LEARNING STYLE, SEAT PREFERENCE, AND PAST PROFESSION: PREDICTING TRADITIONAL OSTEOPATHIC STUDENT ACHIEVEMENT

by

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Abstract

The study was designed to examine the predictive relationship between the variables of seat preference, learning style, and past profession, and student achievement. A convenience sample of N = 248 traditional manual osteopathic students of two Canadian and one Swiss accredited English speaking part-time colleges was recruited for the quasi-experimental predictive study. The participants were adult learners ranging in age from 20 – 69 years with 71% of the sample being female in accordance to the population demographic. The data collection included grade score, learning style as measured by the Learning Style Inventory (LSI 3.1), and a researcher designed survey, Demographic and Seat Preference Survey (DSPS), which gathered information on age, past profession, education, sensory deficits, and seat preferences of three seat diagrams. A multiple regression analysis was used to create the predictive equation. The variables seat preference, learning style, and past profession statistically predicted student achievement $R^2 = .10$, $F(10, 217) = 2.33$, $p = .01$, power .92. The specific variables action seat in the 10 X 5 seating plan $b_{1\ 10X5AS} = 2.91$, $t(217) = 2.51$, $p = .01$, 95%CI[0.63, 5.20]; the professions of athletic therapy $b_{2\ AT} = 4.60$, $t(217) = 2.77$, $p = .01$, 95%CI[1.33, 7.86], Nurse/kinesiologist/occupational therapist $b_{2\ NR/KIN/OT} = 4.10$, $t(217) = 2.54$, $p = .01$, 95%CI[0.92, 7.27], and Other profession $b_{2\ OTHER} = 3.48$, $t(217) = 2.26$, $p = .03$, 95%CI[0.45, 6.52]; and the diverging learning style $b_{5diverging} = -3.03$, $t(217) = -2.13$, $p = .03$, [-5.83, -0.23] contributed significantly to the prediction. In pair-wise comparisons there were significant ($p < .05$) differences in mean achievement scores between the professions of athletic therapists, nurse/kinesiologists/occupational therapists, and other professions, and medical doctor/osteopathic physician/dentist, and massage therapists;

between students preferring the assimilating learning style and students preferring the diverging learning style; and between the 10 X 5 action seats and non-action seats. The findings of the study support the predictive nature of past professions, learning style, and action seat preference in an English-speaking accredited part-time traditional manual osteopathic program. Recommendations for continued data collection and investigating the variables of first language and campus location are made.

Dedication

This dissertation is dedicated to my family: my parents, Reg and Edna, for their positive nature and love; my son, Kirk, for the opportunity to model lifelong learning; and my brothers, Dan, Kirk, and Phillip, for their constancy. You all helped mould me and for that I am eternally grateful.

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CHAPTER 1. INTRODUCTION

Introduction to the Problem

Can seat preference, past profession, and learning style predict student achievement? The learners studying traditional manual osteopathy in part-time accredited programs have varied knowledge bases, learning styles, and professional backgrounds. At present, there is a paucity of academic achievement predictive studies in the traditional osteopathic educational literature to provide evidence for seat preference, past profession – experience, knowledge base, and self-efficacy – or learning styles as factors for success.

Previously, researchers have examined a number of predictive factors of academic success and achievement in healthcare curriculums; however, the three variables of this study have not been sufficiently addressed. Published studies included such predictive factors as undergraduate grade point average (UGPA) (Burns, 2011; Jewell & Riddle, 2005; Lysaght, Donnelly, & Villeneuve, 2009; Sansgiry, Bhosle, & Sail, 2006; Seago, Keane, Chen, Spetz, & Grumbach, 2012; Utzman, Riddle, & Jewell, 2007; Ward, Downey, Thompson, & Collins, 2010); learning style (Gurpinar, Alimoglu, Mamakli, & Aktekin, 2010); test competence, test anxiety, and time management (Sansgiry et al., 2006); and past academic performance and self-efficacy (Peterson, 2009; Seago et al., 2012). Of the studied factors only UGPA, past academic performance, and self-efficacy

are established as statistically significant reliable predictors of student success. In addition, UGPA has been linked to seat preference as another factor in student achievement (Perkins & Wieman, 2005; Tagliacollo, Volpato, & Pereira Jr., 2010; Zomorodian et al., 2012), but the factor of seat preference has not been studied in the traditional osteopathic literature.

Using UGPA and past academic performance as admission criteria does not give credit to an adult applicant for the experience gained through professional activities or life events. As such, UGPA should not be the only factor upon which to base admissions criteria in a post-graduate program. Exploring previously studied factors such as learning styles and seat preference is justified due to the dearth of these topics in the literature regarding predictive factors. In addition, given the nature of adult learning and the associated acknowledgement of experience as learning, adding past profession, which indirectly represents past academic achievement, is an appropriate course of action in an adult learner program.

There are myriad of nursing education predictive studies in the literature. Physical therapy, occupational therapy, pharmacy, dental hygiene, and medicine educational studies are also prevalent and indicate UGPA as the one common predictor of future academic success. However, traditional osteopathic educational literature is sparse and predictive studies in the field are elusive to the researcher. When considering the lack of educational and predictive studies in traditional osteopathic medicine and faculty concerns over student achievement, a study that provides information on predictive factors of past profession, learning style, and seat preference is warranted.

As this study involved three countries with varied practices of osteopathy and definitions, ensuring clarity is critical. The subjects of this study attend accredited part-time traditional manual osteopathic programs in Canada and Switzerland while the Canadian researcher is attending an educational institution in the United States. As such, for the purposes of this study, it is helpful to examine the precise nature of the subject pool, students of traditional osteopathic practice, and the term traditional osteopathy.

The subjects of this study, students of traditional osteopathy in the accredited part-time program, are working professionals, aged mid-20 to mid-60, returning to formal education and embarking on the journey to a new profession. In terms of for this study, the accredited program is a five-year, 1800-hour, part-time program of classroom and clinical study in anatomy, physiology, application of manual therapy tests and techniques, and treatment methodology. The program culminates in an additional two years of independent research for a total of 2500 credit hours.

Traditional osteopathy is the manual method of practicing osteopathy first developed by Andrew Taylor Still in 1874 (Trowbridge, 1991). In the United States (US), the title "osteopath" is legislated to osteopathic physicians (DOs) who have graduated from osteopathic medical schools. The curriculum in the US osteopathic medical schools is predominantly allopathic with less than 300 hours of study related to the practice of traditional manual osteopathy and only fifty percent of US trained osteopathic physicians practice traditional osteopathy on less than five percent of their patients (Johnson & Kurtz, 2001). The subjects in this study are adult professionals returning to formal education to learn traditional manual osteopathic techniques and

treatment methodology in an accredited part-time program. The graduates of the studied program use the designation osteopathic manual practitioners (OMP) and are not physicians. As such, it is understandable that confusion abounds between the two forms of osteopathy and professional designations.

The research question was related to whether certain factors such as past profession, learning style, and seat preference can predict student achievement in a part-time traditional osteopathic program. The remainder of this chapter presents the background, context, and theoretical framework; statement of the problem; purpose of the study; research questions and hypotheses; rationale, relevance, and significance; nature of the study; definition of terms; and assumptions, limitations, and delimitations related to the study.

Background, Context, and Theoretical Framework

Adult learners in the traditional manual osteopathic part-time programs invest time and financial resources in their pursuit of an osteopathic profession over the course of seven years. At this time, there is no financial aid for students of the program and only a limited number of students receive financial support from their employers to attend. Considering the students' investment, these learners are deemed to be self-directed and motivated to learn. However, being motivated alone does not guarantee successful completion of the program or graduating as an osteopathic manual practitioner. In this section, the background of the problem and context of the study including a brief review of the predictive variables is presented. In order to provide a theoretical framework for this study and to guide interpretation of the results, three educational theories are

considered: social learning theory (Bandura, 1977); andragogy (Knowles, 1980); and experiential learning theory (Dewey, 1938; D. A. Kolb, 1984; Rogers, 1969; Rogers & Freiberg, 1994).

Background and Context

With a change in admissions criteria to allow for non-healthcare practitioner applicants and no change in curriculum at the studied campuses, faculty and students are concerned about the potential for decreased achievement levels. Not all students are successful in graduating from the accredited traditional manual osteopathic part-time programs in Canada and Switzerland. Moreover, those students who are successful report being overwhelmed by the material and challenged by the curriculum. The curriculum of the studied program was designed for a specific applicant; a licensed and practicing healthcare practitioner with a minimum educational level of a bachelor's degree and practicing a manual therapy. In the curriculum, each module builds upon the previous module. There are approximately six to eight weeks between modules, which permit the students time to integrate the new techniques and philosophy into their daily practices. In this manner, the students learn as they work in their active profession using manual therapy.

Although the curriculum remains unchanged, there was a change in admission criteria in the past four years. The admission criteria changed to a degree equivalent from a bachelor's degree, and the licensed healthcare practitioner requirement has been removed and replaced with increased supervised clinical hours within the program for non-healthcare practitioners. If the student is not working in a manual therapy setting, he

is no longer able to practice his newfound skills on a daily or weekly basis. Thus, the opportunity for repetition, application, and feedback through reassessment is not present. Students who do not have a degree do not have the experience of writing papers, nor do they have a presumed level of knowledge in anatomy, physiology, and pathophysiology that is required by the curriculum. As a result, the program is challenging for students who enter into the program with the presently acceptable admissions criteria.

Admissions criteria are used to recruit and admit students who have a knowledge base, intelligence, and/or achievement level that is predictive of successful completion of a program. "Recruiting and retaining students who are likely to succeed is an important goal" (Utzman et al., 2007, p. 1165) of any quality educational program. The concern of faculty is that the change in admissions criteria without a curricular change has altered the level of student achievement and challenged some students beyond their abilities.

Undergraduate GPA (UGPA) scores are identified in the literature as an appropriate predictor of future academic success and are used as a criterion in admissions in most institutions of higher learning and healthcare programs. However, UGPA scores do not incorporate life or work experience. In today's changing educational market, adult learners returning to formal education have life and work experience that should be considered as relevant and potentially predictive of future success. The faculty of the studied osteopathic colleges recognizes the experience and knowledge that an adult learner has acquired through life events and work. The admissions committee reviews an applicant's entire file, not just previous UGPA score when considering an applicant.

One may argue that not all students admitted to the program should become osteopathic practitioners. However, educational institutions have a responsibility to assist in the learners' academic pursuit once admitted to a program. "When students struggle academically, programs may use more resources in providing remedial learning experiences and ensuring student competence" (Utzman et al., 2007, p. 1165). Resources necessary to retain a student in academic difficulty in a part-time program are not always available for working professional students due to schedules and geography. Therefore, identifying variables that can predict student achievement could provide admissions committees with valuable information for admission's criteria, as well as educators with insight into the academic support needs of students early in the program.

Being cognizant of the student audience's learning styles may inspire the educator to seek out options for delivery of information and facilitation of learning. Being aware of seat preferences and participation rates related to seat locations might encourage the educator to purposefully engage regions in the classroom of low participation. Ensuring appropriate admissions criteria are established, and early and proactive intervention in the classroom or in academic assistance may promote student achievement and retention.

Each academic program is unique. "Because the prediction of student performance varies by program, individual institutions should study their own data to develop guidelines for predicting students' [achievement]" (Utzman et al., 2007, p. 1179). The researchable problem of this study is to determine if the variables of seat preference, past profession, and learning style are predictive of student success as

measured by grade score in the accredited traditional manual osteopathic part-time colleges studied.

Seat Preference. Does a student's seat preference provide insight into his or her abilities or motivation to learn? The literature regarding seat preference and its relation to various individual variables spans nearly a century. Such variables include GPA (Farnsworth, 1933; Griffith, 1921; Holliman & Anderson, 1986; Zomorodian et al., 2012); motivation (Çinar, 2010; Fernandes, Jinyan, & Rinaldo, 2011); participation (Ogilvie, 2008; Parker, Hoopes, & Eggett, 2011; Roxas, Carreon-Monterola, & Monterola, 2010; Wannarka & Ruhl, 2008); attendance (Perkins & Wieman, 2005; Tagliacollo et al., 2010); and personality (Akimoto, Sanbonmatsu, & Ho, 2000; Hillmann & Brooks, 1991; Totusek & Staton-Spicer, 1982). Interest in the topic has been sporadic but has recently regained favor among researchers with a number of dissertations and articles being written in the past five years (Brotherton, 2010; Ediger, 2009; Fernandes et al., 2011; Gordon, 2010; Hill & Epps, 2010; Jayaratne & Fernando, 2009; Kent, 2009; Miller Kregenow, Rogers, & Price, 2011; Ogilvie, 2008; Parker et al., 2011; Reilly, 2009; Rodway, Schepman, & Lambert, 2012; Roxas et al., 2010; Sabzevary, 2010; Schrieff, Tredoux, Finchilescu, & Dixon, 2010; Wannarka & Ruhl, 2008; Zomorodian et al., 2012).

Discrepancies exist in the literature regarding seat location and GPA. Some research has shown that students at the back of the class have lower levels of academic achievement measured by course grades and GPA than those who sit at or near the front (Benedict & Hoag, 2004; Griffith, 1921; Koneya, 1976; Zomorodian et al., 2012). In a

study involving a studio-style classroom with the instructor in the middle, seat location did not appear to be related to grade (Miller Kregenow et al., 2011). The authors of research regarding GPA and seat preference indicated that the students with higher GPAs preferred to sit at the front (Kalinowski & Taper, 2007). In studies that used randomly assigned seating arrangements, the variable of seat location had no effect upon grade thus indicating that it was the student's personal characteristics and abilities, and not the seat location that determined the grade (N. Armstrong & Chang, 2007; Kalinowski & Taper, 2007). Is it a factor of personality, motivation, gender, learning style, or the environment that students consider consciously or unconsciously when selecting their seats in a learning environment? The literature review in Chapter 2 provides a critical review of the more recent seat preference research in order to respond to the posed question.

Past Profession. The students who attend the part-time program are adult learners who come to the program with various healthcare and non-healthcare professional backgrounds. Many of the students have previous healthcare professions that involve a form of manual practice such as physical therapists, chiropractors, occupational therapists, athletic therapists, dentists, and massage therapists. Other learners, medical doctors, nurses, and kinesiologists, have healthcare education but do not use their hands as a form of manual treatment. Students with non-healthcare backgrounds work in communications, engineering, teaching, yoga instruction, dancing, research, biology, and psychology. The students study in part-time schools while continuing to work in their present professions. Based upon their educational and professional backgrounds, some students are better prepared for learning osteopathy.

A thorough knowledge of anatomy and physiology is critical as stated by the founder of osteopathy, who wrote:

> to be an Osteopath you must study and know the exact construction of the human body, the exact location of every bone, nerve, fiber, muscle, and organ, the origin, the course and flow of all the fluids of the body, the relation of each to the other, and the function each is to perform in perpetuating life and health. In addition you must have the skill and ability to enable you to detect the exact location of every obstruction to the regular movements of this grand machinery of life. (Still, 1908, p. 289)

Recognized learning theory indicates that successful adult learning involves adding information to an established knowledge base when learning new material (Knowles, 1980; Merriam, Caffarella, & Baumgartner, 2007). "Adult learners are likely to do better in learning concepts and principles that tie to their experience and allow them to expand existing knowledge" (Cozolino & Sprokay, 2006, p. 17). When considering adult learner academic achievement, learners who have a strong related knowledge base upon which to build new knowledge benefit from an acknowledged level of competence thus leading to increased self-esteem, self-efficacy, and motivation (Boström & Lassen, 2006; Cozolino & Sprokay, 2006; Schunk, 2008).

The traditional manual osteopathic part-time program's students are working professionals. To date, no published studies have been found regarding the academic achievements of traditional osteopathic part-time students with or without previous degrees or healthcare professions. Cognition of the extent to which previous knowledge and past profession determines academic achievement in this population will provide osteopathic educators with insight into the needs of these adult learners. Although the literature regarding the factor of past profession is sparse, past profession is significant as

a potential predictor of achievement and the complementary literature is reviewed in Chapter 2.

Learning Style. Each learner is an individual with his or her own preference of style or strategy for learning. Kolb's learning styles of assimilating, accommodating, converging, and diverging were chosen for this study. According to Kolb's Experiential Learning Theory (ELT), learners acquire information and construct knowledge through their own experiences and in relation to the environment (A. Kolb & Kolb, 2005b; D. A. Kolb, 1984). The learners who attend the traditional osteopathic part-time program have varied professional experiences including healthcare and non-healthcare fields. Each has an individual knowledge base and preferred manner by which to gain and integrate knowledge.

Based upon Kolb's original ELT, there are four methods of learning: assimilating, converging, accommodating, and diverging (A. Kolb & Kolb, 2005b). Assimilating learners are interested in abstract concepts and logical theories. The assimilating style learner prefers lectures, analysis of information, and requires time to assimilate the information and construct knowledge. Converging learners are technically oriented, less social in their learning process, and prefer to experiment or work with simulations. Accommodating learners enjoy problem solving within a group and use a trial and error methodology. They are practical in nature and do well with on-the-job training. Diverging learners relate well to brainstorming and reflection. Of the four learning styles, the diverging student is the most social and prefers group work and feedback.

Each learner has an individual preference by which to obtain information and consolidate learning.

"The more we know about the identity of the learner, the context of this learning, and the learning process itself, the better able we are to design effective learning experiences" (Merriam, 2004, p. 199). Being aware of the learning styles present in a classroom and the methods by which the learners with different styles attain information provides the facilitator with options for delivery. In the osteopathic program, information is delivered in mini-lectures, a manual test and technique are modeled, and the students then practice the manual test and technique on each other. By retesting, students acquire immediate feedback to their actions. By working with a partner, there is a component of brainstorming and social learning. Thus, the method of teaching traditional osteopathy should satisfy the needs of all learners with respect to ELT. Using evidence-based knowledge, grounded in theory, to promote learning is the role of the scholar-practitioner.

Theoretical Framework

Three theoretical frameworks provide a reference for the proposed study: social learning theory (SLT) (Bandura, 1977); andragogy (Knowles, 1980); and experiential learning theory (ELT) (Dewey, 1938; D. A. Kolb, 1984; Rogers, 1969; Rogers & Freiberg, 1994). The three frameworks identify the methods by which osteopathic and adult learning occurs. Student success and learning as measured by academic achievement rests in part upon the educational experience and environment generated by the facilitators. The osteopathic educator needs to be mindful of the methods of knowledge construction and facilitation to create an environment that meets the needs of

the adult learner. The combination of the three frameworks addresses the characteristics of the adult learner, the method of learning facilitation, and the environment created in which the learning experience can manifest and the student evolves into a professional.

Andragogy. Knowles' theory of andragogy is not so much a theory as it is a description of the characteristics or assumptions of the adult learner. According to Knowles (1980), "andragogy is simply another model of assumptions about learners to be used alongside the pedagogical model of assumptions" (p. 43). The assumptions of an adult learner are: he needs to know why he is learning a subject or content; one's self-concept moves towards self-directedness; experience is a rich resource; real-life roles predicate learning readiness; learning becomes life-centered; and external motivation is secondary to internal motivation (Knowles, Holton, & Swanson, 2005). Adult learners invest in meaningful learning related specifically to their life circumstances and this is true of the learners in the part-time osteopathic program.

In keeping with Knowles' characteristics of the adult learner, traditional manual osteopathic part-time students meet the definition of adult learners. The majority of the students are working healthcare professionals who have chosen to progress their skills and increase their knowledge in the field of osteopathy. Students working in a healthcare profession have a method to integrate osteopathic learning into their daily practice using their patients' experiences and presentations to consolidate the learned material. The students are motivated and directed in learning to improve their skills as practitioners and to help their patients. As professionals, students are seeking to improve not only their

skills, but also their person, which Rogers defined as self-actualization (Rogers, 1969; Schunk, 2008).

When dealing with adult learners, the theory of andragogy, as well as the other two theories addressed in this paper, safety is a critical component of the learning environment. The osteopathic program provides an environment in which to facilitate learning that permits the student to grow personally as well as professionally. In order for this to occur, a safe environment is physiologically and psychologically necessary (Kukolja, Thiel, Wolf, & Fink, 2008; Reeve & Tseng, 2011). As such, it is the responsibility of the learning institution to provide a safe environment that respects learners and faculty (Knowles, 1980; Rogers & Freiberg, 1994). Osteopathy as a profession and treatment methodology is a blend of mind, body, and spirit (Spaeth, 2000), and the osteopathic philosophy is in keeping with creating a safe environment in which learning or treatment is possible.

The subjects of this study meet the assumptions of the adult learner described by Knowles. Although andragogy is not considered a true educational theory by many, the characteristics of the learners are unique. Adult learners have jobs, families, and commitments outside of the classroom. Even with multiple life commitments, the adult learners in the osteopathic program are motivated to invest time, finances, and energy in their pursuit of a new profession.

Social learning theory. Social learning theory (SLT), also known as social cognitive theory, was developed by Bandura in the early 1960s and 1970s (Schunk, 2008), and is a significant theory used in osteopathic learning. SLT is based upon the

premise that learning occurs through observation, modeling, and is affected by self-efficacy and self-regulation. Learning is a result of interactions between the learner, the behavior of the learner and educator, and the environment.

In the osteopathic program, students are exposed to professors modeling clinical problem solving, manual tests and techniques, and professional behavior. Learning modules are a compilation of lecture theory and practice with manual tests and techniques demonstrated by the professor. Vicarious learning through modeling uses the sub processes of "attention, retention, production, and motivation" (Schunk, 2008, p. 128). In class and clinic, students are attentive and observe the modeled behavior of the techniques performed by the professor. Following the modeled technique, students then practice the skills under supervision with appropriate feedback thus facilitating retention and production.

The program also involves clinical internships, apprenticeship activities, during which students imitate osteopathic manual practitioners in a clinical forum with patients. Through the process of performing modeled tests and techniques, students receive immediate feedback from retesting physical findings after performing a technique as well as supervisor feedback. As a result of the retest feedback, learners can self-regulate their performance. Successful application of a technique or treatment plan by the learner or his classmates assists the learner in promoting his level of self-efficacy (Burke & Mancuso, 2012). A strong motivation to emulate the professor model provides an impetus for learning and the promotion of self-efficacy (Bandura, 1977).

In this study, past profession is considered as an experience and the professional success to date provides a learner with a level of self-efficacy that can be used in learning and in being motivated to learn. Depending upon the level of success, students are considered to have different levels of self-efficacy that will have an effect upon their learning (Phan, 2012). Having been through past educational experiences, self-regulation is also considered to be a skill possessed by adult learners. When combining self-efficacy with self-regulation, students have skills and motivation to attempt and complete a program similar to what they may have already experienced in an educational forum (Gore, 2006).

The osteopathic program applies SLT in the delivery and implementation of its curriculum. Through clinical internship and group problem solving, students gain practical experience in a social environment. Professional behavior and skills are demonstrated by instructors and fellow students in an apprenticeship model in keeping with SLT (Bandura, 1977). Students construct knowledge in osteopathy in a situated, social constructivist environment.

Experiential learning theory. A number of scholars participated in the development of ELT: Dewey, Lewin, Rogers, Piaget, Freire, and Kolb. Each contributed from personal frames to derive a theory based upon six propositions: (a) learning is a process, not an outcome; (b) learning is relearning; (c) learning requires conflict resolution; (d) learning is holistic; (e) learning involves the person and the environment; and (f) learning is knowledge construction (A. Kolb & Kolb, 2005b).

Experiences are components that when pieced together provide a frame in which learning can occur. Dewey stated "that every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after" (1938, p. 35). Learning in osteopathy is an example of modifying experiences through learning activities and emulating chosen characteristics and behaviors of peers and instructors. Each experience, in the classroom or with a patient, provides an opportunity to learn.

Merriam et al., (2007) furthered the notion of ELT when five conceptual frameworks within the theory and four methods of EL were presented. The frameworks are constructivism, situative, psychoanalytical, critical, and cultural. Constructivism reflects upon the experience in a critical manner to make meaning of the event. Situative theory incorporates the doing and knowing as related to a situation. Psychoanalytical theory involves the exploration of the learner's feelings. Questioning hegemonic assumptions defines critical cultural theory, and the study of cognitive and environmental relationships frames complexity theories. Reflective practice, situated cognition, cognitive apprenticeships, and anchored instruction rely on previous and present experiences gained through judgment, observation, participation, and action to move towards mastery. The constructivism framework and methods of learning are closely aligned with learning in healthcare and other professions requiring both mental and physical skills.

