will involve faculty from the Department of Basic Medical Sciences, members of the Academic Affairs Department, and students. This project will involve aligning the basic science course outcomes to the NPLEX I competencies. The duration of the project is expected to extend from January 2017 to April 2017.

The purpose of this project is to help address the problem of low first-time pass rates on NPLEX I. This is a chance for faculty, administration, and students to collaborate to develop strategies to improve the coverage of content taught in the naturopathic basic science curriculum that could potentially better prepare students for NPLEX I.

We look forward to working with all of you on this project. A calendar invite will be sent shortly inviting you to attend a kick-off meeting that will introduce the curriculum mapping project, the proposed process, materials and resources, as well as the projected project timeline.

Thank-you,
Tammy M. Aragon
Director of Academic Assessment and Program Development
&
Garrett Thompson, PhD, DC
Dean of Academic Affairs

Kick-Off Meeting Agenda (Proposed)

January 10, 2017

1. Welcome

2. Results of Doctoral Study

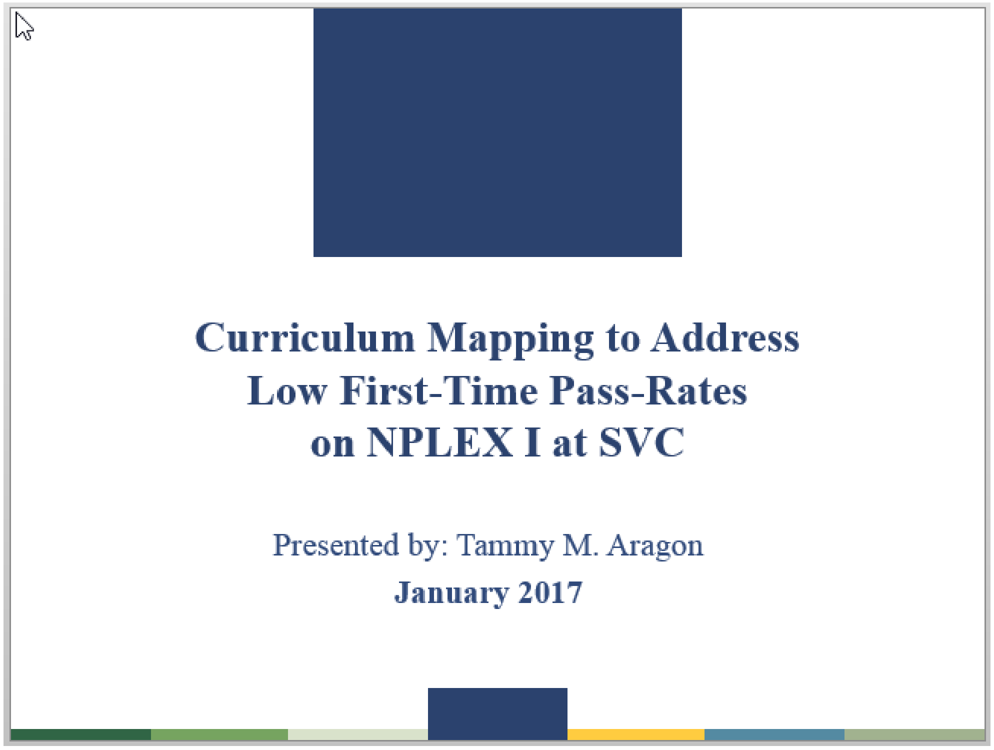
3. Introduction to Curriculum Mapping
    a. Common Uses
    b. Purpose