Kolb advanced ELT in the constructivist paradigm when he discussed that knowledge was created through grasping and transforming experience (A. Kolb & Kolb,

2005b). Grasping experiences are made up of concrete experience (CE) and abstract conceptualization (AC). Transforming experiences are made up of reflective observation (RO) and active experimentation (AE). In a continuous cycle of learning, students experience, reflect, think, and act. Kolb's approach is represented in a whole brain model of learning that relates the frontal cortex with abstract thinking, the pre-motor and motor cortices with acting, the sensory and associative cortices with experiencing, and the temporal cortex with reflecting (A. Kolb & Kolb, 2005b).

In the osteopathic program mentoring, problem solving, clinical apprenticeships, and collaborative learning methods are present and based in a holistic model. These methods incorporate learners' experiences to reflect, analyze, and reconstruct prior experiences to make meaning of events (Zepke & Leach, 2002). The program's curriculum and philosophy of holistic care enables students the opportunity for meaningful experiences, which can be reflected upon critically in an environment of mutual respect and safety. Each clinical case is an experience; "simply put, experiential learning is learning from experience" (Castelli, 2011, p. 18). Osteopathic learners use previous and new experiences to construct knowledge in the classroom and clinical apprenticeships.

In summary, three theories of learning are used to frame this study. Andragogy, SLT, and ELT define the characteristics and assumptions of the learners and methods by which osteopathic students in the part-time program construct knowledge. Learning occurs through modeled behavior in a safe environment that facilitates and generates the experiences necessary to create opportunities for reflection, observation, abstract thought,

and experimentation. The student population is represented by andragogy; the method of learning osteopathic techniques is represented by SLT; and the method by which a student becomes an osteopathic practitioner and professional is represented by ELT.

Statement of the Problem

A recent change in admission criteria at the studied colleges has created concerns for faculty regarding the potential success of students who enter the program with non-healthcare backgrounds. Faculty wants to be confident that the admissions criteria are predictive of academic and professional success in the program. The curriculum, which has not changed, was originally designed for practicing healthcare professionals with an assumed practicing competence level in pathophysiology, anatomy, and assessment skills. Presently, students with non-healthcare backgrounds are required to achieve passing grades in an online anatomy/physiology course prior to admission into the program. At present, the factors that influence success in the osteopathic program are unknown.

The researchable problem is determining the extent to which the variables of seat preference, learning style, and past profession predict traditional osteopathic part-time student achievement as defined by grade score. Seat preference has been related to GPA score; it has not been combined with other factors such as past profession or learning style to predict success of learners in the traditional accredited part-time osteopathic programs. In particular, there is a deficit in the literature regarding the predictive nature of learning style, seat preference, and achievement as related to the traditional osteopathic student. Identifying predictive variables that affect student success may assist professors

to alter delivery or facilitation methods to reach the osteopathic learner in a manner that promotes learning and thus academic achievement. The results of the study may also assist in revising admission criteria or promoting curriculum change.

Educators who have knowledge of some of the factors that predict student success in classrooms have the opportunity to identify and assist potentially at risk students. This study provides researchers with knowledge of factors predicting student success in the osteopathic program. Such knowledge can assist teachers and administrators. Teachers could identify students who would benefit from remedial intervention early in their academic program with the aim of promoting self-efficacy and self-regulation. Administrators could consider changes to admission criteria or the curriculum. Osteopathic educators need to find methods to reach all of the students in the classroom in order to facilitate the learning of future professionals.

Purpose of the Study

The purpose of this predictive study is to understand the interrelationships among seat preference, past profession, and learning style, and student achievement as measured by grade score. The statistical analysis provides evidence for the predictive relationship between past professional experiences, how students learn as measured by Kolb's Learning Style Inventory (LSI 3.1), seat preference, and student achievement in the program. The analysis develops a predictive equation based upon seat preference, learning style, and past profession. If a reliable equation is generated from the data, then there will exist the potential to identify proactively and assist students who may be at risk

of academic underachievement in the part-time traditional manual osteopathic part-time program in accredited English speaking colleges in Canada and Switzerland.

Research Question

The research question that guided this study was:

How and to what extent do the variables of seat preference, past profession, and learning style account for variances in student achievement on grade scores in traditional osteopathic part-time education?

Null Hypotheses

1. There is no statistically significant ($p < 0.05$) predictive relationship among the variables of seat preference, learning style, and past profession, and student achievement as measured by grade score.

2. There is no statistically significant ($p < 0.05$) predictive relationship among the variable of seat preference and student achievement as measured by grade score.

3. There is no statistically significant ($p < 0.05$) predictive relationship among the variable of learning style and student achievement as measured by grade score.

4. There is no statistically significant ($p < 0.05$) predictive relationship among the variable of past profession and student achievement as measured by grade score.

Alternative Hypotheses

1. There is a statistically significant ($p < 0.05$) predictive relationship among the variables of seat preference, learning style, and past profession, and student achievement as measured by grade score.

2. There is a statistically significant ($p < 0.05$) predictive relationship among the variable of seat preference and student achievement as measured by grade score.

3. There is a statistically significant ($p < 0.05$) predictive relationship among the variable of learning style and student achievement as measured by grade score.

4. There is a statistically significant ($p < 0.05$) predictive relationship among the variable of past profession and student achievement as measured by grade score.

Rationale, Relevance, and Significance

Rationale

The traditional manual osteopathic part-time students enrolled in accredited osteopathic programs are all post-graduate learners who come to the program with myriad backgrounds and experiences. Recent changes in admission criteria have led to faculty concerns that students who do not have healthcare professions lack basic anatomy and physiology knowledge. In light of the changing admissions criteria described above, it becomes imperative for instructors to have a method of predicting which students might require early learning intervention. Understanding the strongest predictive variables to academic achievement will provide traditional osteopathic educators with insight into the academic potential of students who enroll in the program. Knowledge of potential student learning issues can permit the implementation of academic support early in the program. To date, there have been no published studies regarding the academic achievement of traditional osteopathic part-time students with previous degrees or the predictive nature of past profession, learning style, or seat preference upon academic achievement.

The study gathered information on past professions of traditional osteopathic part-time students; learning styles as measured by the LSI; academic achievement as measured by grade score; and seat preference as measured by the DSPS. While seat preference in relation to grades, personality traits, motivation, and gender has been discussed in the literature (N. Armstrong & Chang, 2007; S. Armstrong, Hudon, Miller, & Davis, 1992; Benedict & Hoag, 2004; Boström & Lassen, 2006; Parker et al., 2011;

Totusek & Staton-Spicer, 1982), there is a lack of literature regarding the relationship between learning style, seat preference, and past profession to achievement.

Relevance

In the application of theories related to post-secondary adult education, identifying how the studied variables of learning style, seat preference, and past profession affect student achievement, educators benefit from continued evidence in the literature regarding delivery and knowledge of student experiences and behaviors. Professors can use the information regarding variables that affect student success to alter methods of delivery and facilitation in order to reach students in the classroom.

Traditional manual osteopathic part-time students are adult learners who reflect the definition and needs reported in the theory of andragogy (Knowles, 1980; Merriam et al., 2007). Knowing the students and the students' learning styles are components in creating a safe and welcoming learning environment in which learning can be experienced and created (Boström & Lassen, 2006; Merriam et al., 2007). The more information that is known about the learners in the classroom, the better the opportunity to meet the learners' needs both from a learning perspective, but also from a teaching delivery aspect. By understanding the students and their needs, educators model a behavior consistent with a caring profession interested in knowledge creation.

There are studies on professions and LSI relationships, which may provide insightful information in training healthcare professionals (Hauer, Straub, & Wolf, 2005; McCart & et al., 1985). This knowledge and integration of learning styles in education may impact more than the learning process:

> an understanding and incorporation of learning styles in the education of health care providers could have a positive impact not only on the teaching and learning process but also on the effectiveness of interdisciplinary team interactions and the patient educational process. (Hauer et al., 2005, p. 177)

The ability to predict factors affecting student achievement in an adult learning environment can assist faculty and learners in developing appropriate resources and programs to aid learners. Adult learners are faced with numerous challenges in returning to the academic arena. Time, finances, and learning concerns are evident. A faculty, which can acknowledge learning styles and learning challenges in a classroom, can accommodate the challenges through delivery methods. Accommodation can only occur if the faculty is cognizant of the students and the challenges in the classroom. This study gathered the data necessary to provide educators with an awareness of the characteristics of the part-time students in the traditional osteopathic classroom and the predictability of the variables of seat preference, learning style, and past profession in student achievement.

Significance

The significance of the study was two-fold. A contribution to educational research in the field of academic achievement predictability was primary. The second contribution related to an investigation of correlating learning styles and healthcare professions.

Determining the variables that predict academic achievement in an adult population provided valuable insight into the unique characteristics of adult learners and visits variables beyond the established use of UGPA for admissions criteria. At present, the literature has not explored predictive variables of seat preference, learning style, and

past profession in adult learners in a healthcare field. Being cognizant of the learning styles students use provides educators with insight into appropriate delivery and facilitation methods based in learning theory. Establishing evidence for predictive variables can support change for the curriculum or admissions criteria.

Through investigation of learning styles and past profession, the literature is enhanced regarding healthcare science professionals and learning styles (Hauer et al., 2005; McCart & et al., 1985). At present, there is no statistically significant correlation between learning style and profession. This study has the unique position of examining a specific healthcare profession, traditional osteopathy, which has learners with a number of different healthcare professions.

Nature of the Study

The study is a quantitative predictive non-experimental design in which English-speaking students in three accredited part-time traditional manual osteopathic colleges in five locations were sampled. The sample size was 248 students. The quantitative strategy for gathering the data was a collection of survey instruments. Independent variable data was gathered using the LSI 3.1 and DSPS. Kolb's Learning Style Inventory (LSI 3.1) (A. Kolb & Kolb, 2005a) was the measuring tool used to establish learning styles. The DSPS provided information regarding past profession, education, age, sensory challenges, and seat preference. The DSPS has a series of three classroom seating designs, which the students were familiar with from the college classrooms and followed the example of Fransworth (1933) in order to collect data on seat preference location. The DSPS instrument was field tested with content experts prior to data

collection. The dependent variable data, grade score, was requested from the registrars of the colleges. The data were coded for confidentiality once test scores were added to each subject's independent data. A multiple regression analysis was used to develop the predictive equation (Meyers, Gamst, & Guarino, 2006).

The use of a quantitative methodology provided data to measure and quantify the variables in the study. Statistical analysis presented relationships and created a prediction equation of student achievement based upon the independent variables. In quantitative methodology, findings are void of feeling (Lodico, Spaulding, & Voegtle, 2010) and can be generalized to the traditional osteopathic English-speaking student population of the accredited part-time colleges. The quantitative data gathered and the statistical analysis performed provided the results, which will support or fail to support the hypotheses.

Definition of Terms

The following terms were defined in relation to the study:

Action/Non-action seat

Action seats are described in the literature as being seats in the center of the classroom that have been noted as seats of high participation rates (Totusek & Staton-Spicer, 1982; Wulf, 1976). Non-action seats are seats around the periphery of the classroom that are noted as having low participation rates. In this study, two seat diagrams were used and action seats proclaimed in each diagram in relation to the literature. In the 4X7 seat chart, seats 2, 3, 6, 7, 10, 11, 14, 15, 18 and 19 were deemed action seats for statistical analysis. In the 5X10 seat chart, seats 3, 4, 5, 6, 7, 8, 13, 14, 15, 16, 17, 18, 24, 25, 26, 27, 35 and 36 were deemed action seats for statistical analysis.

Learning style

Learning style was defined according to Kolb's Learning Style Inventory (A. Kolb & Kolb, 2005a, p. 5). There are four poles on two axes that determine a learning style: concrete experience (CE) and abstract conceptualization (AC), and reflective observation (RO) and active experimentation (AE). Four learning styles are identified: accommodating, assimilating, diverging, and converging.

Accommodating.

> An individual with an accommodating style has CE and AE as dominant learning abilities. People with this learning style have the ability to learn from primarily "hands-on" experience. They enjoy carrying out plans and involving themselves in new and challenging experiences. Their tendency may be to act on "gut" feelings rather than on logical analysis. In solving problems, individuals with an Accommodating learning style rely more heavily on people for information than on their own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales. In formal learning situations, people with the Accommodating learning style prefer to work with others to get assignments done, to set goals, to do field work, and to test out different approaches to completing a project. (p. 5)

Assimilating.

> An individual with an assimilating style has AC and RO as dominant learning abilities. People with this learning style are best at understanding a wide range of information and putting it into concise, logical form. Individuals with an Assimilating style are less focused on people and more interested in ideas and abstract concepts. Generally, people with this style find it more important that a theory have logical soundness than practical value. The Assimilating learning style is important for effectiveness in information and science careers. In formal learning situations, people with this style prefer readings, lectures, exploring analytical models, and having time to think things through. (p. 5)

Diverging.

> An individual with diverging style has CE and RO as dominant learning abilities. People with this learning style are best at viewing concrete situations from many different points of view. It is labeled Diverging because a person with it performs better in situations that call for generation of ideas, such as a brainstorming

> session. People with a Diverging learning style have broad cultural interests and like to gather information. They are interested in people, tend to be imaginative and emotional, have broad cultural interests, and tend to specialize in the arts. In formal learning situations, people with the Diverging style prefer to work in groups, listening with an open mind to different points of view and receiving personalized feedback. (p. 5)

Converging.

> An individual with a converging style has AC and AE as dominant learning abilities. People with this learning style are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. Individuals with a Converging learning style prefer to deal with technical tasks and problems rather than with social issues and interpersonal issues. These learning skills are important for effectiveness in specialist and technology careers. In formal learning situations, people with this style prefer to experiment with new ideas, simulations, laboratory assignments, and practical applications. (p. 5)

Part-time Program

The part-time program was defined as a five-year, 1800-hour curriculum at an accredited traditional osteopathic school. The program has eight 5-day modules per course year and 250 hours of supervised student patient clinic. A two-year research paper culminates the program following the five years of course work for a total of 2500 credit hours.

Past profession

Past profession was defined as the profession that the student was working in while attending the part-time traditional osteopathic program or in which the student had previously practiced and gained experience. The DSPS was used to collect information regarding past profession as seen in Appendix: Demographic and Seat Preference Survey. The acknowledgement of previous experience and knowledge is a tenet of andragogy

(Knowles, 1980), social learning theory (Bandura, 1986), and experiential learning theory (Dewey, 1938; Rogers & Freiberg, 1994).

Allied Healthcare. Allied healthcare professions were chiropractic, physical therapy, athletic therapy, naturopathy, homeopathy, nursing, kinesiology, occupational therapy, massage therapy, medical doctor, osteopathic physician, and dentistry.

Other. The Other profession group consisted of all professions other than those addressed in the allied healthcare list.

Seat Preference

Seat preference was defined as the seat most preferred by a learner during a classroom learning experience. The learner, in four categories, determined seat preference: most preferred, second preference, least preferred, and normal seat position. The DSPS was used to collect data regarding seat preferences and had three seating diagrams as seen in the appendix.

Student Achievement

Student achievement was defined as the year-end average test score of all academic requirements—exams, oral presentations, written assignments, and practical exams—taken by a student in an academic year. Throughout the paper year-end average test score is reported as grade score.

Traditional manual osteopathic part-time student

A traditional manual osteopathic part-time student was defined as a student of traditional osteopathy who attends an accredited part-time school of osteopathy. The student is aged mid-20 to mid-60 and a working professional. The term traditional, in

this case, does not refer to traditional college students of the age of 18 – 25 years who are enrolled in full-time academic programs.

Traditional Osteopathy

Traditional osteopathy was defined as the manual therapy method of treating the human body using osteopathic manipulation and the principles of osteopathy as developed by A.T. Still (Paulus, 2013; Stark, 2013).

Assumptions, Limitations, and Delimitations

Assumptions

Numerous assumptions are acknowledged in the study:

1. The subjects answered the Demographic and Seat Preference Survey (DSPS) and Learning Style-Inventory (LSI 3.1) honestly and did not corrupt the data with false reports.

2. The participants understod the directions correctly regarding the LSI and DSPS and applied the directions appropriately.

3. The method of recruitment and data collection was successful in generating the data necessary to achieve power for the study.

4. There is a relationship between social learning theory and experiential learning theory and that the relationship is applicable to the study of traditional osteopathy in a part-time program.

5. Those students who chose to participate were representative of the population of traditional osteopathic part-time students.

6. The field test of the DSPS protected the validity of the instrument.

7. The learning styles proposed by Kolb are relevant to healthcare professionals learning traditional osteopathy.

8. The researcher remained blind to subject participation during and after the study.

Although subjects were informed not to disclose participation in the study, it is possible that the subjects did not feel concerned about the blinding process. Attempts were made within the methodology to maintain blinding of the researcher from participants; however, a subject may inadvertently reveal his/her status to the researcher. Ethically, if assumption eight was compromised, the researcher is confident that a professional and unbiased relationship with the subject would be maintained.

Limitations

Limitations of the study exist. The generalization of the results to the global osteopathic student population, the created DSPS, as well as the LSI, all have certain controversial aspects and limits. Each is explained in relation to the study.

The generalization of the results is limited to English-speaking traditional osteopathic part-time students in accredited programs. It is not possible to generalize the results to all osteopathic students in all academic programs across Canada, North America, Australia, or Europe.

The DSPS was developed and field-tested specifically for the study. It has not been validated nor tested for reliability with statistical analysis. The DSPS did undergo expert field-testing prior to implementation. The information gathered was not psychometric in nature and was straightforward. The use of a non-validated survey was a limitation of the study.

The LSI is not without controversy. Although the LSI has been used positively in a number of healthcare research studies (Hauer et al., 2005; McCart & et al., 1985; Wessel & Williams, 2004), and in over 1004 publication including 542 journal articles

and 209 doctoral dissertations (A. Kolb & Kolb, 2005a), numerous authors are critical of the inventory due to concerns of ipsativity of the data and poor internal reliability (Bergsteiner, Avery, & Neumann, 2010; Garner, 2000; Henson & Hwang, 2002). The concerns were refuted by Kayes (2005). Kayes stated that there was supportive evidence for the previously reported internal reliability and validity findings of the LSI 3.

Delimitations

Delimitations of the study are related to the variables, population, and methodology involved. In order to create a feasible design, the variables for determining the achievement prediction equation were limited to seat preference, learning style, and past profession. In the literature, achievement has been correlated with gender, culture, and ethnicity (Chee, Pino, & Smith, 2005; Edgerton, Peter, & Roberts, 2008; Henry, 2006; Khwaileh & Zaza, 2011; Warikoo & Carter, 2009); however, it was decided to limit the variables to seat preference, learning style, and past profession as these variables have not yet been studied in relation to each other in the osteopathic or educational literature.

With regard to the population, the study was narrowed to include only data of English speaking, traditional osteopathic part-time students in accredited programs. The limit of the population affords homogeneity in the academic programs and permitted post hoc analysis in relation to variables not yet identified but common across campuses. The programs' faculty was not studied with respect to personal learning style or teaching methods. The addition of faculty data would confound the study making the scope too broad.

The methodology was limited to a quantitative design for generalization of the results to the defined population of part-time accredited traditional osteopathic programs. A mixed methods design was contemplated in order to add deep richness to the data (Lodico et al., 2010), but due to the geographical logistics of interviewing participants and availability, the decision was made to use a quantitative design only.

Organization of the Study

Chapter 1 presented preliminary information regarding the study. Chapter 2 presents a critical review of the literature, together with an analysis and synthesis of relevant information as it relates to the research problem and its theoretical framework; and the relevance of the present study in relation to previous studies. In Chapter 3 the methodology of the study is described. Chapter 4 provides the reader with the data collected, the statistical analysis, and the results. The dissertation concludes with Chapter 5, which includes the summary and discussion of the results, the findings in relation to the literature, the implications of the results in relation to practice, and recommendations regarding future research and practice.

CHAPTER 2. LITERATURE REVIEW

Introduction to the Literature Review

Have you ever wondered why you choose the seat that you do in different learning environments? Have you realized that you prefer different learning experiences to those of your peers? Have you considered that different professions attract people with different learning styles? Have you thought about why some students have greater success as measured by grade score than others in a professional graduate program? Can the variables of seat preference, learning style, and past profession predict the achievement level of traditional osteopathic students in an accredited part-time program?

The purpose of this study was to determine if there is evidence to support the hypothesis that traditional manual osteopathic student achievement can be predicted using the variables of seat preference, learning style, and past profession. The students of the accredited traditional manual osteopathic part-time programs are adult learners seeking to improve their clinical skills to assist their patients and to improve their knowledge. The curriculum was designed for students who are healthcare practitioners. Recent changes in the admission requirements have permitted the enrollment of non-healthcare practitioners to the program. Faculty are concerned that students who are non-healthcare practitioners do not have the background knowledge to be successful in the

program. This study analyzed the predictive value of seat preference, past profession, and learning style in relation to academic achievement as measured by grade score.

Although motivated to learn, due to the changes in admission criteria, some learners come to the program with deficits in base knowledge and manual abilities. New courses have been added to meet the needs of non-healthcare students regarding basic anatomy and physiology, and increased clinical supervision hours; however, there is no adaptation or instant resolution for the absence of previous clinical experience. The ability to identify learners in need of academic support early in the program with the support of research findings can provide the colleges with valuable information that may be used for curriculum change, academic support, and admission criteria consideration.

The literature reviewed provides the reader with historical insight into studies of the chosen variables of seat preference, learning style – accommodating, assimilating, diverging, and converging – and past profession as related to student achievement. The theoretical framework of the study incorporates andragogy (Knowles, 1980), experiential learning theory (Dewey, 1938, 2007; A. Kolb & Kolb, 2005a, 2005b; Rogers, 1969; Rogers & Freiberg, 1994), and social learning theory (Bandura, 1977, 1986). The literature is discussed regarding each variable, the factors related to each variable in relation to achievement, the quality of the research, the gaps in the research, the implications of the research available to date, and the research related to methodology and design. The chapter concludes with a synthesis of the literature presented.

The literature search process used numerous databases to seek out primary literature related to the topics of seat preference, learning style, past profession, and

predicted achievement along with the theoretical frameworks. The databases of ProQuest and its affiliates, EBSCOhost, ERIC, SAGE, Academic Search Premier, CINAHL Complete, and Dissertation and Thesis were searched with the following key words: seat* location*, seat* preference*, achievement, learning style*, past profession, self-efficacy, predict*, healthcare, Kolb, Bandura, Dewey, and Rogers. The Experiential Learning Website was reviewed for its bibliographic references.

Primary sources from peer reviewed and academic journals were chosen for review combined with texts. Tertiary literature was used sparingly and chosen for the historical and written work of theorists. Quantitative predictive research studies were reviewed for methodology, design, and sample sizes related to the present research. Dissertations were evaluated for methodology and design information. Qualitative research was examined to add richness to the review when appropriate.

The concept map in Figure 1 is designed to assist the reader in the process by which literature was reviewed and grouped for analysis. The variables, frameworks, and methodologies, as well as the forms of literature reviewed are presented. The concept map provides the reader with an overview of the literature sources, the topics, and the inter-relationships.

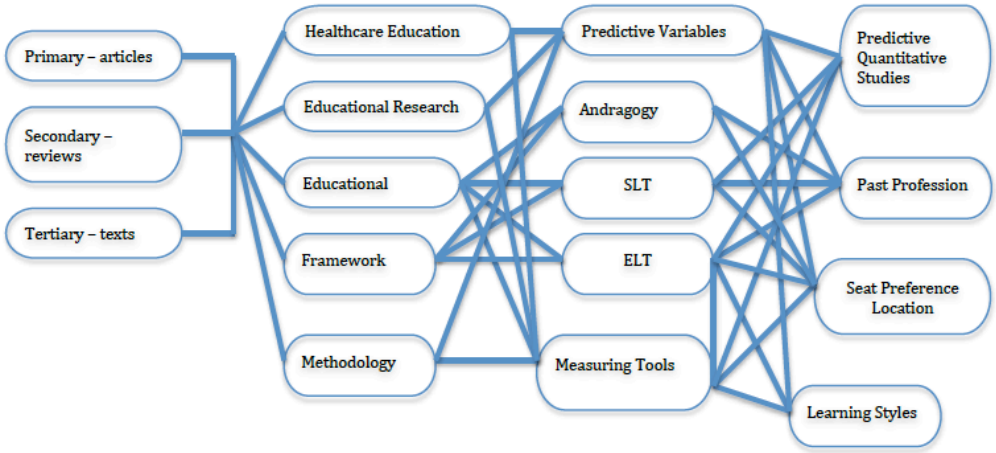

Figure 1. Concept map of literature review

Theoretical Framework

The theoretical framework of the study is set within the context of andragogy, social learning theory (SLT), and experiential learning theory (ELT). Each of the three theories provides a portion of an explanation or frame within which an osteopathic learner becomes an osteopathic practitioner. The osteopathic learner is defined by the theory of andragogy. The osteopathic student becomes a practitioner by learning the required skills, behavior, and knowledge of a profession through the educators' application of SLT. The osteopathic learner evolves into an osteopathic healthcare professional through the process of integrating knowledge, behavior, and skills with experiences provided within the frame of ELT. The three theories together afford the educator and the learner a holistic framework within which an osteopathic student becomes an osteopathic healthcare professional.

Although the construct of learning cannot be measured, academic achievement as measured by test scores and an ability to perform an outcome task are considered

evidence of learning. Extrapolating the frameworks' methods and theories of learning osteopathy to potential success within the program, the variables of seat preference, past profession, and learning style are viewed as contributors to learning and thus worthy of study as potential predictors of academic achievement. Each variable is discussed within the context of the appropriate theory as illustrated in Figure 2.

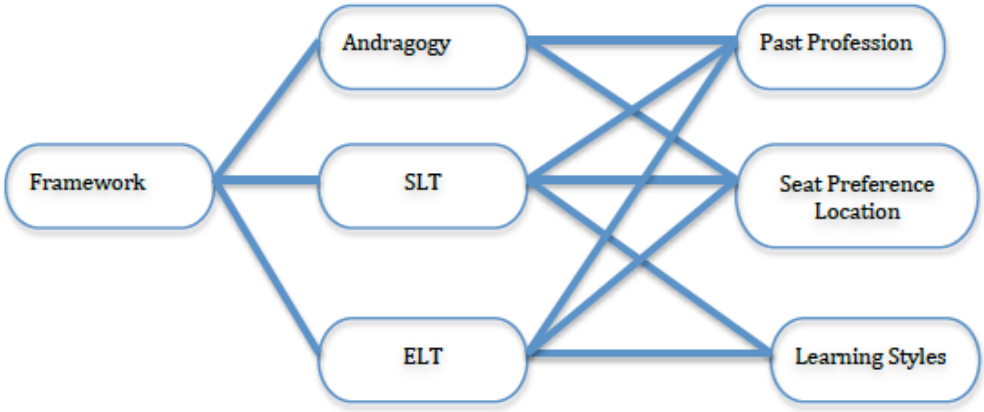

Figure 2. Concept map of theoretical framework

Three theoretical frameworks provide a reference for the proposed study: social learning theory (Bandura, 1977, 1986); andragogy (Knowles, 1980); and experiential learning theory (Dewey, 1938; D. A. Kolb, 1984; Rogers, 1969; Rogers & Freiberg, 1994). The three frameworks identify the methods by which osteopathic and adult learning occurs. Student success and learning as measured by academic achievement rests in part upon the educational experience and environment generated by the facilitators. The osteopathic educator needs to be mindful of the methods of knowledge construction and facilitation to create an environment that meets the needs of the adult learner. The combination of the three frameworks addresses the characteristics of the

adult learner, the method of learning facilitation, and the environment created in which learning can occur.

For each of the three theories, a brief history and description of the theory is provided. Any assumptions related to the theories are discussed. Finally, the three theories are discussed in relation to the framework of the study, its subjects, and research variables.

Andragogy

In order to place andragogy within the framework of this study, a brief history is provided. Following the history is a presentation of the assumptions and concepts related to the theory. Integrating the theory of andragogy with the facilitation of traditional manual osteopathic learning provides insight into the characteristics of the population studied.

History. The teaching of adults is not a new concept in education (Taylor & Kroth, 2009). There is evidence of adult education in the teachings of Jesus, Confucius, Plato, and Aristotle to name only a few of the great educators over the past millennia (Knowles et al., 2005). But it was not until the mid-1800s and the work of Knapp that the theory of andragogy became popular. As with all new ideas, following a period of popularity, the concept waned prior to the turn of the 20th Century.

A revival of andragogy began in the early 1920s. One might postulate that the revival was associated with post World War I society's need to educate disabled and released soldiers returning to civilian life. During the 1920s the work of Thorndike and Lindeman was presented fostering two different approaches to the education of adults

(Taylor & Kroth, 2009). Thorndike took the psychological approach to consider the adult's ability to learn and the affect that aging had upon an adult's intelligence (Merriam et al., 2007). Thorndike's research used controlled environments. Lindeman chose to study the social perspective of adult learning applied to the learning environment (Lindeman, 1926). According to Lindeman, experiences, education, and knowledge are always evolving. The environment of his research was relegated to beyond the "authoritative, conventionalized institutions of learning" (Lindeman, 1926, p. 28).

In the 1960s the term andragogy was popularized in North American literature and academia by Knowles who inherited the term from the Europeans (Knowles, 1980). Knowles described a series of assumptions in a humanist framework, which has gained notoriety since its inception in 1980 (Brookfield, 1998; Rachal, 2002). Andragogy, though not a term coined by Knowles, has been defined as the "art and science of helping adults learn" (Knowles, 1980, p. 43). But what or who is an adult learner? Educators and authors have attempted over the decades to define who or what constitutes an adult learner. Just as Lindeman discussed adult learning as a constant evolution, the definition of an adult learner has evolved. Presently, the general consensus within the literature is that the adult learner is not defined by age, but by "an individual's role in society and those factors surrounding them" (Taylor & Kroth, 2009, p. 5).

Over the past century, the discipline of adult education has advanced and yet the practice of adult education remains similar to that discussed in the 1920s. Today's authors of adult education literature and educators advocate for the use of group discussion, problem solving, collaboration, and appropriate assessment just as the authors

and educators in the 1920s to 1940s did (Taylor & Kroth, 2009). Andragogy is discussed in relation to the learner, to the educator or facilitator, and to the multiple contexts in which adults learn, both formally and informally, in the classroom and in industry. Technology has advanced over the decades but the core concepts of andragogy have not.

The methods of facilitating learning through time are essentially the same; it is the forum, tools, technology, and information dissemination that has changed. What is different from the early days of andragogy is the rapidity of change in today's world. As the world, technology, and knowledge are continually altering and advancing, individuals and companies are required to constantly add to their knowledge in order to remain current and competitive (Chan, 2010). The demand for continuing education in industry and professions has increased to coincide with the progress of knowledge and technology.

Although the history of adult learning is lengthy, the distilled method of facilitation remains unchanged. From biblical times to ancient Greece, to ancient Asia, to present day, the use of a student-centered approach to adult learning was and is recognized as fundamental to success. What has changed are the forums in which learning is occurring; instead of discussion occurring in a room it now occurs across continents through the use of webinars and the Internet. The adult learner is wholly unchanged; the learner is still seeking to expand his/her awareness and knowledge. What has changed from past to present is the speed and method by which information is transmitted and learning is facilitated.

Assumptions. The term andragogy as a theory is not without its critiques. The first critique is the term theory. The second critique is the context in which adult learning occurs. In this section, andragogy is considered as a model; the context is defined, and the list of assumptions and characteristics related to the adult learner are identified.

The term theory is used in relation to andragogy but andragogy is not a true theory based in empirical fact. A theory is testable. Andragogy as a theory has remained untested due to the lack of a valid and reliable inventory (Holton, Wilson, & Bates, 2009; Taylor & Kroth, 2009). According to Knowles (1980), "andragogy is simply another model of assumptions about learners to be used alongside the pedagogical model of assumptions" (p. 43). Authors of adult education literature repeat this sentiment (Brookfield, 1998; Cassidy, 2004; Merriam et al., 2007; Norman, 1999; Rachal, 2002). As such, andragogy is discussed as providing the frame of characteristics and assumptions of the adult learner and not as a theory of learning.

Knowles' original writings stated four assumptions regarding adult learners (Knowles, 1980) that were increased to six in 1984 (Merriam et al., 2007). The following assumptions are made as a person grows older and matures: they need to know why they are learning; self-concept moves towards being self-directed; experience is a rich resource; learning readiness is related to real-life roles; learning moves towards being life-centered; and internal motivation is more important than external motivation (Knowles et al., 2005). Added to this list of characteristics is the need for learners to feel safe in the learning environment (Knowles, 1980). This set of assumptions was

embraced by adult educators as education moved from behaviorist to constructivist paradigms in the mid-1900s.

The second critique was that Knowles ignored the context within which adult learning occurred (Merriam, 2001). Authors concerned with the social and political context of adult learning have stated that andragogy lost the humanism construct when Knowles did not acknowledge societal influences related to andragogy (Grace, as cited by Merriam, 2001). Since the 1990s, adult education has been mandated to fight oppression and promote its political agenda (Merriam, Courtenay, & Cervero, 2006). But not all adult education programs have a political agenda. Within the context of osteopathy, adults learn new skills and progress their knowledge and person. Osteopathic education does not have a political agenda, and as such the frame and assumptions presented by Knowles are adequate and useful in relation to this study.

Integration of andragogy and osteopathic studies. As previously stated, the traditional manual osteopathic students, who study in the part-time program, are the epitome of the adult learner characterized by Knowles. The students are working professionals with responsibilities beyond the classroom. They are seeking to improve their manual therapy skills as well as develop as a practitioner and healthcare professional. Their patients in their daily practices make the context of the learning applicable and real. The students are motivated intrinsically to improve their skills and person. The time and financial commitment in a six to seven year program is considerable thus countering any immediate extrinsic motivation of monetary gain. The learners in the studied osteopathic programs are self-directed in their pursuit of a new

career that often builds upon their previous knowledge and professions. Thus, andragogy, as a theoretical framework of the study, provides a frame for the characteristics of the studied population.

Social Learning Theory

Social learning theory (SLT) provides the frame within which the professional skills and methods of thinking in the osteopathic profession are taught. The learning of motor and mental skills for the application of techniques is a learned behavior that is explained by SLT. The following section includes the history of SLT, a brief outline of the theory, and the integration of the theory with the study of traditional manual osteopathy.

History. Learning through social interaction was the chief area of Bandura's research in the 1950s, which lead to the formulation of SLT in the late 1960s and 1970s. Also known as social cognitive theory (Bandura, 1986), Bandura's work is the result of years of observation of behavior that generated a theory that comprises "acquisition and performance of diverse skills, strategies, and behaviors" through modeling (Schunk, 2008, p. 78). Bandura continued to write through the 1980s and 1990s expanding his theory to include self-regulation and self-efficacy as components of learning.

Theory. Social learning theory has a number of constituent components that assist in permitting an educator or learner to understand how learning occurs. According to Bandura (1986), learning is a change in behavior that occurs through observation, enactive learning, incentive motivators, vicarious motivators, self-regulatory

mechanisms, and self-efficacy. Behaviors are modeled and observed by learners who then imitate the behavior if the behavior is seen as being beneficial to them.

Underlying the components of learning stated above is the triadic reciprocality of interactions that occurs between personal/cognitive factors, behaviors, and the environment (Bandura, 1977). A change in behavior is considered to be the result of learning. In SLT, learning can occur enactively through action or vicariously through observation. Cognitive or personal factors, which contribute to learning, are motivators, self-efficacy, and self-regulation. The environment is the scenario or situation in which the learner is present. Each component of the triadic reciprocal interactions is explored individually in the paragraphs that follow.

Behavior. A change in behavior is regarded as evidence of learning. Learning by doing is termed enactive learning while learning by observation is termed vicarious learning. Both forms of learning are involved in attaining skills through the concept of modeling. The use of modeling has "been acknowledged to be one of the most powerful means of transmitting values, attitudes, and patterns of thought and behavior" (Bandura, 1986, pp. 46-47).

Observation as a method of acquiring knowledge is crucial, time efficient, and appropriate for many of the professions that require skills and behaviors to be attained within the fixed timeframe of a degree or professional program. Observing a professor model a thought process (cognitive modeling), assessment, or treatment technique (motor skill) provides learners with the information necessary to acquire skills vicariously through observation and then enactively through rehearsal and feedback. Modeled

behavior applies to both cognitive modeling as well as motor skill modeling. For modeling to be successful, there are four processes necessary in the achievement of observational learning: attention, retention, production, and motivation (Bandura, 1986).

In the first process, attention, students must be attentive to what is being taught or modeled in order to be successful in learning the task or skill. When a task being modeled is perceived as useful, functional, or applicable, students are motivated to learn the task and are attentive to the process. The model can also have an effect on students' attention. A charismatic model or one who has projected characteristics that a student wishes to imitate or emulate will command attention and motivate students to learn the task being presented.

In the second process, retention, a series of sub processes are required to convert the desired modeled behavior into a usable memory (Bandura, 1986). The sub processes of retention consist of organizing the information, rehearsing, and coding. The organizing of the information can occur through visual imagery or verbally (Bandura, 1977). The visual imagery or coding is particularly imperative in learning manual osteopathic skills, as it is often difficult to verbalize the exact procedure in words. Students depend upon their visual coding to acquire the memory of the technique or skill. But imagining the skill is not often enough to ensure that the skill is learned. Practice or rehearsal is a necessary condition when learning motor skills such as manual techniques to ensure that the skill is retained in memory.

In the third process, production, modeled behaviors are converted from concepts and observations into skill acquisition. In the production phase, learners practice and

perfect skills through continued performance and revision with constructive feedback from a competent role model (R. A. Tan & Alpert, 2013). According to Donaldson and Carter (2005), learners' competence and confidence in their skills was fostered through access to and constructive feedback from "good" role models. Practicing new skills under supervision enables students to move towards manual skill and problem solving mastery.

Students observe manual assessments and techniques in classrooms under the supervision of instructors. Problem solving for clinical cases is also modeled (Sandhouse, 2014). Learners then have the opportunity to practice the manual techniques with feedback from the instructors (Esteves & Spence, 2014). As their learning progresses, students treat patients in student clinic, to the level of their knowledge, under the direct supervision of osteopathic manual practitioners. Through this process, students acquire the ability to assess, formulate treatment plans, and carry out a manual therapy treatment requiring skills in problem solving, palpation, and the ability to manipulate the body in a safe and effective manner, which requires complex physical abilities. The production process as related to the osteopathic profession is one of continuous progression and skill mastery leading to a level of expertise over the course of time. Mastering skills and helping patients are critical motivators for traditional manual osteopathic students, which directs the reader to the final process in modeled learning, motivation.

In the fourth process, motivation, learners determine the value and consequences of the modeled behaviors and convert the value into motivating factors (Bandura, 1986).

If value is assigned to the modeled behavior, students are motivated to pay attention, acquire, and reproduce the behavior. In treating patients, if modeled behavior is seen to alleviate pain or increase mobility of body structures, then the behavior is seen as valuable in treatment, thus leading the student to be motivated to learn and acquire the skill. Moreover, a role model who is seen to be effective and successful in treating patients is a motivator for students to imitate. Students, who successfully acquire skills and are provided with instructor feedback, as well as feedback from reassessing patients, are motivated to continue to learn through the promotion of self-efficacy. Furthermore, students who observe fellow students being successful are motivated to learn as a result of an "if she can do that, so can I" attitude (R. A. Tan & Alpert, 2013). Motivation is the impetus by which a student engages in learning. Without motivation, learners are not attentive and retention is minimal.

A change in behavior is seen as evidence of learning. Observational learning in professional studies is an efficient method for transmitting and producing outcome learner based behavior. Good role models are essential for demonstrating appropriate, value-laden behaviors, which encourages students to be attentive, retain information and skills, produce effective behaviors, and to be motivated to reproduce modeled skills and imitate models.

Personal factors. Personal or cognitive factors such as motivators, self-efficacy, and self-regulation are responsive to and interactive with the environment and behaviors. A motivated learner will be attentive in the environment and his behavior will be favorable to learning (Schunk, 2008). Students who have a high level of self-efficacy

will demonstrate confident behaviors when performing skills (van Dinther, Dochy, & Segers, 2011).

Students can be motivated by a multitude of factors. In the case of post-graduate adult learners, there are intrinsic and extrinsic factors involved in the motivation to return to learning. In a study of post-graduate music learners (n = 13) at a Canadian university, the motivating factors to return to school were intrinsic: personal development, intellectual development, and professional development (Dust, 2006). In Dust's research, potential monetary gain was not a significant extrinsic motivating factor for the studied students. Similar findings were presented when researching older undergraduate students in Australia (Ellis, 2013).

In a qualitative study of graduate entry-level dental students (n = 14) in the United Kingdom, a number of motivating factors were considered under the auspices of push, pull, and mediating factors (Newton, Cabot, Wilson, & Gallagher, 2011). The push factors were related to past professional dissatisfaction regarding pay and working conditions. The pull factors included an opportunity for career development, being patient oriented, and having a career with a hands-on component. Mediating factors included improving quality of life, financial security, balancing work and family, and job satisfaction. Although no studies have been completed on traditional manual osteopathic students entering a graduate level program, the motivational factors identified in the three discussed studies are considered applicable.

Self-efficacy and self-regulation are the other two personal factors related to SLT. According to Bandura, "self-efficacy is defined as people's judgments of their

capabilities to organize and execute courses of action required to attain designated types of performances" (1986, p. 391). In a study of 629 college freshmen, the researcher found that end of semester self-efficacy was a better predictor of academic achievement than beginning of term self-efficacy scores (Gore, 2006). Self-efficacy was an accurate predictor of achievement when experience and achievement occurred at the level of education studied (Brady-Amoon & Fuertes, 2011; Gore, 2006). In other words, students' self-efficacy is accurate only to the level of educational experience in relation to academic achievement: learners with previous similar academic environments will have a true level of self-efficacy in relation to their abilities.

But self-efficacy is also influenced by peers and models, mastery experiences, and social influences (Schunk, 2008; van Dinther et al., 2011). Observing a fellow student successfully accomplish a skill or task provides a vicarious experience to develop self-efficacy. Mastering a task creates an experience to build self-efficacy. In addition, working in groups enables learners to encourage each other regarding their potential. Self-efficacy is an important and contributing factor to learning and achievement, but only when the level of self-efficacy is accurate and related to the academic arena of study.

Self-regulation is the "process by which an individual seeks to accomplish goals through the self-directed use and modification of highly specific strategies" (Sandars & Cleary, 2011, p. 875). Self-regulation in adult learning is under the control of the learner; the learner chooses where, how, when, what, and with whom he/she will learn or study. Learners who choose to use goal-directed behaviors, strategies for goal attainment, and

modifying behaviors to create favorable learning situations exemplify the use of self-regulation. Self-regulation also uses assessment and reassessment of activities as modifiers for skill and task accomplishment. In adopting self-regulatory techniques that support learning, the learner actively engages in his/her success.

The personal factors involved in SLT are motivation, self-efficacy, and self-regulation. Motivation has both intrinsic and extrinsic influences such as personal growth, professional growth, job satisfaction, and improved quality of life balance. Vicarious observation or mastery experience can provide learners with a level of self-efficacy to support their thoughts that they can be successful in learning. Self-regulation behaviors provide the environment and situation in which learning can be accomplished. The personal factors of SLT are under the control of the learner.

Environment. The environment in a learning situation is either conducive to learning or unfavorable. A conducive environment is one in which the adult learner feels safe to perform a skill or task, reflect, and receive feedback (Esteves & Spence, 2014). The environment and behavior are in a continuous state of interchange depending upon the actions and activities of both the learner and the facilitator. The environment provides the frame for appropriate behaviors and the behaviors cause alterations in the environment (Baeten, Dochy, & Struyven, 2013). In Baeten's study, different teaching environments were used to determine the effect on student learning. The result was that students had higher achievement scores in a lecture environment when compared to a case based learning environment. This may have been due to familiarity of students with lecture formats; possibly representing a level of learner comfort.

The environment, behavior, and personal factors are interrelated and affect each other. An optimal learning experience is one that has all three factors blending and is harmoniously integrated. The personal factor relates to the student who is motivated, has the ability to self-regulate, and has a level of self-efficacy that is accurate to the academic arena. The behavior factor is affected by the model's ability to generate interest and worth in the learning event in order that the learner is attentive, can retain and produce the skill, and receive feedback. The environmental factor is created by the physical space and the academic process involved. The environment needs to be both physically and mentally safe for the learner and the facilitator in order for the other two factors to be integrated successfully. Each factor influences the other two in the learning experience, and the learner and the educator have responsibilities to maintain an integrated triad in which learning can occur.

Integration of SLT and osteopathic studies. Social learning theory offers a framework for learning and performance. Bandura presented the triadic reciprocality framework; a construct in which the individual, the environment, and the behavior interact to enable learning (Schunk, 2008). Integral to SLT is the process of observation and modeling. Learning can occur separate from performance or attainment of skill but the integration of the kinesthetic, visual, and auditory processing involved in the skill imitation engages learners through all their senses. This concept is useful in osteopathic manual therapy.

The application of SLT provides a method by which an osteopathic student learns the techniques necessary to become a manual osteopathic practitioner. Initially students

acquire knowledge and skills in the classroom before proceeding to supervised patient clinic. In addition to clinic, students who have manual therapy practices such as physiotherapists, massage therapists, athletic therapists, and chiropractors, begin to integrate new knowledge and techniques into their daily clinical practices thus enabling their continued learning outside the program. Those students without manual therapy practices, such as nurses, occupational therapists, doctors, dentists, homeopaths, naturopaths, kinesiologists, and non-healthcare workers, have reduced rehearsal and feedback opportunities, as they are limited to manual osteopathic technique and treatment exposure in supervised clinic.

Classroom lectures are a compilation of theory and practice with manual techniques and approaches being modeled by the professor (Esteves & Spence, 2014). As the students receive feedback on techniques and clinical case problem solving, they begin to learn how and what an osteopathic practitioner does. Through the practical element of the course, techniques are demonstrated with test and retest components. Students observe the modeled behavior of the techniques performed by the professor and retesting provides feedback that the techniques are useful in removing osteopathic lesions and promoting mobility. Modeling and feedback encourages student motivation to help patients and emulate the professor model thus offering an impetus for learning (Bandura, 1977).

In the osteopathic program, manual skills and skill knowledge application are required to be successful. In a clinical setting, a practitioner is required to assess a case, evaluate physical findings, and synthesize a treatment plan for a patient. Once a

treatment plan has been created, the practitioner must then have the manual skills to physically treat the patient. Manual skills include the ability to feel tissue tensions, end range joint palpation, and tissue response to the application of a treatment technique.

In order to learn a skill through modeled behavior a number of criteria are involved: (a) the model is seen as an expert, (b) students have to be attentive, (c) students have the opportunity for rehearsal with feedback, and (d) students are motivated due to awareness of consequences (Schunk, 2008). Learners observe the behavior and recognize their potential ability to acquire the skill. If the modeling is done successfully, self-efficacy increases fostering further motivation to practice.

The apprenticeship model of SLT is used in clinical internships as the supervisors model professional behavior and treatments (Bandura, 1977), and the conduct of inquiry (Rogers & Freiberg, 1994). As the learners progress in the program, they enter supervised clinical internships and use collaborative problem solving cases. Students gain experience, and learn vicariously and enactively as they have professional behavior modeled by instructors and fellow students (Sandhouse, 2014). In the clinical setting, students have the opportunity to learn through attention, rehearsal with feedback, production, and are motivated to continue learning as they assist with patients' health and well-being.

Experiential Learning Theory

Experiential learning theory (ELT) provides the frame within which the osteopathic student constructs knowledge in order to become an osteopathic practitioner and professional. The method of learning through experience, reflection, observation,

and experimentation is explained by ELT. The following section includes the history of ELT, a brief outline of the theory, and the integration of the theory with the study of traditional manual osteopathy.