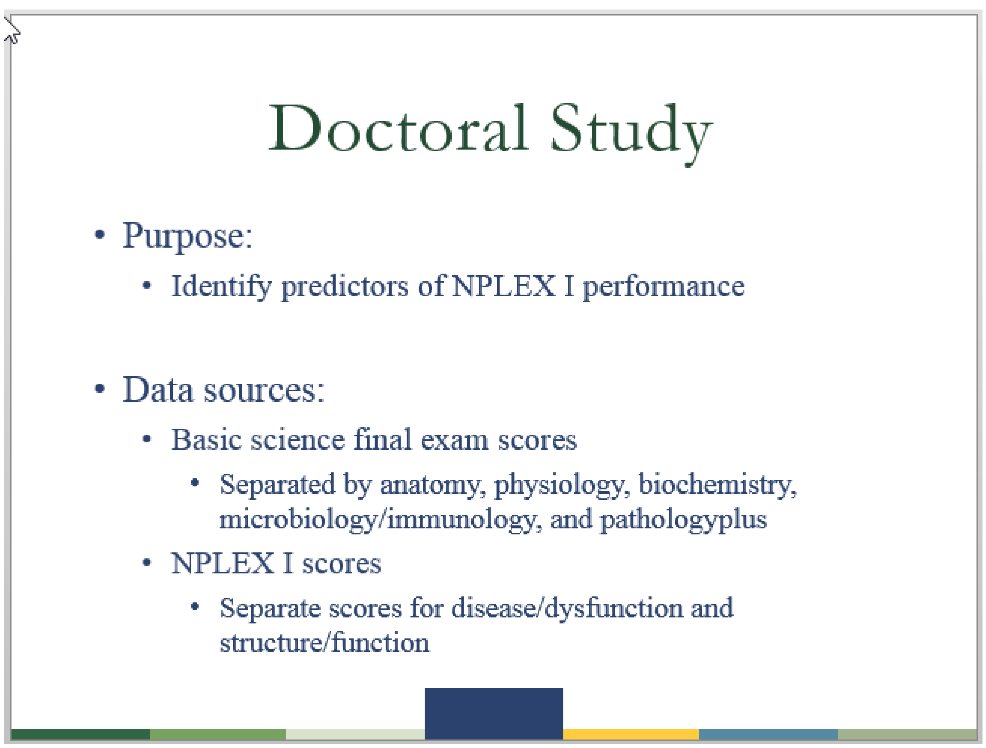
4. Overview of Curriculum Mapping Project at SVC
    a. Purpose
    b. Participants
    c. Time commitment

5. Project Timeline
    a. Meeting objectives
    b. Participants

6. Review Resources
    a. Basic science course syllabi
    b. NPLEX I competencies
    c. Program level outcomes (SLOs)
    d. Strategic plan
    e. Curriculum mapping examples
    f. Curriculum mapping template

Kick-Off Meeting Presentation (Proposed)





Doctoral Study Results

- Results:
  - PathologyPlus (GNMD courses)
    - Odds of passing disease/dysfunction increase by 10.68%
  - Anatomy
    - Odds of passing structure/function increase by 10.22%
  - Physiology
    - Odds of passing structure/function increase by 10.58%
  - Biochemistry and Microbiology/Immunology
    - Not predictors
- Solution:
  - Identify gaps between basic science course outcomes and NPLEX I competencies

Curriculum Mapping

Curriculum mapping is a process in which the relationships between courses, activities, outcomes, objectives, and goals are linked, resulting in a map of the relationships between each of these within the curriculum (Sarkisian & Taylor, 2013).

Curriculum Mapping

Common Uses:

- Audit curriculum
- Identify gaps in curriculum
- Demonstrate curricular alignment
  - Student learning outcomes (SLOs)
  - Accreditation standards
  - Program competencies
  - Licensing exam competencies
- Identify where specific outcomes are covered
  - "Intended," "taught," and "received" outcomes

Curriculum Mapping

Purpose:

- Increase curricular alignment (close gaps)
  - Enhance outcomes
    - Student learning outcomes
    - Program competencies
    - NPLEX I competencies
  - Course development or redevelopment
    - Increase or modify learning outcomes
    - Increase or modify assessments
    - Increase or modify content coverage
      - Add missing content
      - Spend more time on, go into more detail on specific content
- Satisfy accreditation standards
- Faculty development

Project Overview

Project:

- Map the basic science course outcomes to the NPLEX I competencies

Purpose:

- Identify gaps in curriculum
- Identify strategies to increase curricular alignment
  - Increase or modify learning outcomes
  - Increase or modify assessments
  - Increase or modify content coverage
    - Add missing content
    - Go into more detail on specific content
- Address low-first-time pass-rates on NPLEX I

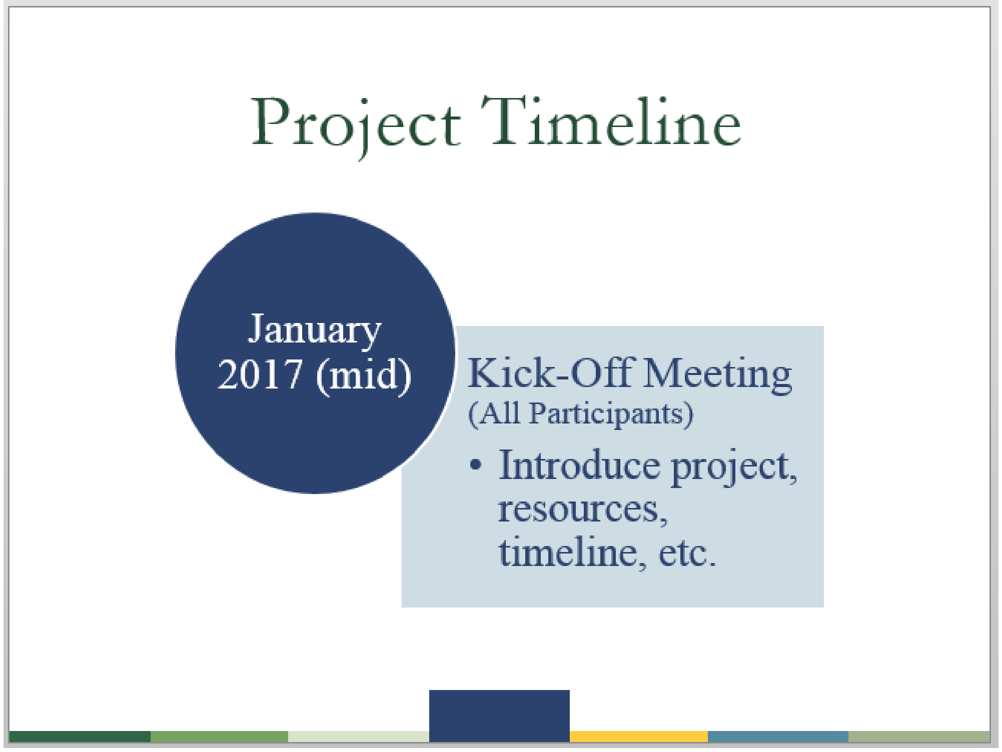
Project Overview

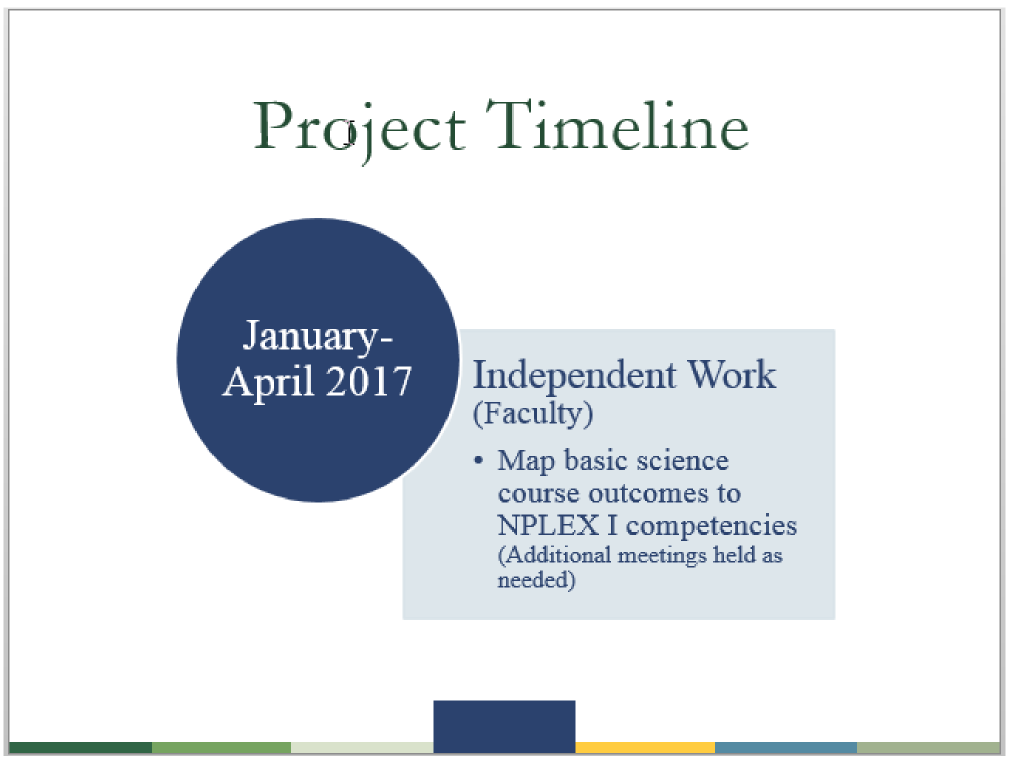
Participants & Roles:

- 4-6 Basic Science Faculty Members (mapping/strategy)
- 1-2 Students (strategy)
- 2 Administrators (support/strategy)
- 1 Project Manager (oversight)

Time Commitment (~ 9 months):

- Faculty: 40-50 hours (Jan – Apr)
- Students: 8-10 hours (Jan, Apr)
- Administrators: ~8-50 hours (Jan – Apr)
- Project Manager: ~8-50 hours (Jan – Apr)


Project Timeline
January 2017 (mid)
Kick-Off Meeting
(All Participants)
• Introduce project, resources, timeline, etc.


Project Timeline
January-April 2017
Independent Work
(Faculty)
• Map basic science course outcomes to NPLEX I competencies
(Additional meetings held as needed)


Project Timeline
April 2017 (mid)
Strategy Meeting
(All Participants)
• Review the completed map
• Discuss gaps
• Identify curriculum improvement changes


Project Timeline
April 2017 (mid-late)
Independent Work
(All Participants)
• Gather additional information to address/support changes (Additional meetings held as needed)


Project Timeline
April 2017
(late)
Proposal Meeting
(All Participants)
• Create proposal for curriculum changes


Project Timeline
April 2017
(late)
Presentation
(Project Manager)
• Present proposal
• Curriculum development
(May –September)

Project Timeline

October 2017

Implementation
(Faculty/Administration)

- Implement proposed curriculum changes

Resources

Material & Resource Links:

- Basic science course syllabi
- NPLEX I competencies
- Program level outcomes (SLOs)
- Strategic plan
- Curriculum mapping examples
- Curriculum mapping template


Questions
Contact:
Tammy M. Aragon
tammy.aragon@waldenu.edu
480-242-6199

Curriculum Mapping Project Timeline (Proposed)

Curriculum Mapping Project Evaluation Survey (Proposed)

Thank-you for participating in the curriculum mapping process! Please take a moment to share your feedback about this process.

1. Participating in the curriculum mapping project helped me understand how each basic science course fits into the bigger picture of naturopathic education. (If you answered strongly disagree or disagree please indicate how it can be improved)

   ☐Strongly Disagree ☐Disagree ☐Neutral ☐Agree ☐Strongly Agree

   Comments:
   ____
   ____

2. Participating in the curriculum mapping project helped me understand the benefits of curriculum mapping. (If you answered strongly disagree or disagree please indicate how it can be improved)

   ☐Strongly Disagree ☐Disagree ☐Neutral ☐Agree ☐Strongly Agree

   Comments:
   ____
   ____

3. List two things about this process you found beneficial.
   ____
   ____
   ____

4. List two areas of improvement you would like to see integrated into this process.
   ____
   ____
   ____

Thank-You for Your Feedback!