History. Experiential learning theory has been in a continuous state of growth since its inception. Kolb credited the works of Dewey, James, Lewin, Piaget, Rogers, and Freire (A. Kolb & Kolb, 2009; D. A. Kolb, 1984). Dewey's work in the early part of the twentieth century was instrumental in illuminating the importance of experience and reflection upon the learning experience with development being a lifelong process (Castelli, 2011; D. A. Kolb & Yeganeh, 2012). James and Dewey were both subscribers to the concept of continuity of consciousness and experience, ever in a state of flux and ever in a state of motion (Dewey, 1938; A. Kolb & Kolb, 2009). Lewin's work in the 1930s and 1940s brought forth studies in group dynamics and the development of the methodology of action research, which assisted Kolb in considering the cyclical nature of ELT (D. A. Kolb, 1984). In the 1960s, Piaget and Rogers were influential in enhancing the theory. Piaget discussed how experience shaped intelligence and the relationship between knowledge and learning. Piaget brought the words assimilation and accommodation into the theory. Rogers complemented the theory regarding the holistic nature of experiential learning when he stated "*It has a quality of personal involvement*—the whole person in both his feeling and cognitive aspects being *in* the learning event" (Rogers, 1969, p. 5). In the early 1970s, Freire introduced the concept of "'critical consciousness,' the active exploration of the personal, experiential meaning of abstract concepts through dialogue among equals" (D. A. Kolb, 1984, p. 16). Building upon the

previous works, Kolb presented his theory in 1984 and developed the Learning Style Inventory (LSI). The LSI has undergone multiple revisions over the past 30 years as a result of the evolution of the theory (A. Kolb & Kolb, 2005a, 2009).

Theory. According to ELT, "*learning is the process whereby knowledge is created through the transformation of experience"* (D. A. Kolb, 1984a, p. 38). Each experience is affected by previous experiences and each experience affects future experiences in the experiential continuum (Dewey, 1938). Learning is relearning through the transformation of previous knowledge or experience in the presence of a new experience.

Experiential learning is an experiential continuum; the process of learning is adaptive and is relative to time and situation (D. A. Kolb, 1984). An immediate, short-term adaptation is considered performance, not learning. Learning is considered to be a longer-term mastery of similar situations, while development "encompasses lifelong adaptations to one's total life situation" (p. 34). Thus, the holistic nature of learning embraces experiences in relation to time and situation; each experience influences the present and the future while being reflective upon the past.

These past and present experiences are used to construct knowledge in two manners that work in combination: grasping experiences and transformative experiences (A. Kolb & Kolb, 2005b). Grasping experiences are defined as Concrete Experiences (CE) and its opposing Abstract Conceptualization (AC), while transforming experiences are defined as Reflective Observation (RO) and Active Experimentation (AE). These four poles create quadrants that make up the learning cycle by which learning is

constructed using "experiencing, reflecting, thinking, and acting" (p.194). This spiral of learning brings into consideration the action research concept of Lewin and the continuity of experience of James and Dewey. The optimal learning experience would engage each quadrant and permit the learner to integrate each quadrant's experience with the others. In this manner, concrete experiences are observed, then reflected upon. Once reflected upon, the experience is assimilated and then titrated into abstract concepts, which promote the construction of new ideas. These ideas are then enacted upon and trialed thus generating a new experience. As a result of our past experiences, learners may find that they have a preferential method or mode of learning, which has been labeled their learning style.

In ELT, as discussed in Chapter 1, the learning styles posited by Kolb (1984) that have two modes of learning are: diverging, assimilating, converging, and accommodating. A diverging learner represents the quadrant framed by concrete experience and reflective observation. The assimilating learner represents the quadrant framed by reflective observation and abstract conceptualization. The converging learner represents the quadrant framed by abstract conceptualization and active experimentation. The accommodating learner represents the quadrant framed by active experimentation and concrete experience.

Just as experiences are relative to time and situation, they are also interdependent with developmental stages (A. Kolb & Kolb, 2005b). According to D. A. Kolb (1984a), there are three developmental stages: the earliest being the acquisition phase during early years; the middle phase of specialization occurring in early adulthood; and the final phase

of integration that occurs around midcareer. Increasing complexity and relativism distinguish the developmental stages: "development of CE increases affective complexity, of RO increases perceptual complexity, of AC increases symbolic complexity, and of AE increases behavioral complexity" (A. Kolb & Kolb, 2005b, p. 195).

Integration of ELT and osteopathic studies. Adults have a plethora of rich experiences upon which to build knowledge. The experiences are components that when pieced together provide a frame in which learning is performed and knowledge is constructed. In the part-time traditional osteopathic program the students are adults; the majority of whom are working healthcare professionals. By implementing what learners have experienced in class with their patients on a daily basis, they have the opportunity to experience, reflect, think, and act upon the techniques and the methodology of treatment. This is evidenced by adult educators who stated

> adults develop a kind of situational reasoning that they use to interpret their experiences and guide their actions. This reasoning does not follow the rules of formal logic. Instead, it is attentive to context, responsive to idiosyncrasy. Through contextualized reasoning, adults show a type of cognitive flexibility. They adjust to the nuances of situations in which they find themselves by evolving theories of action that change from time to time and place to place. (Brookfield, Tennant, & Pogson, 2005, p. 377)

Working with patients on a daily basis provides an avenue for learning through experience. An adult's experiences and the need to learn through experience was exemplified as "the resource of highest value in adult education is the learner's experience" (Lindeman, 1926, p. 6). The classroom experience, the past educational experience, and the daily working experiences of the students enable learners to build

knowledge and assimilate the new knowledge with their present skills. Students working in a healthcare profession have a method to integrate the osteopathic learning into their daily practice providing a significant advantage over the students who do not work in a healthcare profession or have a clinical manual practice.

In the population of this study, the majority of subjects have reached the integration phase of development; they are in midcareer and looking for a change or a progression of their knowledge and skill set. Depending upon their career choice and previous experiences, development in the different modes of experiencing will differ among the subjects. According to Kolb's theory and research, the majority of the subjects should have accommodating and converging learning styles as healthcare professions are science and social based professions (D. A. Kolb, 1984). The researcher is in partial agreement with this prediction; however, the need to be abstract thinkers to develop treatment plans based upon the synthesis of a history and clinical findings would predicate that assimilators are attracted to this profession. This concept is discussed further in the literature review pertaining to learning styles.

Theoretical Framework Summary

The educational theories of social learning, andragogy, and experiential learning complement each other and osteopathic education. Learners and educators construct knowledge together based upon experience and professional information. In this study, andragogy defines the characteristic of the subjects studied; the application of SLT provides the method by which techniques and professional behaviors are modeled and

learned; and the cyclic nature of ELT provides the framework by which learners become osteopathic manual practitioners and professionals.

As osteopathy is a second career for the subjects, their motivations for attending the program vary, but their motivation to complete the program is universal. Self-efficacy is considered in relation to past professional experiences, as the two have been linked and are discussed further in the literature review related to past profession. Experiences are critical for learning and the cyclical method of ELT provides the frame for learning through the application of SLT to occur. Reflection is not only a component of ELT but also of SLT. Reflection is required for a learner to self-regulate and reassess not only their learning but also their actions. It is necessary for a learner to reflect upon the technique skill, as well as its application, efficacy, and use. Through ELT, observation, reflection, thinking, and experiencing enable learners to understand what, why, when, where, and how they will apply the techniques learned within the frame of osteopathic treatment knowledge.

This thesis expands the knowledge base of learning styles and the potential correlation of learning style and achievement. According to ELT, accommodating and converging learning style preferences are suited to science-based professions, and extrapolating that logic, students with these predominant learning styles should be more successful than the diverging and assimilating learning styles in the traditional osteopathic program. This logic is countered, as abstract problem solving is required to consider the inter-relationships of the body's systems. As such, the assimilating learning style is expected to perform well. Learning style and achievement are tested specifically

by the hypotheses. As well, data were collected regarding learning style and professions. As such, the body of knowledge will be added to in respect to correlating profession and learning style.

Consistent with SLT, students who have had success in previous university or post-graduate programs should have an accurate appreciation of their self-efficacy and motivation to complete the program. Those students who have not the same level of experience, may vicariously obtain a level of self-efficacy and motivation necessary to learn and develop. This thesis did not measure self-efficacy or motivation directly and as such any findings related to past experiences are tempered by this limitation. However, past profession as a variable related to experience and achievement is tested by the hypotheses.

The participants of this study exemplify the characteristics of Knowles' adult learner and reflect the definition and needs reported in adult learning literature (Knowles, 1980; Merriam et al., 2007). The youngest students are in their early twenties while the oldest are in their sixties. Osteopathic students are adult learners and the majority is working healthcare professionals. The students have social commitments and societal roles beyond school; some are parents; some are spouses; and some are caregivers. The students are self-motivated and self-directed in learning.

The learners' goals are to succeed in the program, to become an osteopathic practitioner, and help their patients to live better lives. It is a noble pursuit but one that is not without sacrifice. The five years of course work takes the learner away from his/her family for forty days per year, which includes eight weekends. The research thesis can

take another two years of self-study. Time spent studying varies depending upon the student; however, a weekly study schedule includes a minimum of 15 hours. There is minimal to no financial support from external sources. Some students upon graduation will see an increase in pay but many do not have a financial return beyond their present pay scale. Motivation is internal as a practitioner strives to evolve in knowledge and personal growth. There is also an external motivation in the appreciation from patients for aiding in their care. This program is a commitment requiring time, energy, finances, and personal sacrifice in order for practitioners to progress their skills on a professional level, themselves on a personal level, and to help their patients.

Given the commitment of the student to his learning, it is the responsibility of the learning institution to provide a safe environment that respects learners and faculty (Knowles, 1980; Rogers & Freiberg, 1994). The osteopathic professor's job is to facilitate learning that permits the student to grow personally as well as professionally. As professionals, students are seeking to improve not only their skills, but also their person, which Rogers defined as self-actualization (Schunk, 2008). In the same vein, osteopathy has been defined as a blend of mind, body, and spirit (Spaeth, 2000). It is fitting that the framework, holistic learning theories, and methods by which osteopathy is learned reflect the holistic philosophy of osteopathic treatment.

Review of the Research Literature and Methodological Literature

Review of Research Regarding Learning Style, Seat Preference, Past Profession, in relation to Achievement

Learning Style. Just as there are a multitude of different learners, there are numerous different learning styles used by students. There are also many different learning style tests. The purpose of these tests is to assist learners and teachers in processing information, understanding how one learns, and meeting the needs of learners through appropriate delivery methods and experiences (Andreou, Papastavrou, & Merkouris, 2014). There are research studies using visual, auditory, reading, and kinesthetic assessment (VARK) (AlKhasawneh, 2013; Marek, 2013), the learning environment, learning cycles, and different learning styles (Hawk & Shah, 2007).

Hawk and Shah reviewed and compared five learning style models: Kolb's experientially based LSI, Gregorc's phenomenological based Gregorc Style Delineator (GSD), Fleming's sensorial based VARK, Felder and Silverman's experientially, sensorial, and phenomenological based Index of Learning Styles (ILS), and Dunn and Dunn's combination based Productivity Environmental Preference Survey (PEPS) (2007). The Learning Style Questionnaire (LSQ) developed by Honey and Mumford and used in healthcare research (Rassool & Rawaf, 2008), was not addressed in Hawk and Shah's review. These tests are a sampling of what can be found in the literature.

In an effort to provide educators with the tools to be efficacious in teaching and promoting learning, the literature is rich with articles on learning styles and tools. But one must consider the framework within which a study is performed; due to the nature of manual osteopathic practice and the student population of mature working professionals,

the experiential framework was chosen for this study. The LSI has been used positively in a number of healthcare research studies (Hauer et al., 2005; McCart & et al., 1985; Wessel & Williams, 2004) and is seen to "possess predictive powers that exceed that of the other scales purporting to measure learning style" (Manolis, Burns, Assudani, & Chinta, 2013, p. 51). As such, the extensive use of Kolb's LSI in healthcare educational research enables the researcher to compare present literature to the study results. For the purposes of this study, learning styles have been defined as and are limited to assimilating, accommodating, diverging, and converging that use four abilities – concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) – as proposed by Kolb and colleagues (D. A. Kolb, 1984; D. A. Kolb & Yeganeh, 2012).

In reviewing the LSI literature, the LSI's validity and reliability is discussed. The variables of profession and achievement are considered with respect to allied healthcare professions, engineering, and education. Engineering and education have been added to the literature review to represent students who are not healthcare professionals. No literature was discovered relating seat preference to learning style, thus the findings of this study will provide awareness and preliminary results for the literature.

Validity and reliability. The measurement tool, the Learning Styles Inventory (A. Kolb & Kolb, 2005a), has been used extensively in educational research but is not without controversy due to concerns of validity and reliability. The early concerns of critics have been addressed in revisions of the instrument (Hawk & Shah, 2007; A. Kolb & Kolb, 2005a). In recent studies, the LSI 3.1 was found to be reliable and valid (A.

Kolb & Kolb, 2005a; Pedrosa de Jesus, Almeida, Teixeira-Dias, & Watts, 2006). In particular, a study of Turkish university students reported acceptable Cronbach α reliability scores of .68 for CE, .71 for RO, .78 for AC, and .71 for AE. The unified scores were .75 for AC-CE and .72 for AE-RO (Tümkaya, 2012).

In order to address the concern of using categorical data and its decreased ability to be correlated with other constructs, one research article proposed changing the LSI from a 48 point categorical test to a 17 point continuous test (Manolis et al., 2013). The findings of the study indicated that the LSI could be reduced and maintain validity. The new Reduced LSI (RLSI) findings supported a learning style based upon three unidimensional factors, AC, CE, and AE-RO, rather than Kolb's two dimensional model of AC-CE and AE-RO. The AC and CE factors were identified as individual primary dimensions used in providing knowledge, while the AE-RO factor was a secondary dimension that facilitates the transformation of knowledge. Further research is required to develop and test the RLSI. Although the creation of the RLSI is not pertinent to this study, it is of interest to the scholar-practitioner who wishes to further research with the LSI and perhaps the RLSI.

Professions and learning styles. As previously stated, the LSI has been used extensively in the healthcare educational literature. Although there have been learning styles that predominant in the healthcare professions, few authors have been able to report statistically significant findings when correlating profession to a specific learning style. The published literature is reviewed in relation to nursing, medicine, physiotherapy

(PT), athletic therapy (AT), occupational therapy (OT), pharmacy, and engineering, and learning styles or the factors of AC, CE, AE, RO, AC-CE, and AE-RO.

Nursing. In the nursing literature of studies using the LSI, dominant learning styles have been indicated to be diverging (Andreou et al., 2014; D'Amore, James, & Mitchell, 2012; Hauer et al., 2005); accommodating (Andreou et al., 2014; Baker, Pesut, McDaniel, & Fisher, 2007; DiBartola, 2006; Smith, 2010); converging (Andreou et al., 2014; El-Gilany & Abusaad, 2013; Fogg, Carlson-Sabelli, Carlson, & Giddens, 2013); and assimilating (Lockie, Van Lanen, & Gannon, 2013). Of note is that the assimilating style was ranked first, second, or tied for second in five of the nine studies reviewed (D'Amore et al., 2012; El-Gilany & Abusaad, 2013; Fogg et al., 2013; Lockie et al., 2013; Smith, 2010). In the same vein, the diverging style was ranked first, second, or tied for second in six of the nine studies reviewed (Andreou et al., 2014; D'Amore et al., 2012; El-Gilany & Abusaad, 2013; Hauer et al., 2005; Lockie et al., 2013; Smith, 2010).

Due to the scattered nature of learning styles throughout the nursing literature it is difficult to state with any confidence that there is a specific dominant learning style related to the nursing profession. However, there are the constants of findings related to RO and CE modes (D'Amore et al., 2012; Hauer et al., 2005). According to D. A. Kolb (1984), RO and CE modes relate to one's ability to reflect on and observe experiences with an open mindedness and embrace new experiences without bias. A person with a diverging learning style is sensitive to feelings and values, has the ability to listen, and enjoys working with people. A person with an assimilating learning style builds and tests

theories, and organizes information. These two learning styles share the RO axis and the characteristics of the learner are consistent with those of the nursing profession.

Medicine. In the medical literature reviewed, there was a stronger consensus presented for a specific learning style than in the nursing literature. The predominant finding in these studies was that most medical students and faculty used an assimilating learning style and had preferences for abstract conceptualization to acquire their knowledge (Adesunloye, Aladesanmi, Henriques-Forsythe, & Ivonye, 2008; Chapman & Calhoun, 2006; DiBartola, 2006; Gurpinar et al., 2010; Gurpinar, Bati, & Tetik, 2011). The study sample sizes ranged from $N = 42$ to $N = 455$. Again, as in the nursing literature, the specific learning style was not statistically significant. The assimilating style ranked first representing 42 – 55% of the samples studied with the exception of one study; in one study of 170 first year medical students, 48% of learners preferred the diverging learning style, while 42% of learners preferred the assimilating learning style (Gurpinar et al., 2010). The predominant second learning style in two of the three studies, $N = 42$ and $N = 455$, was the converging learning style (Adesunloye et al., 2008; Gurpinar et al., 2011). When researching residents and faculty, there was no statistically significant relationship of learning style with age, gender, or education; however, there was an increase in AC scores with age and a decrease in AE scores with age (Adesunloye et al., 2008).

In a study of first and second year medical students, the authors discovered that the assimilating style remained quite constant over the two years while the diverging style was reported to have a 93% change between first and second year (Gurpinar et al.,

2011). It is necessary to report that the changes occurred in a study researching three delivery methods: problem based learning (PBL), an integrated curriculum, and a hybrid curriculum. The change in learning styles may have been related to the differing curriculums and the need for students to adapt and embrace the method of learning. In Chapman and Calhoun (2006), the authors were researching medical students in a computer based simulation elective and found a preference for active over passive learning, individualized over group learning, and field independent over dependent learning. The students preferred an analytical approach to a global approach in keeping with the assimilating style of learning.

Physiotherapy. In the physiotherapy (PT) literature two studies were reviewed. One study's results indicated that PTs preferred a converging learning style with active experimentation (Hauer et al., 2005), while the other study indicated an accommodating learning style (DiBartola, 2006), which was also reported in the LSI literature (D. A. Kolb, 1984). Both of these styles share the AE axis. Students who have a predominant learning style score on the AE axis prefer active learning with a component of trial and error experimentation application. Converging learners defined by the AE and AC axes prefer goal setting and decision making while getting the job done (D. A. Kolb, 1984). These characteristics are consistent with the skills required to be successful in a physiotherapy profession. These findings are interpreted with caution as both studies' samples involved four other professions with the PTs numbering 13 (DiBartola, 2006) and 17 (Hauer et al., 2005). As well, it can be argued that there is a necessity for abstract

conceptualization in the physiotherapy profession in order to evaluate patients and generate treatment plans; this was not evident in the two studies reviewed.

Athletic therapy. In the athletic therapy (AT) literature, a study of 26 AT students indicated that the predominant learning styles in a classroom setting were assimilating 65% and converging 15%, while the other styles were only graphically represented (Coker, 2000). Coker then asked the same subjects to think of being in a clinical setting and administered the LSI a second time. In the clinical setting, 42% preferred the converging learning style while 31% preferred an accommodating learning style. In the results, 58% of subjects changed their learning style in relation to the setting. Coker's study was the only study found that used this methodology of having the same subjects consider a different learning setting. The findings, although limited to a small sample size, offer insight into the PT results noted above, which indicated a preference to accommodating and converging learning styles. It is not known what the mindset or the setting was for LSI administration in any of the other literature reviewed.

Occupational therapy. In the occupational therapy (OT) literature, only two studies were found and the sample sizes were the smallest of all the literature reviewed: $N = 12$ (Hauer et al., 2005), and $N = 4$ (DiBartola, 2006). In the 2005 study, OTs were reported to prefer an assimilating learning style while in the 2006 study, OTs were reported to prefer a converging learning style. This is in contrast to the LSI literature where OTs are situated in the accommodating quadrant (D. A. Kolb, 1984). Both of the assimilating and converging styles share the AC axis that concentrates on logical ideas and concepts, and planning. The OT professional is required to logically generate

treatment plans to facilitate function in patients. As such, the AC orientation is considered appropriate. Again, the findings of the reported study are reviewed and accepted with caution, as the sample sizes were inadequate to extrapolate to the OT population.

Pharmacy. In the pharmacy literature, of the two studies reviewed, the common factor was the AC axis. One group of authors reported that 47% of 299 students and 59 faculty preferred an assimilating learning style while 30% preferred the converging learning style with no significant differences between faculty and learners (Crawford, Alhreish, & Popovich, 2012). A finding of note was a gender difference; females tended to prefer an assimilating style while males were highly represented in the diverging style.

In the second study reviewed, 240 students in a four-year program generated the sample (Williams, Brown, & Etherington, 2013). The converging learning style was preferred by 38% of the sample, while 24% preferred an assimilating style. Thus the majority of the students shared the AC axis. These two studies had similar findings that were supported in previous pharmaceutical literature (Williams et al., 2013). As indicated in the previous professional paragraphs, the AC axis shared between the converging and assimilating styles represents learners who generate ideas and theories using scientific thought and inductive reasoning to accomplish goals and learn (D. A. Kolb, 1984).

Engineering. In the engineering educational literature, two studies were reviewed (Gogus & Gunes, 2011; Hargrove, Wheatland, Duowen, & Brown, 2008). In both studies, assimilating and converging learning styles were well represented; in Gogus and

Gunes, 55% of 260 engineering students preferred the converging learning style while 35% preferred the assimilating learning style. Hargrove et al., reported 44% of 232 learners preferred the assimilating learning style while 28% preferred the converging style. These findings are representative of the ELT literature that indicated engineers favor AC and AE learning modes to build theories using scientific theories with precision while accomplishing goals and tasks (D. A. Kolb, 1984).

Education. In the education literature, two studies were reviewed (Tulbure, 2012a; Yilmaz-Soylu & Akkoyunlu, 2009). In a study of 39 education students there was an even division between converging and assimilating styles (Yilmaz-Soylu & Akkoyunlu, 2009). Tulbure found in a study of 269 pre-service teachers that 30% preferred a converging learning style; 26% preferred an assimilating learning style; 26% preferred a diverging learning style; and 18% preferred an accommodating learning style (2012a). Both of these studies are in contrast to the predicted accommodating learning style of educators (D. A. Kolb, 1984). Given that educators should be people oriented and use reflection as a method of teaching and learning, it is surprising that the RO component was not considered in Kolb's matrix. Although these are but two studies, on the surface the findings appear to be representative of the expected characteristics of educators.

Summary. As evidenced in the reviewed literature, there is a diversity of learning styles with no statistical significances reported within the professions. However, when taking a holistic view of the studies, in nursing there was a propensity toward diverging and assimilating styles; in medicine, OT, AT, pharmacy, and engineering there was a

propensity toward assimilating and converging styles; in PT and clinically oriented AT there was a propensity toward converging and accommodating styles; and in education there was a propensity toward converging, assimilating, and diverging styles. Based on these findings, it is expected that the predominating learning styles in osteopathic students will be assimilating and converging learning styles as students use abstract conceptualization to integrate information regarding patients and develop logical treatment plans to execute. A strong argument is made for a large representation of diverging students given the holistic and personable nature of osteopathic manual therapy. The descriptive statistics in Chapter 4 provides the analysis of learning styles among the studied traditional osteopathic students.

Achievement and learning style. In the literature reviewed concerning academic achievement related to Kolb's learning styles, there were mixed reports as to the relationship between the two variables. Although authors reported differences in the academic scores of students with different learning styles, healthcare profession studies indicated that there was no statistically significant difference between achievement and learning style (Gurpinar et al., 2010; Lockie et al., 2013; Spears et al., 2008). The studies that offered insight into learning styles and achievement are discussed.

In a predictive relationship study of nurses regarding learning styles and the results of the National Council Licensure Examination-Registered Nurses (NCLEX-RN), it was reported that nurses who preferred the accommodating learning style had a pass rate of 68%, which was statistically significantly lower ($p < 0.057$) than nurses with assimilating, converging, and diverging learning style preferences who had a greater than

80% pass rate (Lockie et al., 2013). This finding was reported as being statistically significant; however, the actual *p*-value did not achieve the level of significance of $p < 0.05$ considered appropriate in scientific literature. As such, the findings were overstated but relevant to this study's hypotheses.

In a study that considered different educational majors with the same learning styles but different educational delivery experiences, it was revealed that the learning situation had an effect on the different majors of similar learning styles (Tulbure, 2012b). Statistically significant results were reported between educational and economic majors within the same learning style; the study did not report on the statistics between learning styles. In the data, educational science and economic students with an assimilating learning style had the highest mean scores of 8.58 (*SD* ± 1.10) and 8.17 (*SD* ± 1.31) respectively, of all subjects when the learning experience was presented in a "Geographical organization of information" (GOI) (p. 401). The lowest mean scores of 7.05 (*SD* ± 1.46) and 7.08 (*SD* ± 1.23) in the GOI category were obtained by the converging learning style educational science and economic students respectively. Regrettably, the author did not analyze the data with respect to between learning styles, which would have been valuable to this present research. In the cooperative learning experience, the economic students with a preference for the diverging learning style had a mean score of 8.79 (*SD* ± 0.92); this score was statistically significantly higher, $t = -5.60$, $p < 0.01$, than the lowest mean score 6.75 (*SD* ± 1.35) achieved by the educational science students of the same diverging learning style. These findings are indicative of a

difference in level of achievement between learning styles and within learning styles within a specific learning experience.

In a study of 418 Turkish engineering students, 71% of the students with a GPA of 3-4 preferred a converging learning style while 18% of the students in the same GPA category preferred an assimilating learning style (Gogus & Gunes, 2011). Only 6% and 5% of the students who obtained a GPA of 3-4 preferred the accommodating and diverging learning styles respectively. These differences were significant ($p < 0.01$) when compared to the convergers (53%) and assimilators (38%) with GPA scores of 2-3. Although the authors did not analyze the difference between the learning styles within a GPA category, it is evident from reviewing the very successful group, GPA scores between 3-4, that the converging learning style preference was the most successful academically of all the learning styles.

In a study of 285 grade 10 Iranian high school students, 35% of students had a converging learning style preference and a mean average of 85.7 (SD ± 11.17) (JilardiDamavandi, Mahyuddin, Elias, Daud, & Shabani, 2011), which was significantly higher $F(3, 285) = 9.52$, $p < .05$, than the 22% and 19% of students who preferred accommodating ($M = 77.30$, SD ± 12.49) and diverging ($M = 76.46$, SD ± 14.14) learning styles respectively. Additionally, 23% of students had an assimilating learning style preference and a mean average of 84.39 (SD ± 13.04) that was significantly higher than the means scores of students with accommodating and diverging learning style preferences.

To summarize the literature regarding achievement and learning style relationships, there is no significant learning style that has better academic achievement scores in the healthcare literature reviewed. In studies where a statistically significant difference in academic achievement was observed between Kolb's learning styles, the students with preferences for assimilating and converging learning styles appeared to be the most successful. Considering the work of Tulbure (2102b) and Coker (2000), it is posited that there are numerous factors that are necessary to bear in mind when reviewing the literature related to these variables: academic major, learning experience, and the state of mind of subjects when filling out the LSI. In regards to the present study, if the literature is an accurate prediction of the relationship between learning style and achievement, students with assimilating and converging learning style preferences will score higher than students with diverging and accommodating learning style preferences, but the findings are not likely to be statistically significant.

Seat Preference. Seat preference is a choice and "as choices play a crucial role in many aspects of human functioning, the role of location in choice has the potential to exert great influence" (Rodway et al., 2012, p. 221). Does your choice of seat in a learning environment reflect your grade? The literature has addressed these questions but the answers remain inconsistent. There is an absence of studies related to different professions and seat preference, and seat preference and learning styles. As such, the literature in relation to seat preference is limited to achievement with a cursory comment regarding personality and motivation.

History. The seminal works of Griffith (1921) and Farnsworth (1933) were the earliest papers found correlating seats and achievement. The articles used simple descriptive statistics, provided preliminary information on the psychology of a university audience (Griffith, 1921), and presented students' reasoning for seat preference (Farnsworth, 1933). Interest in the topic waned after Farnsworth (1933) but resurged in the mid 1960s and early 1970s with concerns for the learning environment and technology usage (Becker, Sommer, Bee, & Oxley, 1973; Gausewitz, 1964; Gur, Marshalek, & Gur, 1975; Koneya, 1973, 1976; Leventhal, Lipshultz, & Chiodo, 1978; McCorskey & McVetta, 1978; Sommer, 1965). Interest resumed in the 1990s and has continued intermittently to the present.

Recent literature has revolved around the physical environment regarding comfort, safety, and group dynamics (Ogilvie, 2008; Veltri, Banning, & Timothy Gray, 2006; Wannarka & Ruhl, 2008), and personality traits (Akimoto et al., 2000; Çinar, 2010; Fernandes et al., 2011; Parker et al., 2011; Totusek & Staton-Spicer, 1982; Zomorodian et al., 2012). The literature in regards to the variable of academic achievement is discussed in keeping with the hypotheses of this study. What is lacking in the seat preference literature is discussion concerning a potential relationship between learning style and seat preference.

Achievement. The authors of seat preference and academic achievement literature have considered seat location and random assignment versus student choice as variables (N. Armstrong & Chang, 2007; Kalinowski & Taper, 2007; Miller Kregenow et al., 2011; Perkins & Wieman, 2005; Tagliacollo et al., 2010; Zomorodian et al., 2012).

In order to facilitate an understanding of the classroom and present the information in a cohesive manner, the literature is discussed in relation to location, random versus assigned seats, and the concept of interaction zones in regards to achievement.

Location. The research regarding grade point average and preferred seat indicated that the students with higher GPAs preferred to sit at the front (Kalinowski & Taper, 2007; Miller Kregenow et al., 2011; Tagliacollo et al., 2010; Zomorodian et al., 2012) while Griffith (1921) and Farnsworth (1933) found that students with higher grades preferred the middle rows near the center of the theatre. The idea of the center being more important than the periphery was disputed in a study that found students sitting in the first two rows or within seven meters of the instructor regardless if the seat was peripheral or central achieved the highest grades (Holliman & Anderson, 1986).

In a study spanning fifteen years involving 1829 sophomore and junior accounting students, it was reported that there was a significant difference $F(4,1824) = 3.49$, $p = 0.01$) between grades and rows in a classroom with five rows and 63 seats (Marshall & Losonczy-Marshall, 2010). In particular, the students who sat in row two ($M = 80.44$, $SD \pm 12.34$) had a significantly higher score, $p = 0.05$, than the students sitting in row five ($M = 77.67$, $SD \pm 13.20$), and the third row students scored significantly higher ($M = 80.73$, $SD \pm 11.68$) than the fifth row students, $p = 0.02$. Thus the students in rows two and three scored higher than the front row and back two rows, and significantly better than the fifth row.

Random versus assigned seats. Interesting and conflicting results have been reported in studies that used random self-selection or assigned seating arrangements. For

instance, in a biology class with a sample of 43 students, there was no statistically significant difference in students' grades in relation to location when seats were randomly assigned on the first day of class (Kalinowski & Taper, 2007). In an earlier study of 81 students in two cohorts, $n = 44$ and $n = 37$, taught by the same instructor with one cohort self-selecting seats and the other having assigned seats, no significant difference was found in GPA or in classroom grade in relation to row or defined action zone (Wulf, 1976).

These findings are challenged by the results of a study of 201 physics students randomly assigned to four groups with group #1 situated at the front of the class and group #4 at the back (Perkins & Wieman, 2005). Initial analysis revealed no significant difference in GPA between the groups. At mid-semester, group #1 was moved to the back and group #4 was moved to the front. The authors discovered that 27% of group #1 received an A grade and only 2% received an F grade. This was in contrast to the 18% of group #4 who received an A grade and 12% who received an F grade. Perkins and Wieman found that group grades remained stable through the semester indicating that the original seat location had an effect on grade although the effect did not achieve statistical significance (2005).

Since the studies cited above used relatively small samples there is a chance that classroom size, both in population and physical size, may have been a variable. As such, a study using a 350 seat lecture theatre and 20 classes taught by three instructors is presented (N. Armstrong & Chang, 2007). Armstrong and Chang studied three groups: a self-selected seating with lecture format ($n = 1704$), a self-selected seating with co-

operative learning format (n = 1836), and a randomly assigned seating with co-operative learning format (n = 2274). Achievement testing used multiple-choice exams for ease of marking. They found that seven of 20 classes had statistically significant correlations of seat and grade. The correlations were weak ($-0.254 \leq r \leq 0.156$). In six of the seven findings, grades were negatively associated with distance from the professor and occurred in the self-selection groups. In the seventh group, which had a random seating assignment, grades improved with distance from the professor indicating that the increased distance did not adversely affect students' grades. Although the study had the largest sample size reviewed in the literature (N = 5814), the issue of different teaching methods, in particular the co-operative learning format, and lack of pre- and post-class testing for learning gains does not rule out the potential effect of seat location influencing the results. The authors did posit that "the differences in performance observed were consistent with the idea that highly motivated students are more likely to sit in the front, resulting in an uneven distribution of scores" (N. Armstrong & Chang, 2007, p. 57).

Interaction zones. Although the literature has considered the distance from the professor to be both significant and insignificant, some authors considered areas of high interaction or participation as being potentially important to achievement (Marshall & Losonczy-Marshall, 2010; Wulf, 1976; Zomorodian et al., 2012).

Wulf's study presented interesting findings, albeit not statistically significant, regarding action zones (1976). In a U-shaped seat design, the middle four seats of the first and second rows were labeled the Middle Center action zone, with five other zones made up of Middle Left, Middle Right, Middle Rear, Immediate Left, and Immediate

Right. The findings of the assigned seat group when questioned about seat preference indicated that students behaved and achieved as if they were sitting in their preferred seat. As previously stated, the findings were not significant; however, the majority of students with A and B grades preferred the Middle Center action zone while less than 50% of the students with C grades preferred the Middle Center action zone.

In a study of 106 medical students who self-selected their seats, there was a significant association found between grade score and interaction zones (Zomorodian et al., 2012). The classroom was broken into high (H), medium (M), and low (L) interaction zones. The classroom, from front to back, had fourteen seats in twelve rows and seven seats in the final three rows, which were separated four and three by the projection center. The H zone was V-shaped encompassing six rows from front to back and funneling from eleven seats in the middle of the front row to the most middle seat in the sixth row. The M zone made up the periphery of the classroom lateral to the H zone, two seats on the left side and one seat on the right side of the H zone at the front and expanding to fourteen seats in the eighth row. The findings supported a significant but weak relationship between grade score and the distance of the student from the professor $r = -0.2$, $p = 0.031$. There were nine students with A grades; six of those students sat in the H zone and three sat in the M zone. Simply put, there were no A students who preferred to sit at the back of the class (Zomorodian et al., 2012).

In the study by Marshall and Losonczy-Marshall (2010), analysis was performed to determine if students who chose seats in the middle of the room scored higher than those students who chose peripheral seats. The students sitting in the center of the room

(M = 80.8, SD ± 12.0, n = 843) scored significantly higher $t(1826) = 3.52$, $p < .001$, than those students sitting in perimeter seats (M = 78.8, SD ± 12.4, n = 985) (p. 572).

Personality and motivation. In an attempt to explain some of the variables that potentially contribute to seat preference and the academic achievement of those students who prefer the front seats, authors have explored the impact of personality and motivation regarding seat selection (Akimoto et al., 2000; S. Armstrong et al., 1992; Benedict & Hoag, 2004; Brooks & Rebeta, 1991; Çinar, 2010; Fernandes et al., 2011; Hillmann & Brooks, 1991; Tagliacollo et al., 2010; Totusek & Staton-Spicer, 1982). The findings of these studies is tempered with the caveat that "even though a student may sit in a front or center location [action seat], appearing motivated and engaged, the student may still not learn" (Fernandes et al., 2011, p. 75).

Totusek and Staton-Spicer (1982) correlated personality traits with action seats. As described in the achievement section above, action seats are seats located in the front half and the middle of a classroom. According to the authors, students who preferred action seats were more imaginative, aggressive, competitive, assertive, and in need of greater attention than students sitting in non-action seats. The need for greater attention or salience for students sitting in action seats was echoed by Akimoto et al. (2000).

Numerous authors have reported motivation to learn, self-efficacy, and self-esteem as necessary components for learning. In the majority of studies, students preferring action seats have reported a higher motivation to learn, greater levels of self-esteem, and positive self-concept (Benedict & Hoag, 2004; Çinar, 2010; Dykman & Reis, 1979; Hillmann & Brooks, 1991; Tagliacollo et al., 2010). Students whose seat

preference was motivated by social interaction usually chose the middle seats (Tagliacollo et al., 2010), which increased the likelihood of their receiving an D or F grade (Benedict & Hoag, 2004). Those students who chose to sit in the back rows indicated their reasoning as a preference for social isolation (Pedersen, 1994; Tagliacollo et al., 2010).

Summary. As indicated in the literature, students who prefer to sit in the middle and the front have a tendency to have higher grades. Those students who prefer action or high/medium interaction zones have significantly higher grades than those students who prefer to sit at the back of the class. Also, students sitting in action seats tend to be more motivated to learn and have higher levels of self-esteem than those sitting at the back of the class. As the results of randomly assigned seat studies indicate no statistically significant relationship between seat location and grade score, it is necessary to consider the conditions in each individual classroom experience.

Having knowledge of the classroom's students' learning characteristics, motivation, and personalities is essential to the professor who wishes to support the learning experience of the students. Acknowledging students' differences and being cognizant of the characteristics of the learners enables professors to address all areas of the classroom in order to facilitate learning (Çinar, 2010). As stated by an adult educator, "the more we know about the identity of the learner, the context of this learning, and the learning process itself, the better able we are to design effective learning experiences" (Merriam, 2004, p. 199).

In regards to this study, subjects self-selected their seats within the classrooms. Also, there were two seating diagrams upon which the subjects indicated their preferred seat, second preferred seat, least preferred seat, and their normal seat. In this manner, the analysis was performed taking into consideration actual and preferred seat locations. Based upon the literature, it was expected that the subjects sitting in the middle and action seats would be more successful academically than those sitting on the periphery and at the back. Motivation and personality factors were not considered within the context of the study.

Past Profession. In searching the literature for students with previous professions and educational experiences, there was a paucity of information. In the absence of studies on past professions, studies were reviewed that presented past educational performance, and articles on graduate and second career students in an attempt to provide information regarding the variable of past profession.

A qualitative study of 14 graduate dentistry students in England had a subject pool that was similar to the subjects in the present study (Newton et al., 2011). The students indicated that the course of study was hard work, but worth it. The students found their past experiences in team work, research skills, patient skills, and abilities in study techniques provided relevant, transferable, and adaptable skills. In particular, the authors cited Wilson, Clarke, Eaton, and Gallagher, who indicated that having a previous degree "contributed to stronger acquisition of bio-scientific knowledge, and that age and maturity accounted for better clinical skills" (p. 37). As all of the subjects in this present

study are adult learners, it was predicted that those osteopathic students with a minimum bachelor degree and healthcare profession would be more successful in the program.

Phan (2012) studied 234 university students regarding math achievement and the effects of previous academic achievement and effort. Phan found that prior academic achievement had an effect on achievement in mathematics, B = .11, SE = .04, $p < .01$. Prior academic achievement had a positive effect on learning and future academic achievement. This study provided support for the hypothesis that past profession has a positive relationship with academic achievement.

In another qualitative study, second career teachers were interviewed regarding their level of self-efficacy in regards to their teaching abilities (P. I. J. Tan, 2012). Student teachers reported that they used transferable skills from their previous professions to work through challenges and promote self-efficacy. When the student teachers' students demonstrated achievement, the student teachers' self-efficacy increased. This is paralleled with osteopathic students and the improvement in their patients' conditions. If osteopathic students in student clinic or in their personal practices are successful in assisting their patients, self-efficacy levels would be expected to increase.

In a conceptual paper of learning strategies and meta-cognition, the concept of salutogenesis was presented (Boström & Lassen, 2006). Salutogenesis relates to health and well-being, and is in keeping with osteopathic teaching and practice. In the context of learning, meaningfulness of learning may "induce positive pressure towards salutogenesis" (p. 185). Having positive experiences in learning increases the sense of

control and promotes self-concept. Prior academic achievement promotes self-efficacy and provides learners with the ability to use previous skills and resources to enhance learning.

Summary. Self-efficacy and past experiences in relation to academic achievement promote positive experiences in learning. Previous knowledge, work experience, and life experience have been qualitatively reported to aid in academic achievement and reported self-efficacy. There is quantitative evidence to support previous academic achievement as having a positive effect on future academic achievement. Thus osteopathic students with previous healthcare professions and experience should have increased levels of self-efficacy and skills that will be transferable to learning and practicing osteopathy. As such, it is predicted that part-time traditional manual osteopathic students who have a previous healthcare degree and manual therapy practice will perform better in the osteopathic program than students who do not have healthcare backgrounds or who do not have manual therapy practices in which to hone their newly acquired skills.

Review of Methodological Issues

This study was a predictive study, which was designed to provide evidence concerning the interrelationships among seat preference, past profession, and learning style, and student achievement as measured by grade score. A predictive study requires a quantitative design in order to capture data to analyze and generate a predictive equation (Lodico et al., 2010). In considering the design and methodology of this study, predictive studies in healthcare professions were reviewed to substantiate the method and design.

As well, justification for the use of the LSI is presented along with the need for the development of the Demographic Seat Preference Survey (DSPS).

In the healthcare literature, academic predictive studies for nursing ranged from nurse anesthetists (Burns, 2011), to community college (Seago et al., 2012), to baccalaureate (Peterson, 2009) students. In the physiotherapy literature, the predictive studies were in regards to student risk of academic probation (Jewell & Riddle, 2005; Utzman et al., 2007), and competence on the Canadian Physiotherapy Competency Examination (P. A. Miller, Cooper, & Eva, 2010). Four articles related to predicting academic success were associated with pharmacy (Sansgiry et al., 2006), occupational therapy (Lysaght et al., 2009), dental hygiene (Ward et al., 2010), and medical (Gurpinar et al., 2010) students.

All of the studies used previous academic achievement as a predictor of present or future academic success, but only the study of nurse anesthetists used a predictive variable of years of clinical experience (Burns, 2011). A statistically significant negative correlation existed between years of critical care nursing experience and current GPA. Thus, years in clinical practice may put a student at a disadvantage when returning to academia; however, the correlation was weak, $r = -0.135$, $\beta = -0.08$, $N = 914$. In keeping with the characteristics of andragogy and the unique makeup of the students in the part-time traditional osteopathic program, past profession was considered a crucial predictive variable and was used instead of past GPA scores.

In the study regarding medical students, a logistic linear regression analysis was used to predict student satisfaction, nominal level data, using independent variables of

learning style and other student characteristics (Gurpinar et al., 2010). The assimilating learning style "was the unique statistically significant factor predicting student satisfaction with traditional training" (p. 194), and was also significantly indicated in predicting scores on theoretical block exams. The authors of the study developed a sociodemographic questionnaire to gather data regarding age, sex, school, and decisions to study medicine. In support of the LSI's reliability, the Cronbach α-value was 0.89 (Gurpinar et al., 2010). Thus, there existed evidence for use of the LSI as a reliable tool and the need for developing the DSPS to gather information on students' seat preferences and past professions for this study's predictive analysis.

In Burns (2011) study, a multiple regression analysis was preformed to determine what amount of variance in current GPA scores could be predicted by the variables of GPA, ScienceGPA, total Graduate Record Examination (GRE) score, and number of years of critical care nursing experience. The use of multiple regression analysis was warranted, as the predictive variable was interval level data. Burns reported significant findings with an $R^2 = .145$ indicating that the predictive variables accounted for 14.5% of the variance of current GPA scores. The analysis performed was similar to the analysis for this study, as the predicted variable was interval level data; however, due to the need to dummy code seat preference, learning style, and past profession, the present study used an intrinsically linear model multiple regression analysis (Meyers et al., 2006).

All of the studies used regression models to develop the prediction equation. In the dental hygiene study, a forward, step-wise regression model previously generated in the literature was used to correlate actual and predicted GPA of a new cohort (Ward et

al., 2010). Although step-wise regressions offer interesting models, for the purposes of this dissertation, an intrinsically linear model multiple regression was chosen based upon the evidence in the literature regarding seat preference, LSI scores, and previous profession to predict academic achievement. It was hypothesized that the seat preference, past profession, and learning style would have similar impacts on the predictive equation, thus justifying not using a step-wise regression.

The design of the DSPS mimicked the data collection procedure of Farnsworth (1933) for seating preference and achievement scores, and incorporated the addition of the LSI data as used by healthcare research (Gurpinar et al., 2010; Hauer et al., 2005; McCart & et al., 1985; Wessel & Williams, 2004). The DSPS was created for the purpose of the study to collect demographic data as well as seat preferences. As there were two different classroom designs used throughout the sampled locations, the DSPS seating diagrams reflected the floor plans with which students were familiar.

The studies reviewed incorporated demographic surveys, access to student grades, adapted test anxiety inventories, scales of self-efficacy and self-esteem, and used a convenience sampling method to gather data. Farnsworth (1933) used a seating plan for which students were provided instructions. A similar methodology and design was used in this dissertation incorporating two different seating plans for students. Thus, the methodology and design was grounded in the works of authors of similar studies.

Synthesis of Research Findings

The literature presented provides the reader with an exhaustive view of the use of predictive studies in allied healthcare education, seat preference, past professional

experience, and experiential learning theory and the use of the LSI. The pertinent outcome of the studies indicated that previous GPA scores are predictive of future academic success. The quantitative studies, with the exception of Burns (2011), did not incorporate past professional experience as a variable. In the two qualitative research studies presented, past professional experience permitted students to use transferable skills to achieve educational goals and promote self-efficacy. Given the nature of adult education and the emphasis of experience in ELT, SLT, and andragogy, the gap in the literature regarding past professional experience and learning makes past profession as a predictive variable worthy of study.

The studies of learning styles reviewed were limited to those that used the LSI in keeping with the methodology of the present study. The findings reported in the literature related to allied healthcare professions revealed a propensity of learning styles to include abstract conceptualization and reflective observation. To summarize the healthcare literature regarding achievement and learning style relationships, there was no significant learning style that had better overall academic achievement scores. In studies with a statistically significant difference in academic achievement between Kolb's learning styles, the students with preferences for assimilating and converging learning styles appeared to be the most successful. Considering the work of Tulbure (2102b) and Coker (2000), it was posited that there are numerous factors that are necessary to bear in mind when reviewing the literature related to these variables: academic major, learning experience, and the state of mind of subjects when filling out the LSI. In regards to the present study, if the literature provided an accurate representation of the relationship

between learning style and achievement, students with assimilating and converging learning style preferences will score higher than students with diverging and accommodating learning style preferences, but the findings are not likely to be statistically significant.

As indicated in the seat location/preference literature, students who preferred to sit in middle and front seats had higher grades. Those students who preferred action or high/medium interaction zones had significantly higher grades than those students who preferred to sit at the back of the class. Also, students sitting in action seats tended to be more motivated to learn and had higher levels of self-esteem than those sitting at the back of the class. As the results of randomly assigned seat studies indicate no statistically significant relationships between seat location and grade score, it is necessary to consider conditions in each individual classroom experience. In the present research study, those students sitting in the action seats are predicted to have higher academic achievement scores in keeping with the reported findings in the literature.

The purpose of this study was to determine if the variables of seat preference, learning style as measured by the LSI 3.1, and past profession are predictive of and could explain a portion of the variance of the mean academic achievement score as measured by year-end test scores in part-time traditional manual osteopathic students. Based upon the literature reviewed, there was a paucity of research related to part-time osteopathic students with past professions thus warranting the research hypothesis related to profession and academic achievement. Within the literature, there was support for the predictability of seat preference in relation to academic achievement, but this had not

been studied in the osteopathic educational literature. As the sample for this study was composed of students from myriad professional experiences, it was a unique opportunity to study the learning styles in this mixed group of professionals who had decided to study traditional manual osteopathy. The findings related to learning styles would add to the body of knowledge regarding learning preferences among adult learners in allied healthcare professions. To date, no studies have been found relating these three variables in relation to academic achievement in the osteopathic educational literature or the general educational literature. Insight into how this group of students' preferred learning styles will be of benefit to osteopathic educators.

Critique of Previous Research

Overall, the literature reviewed provided the reader with a global appreciation for the work and research required to develop the present knowledge base related to seat preference, learning styles, and prediction of achievement in post-secondary adult education. The studies reviewed were pertinent, peer-reviewed papers with appropriate conclusions but limited generalizability. The authors of all of the studies called for future research to validate findings and provided suggestions for future research given the limitations of their studies.

In critiquing the literature, the most salient issue was the lack of thorough statistical analysis, or perhaps the absence of a thorough analysis presented in the studies. With the exception of a few, most articles did not indicate a power analysis, or an observation of outliers in the data, or the manner in which the outliers were handled. In the absence of a power analysis, the findings of a study are limited to the sample studied

and even then, it is questionable as to whether the findings are important and relevant. In two studies the findings were overstated; one due to an α-value of 0.15 stated as significant (Hargrove et al., 2008), and the other reporting general statistically significant findings that would mislead an abstract reader when the statistics supported only two specific findings (Lockie et al., 2013).

Due to the nature of the studies, the predominant sampling method used was a sample of convenience. Although this is not considered the strongest sampling method, as the results are not generalizable to the population beyond the studied sample, it is a reasonable method given the purpose of the findings (Creswell, 2009; Lodico et al., 2010). The sampling method used raises the concern of potential responder bias; however, with prediction studies sampling entire classes, responder bias is dampened. Given the limitation of the sampling method of the literature reviewed, it was important to achieve power for the statistical analysis in order to be able to confidently comment on the findings in relation to the subject population. It was noted that for populations of 500, "approximately 217 participants from the population should make up the sample" (Lodico et al., 2010, p. 217). Thus, many of the studies reviewed did not achieve sample sizes large enough to ensure the findings were representative of the population surveyed.

In the present study, a convenience sample was used to sample all English-speaking campuses within accredited part-time traditional manual osteopathic programs in Canada and one Swiss affiliated college. The study sample (n = 246) reached the size required to achieve power. In keeping with the rigors of reporting research findings, the results are only generalizable to the English-speaking campuses studied.

Chapter 2 Summary

The literature reviewed was chosen based upon applicability, credibility, and accessibility. The articles presented represent an exhaustive search of the allied healthcare educational literature and when appropriate, the general education literature related to the variables of achievement, seat preference, learning style as measured by the LSI, and past profession or past academic achievement. The literature was critically assessed regarding study design, statistical methods, sample size, methodology, and presentation of the results.

The theoretical framework for this study was a compilation of Social Learning Theory (Bandura, 1977, 1986), Experiential Learning Theory (A. Kolb & Kolb, 2005a; D. A. Kolb, 1984), and Andragogy (Knowles, 1980; Knowles et al., 2005). The characteristics of an adult learner as defined by andragogy reflected the subjects in the study, who were working professionals studying in a part-time program while continuing in their full-time professions. The method of learning the necessary osteopathic techniques and manual skills uses the application of SLT. The method of becoming an osteopathic practitioner through reflection, abstract conceptualization, active experimentation, and concrete experience uses the application of ELT.

A theoretical assumption was that there is a predominant learning style among the part-time traditional manual osteopathic students. Learning styles have not been statistically linked to general achievement in post-graduate courses, but the different styles have been associated with professions. In the healthcare literature, the traditional osteopathic manual practitioner has not been linked to a specific learning style. As a

result of the data gathered, there was an opportunity to correlate professions with learning styles to determine if there was support for the findings reported in the literature. Based upon the literature reviewed, it was predicted that the assimilating learning style would be predominant but perhaps not statistically significant. It was also hypothesized that students preferring the assimilating learning style would have the highest grades, although again, not statistically significant higher than the other learning styles.

The assumption from the literature was that students who sit in front row/action seats obtain higher grades than students who sit in peripheral or back seats. Farnsworth (1933) postulated that the higher grades on the right side of the classroom were related to professor attention to that specific sector. His findings were observational only but did correlate with student observations. As the subjects in this study self-selected their seats, the assumption was that the subjects sitting in action seats would have significantly higher grades than those students sitting in non-action seats.

The traditional manual osteopathic students at the accredited part-time colleges studied were all post graduate learners who came to the program with myriad backgrounds and experiences. A recent admissions criteria change within the studied programs to admit students with non-healthcare backgrounds has led to concerns of students lacking basic anatomy and physiology knowledge, and experience necessary to be successful. Past professional achievement was linked with self-efficacy and was expected to be a factor in achievement scores of the subjects. To date, there have been no published studies regarding the academic achievement of osteopathic students with previous degrees or the predictive nature of past profession upon academic achievement.

A deficit exists in the literature regarding osteopathic learners and past profession impact upon achievement. There is also a deficit in the reviewed literature regarding the relationship of seat preference and learning style. This study was designed to offer information regarding the predictive relationship of student achievement and the variables of past profession, seat preference, and learning style.

To date, there have been no studies conducted within the accredited traditional osteopathic part-time private colleges in Canada and its international affiliates regarding the predictive nature of factors involved in student achievement. In this preliminary study, the potential individual factors of seat preference, past profession, and learning style were chosen from the literature. The results will provide evidence to support or revise the present admissions criteria, curriculum, and level of academic support available.

CHAPTER 3. METHODOLOGY

Introduction to Chapter 3

In Chapter 3 the methodology of the dissertation is presented. The specific components of the methodology include the purpose of the study, research question and hypotheses, research design, population and sampling procedures, instrumentation, data collection, field testing, operationalization of variables, data analysis procedures, limitations of the study, internal and external validity, expected findings, and ethical issues. Each component is discussed and elaborated upon such that the reader is oriented to the study and the study is reproducible.

Purpose of the Study

The purpose of the predictive study was to understand the interrelationships among seat preference, past profession, and learning style, and student achievement as measured by grade score. Understanding the strongest predictive independent variables will provide traditional osteopathic educators with insight into the academic potential of students who enroll in the program. Knowledge of potential student learning issues can permit the implementation of academic support early in the program.

Predictive achievement studies were present in healthcare and educational literature regarding nursing students (Briggs, House, & Embry, 2009; Burns, 2011; Peterson, 2009; Seago et al., 2012; Ukpabi, 2008; Waterhouse & Beeman, 2003); occupational therapy students (Lysaght et al., 2009); physical therapy students (Jewell & Riddle, 2005; P. A. Miller et al., 2010; Utzman et al., 2007); dental hygiene students (Ward et al., 2010); pharmacy students (Sansgiry et al., 2006); medical students (Gurpinar et al., 2010); and chiropractic students (Schutz, Dalton, & Tepe, 2013). The variables studied in the literature ranged from self-esteem, motivation, learning inventory scores, and metacognitive skills, to GPA, previous academic achievement, and critical thinking. To this date, there are no known predictive studies related to the part-time traditional osteopathic student population and the variables of seat preference, learning style, and past profession, and academic achievement.

Research Questions and Hypotheses

The research question that guided this study was:

Research question. How and to what extent do the variables of seat preference, past profession, and learning style account for the variances in student achievement as measured by grade score in traditional osteopathic part-time education?

$H_0$1. There is no statistically significant ($p < 0.05$) predictive relationship among the variables of seat preference, learning style, and past profession, and student achievement as measured by grade score.

$H_0$2. There is no statistically significant ($p < 0.05$) predictive relationship between the variable of seat preference and student achievement as measured by grade score.

$H_0$3. There is no statistically significant ($p < 0.05$) predictive relationship between the variable of learning style and student achievement as measured by grade score.

$H_0$4. There is no statistically significant ($p < 0.05$) predictive relationship between the variable of past profession and student achievement as measured by grade score.

$H_1$1. There is a statistically significant ($p < 0.05$) predictive relationship among the variables of seat preference, learning style, and past profession, and student achievement as measured by grade score.

$H_1$2. There is a statistically significant ($p < 0.05$) predictive relationship between the variable of seat preference and student achievement as measured by grade score.

$H_1$3. There is a statistically significant ($p < 0.05$) predictive relationship between the variable of learning style and student achievement as measured by grade score.

$H_1$4. There is a statistically significant ($p < 0.05$) predictive relationship between the variable of past profession and student achievement as measured by grade score.

Research Design

This study used a quantitative non-experimental predictive design (Creswell, 2009) similar to published studies relating previous GPA to academic achievement in an occupational therapy masters program (Lysaght et al., 2009), and academic success and psychological wellness in undergraduates (Chow, 2010). Studies that considered academic achievement with self-esteem or personality traits, or correlated learning styles to profession were used as design models (N. Armstrong & Chang, 2007; Benedict & Hoag, 2004; Hauer et al., 2005; Totusek & Staton-Spicer, 1982). As it is often challenging to perform experimental research in education, regression analysis is a

powerful tool with regard to identifying correlative relationships among variables (R. Watts, Personal Communication, May 14, 2012). This study used a quantitative predictive non-experimental design in order to answer a research question with measurable numerical data that could be analyzed statistically to test the hypotheses. The data generated by the study were continuous—grade score—and categorical—seat preference, learning style, and past profession—and provided appropriate quantitative data for analysis.

Target Population, Sampling Method, and Related Procedures

Target Population

The target population for this study was students enrolled in the accredited part-time traditional osteopathic colleges in Canada and Switzerland. In the three colleges, there were five English-speaking campuses specifically targeted for the study. The students are adult learners, the majority of which have previous healthcare professions. These campuses were chosen as they were accredited programs, they were accessible, and the language of instruction was English in keeping with the researcher's first language.

Osteopathic schools in Canada are privately owned businesses that are not regulated by the Ministry of Education. In Canada, the practice of manual osteopathy is yet to be regulated. As such, there are many schools that have varying standards and curricula. There are only two accredited osteopathic colleges in Canada with the accrediting institution in England. The two affiliated osteopathic colleges in Canada

have accredited conversion degree programs. An internationally affiliated college, in Switzerland, has also been accredited.

The student population of the three accredited part-time colleges and affiliated campuses in 2013-14 academic year was: 103 in Location 1, 49 in Location 2, 258 in Location 3, 39 in Location 4, 59 in Location 5, 296 in Location 6, and 95 in Location 7. The total student population of the accredited colleges in Canada and its Swiss affiliate was 899. The language of instruction is English in Locations 1 thru 5, which was the reason for targeting these campuses, as the researcher is unilingual English. For the purposes of this paper the campuses with English instruction are identified as English-speaking. However, not all the students in these campuses have English as a first language.

The convenience sample for the study recruited volunteer participants in a quasi-experimental format. Email, Skype, and direct contact with the English-speaking campuses of the accredited traditional manual osteopathic part-time colleges were methods of recruitment. The population was approximately 508 students in the 2013-2014 school year as presented in Table 1. Please note that Location 2 is a new campus and did not have a third, fifth, or thesis writer class. Location 4 is a small campus and did not have a first, third, or fifth year class.

Table 1. Student Population English Part-time Accredited Colleges 2013-2104

Campus	1st Year	2nd Year	3rd Year	4th Year	5th year	Thesis Writer	Total by Location
Location 1	18	13	15	10	16	31	103
Location 2	12	21	0	16	0	0	49
Location 3	30	35	27	36	28	102	258
Location 4	0	19	0	10	0	10	39
Location 5	14	8	9	11	13	4	59
Total by Year	74	96	51	83	57	147	508

Sample Size

According to Field (2009), the power analysis for a predictive equation with an alpha level of 0.05 is 104 + *k* where *k* is the number of predictors. In the study, there were thirteen predictor variables, seat preference (2): action and non-action seats for each of the 10 X 5 and 4 X 7 seat configurations; past profession (7): medical doctor (MD), osteopathic physician (DO), and dentist (DDS); Naturopath (ND) and Homeopath (HD); chiropractor (DC) and physical therapist (PT); athletic therapist (AT); Nurse, Kinesiologist, and occupational therapist (OT); massage therapist (RMT); and other professions; and learning style (4): assimilating, diverging, converging, and accommodating; making the minimum sample size $N = 117$ subjects.

Using the power analysis function in the statistical software program Stata/IC 13.1 with a conservative command string of powerreg, r2f(.10) r2r(.0) nvar(13) ntest(13) alpha(.05) power(.90), the sample size required was calculated as $N = 213$ (Acock, 2012). The null hypothesis stated that the amount of variance in the criterion variable, average

grade score, explained by the predictor variables, seat preference, past profession, and learning style, would be R^2=0.

H_0: $R^2 = 0.00$

H_a: $R^2 = 0.10$

In the command string, r2f (.10) indicated that the predictor variables explain 10% of the variance in the criterion variable. The alpha level was 0.05. Power was 0.90. The number of variables was thirteen and the number of variables tested was thirteen. The results of the power analysis indicated that 213 subjects were required to have a power of 0.90 with an alpha of 0.05 when thirteen independent variables were used and the results would only be considered interesting when the true R^2 of the sample was at least 0.10 (Acock, 2012). The sample size of the study available for full data analysis ($N = 229$) exceeded the minimum number of subjects required to achieve power recommended by Acock's or Field's equations.

Setting

The setting of the study was the homes and classrooms of the students attending the English speaking campuses of the five locations targeted for the study. The settings were chosen for language and convenience, but the subjects were also representative of the part-time traditional osteopathic student population. The researcher is a faculty member of the accredited part-time traditional manual osteopathic colleges. Being a faculty member made site access feasible. Site permission was obtained in keeping with Institutional Review Board (IRB) standards. To minimize ethical concerns regarding the

use of students known to the researcher, the methodology was designed to ensure blinding of the participants' identity.

Sampling Method

The sampling method used a non-probability convenience sampling. Using non-probability sampling, "the researcher selects individuals because they are available, convenient, and represent some characteristic the investigator seeks to study" (Creswell, 2009, p. 155). Approval for site access was achieved through letters to the president and principals of the colleges, and the authorized contacts were established. The IRB granted approval for the study on May 28, 2013. With the approval of the president of the colleges and the principals, following the pre-data collection meeting with the researcher's dissertation committee, emails were sent on June 5 and 19, as well as July 2, 2013 to the students at the targeted five locations. The classes of the sampled colleges were petitioned for volunteers by email, Skype, and in person.

Email Recruitment. Email recruitment occurred through the authorized contacts. Emails were sent out initially on June 5, 2013 after Institutional Review Board (IRB) approval was granted. Email recruitment was initiated as IRB approval occurred after the end of term in the colleges and email recruitment was the only method to reach the students through the summer months. Email recruitment was repeated on June 19 and July 2, 2013. The authorized contacts of the five locations sent an information and recruitment email with the attached consent form, Kolb's Learning Style Inventory 3.1 (LSI 3.1) and Demographic and Seat Preference Survey (DSPS) to potential volunteer subjects through class representatives. Potential subjects used a specific email address to

contact the researcher to ask any questions regarding the study prior to consenting to participate in the study. Once the subject agreed to participate, the participant downloaded and filled out the three documents. These documents were returned to the research assistant's email, faxed to the research assistant, or mailed to the research assistant. Upon receipt, the research assistant assigned the confidentiality code to the data and confirmed that all the forms were complete. The research assistant then provided the researcher with the coded data to ensure the researcher was blind to the identity of the participants.

Skype Recruitment. The second method of recruitment used Skype video conferencing. The researcher convened a Skype meeting with Location 5, on June 18, 2013 to recruit participants. The authorized contact for Location 5 was present with the students. The researcher provided information to the potential volunteer subjects and answered any questions that arose. The researcher then signed off of Skype in order to maintain blinding to participant involvement. The authorized contact for Location 5 disseminated the information package, consent form, and instruments to the students following the Skype meeting. The authorized contact collected the completed forms and sent the package by Purolator to the research assistant. Upon receipt, the research assistant assigned the confidentiality code to the data and confirmed that all the forms were complete. The research assistant then provided the researcher with the coded data to ensure the researcher was blind to the identity of the participants.

Classroom Recruitment. The final method of recruitment was face-to-face contact in the classroom between students and the researcher or the gatekeeper for the

site. Classroom recruitment was necessary because email and Skype recruitment were not successful in achieving the required sample size. The sample size was $N = 83$ at the beginning of August 2013. In order to achieve the appropriate sample size, the third form of sampling was commenced on August 9, 2013 and continued until October 6, 2013 at which time a sample size of $N = 248$ was achieved and recruitment and data collection ceased.

The researcher provided information to the potential subjects and answered any questions regarding the study. After all the questions were answered, the researcher or authorized contact left the coded forms at the front of the class and left the room. Those students who voluntarily participated took the information package with consent form, DSPS, and LSI 3.1. The participants filled out the forms and placed the completed forms in an envelope at the front of the class. The researcher or authorized contact entered the room, sealed the envelope with all the forms without viewing the documents, and the envelope was sent to the research assistant via Purolator or hand delivered. Upon receipt, the research assistant assigned the confidentiality codes to the data and confirmed that all the forms were complete. The research assistant then provided the researcher with the coded data to ensure the researcher was blind to the identity of the participants.

Instrumentation

The instruments used to gather quantitative data in the study consisted of one inventory, the LSI 3.1; a survey, the DSPS; and achievement scores from student records. The LSI 3.1 had been used in a number of healthcare education research studies (Gurpinar et al., 2010; Hauer et al., 2005; Wessel & Williams, 2004). The DSPS was

created for the study to gather demographic and seat preference information. The achievement scores of the participants were obtained from the students' files accessed by the registrars of the colleges.

Learning Style Inventory 3.1

The Kolb Learning Style Inventory (LSI 3.1) is a self-assessment instrument designed to "help individuals identify the way they learn from experience" (A. Kolb & Kolb, 2005a, p. 1), and is based upon Kolb's theory of experiential learning (D. A. Kolb, 1984). While the instrument was provided free of charge from the Hay Group for the purposes of this study and permission was granted for use of the LSI 3.1 for data collection, the reproduction of the instrument in the dissertation was strictly forbidden under the terms of agreement with the Hay Group. As such, the LSI 3.1 is not provided in the body or appendix of this paper.

There have been five versions of the LSI since 1969 in order to continually improve the inventory in response to its critiques (A. Kolb & Kolb, 2005a). The latest version has been reported to be valid and reliable (Chapman & Calhoun, 2006; A. Kolb & Kolb, 2005a; Pedrosa de Jesus et al., 2006). Internal consistency reliability studies have reported Cronbach's alpha coefficients ranging across the scale scores from .52 to .84 indicating good internal reliability (Kayes, 2005; A. Kolb & Kolb, 2005a; Pedrosa de Jesus et al., 2006). Further supporting evidence was provided in a study of Turkish university students, in which the Cronbach alpha reliability scores were .68 for CE, .71 for RO, .78 for AC, and .71 for AE. The unified scores were .75 for AC-CE and .72 for

AE-RO (Tümkaya, 2012). As a final comment on validity and reliability, Kayes (2005) reported that

> this study provides exploratory evidence for the internal reliability and validity of the LSI-3, consistent with prior research. The dimensional scale scores were acceptable levels. In regards to the internal construct validity, comparison of the between item and within item correlations suggest support for the internal construct validity. (pp. 255-256)

In test-retest correlation studies, Kappa coefficients ranged from .36 (Ruble & Stout as cited by A. Kolb & Kolb, 2005, p. 16) to .86 (Veres et al., as cited by A. Kolb & Kolb, 2005a, p. 16) indicating moderate to excellent correlations. In a test-retest study of medical students over a two-year period, there was no statistically significant change in learning styles (Gurpinar et al., 2011).

The decision to utilize the LSI 3.1 was based upon four rationales. The LSI had been used extensively in the healthcare educational literature (Gurpinar et al., 2011; Hauer et al., 2005) making it feasible to draw comparisons among the different healthcare professions, many of which have members studying osteopathy in the part-time program studied. The length of time to complete the inventory was a factor considered in its choice. A short, concise instrument was thought to be more appealing to the subjects and thus more likely to ensure participation in the study. The final two rationales were ease of administration and scoring. The LSI 3.1 does not require lengthy instructions and a spreadsheet was constructed to score the results efficiently.

The LSI 3.1 is a 12-item inventory, which when scored identifies a learner's preference for one of the four learning styles in the experiential learning theory (ELT): assimilating, accommodating, converging, and diverging as discussed in Chapter 2. The

12 sentence stems have four forced-choice ranked endings. The sentence ends with one of four words, which are ranked as one for "least like me" to four for "most like me" (A. Kolb & Kolb, 2005a). The endings reflect four modes on the learning cycle: concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE) (A. Kolb & Kolb, 2005a).

The scores for each mode can range from 12 – 48. The learning preference is determined by subtracting the CE score from the AC score and the RO score from the AE score. The researcher plotted the scores on the ACCE axis (abstract conceptualization and concrete experience) and the AERO axis (active experimentation and reflective observation) to identify the participant's preferred learning style. Scores in the CE-RO quadrant represent the diverging learning preference. Scores in the RO-AC quadrant represent the assimilating learning preference. Scores in the AC-AE quadrant represent the converging learning preference. Scores in the AE-CE quadrant represent the accommodating learning preference (A. Kolb & Kolb, 2005b).

The variables measured were the ACCE score and the AERO score. These variables provide interval data and were used in the predictive equation as X_3 and X_4. The learning style variable X_5 is nominal data and was represented as (a) assimilating, (b) accommodating, (c) diverging, and (d) converging. The learning style variable was analyzed descriptively and used in the predictive equation in order to respond to the research question.

The LSI 3.1 was administered in paper format. The raw data will be kept for seven years in a sealed envelope in a locked cabinet and be available for review upon

request. Individual scores are associated by confidential codes. As the LSI 3.1 was scored following confidential coding, the study participants do not have access to their individual scores. The learning styles are presented in table format in the analysis and results, and the conclusion and discussion chapters.

Demographic and Seat Preference Survey

The Demographic and Seat Preference Survey (DSPS) was developed to gather specific information regarding age, gender, past profession, education, sensory challenges, and preferences for seat selection (Appendix). The survey consists of multiple-choice options, forced choice ranking, choice ranking, and fill in the blank questions as presented in Table 2. DSPS Specifications.

The rationale for asking for first language of the subjects was pertinent to the international makeup of the colleges. Although the colleges sampled use English as the language of instruction, many of the students' first language is not English. Learning in a language other than one's first language can affect the achievement scores of an individual (Din Yan, Tsang, & Cheung, 2003; P. Miller & Peleg, 2010; Saeed & Jarwar, 2012). As the same exams are given across the campuses, data was gathered to consider the effect that language has on grade score.

The question regarding campus location served a dual purpose for data collection and analysis. The knowledge of campus facilitated the gathering of academic achievement scores from the registrars. Campus information permitted analysis between campuses, which may explain language and/or cultural differences. As discussed in the literature, "research can also examine the role of native language of the students since

language is a medium for transmitting and internalizing culture (Omidvar & Bee Hoon, 2012, p. 281). The analysis of culture and language was beyond the scope of this study.

The question regarding education level provided information regarding the subject's highest level of academic achievement to date. The positive effect of prior academic achievement on future achievement has been addressed in the literature (Phan, 2012). Knowledge of previous academic achievement may provide assistance in explaining the results and offer insight into the discussion regarding knowledge base and academic skills.

The three seating plan diagrams were constructed from floor plans within the classrooms of the campuses. The first diagram is a forced ranking of nine zones within a classroom. The second diagram represents a classroom design of 4 X 7 that is common to Locations 1, 2, 4, and 5. There are two tables per row with four seats, two students per table. There are seven tables in each column from front to back for a total of 28 seats. The third diagram presents a 10 X 5 configuration consistent with classroom designs at Location 3. There are five tables per row and five tables deep resulting in 50 seats. Participants indicated where the first preferred seat, second preferred seat, least preferred seat, and normal seat were located.

Table 2. DSPS Specifications

Question	Item type	Data	Construct measured	Content domain	Literature Support
1. Year of study	MC	N	Year of study	D	(Brown et al., 2009; Crawford et al., 2012)
2. First Language	MC	N	Language	D	(Din Yan et al., 2003; P. Miller & Peleg, 2010)
3. Campus	MC	N	Geographic/ language	D	(Omidvar & Bee Hoon, 2012)
4. Past Profession	MC	N	Profession	D	(Brown et al., 2009)
5. Education	MC	N	Education level	D	(Phan, 2012)
6. Sensory challenges	MC	N	Sensory factors	D	(Benedict & Hoag, 2004; Farnsworth, 1933; Miller Kregenow et al., 2011)
7. Location stability of seat	MC	N	Mobility of seat location	SP	(Dykman & Reis, 1979; Miller Kregenow et al., 2011; Zomorodian et al., 2012)
8. Reason for seat choice	FR	O	Rationale of choice	SP	(Farnsworth, 1933; Fernandes et al., 2011; Miller Kregenow et al., 2011; Tagliacollo et al., 2010)
9. Age	MC	N	Age	D	(Moseley & Dessinger, 2008)
10. Comments	OE	Q	Rationale of choice	SP	(Miller Kregenow et al., 2011)
Diagram 1	FR	O	Zone of preference	SP	(Farnsworth, 1933; Totusek & Staton-Spicer, 1982; Wulf, 1976; Zomorodian et al., 2012)
Diagram 2	CR	O	SP	SP	(Farnsworth, 1933; Kaya & Burgess, 2007; Totusek & Staton-Spicer, 1982; Wulf, 1976; Zomorodian et al., 2012)
Diagram 3	CR	O	SP	SP	(Farnsworth, 1933; Kaya & Burgess, 2007; Totusek & Staton-Spicer, 1982; Wulf, 1976; Zomorodian et al., 2012)

Note: MC = multiple choice; CR = choice ranking; FR = forced ranking; OE = open-ended; N = nominal; O = ordinal; Q = qualitative; D = demographic; SP = seat preference.

Academic Achievement Scores

Achievement scores were collated with the confidentiality codes for analysis. The scores represented the 2012-2013 year-end average test score of the last completed year of study of the participant. In the case of first year subjects, the 2013-2014 final year-end average test score was used as the achievement score.

Data Collection

The data collection instruments provided the data necessary to analyze and answer the research questions and test the hypotheses. The data collected were appropriate for the multiple regression analysis, which was performed to construct the prediction equation (Acock, 2012; Meyers et al., 2006).

Data collection commenced following IRB approval on May 28, 2013 and completion of the dissertation committee pre-data collection call on June 5, 2013. Email recruitment commenced on June 5, 2013 with follow-up emails sent on June 19, 2013 and July 2, 2013. A Skype recruitment meeting was convened on June 18, 2013 with Location 5. The final recruitment method was face-to-face in the classrooms by the researcher or established authorized contacts and concluded on October 6, 2013.

The authorized contacts at the studied locations were sent an email package, which included an information letter for potential subjects, the consent form, LSI 3.1, and DSPS. Students were able to ask questions regarding the study by emailing the researcher prior to volunteering to participate in the study. Students who agreed to participate in the study filled out the informed consent, LSI 3.1, and DSPS. The data was sent to the research assistant via email, fax, or mail. The research assistant confirmed

that the information was complete, and coded the data for analysis. The research assistant contacted the registrars of the appropriate colleges to receive the grade scores for the subjects. The scores were collated with the confidential codes and sent to the researcher for analysis.

The researcher reviewed the data for completeness and accuracy. The LSI 3.1 was scored using the LSI 3.1 scoring equations and an Excel spreadsheet to determine the AC, CE, AE, RO, AC-CE and AE-RO scores. The scores were plotted on the quadrant-scoring grid to determine the learning style. The coded data for each subject from the DSPS, LSI 3.1, and academic scores were then entered into an Excel spreadsheet in preparation for statistical analysis with SPSS 20 (George & Mallery, 2011) and STATA 13.1 statistical programs. Excel 2008 for Mac, version 12.3.6 was used for the spreadsheet.

Field Test

An expert field test was conducted for the created instrument, DSPS, prior to IRB approval. The expert field test was performed in order to provide initial evidence for validity of the self-developed DSPS. The DSPS was developed to acquire the demographic and seat preference information necessary to analyze data required to answer the research question and test the hypotheses regarding seat preference and past profession. The expert panel reviewed the initial survey and offered feedback regarding the form, flow, and type of questions.

The expert panel was chosen for its combined experience and educational research qualifications. The expert panel members had experience in research,

instrument development, and statistics that ranged from 25 to over 40 years of experience. The panel members' qualifications included doctors of philosophy, doctors of education, and a professional engineer/statistician.

Feedback included comments regarding clarity of the directions to the subjects for the seat preference diagrams. It was recommended that a question related to culture be removed, as the information was not relevant to the research question or hypotheses to be tested. Open-ended questions were modified to become forced choice and multiple-choice to facilitate interpretation and analysis. After revision following feedback, the panel provided final approval for the DSPS on February 25, 2013.

Operationalization of Variables

This study had six variables, one criterion variable and five predictive variables. The dependent variable in a predictive study is a criterion variable. The independent variables in a predictive study are predictive variables. In order to analyze data in a predictive study using a multiple regression analysis, the criterion variable must be represented by interval level data (Acock, 2012; Meyers et al., 2006).

In this study, the criterion variable was academic achievement. The average year-end score provided the measure of academic achievement for each subject. The criterion variable in the study was represented by interval level data in keeping with the rules of multiple regression analysis.

In this study, the predictive variables were learning style, seat preference, past profession, and AERO and ACCE scores. The predictive variables in this study were represented by both nominal and interval level data. Learning style, seat preference, and

past profession were nominal level data while AERO and ACCE scores were interval level data.

The predictive variable learning style is a theoretical conceptualization of how a person learns. In Kolb's ELT, there are four constructs: abstract conceptualization (AC), reflective observation (RO), concrete experience (CE), and active experimentation (AE). The AC, CE, AE, RO, ACCE, AERO data from the LSI 3.1 is interval data and was coded with its numerical score. These four constructs are combined along two axes: AERO and ACCE. The AERO score represents the active experimentation-reflective observation axis and the ACCE score represents the abstract conceptualization-concrete experience axis. The LSI 3.1 inventory provides interval level scores that are plotted to determine the learning style. The use of ACCE and AERO scores provided interval level data for the multiple regression analysis. The use of the four learning styles identified by the AERO and ACCE scores—assimilating, converging, diverging, and accommodating—represent nominal level data. Learning style nominal data was determined from the LSI 3.1 scores and coded as 1 for assimilating, 2 for accommodating, 3 for diverging, and 4 for converging learning styles.

The predictive variable of seat preference is represented by the subject's preferred seat as indicated on Diagrams 2 and 3 of the DSPS (see Appendix). As the nominal data for multiple seat preference and seats with cell counts less than five can create issues with multiple regression statistical analysis, a decision was made to generate a new code for seat preference. The new seat code was action versus non-action that indicated high/medium versus low participation seats in keeping with an example in the literature

(McCorskey & McVetta, 1978). For Diagram 2, seats 2, 3, 6, 7, 10, 11, 14, 15, 18, and 19 were marked as action or high/medium participation zones. For Diagram 3 seats 3, 4, 5, 6, 7, 8, 13, 14, 15, 16, 17, 18, 24, 25, 26, 27, 35, and 36 were marked as action or high/medium participation zones. If a subject's preferred seat was an action seat it was coded as one and a non-action seat preference was coded as zero. The variable in the data set was named Recodep1B50 to represent the seat diagram with 50 seats. The same method was applied to seat preference in Diagram 2 with the data set variable name of Recodep147. Recodep1B50 and Recodep147 were the labels used as nominal level data to analyze the predictive variable seat preference.

The subject's previous and/or practicing profession while attending the program represents the predictive variable of past profession. Past profession was coded by category and is nominal data. The data of past profession was measured by force choice category in question four of the DSPS. Category 1 included medical doctors (MD), osteopathic physicians (DO), and dentists (DDS) representing post-graduate education without a manual therapy component. Although doctors and dentists incorporate the use of their hands when treating patients, they do not treat manually. Category 2 included naturopaths (ND) and homeopaths (HD) representing post-graduate complementary therapy without a manual therapy component. Category 3 included physiotherapists (PT) and chiropractors (DC) representing post-graduate education with a manual therapy component. Category 4 included athletic therapists (AT) and represented bachelor level education with a manual therapy component. Category 5 included nurses, kinesiologists, and occupational therapists (OT) representing master/bachelor level

education with a minimal manual therapy component. Category 6 included massage therapists (RMT) representing college level education with a manual therapy component. Category 7 included non-healthcare professionals with a variety of educational backgrounds and no manual therapy component. Category 7 was an open category that subjects filled in related to their non-healthcare profession. Category 7 had responses of biology, yoga instructor, Pilate's instructor, engineer, paramedic, and communications.

Data Analysis Procedures

Analysis

The analyses for this study involved descriptive statistics and a multiple regression. Descriptive statistics and summaries were used to provide an overall view of the data and variables with respect to the distribution of the data and statistical assumptions. Outliers were reviewed and a decision was made that the outliers should be retained in the data set. The descriptive data were analyzed with the statistical software program SPSS 20. The distribution was not normal and in the presence of retained outliers, Stata/IC 13.1 statistical software was used for the multiple regression analysis. Stata/IC 13.1 has a robust function for multiple regression analysis that SPSS does not have ("Does IBM SPSS Statistics offer robust or nonparametric regression methods?," 2012).

Multiple regression analysis is useful in behavioral research as there is often more than one variable, which may explain the variance in the dependent or criterion variable. When "several variables rather than just one [are used] to predict a value on a

quantitatively measured criterion variable" (Meyers et al., 2006, p. 147), multiple regression is the statistical test used. In considering the theoretical framework, "the model that emerges from the analysis can serve an explanatory purpose as well as a predictive purpose" (Meyers et al., 2006, p. 147). Multiple regression analysis is used to generate a linear equation "that identifies the best weighted combination of independent variables in the study to optimally predict the criterion variable" (Meyers et al., 2006, p.149).

To analyze the data in a predictive study, a multiple regression statistical analysis is required (Meyers et al., 2006). In this study, the criterion variable, $Y_{predicted}$, was represented by average year-end test scores and was continuous data. The independent variables—seat preference (X_1) and past profession (X_2)—had categorical data. Kolb's learning style inventory scores were divided into the abstract conceptualization-concrete experience (ACCE) score (X_3), and the active experimentation-reflective observation (AERO) score (X_4) provided continuous data from the LSI 3.1. Using these variables, a predictive equation was developed in keeping with common statistical practices.

$$Y_{Predicted1} = \text{constant} + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4$$

In hindsight, while writing the paper it was discovered that the predicted equation $Y_{Predicted1}$ might be confusing to the reader, as it did not fully reflect the research question or hypotheses. The learning style had been compartmentalized into ACCE and AERO components in order to statistically analyze the data, but the actual learning style was not reflected in the equation. In order to clearly answer the research question, a second

prediction equation $Y_{Predicted2}$ was added with the variable learning style (X_5) as categorical data.

$$Y_{Predicted2} = \text{constant} + b_1X_1 + b_2X_2 + b_5X_5$$

The use of ACCE and AERO scores provided insight into a subject's thinking/experiencing versus watching/doing; however, using learning style as a variable enables the reader to observe the global component of learning style with respect to the predictive equation. Based upon this rationale, a decision was made to use the equation $Y_{Predicted2}$ for analysis. As such, the number of variables for analysis was decreased from fifteen to thirteen. This altered the power analysis, such that the sample size required for the analysis was $N = 213$ with a conservative command string of powerreg, r2f(.10) r2r(.0) nvar(13) ntest(13) alpha(.05) power(.90) (Acock, 2012).

Predictive equations enable the researcher to determine if evidence exists of a relationship between the predictive variables and the criterion variable. A predictive design is effective in answering research questions that seek to identify and understand the relationships between variables in predicting a result (Creswell, 2009).

Predictive variables are identified in the literature as potential contributors to the dependent or criterion variable. In the literature reviewed for this study, seat preference was indicated as a factor in achievement (N. Armstrong & Chang, 2007; Fernandes et al., 2011; Zomorodian et al., 2012). With respect to the other two variables, past profession and learning style in a post graduate level population; there was a paucity of literature in peer-reviewed journals, thus making the variables worthy of study. In a world in which it is now common to change positions and careers through life, and in keeping with the

theories of andragogy and social cognitive theory, the influence that past profession has on future achievement warrants study.

Research Question

The research question that guided this study was:

How and to what extent do the variables of seat preference, past profession, and learning style account for the variances in student achievement as measured by grade score in traditional osteopathic part-time education?

To answer the research question, a multiple regression analysis is required (Acock, 2012; Meyers et al., 2006). The descriptive statistics, frequencies and means, provide information regarding the nature of the independent predictive variables and their effect on the dependent criterion variable.

Null Hypotheses

$H_0$1. There is no statistically significant ($p < 0.05$) predictive relationship among the variables of seat preference, learning style, and past profession, and student achievement as measured by grade score.

H_0: $b_1 = b_2 = b_5 = 0$

$H_0$2. There is no statistically significant ($p < 0.05$) predictive relationship between the variable of seat preference and student achievement as measured by grade score.

H_0: $b_1 = 0$

$H_0$3. There is no statistically significant ($p < 0.05$) predictive relationship between the variable of learning style and student achievement as measured by grade score.

H_0: $b_5 = 0$

$H_0$4. There is no statistically significant ($p < 0.05$) predictive relationship between the variable of past profession and student achievement as measured by grade score.

H_0: $b_2 = 0$

To answer the research question and test the null hypotheses, a multiple regression analysis to develop a predictive equation was used. The dependent variable, grade score, was continuous. The independent variables of seat preference, past profession, and learning style were categorical, which required dummy coding to perform the statistical analysis. The results of the predictive equation provided the researcher with the information necessary to examine the relationship between the independent variables. The alpha level was set at 0.05. The R^2 indicated the combination of the independent variables accounting for the variance in the criterion variable student achievement. The significance of each of the predictor variables was determined using *t* tests.

The raw score regression equation was stated as:

$$Y_{predicted1} = \text{constant} + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4$$

$$Y_{predicted2} = \text{constant} + b_1X_1 + b_2X_2 + b_5X_5$$

Where X_1 was the seat preference, X_2 was the past profession, X_3 was the ACCE score, X_4 was the AERO score, and X_5 was the learning style. As previously stated, the AERO and ACCE scores were embedded within the variable learning style, as such only the $Y_{predicted2}$ equation was analyzed.

Limitations of the Research Design

There were limitations to the research design. The sample, sampling technique, DSPS, and LSI 3.1 were limitations, but were necessary given the variables of time, responses, and feasibility. Each of the limitations is explained below.

The generalization of the results is limited to accredited traditional osteopathic part-time colleges in which the language of instruction is English. It is not possible to generalize the results to all osteopathic programs in all academic institutions across Canada, North America, Australia, or Europe. Attempting to sample a greater number of osteopathic programs would have involved comparisons of curricula and testing methods. In order to make the study feasible and practical, three related institutions with common assessments across five locations was chosen.

The sampling technique was one of convenience. Although the response rate was 49% overall, a higher response rate would have been preferred. In considering the method of email recruitment, the authorized contacts sent the information to class representatives. As a result, many of the thesis writers, who were no longer in class and were independent in their studies, were missed in the recruitment due to the lack of class representative contact. There were 147 thesis writers in the campuses sampled; the response rate for this group was 18%, which was much lower than the other years sampled. Many of the thesis writers did not receive the recruitment emails.

The DSPS was developed and field-tested specifically for the study. It has not been validated nor tested for reliability with statistical analysis. The information gathered was not psychometric in nature and was straightforward. The seat preference

diagrams were based upon the classroom designs at the sampled colleges. The use of a non-validated survey was a limitation of the study.

The LSI 3.1 as a measuring tool was not without controversy. Although the LSI 3.1 has been used in a number of healthcare research studies (Hauer et al., 2005; McCart & et al., 1985; Wessel & Williams, 2004), and in over 1004 publication including 542 journal articles and 209 doctoral dissertations (A. Kolb & Kolb, 2005a), numerous authors were critical of the inventory due to concerns of ipsativity and poor internal reliability (Bergsteiner et al., 2010; Garner, 2000; Henson & Hwang, 2002). The concerns were refuted by Kayes (2005). Kayes stated that there was supportive evidence for the previously reported internal reliability and validity findings of the LSI 3.1.

Internal Validity

Internal validity in a study is threatened in three ways (Creswell, 2009). The first manner is related to participants and the threats include history, maturation, regression, selection, mortality, and interactions with selection. For instance, in an educational study that measured the effect of an intervention over time, history, maturation and interactions would be threats to validity. Subjects might dropout affecting the sample size and power; as subjects mature and acquire experience and knowledge, there could be an effect on their learning independent of the intervention thus confounding the results. The second manner is related to treatments used in a study (p. 309). This threat becomes an issue when treatments are repeated or are susceptible to external factors such as exposure to uncontrollable variables. The third manner relates to the procedures of the study and the threats include the method of testing and instrumentation. As an example, if a test is

repeated often, then the act of repeating the test may be result in learning and not be representative of the experimental procedure that it is attempting to measure. It is critical to the study that the instruments should be valid and reliable. If the instrument does not measure what it is supposed to measure then it is not valid and the results have no meaning. If the instrument is not reliable, then the data that is compiled is of no use. It is imperative to minimize the threats to internal validity in order to be able to generalize the results to the population being sampled. The threats in this study are discussed in relation to each manner stated above.

In this non-experimental study there was one point of contact. As such, history, maturation, regression, mortality, and interactions with selection were not perceived as threats to internal validity. There was no potential for maturation, mortality, or interactions.

A threat in this study was the method of sampling. A purposive convenience sample can lead to a sample that has an inherent bias to filling out surveys or be representative of a select portion of the demographic. A sampling of convenience is not a rigorous method of sampling; however, in order to generate the largest sample possible, it is a useful process and is deemed quasi-experimental (Creswell, 2009). The threat of the method of sampling was minimized by the relatively high return rate for a survey, 49%, and achieving a sample size, which met the conditions of the power analysis for a multiple regression with three predictive variables.

This study was a predictive study. There was no experimentation component. Thus, the second manner of threat did not exist.

With respect to procedures of the study, the method of testing was not considered a threat, as it was a one-time contact without repetition or concern for safety. There was no potential for improving scores with repetition of testing. The instrumentation administration did not change through data collection. All subjects were provided with the same instructions and the scales of measurement for one time point did not alter. The instrumentation may have posed a threat to validity, as the DSPS was not a validated instrument. The DSPS did undergo expert field-testing to minimize this threat. The LSI 3.1 has been discussed in the literature review and has been shown to be valid and reliable in numerous educational studies (Kayes, 2005; Pedrosa de Jesus et al., 2006). In the design of this study, steps were taken to ensure that there was minimal risk to internal validity.

External Validity

External validity is achieved through presentation of the findings. The conclusions are extrapolated only to the population of the studied colleges. In order to ensure further external validity, the population would have to be sampled again at another time. To generalize the findings beyond that of the sampled accredited traditional manual osteopathic part-time colleges would require repeating the research at another academic institution and comparing findings (Creswell, 2009). Extrapolations of the findings of this study are limited to the population of part-time accredited traditional manual osteopathic colleges in Canada and its affiliate in Switzerland with English as the language of instruction.

Expected Findings

The quantitative predictive non-experimental study of traditional manual osteopathic students at the part-time campuses where English is the language of instruction endeavored to answer the research question: How and to what extent do the variables of seat preference, past profession, and learning style account for the variances in student achievement on grade score? It is expected that the three variables will statistically significantly ($p < .05$) account for at least 10% of the variances in student achievement as measured by grade score.

It was expected that all four learning styles would be represented in the osteopathic classroom; however, based upon the literature it was postulated that there would be a large representation of converging learners. "The learning style of the PT [physical therapy] students was that of converging, with a strong tendency toward active experimentation versus reflective observation" (Hauer et al., 2005, p. 177). As physical therapy is similar to osteopathic manual treatment, and follows a similar logic in diagnosis and treatment, the learning styles should be similar. Contrary to the literature, there are crucial components of problem solving and critical thinking necessary to generate an osteopathic diagnosis and create a treatment plan, which is more in keeping with the assimilating learning style. As such, the assimilating style was expected to represent the largest section of students followed by the converging and diverging learning styles. The accommodating learning style was expected to be the least represented in the sample. It is noted that none of the studies reviewed had results with statistically significant findings when correlating learning style to profession or learning

style to general academic achievement at the post-graduate level. However, given that the assimilating learning style has been reported in the healthcare literature as having higher grades, it was predicted that the subjects with an assimilating learning style would have higher levels of academic achievement in the osteopathic program.

The prediction equation was expected to reveal heavy weighting on seat preference and past profession. Those students who sit in the front and middle, also classified as action seats, were expected to score better than those students who sit on the periphery or at the back of the classroom (Tagliacollo et al., 2010). To be successful in the osteopathic program, students are required to be competent in manual therapy techniques, and have in-depth knowledge of anatomy, physiology, and pathophysiology, as well as critical thinking skills.

Theoretically, past professions that involved a high level of manual therapy, anatomy, physiology, and pathophysiology training, should excel in the osteopathic program. The professions of PT and DC have high-level admissions requirements and are both at a post-graduate level in Canada. Athletic therapists (AT), who have a bachelor's level education, are expected to have comparable academic achievement to the PTs and DCs due to the nature of their work with the musculoskeletal system and their healthcare training. From a conceptual framework perspective, having succeeded in these professions, students should have a level of self-efficacy to support a challenging program (Phan, 2012).

It was expected that students who have only one of the competencies of manual therapy or medical knowledge upon admissions to the program would be challenged

academically. Although medical doctors (MD), osteopathic physicians (DO), and dentists (DDS) have high levels of pathophysiology, anatomy, and physiology knowledge, they are not accustomed to the palpatory sense required for manual therapy techniques. As such, the category of doctors was expected to score similar to massage therapists (RMT). The massage therapists have the manual skills but struggle with the anatomy, physiology, and pathophysiology knowledge. The kinesiologists (KIN), nurses (NR), and occupational therapists (OT) have limited manual skills but adequate anatomy and physiology knowledge. The homeopaths (HD) and naturopaths (ND) have a global view of the body, but limited manual therapy skills. The Other profession category, which covers the non-healthcare students, was expected to have the lowest level of academic achievement.

The results of the analysis provided the evidence to answer the research question. Understanding the strongest predictive independent variables will provide osteopathic educators with insight into the students who enroll in the program as well as how to address potential learning issues early in the program. The findings may help to inform future policy on admissions, assist in developing student support programs, and guide teachers as to the learning characteristics of the students attending the college.

Ethical Issues

In any form of research, ethical issues must be considered to ensure the well-being and confidentiality of the subjects. Researchers need to be cognizant of any issues that may arise during the course of and after the completion of a study. Issues worthy of concern are confidentiality of subjects, conflict of interest, potential coercion of subjects,

potential harm, honesty, and informed consent (Creswell, 2009). An Institutional Review Board (IRB) reviewed the study prior to commencement. IRB approval was granted for the study's design and methodology. The study methodology was followed as approved.

Researcher's Position Statement

The following assessment and statement defined the concerns and delineated the position of the researcher in the study. Conflict of interest is discussed followed by the researcher's position statement.

Conflict of interest assessment. In this study, three potential conflicts were identified. The three potential conflicts of interest were influence, coercion, and confidentiality. These are addressed individually.

The first potential conflict of interest was the possible influence of the Hay Group on the research. The Hay Group provided the LSI 3.1 free of charge for the purposes of gathering data regarding subjects' learning styles. The Hay Group did not provide any form of remuneration, nor did the Hay Group have influence or input into the study's design or outcomes. The Hay Group will receive a copy of the results as part of the agreement.

The second potential conflict of interest was the possible coercion of subjects during recruitment as the researcher is the Director of Education at the studied colleges and is responsible for teaching three modules across some of the campuses involved in the study. The study design assisted in limiting the effects of coercion. In the majority of instances, the authorized contacts were used to present the study to potential subjects. When the researcher was directly involved in recruitment, the study information was

presented and then the researcher left the room. Potential subjects could then choose to volunteer in anonymity. The number of responses in the study was 248 of a potential 506 indicating that not all potential participants chose to participate. All data was coded for confidentiality prior to the researcher receiving the data. The researcher remained blind to subject participation.

The third potential conflict of interest was a possible breach of confidentiality due to the use of a staff member and a family member for data confidentiality coding. The researcher's niece is a data management expert and was hired to manage the incoming online data through an email address. The researcher's office manager was hired to manage the incoming mail and classroom collection of data. The methodology was designed to prevent the researcher from contacting the data prior to confidentiality coding. This was maintained throughout the study.

The potential conflicts of interest identified were controlled for throughout the study by the design and the execution of the methodology.

Position statement. The researchable problem of student challenges related to the admission criteria changes was identified by a number of the faculty at the studied colleges. As the Director of Education, the researcher is involved with students who are having difficulty learning the material. The participants in the study are students at five campuses of the accredited traditional manual osteopathic part-time colleges in Canada and Switzerland. The participants may or may not have had the researcher as a professor depending upon the participant's year of study and campus. The researcher teaches a first year course in two locations, a second year module in four locations, and two fourth

year courses in four locations. Depending upon the researcher's teaching contract each year, some of the potential subjects may not have had the researcher as a professor.

The researcher is concerned with assisting students and facilitating learning. As such, the results of the study assist the researcher in determining if the admission criteria should remain the same, and/or if new courses or levels of support are required to ensure that students are supported in their learning. The bias of the researcher is the preconceived notion that the students without healthcare backgrounds or degrees, and with a diverging learning style are challenged by the curriculum. As there has been no research performed on this topic within the traditional osteopathic educational literature, the results will provide quantitative evidence to support or reject the bias.

The study was designed to control for the potential bias. A quantitative study limits the potential imposition of a researcher's biases on the data. A large sample was recruited by the authorized contacts, the researcher, and by email. The method of recruitment across all of the English-speaking campuses limited the influence of the researcher on the sample demographics. The sole aim of the researcher was to recruit as many subjects as possible in order to generate as much data such that the best potential evidence for the acceptance or rejection of the null hypotheses was available for discussion.

Ethical Issues in the Study

The method to control for ethical issues in the study was to undergo IRB assessment and gain IRB approval. In receiving IRB approval the ethical issues of this study were recognized and addressed. In keeping with the Personal Information Privacy

Electronic Documents Act ("The Personal Information Protection and Electronic Documents Act," 2013), and the Belmont Report (National Commission for the Protection of Human Subjects of Biomedical and Behavioral Research, 1979), participants' volunteerism, privacy, anonymity, confidentiality, protection from harm, and informed consent are assured.

All subjects were volunteers and were informed that they could withdraw from the study at any time. As the researcher is a professor at the locations used for recruitment, the researcher was sensitive to the potential of coercion. In order to avoid any impropriety related to coercion, the researcher or authorized contact, when recruiting, presented the study, answered questions related to the research, and then left the room. No remuneration or extra grades were offered as enticement. Volunteers could take a research package, fill it out, and place it in the envelope. The authorized contact or researcher sealed the envelope without looking at the contents. The envelope was then couriered to the research assistant for coding.

Privacy, anonymity, and confidentiality were assured through the methodology and the manner of presentation. No subject was singled out in the results of the study. Data was coded to ensure confidentiality and privacy. The files were coded and locked in a secure cabinet in the office of the researcher. The consent form was the only information that contained the name of a subject. The consent forms are in a sealed envelope in a locked drawer in a secure cabinet in the office of the researcher. A copy of the consent form was placed in the subject's student file at the registrar's office as required by the colleges for release of the grade scores.

The study had minimal harm associated with it: the collection of data was limited to grade score, learning styles, seat preference, and demographic data. Each subject was informed regarding the purpose, design, and methodology of the study. The subjects provided informed consent for participation in the study as well as the release of the subjects' grade scores to the research assistant for coding.

Chapter 3 Summary

The quantitative non-experimental study provided measurable data to determine if evidence exists for the prediction of the academic achievement ability of the traditional manual osteopathic part-time students in the accredited English-speaking campuses studied. Through the study of the past profession, seat preference, and learning style, insight into the potential academic achievement of students would be gleaned. The multiple regression analysis provided the statistical information to support or reject the hypotheses and thus make available information to answer the research question: How and to what extent do the variables of seat preference, past profession, and learning style account for the variances in student achievement on grade score?

The researcher received IRB approval for the design and methodology of the study. Data collection began in June 2013 and continued until October 2013 using email, Skype, and classroom recruitment methods. The response rate was 49% or 248 of 508 potential subjects. The sample size used for analysis was 228 and was more than sufficient to achieve power for the proposed statistical tests. The researcher followed the IRB approved methodology and was cognizant of the ethical concerns related to the

study. The data were collected and controlled to ensure confidentiality of the subjects was maintained.

The a priori prediction was that students who sit in action seats score higher on academic achievement tests than those sitting in non-action seats; students who have past professions of chiropractic, physical therapist, or athletic therapists score higher on academic achievement tests than the other healthcare professions sampled; the other professional category score the lowest of the professions sampled; and the students who prefer an assimilating learning style score better than other learning styles. Chapter 4 provides the reader with the statistical analysis of the data gathered.

CHAPTER 4. DATA ANALYSIS AND RESULTS

Introduction

The results from analyses of the data gathered regarding learning style as measured by the Learning Style Inventory (LSI 3.1), seat preference and past profession as provided by the Demographic and Seat Preference Survey (DSPS), and academic achievement score as measured by grade score are presented. Results of this study were organized in accordance to a description of the sample, a summary of the results in relation to the four hypotheses, and a detailed statistical analysis. In keeping with scientific reporting and analysis, the null hypothesis was considered rejected when the probability of a Type I error was .05 or less.

Description of the Sample

The sample of this study was derived from the five English-speaking campuses of accredited part-time traditional manual osteopathic programs in two Canadian private colleges and one affiliated Swiss private college. A convenience sampling method was used to gather the data. A total of 248 subjects responded to the survey from a sample of 508 representing a response rate of 49%. From the 248 responses, missing data and incorrectly filled out LSI or DSPS forms resulted in different response sizes for some of the analyses depending upon the data required. Achievement grade score data were

available for 238 subjects. Learning style, grade score, and seat preference data were available for 228 subjects for the 10 X 5 seating plan and 226 for the 4 X 7 seating plan. The sample acquired was sufficient to reach a power of .90, $R^2 = .10$, to use the proposed multiple regression analysis discussed in Chapter 3.

The demographics of the sample are presented in relation to age, first language, location and year of study, education level, past profession, learning style, and seat preference. There were 72 males and 175 females representing 29% and 71% of the sample, respectively. In Table 3, the ages of the subjects were categorized by decade with 42% of the subjects being aged 30 – 39 while 25% of the subjects were aged 20 – 29, and 40 – 49, respectively. There was one subject with the variable age missing.

Table 3. Responder's Gender by Age

Gender	Age					Total
	20-29	30-39	40-49	50-59	60-69	
Male	18	29	18	7	0	72
Female	43	75	44	10	3	175
Total	61	104	62	17	3	247

Although the language of instruction among the five locations was English, not all subjects spoke English as a first language. As seen in Table 4, 80% of the sample was made up of English as a first language subjects. Subjects with French as a first language made up 5% of the sample while subjects with a first language other than French or English made up 15% of the sample. The other languages included German, Italian,

Punjabi, Polish, Croatian, Hebrew, Arabic, Chinese, Filipino, Spanish, Romanian, Afrikaans, Portuguese, Rhaeto-Romanic, Urdu, and Russian.

Table 4. Responder's First Language by Location ($N = 248$)

Language	Location					Total
	1	2	3	4	5	
English	53	27	91	24	4	199
French	3	4	1	3	1	12
Other	4	2	11	0	20	37
Total	60	33	103	27	25	248

Note: N = sample size.

In Table 5, the achievement scores of the respondents are presented by first language. Achievement scores were available for 238 subjects.

Table 5. Responder's First Language and Achievement Score ($N = 238$)

Language	*N*	*M (SD)*	95% CI
English	190	79.83 (7.61)	[78.80, 80.91]
French	12	74.83 (13.53)	[66.24, 83.43]
Other	36	73.11 (9.54)	[69.88, 76.34]

Note: N = sample size; *M (SD)* = Mean (Standard Deviation); CI = confidence interval.

As calculated from Table 6, Location 1 student enrollment was 103 or 20% of the sample; there was 58% participation in the study making up 24% of respondents. Location 2 student enrollment was 49 or 10% of the sample; there was 67% participation in the study making up 13% of respondents. Location 3 student enrollment was 258 or 51% of the sample; there was 40% participation in the study making up 42% of

respondents. Location 4 student enrollment was 39 or 8% of the sample; there was 69% participation in the study making up 11% of respondents. Location 5 student enrollment was 59 or 12% of the sample; there was 42% participation in the study making up 10% of respondents.

Table 6. Responder and Non-Responder by Location and Year of Study

	Year of Study						
Location	1	2	3	4	5	Thesis Writer	Total
Location 1							
Non-Responder	0	5	10	0	8	20	43
Responder	18	8	5	10	8	11	60
Location 2							
Non-Responder	0	12	0	4	0	0	16
Responder	12	9	0	12	0	0	33
Location 3							
Non-Responder	7	23	9	15	8	93	155
Responder	23	12	18	21	20	9	103
Location 4							
Non-Responder	0	2	0	4	0	6	12
Responder	0	17	0	6	0	4	27
Location 5							
Non-Responder	14	5	3	8	2	2	34
Responder	0	3	6	3	11	2	25
Total							
Non-Responder	21	47	22	31	18	121	260
Responder	53	49	29	52	39	26	248
Total	74	96	51	83	57	147	508

There was a 72% response rate among first year students who made up 21% of the respondents. The second year students had a response rate of 51% and made up 20% of the respondents. The third year students had a response rate of 57% and made up 12% of the respondents. The fourth year students had a response rate of 63% and made up 21% of the respondents. The fifth year students had a response rate of 68% and made up 16% of the respondents. The thesis writers (TW) had a response rate of 18% and made up 10% of the respondents. As previously stated, the overall response rate was 49%.

In Table 7, mean grades scores for the locations are presented. The skewness and kurtosis values revealed that the grade score data of Location 2 and 3 were not normally distributed.

Table 7. Responder's Location and Achievement Score ($N = 238$)

Location	*n*	*M (SD)*	Skewness	Kurtosis	95% CI
1	52	81.21 (7.04)	-0.11	-0.42	[79.25, 83.17]
2	33	76.64 (8.21)	-0.81	2.12	[73.72, 79.55]
3	103	78.98 (7.83)	-1.14	2.14	[77.45, 80.51]
4	25	81.28 (8.43)	-0.49	0.40	[77.80, 84.76]
5	25	71.12 (11.08)	-0.84	1.62	[66.55, 75.69]

Note: n = sample size; *M (SD)* = Mean (Standard Deviation); CI = confidence interval. Missing grade scores: Location 1 (8) and Location 4 (2).

In the category of education, 47% of subjects held a bachelors degree; 16% had higher-level degrees ranging from graduate to masters to PhD; 35% had post-secondary education in the form of a college or private school diploma; and 1% had high school education as seen in Table 8. Specific to professions, 60% of RMTs had maximum

college level education, while 36% and 4% had bachelor and graduate level education, respectively. In the Other profession, 30% had maximum college level education, while 43% and 27% had bachelor and graduate level education, respectively. The other healthcare profession had minimum bachelor level education.

Table 8. Responder's Education Level and Achievement Score

Education	*N*	*M*	*SD*	Skewness	Kurtosis
High school	2	72.50	7.78	.	.
Private college certificate or diploma	54	77.33	8.39	-1.04	2.41
College diploma	30	76.50	9.46	-1.97	6.92
BA/BSc	113	79.47	8.16	-0.74	0.61
Graduate studies (MD, DO, DDS, DC, ND, HD)	16	82.81	6.91	0.06	-0.34
Masters (PT, OT)	20	76.75	10.94	-0.64	0.43
PhD	2	84.00	5.66	.	.
Total	237	78.58	8.65	-0.98	2.11

Note: missing 10 grade values:1 high school, 2 private college, 1 college diploma, 4 bachelors, 1 graduate study, and 1 masters. MD = medical doctor; DO = osteopathic physician, DDS = dentist; DC = chiropractor; ND = naturopath; HD = homeopath; PT = physical therapist; OT = occupational therapist.

In Table 9, the registered massage therapists (RMT) made up 46% of the sample, the naturopaths/homeopaths (ND/HD) 2%, and the medical doctors, osteopathic physicians, and dentists (MD/DO/DDS) accounted for 1% of the sample. Chiropractors and physical therapists (DC/PT), and athletic therapists (AT) combined made up 21% of the sample, while nurses, kinesiologists, and occupational therapists (NR/KIN/OT) accounted for 14% of the sample. The other category made up 16% of the sample and had the following professions or jobs listed in question 4 of the DSPS: manual therapy,

teacher, social pedagogy, yoga and Pilates instructor, journalism, radiology, neural development, tool and die maker, emergency medicine paramedic, acupuncturist, psychology, chef, media researcher, PhD candidate, pedorthist, dental hygienist, chiropodist, professor, medical science, sales, investment manager, medical illustration, copywriter, equine osteopath, framer, rolfer, communications, and exercise physiologist.

Table 9. Responder Profession by Location

	Location					
Profession	1	2	3	4	5	Total
MD/DO/DDS	1	0	2	0	0	3
ND/HD	0	0	2	1	2	5
DC/PT	8	0	6	4	9	27
AT	9	2	14	0	0	25
NR/KIN/OT	13	3	14	3	2	35
RMT	18	25	49	16	7	115
Other	11	3	16	3	5	38
Total	60	33	103	27	25	248

Grade is the term used to represent the year-end average test score in the analysis. The mean achievement scores with standard deviations in parentheses presented in Table 10, revealed that the NR/KIN/OT, ND/HD, DC/PT, AT, and the Other professions were within 0.35 percent of each other. The MD/DO/DDS and the RMT professions had mean achievement scores of 76 (n = 2, SD = 2.83) and 76.56 (n = 110, SD = 8.71), respectively. The skewness (-1.36) and kurtosis (3.25) of the RMT group, and the kurtosis of the DC/PT (1.79) indicated that the data were not normally distributed.

Table 10. Responder's Past Profession and Achievement Score

Profession	*N*	*M (SD)*	Skewness	Kurtosis	95% CI
MD, DO, DDS	2	76.00 (2.83)	.	.	[50.59, 101.41]
ND, HD	5	80.20 (8.76)	-0.97	-0.23	[69.33, 91.07]
DC, PT	25	80.16 (10.17)	-0.93	1.79	[75.96, 84.36]
AT	25	80.32 (7.05)	-0.10	-0.60	[77.41, 83.23]
Nurse, Kin, OT	34	80.32 (8.34)	-0.91	0.43	[77.41, 83.23]
RMT	110	76.56 (8.71)	-1.36	3.25	[74.92, 78.00]
Other	37	80.51 (7.94)	-0.37	-0.45	[77.87, 83.16]

Note: N = sample size; *M (SD)* = Mean (Standard Deviation); CI = confidence interval.
MD = medical doctor; DO = osteopathic physician, DDS = dentist; DC = chiropractor; ND = naturopath; HD = homeopath; PT = physical therapist; AT = athletic therapist; Kin = kinesiologist; OT = occupational therapist; RMT = massage therapist.

In Table 11, the learning styles data were presented in relation to profession. The MD/DO/DDS group (n = 3) did not have a subject with a diverging learning style; the ND/HD group (n = 5) did not have a subject with an assimilating learning style. The percentages that follow are based upon a sample of 239. Participants with assimilating, converging, diverging, and accommodating learning styles represented 34%, 13%, 31%, and 22% of the sample, respectively. In Table 12, the assimilating learning style made up 17% of the sample from Location 5, 42% of Location 4, 37% of Location 3, 30% of Location 2, and 34% of Location 1.

Table 11. Responder's Past Profession by Kolb's Learning Style

Profession	Learning Style				Total
	Assimilating	Accommodating	Diverging	Converging	
MD, DO, DDS	1	1	0	1	3
ND, HD	0	2	1	2	5
DC, PT	9	3	9	3	24
AT	8	5	7	5	25
Nurse, Kin, OT	11	10	7	7	35
RMT	35	23	43	9	100
Other	17	7	8	5	37
Total	81	51	75	32	239

Note: MD = medical doctor; DO = osteopathic physician, DDS = dentist; DC = chiropractor; ND = naturopath; HD = homeopath; PT = physical therapist; AT = athletic therapist; Kin = kinesiologist; OT = occupational therapist; RMT = massage therapist. Missing values = 9.

Table 12. Responder's Learning Style by Location

Learning Style	Location					Total
	1	2	3	4	5	
Assimilating	20	10	37	10	4	81
Accommodating	12	6	20	5	8	51
Diverging	17	15	31	7	5	75
Converging	9	2	13	2	6	32
Total	58	33	101	24	23	239

In Table 13, the mean achievement scores by learning styles are presented. In the data, nine subjects were missing a learning style while ten subjects were missing an achievement score accounting for the discrepancies between counts in Table 10 and Table 11. The skewness and kurtosis values of the converging and diverging learning styles were greater than 1 or less than -1 indicating that the data were not normally distributed (George & Mallery, 2011).

Table 13. Responder's Achievement Score by Learning Style ($N = 229$)

Style	*N*	*M (SD)*	Skewness	Kurtosis	95% CI
Assimilating	76	80.24 (7.26)	-0.56	0.88	[78.58, 81.90]
Accommodating	49	77.98 (8.51)	-0.31	-0.73	[75.53, 80.42]
Diverging	73	76.67 (9.88)	-1.18	2.51	[74.37, 78.98]
Converging	31	79.48 (8.82)	-1.32	3.53	[76.25, 82.72]

Note: N = sample size; *M (SD)* = Mean (Standard Deviation); CI = confidence interval.

In reviewing the most preferred seats in the 4 X 7 Seating Plan, the most preferred seats in descending order were seats 6, 2, 11, 3, 5, 7, and 12, as seen in Figure 3. There were five subjects that were missing seat preference data ($N = 243$).

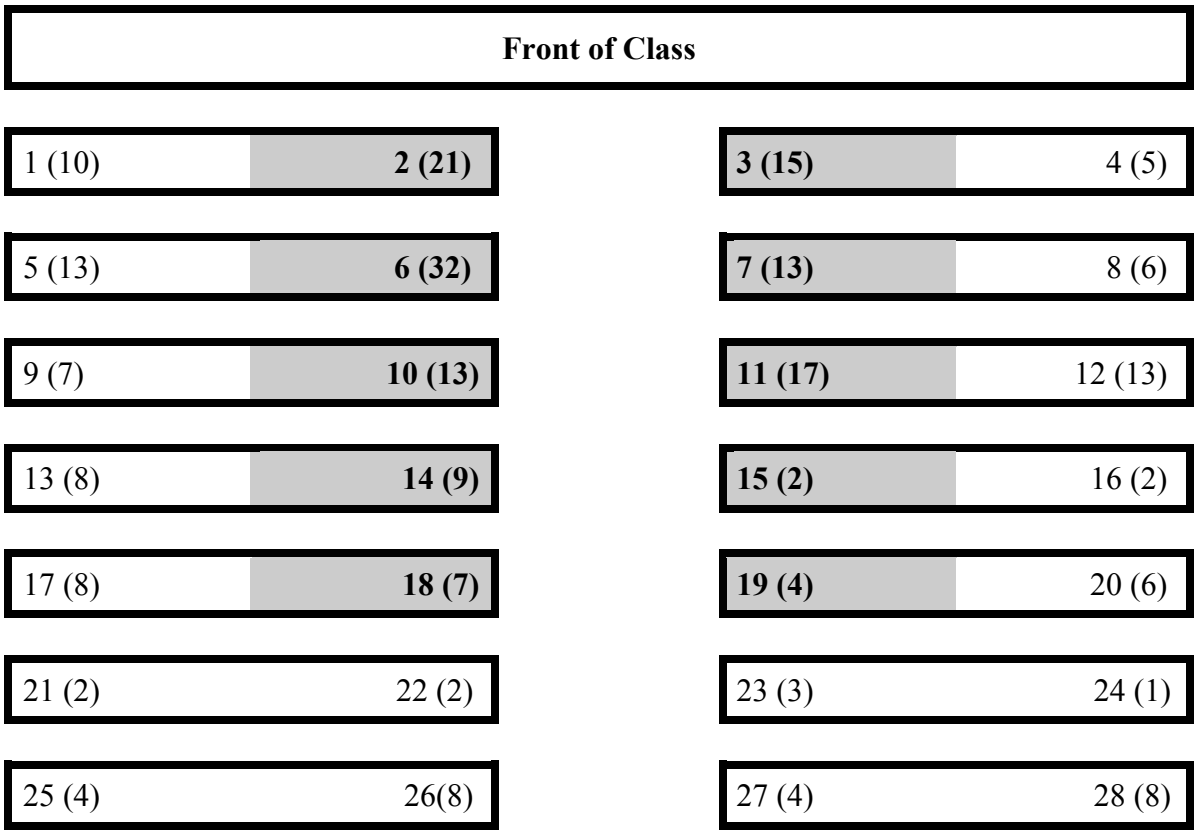

Figure 3. 4 X 7 Seat preference with actions seats. The bolded numbers and shaded rectangles indicate an action seat. The number in parentheses indicates the number of times the seat was chosen as a primary preferred seat. (N = 243)

In reviewing the most preferred seats in the 10 X 5 Seating Plan, the most preferred seats in descending order were seats 14, 5, 24, 16 and 17, and 12, 15, and 23, as seen in Figure 4. There were two seats, 9 and 36, that received no votes as the most preferred seat in the 10 X 5 Seating Plan. There were three subjects that were missing seat preference data (N = 245).

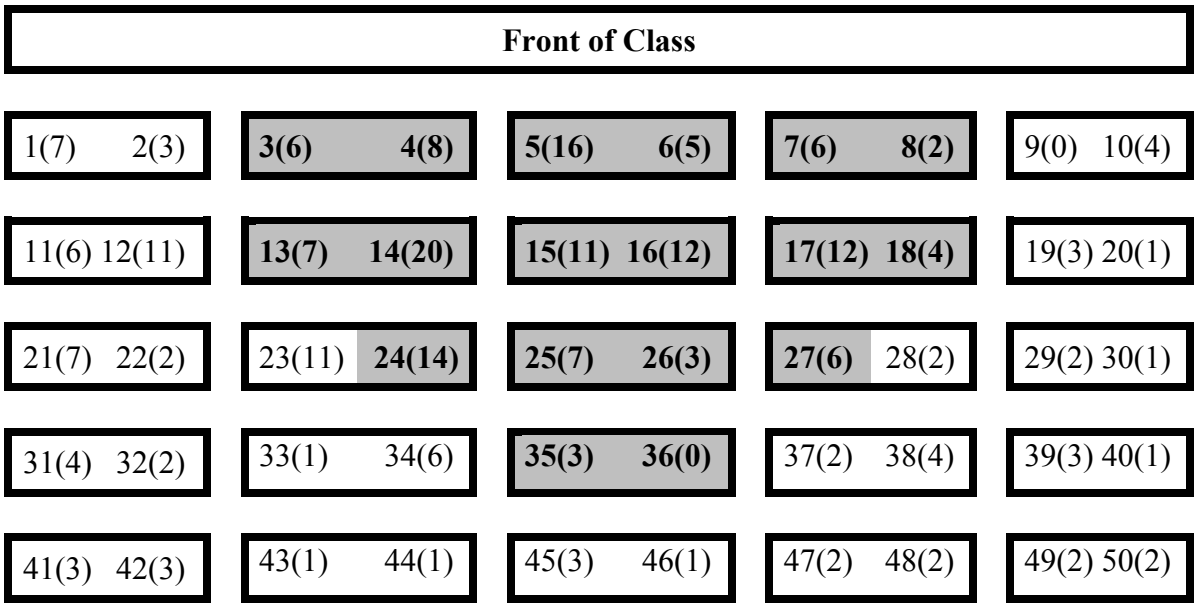

Figure 4. 10 X 5 Seat preference with action seats. The bolded numbers and shaded rectangles indicate an action seat. The number in parentheses indicates the number of times the seat was chosen as a primary preferred seat. (N = 245)

When observing action versus non-action seats in the 4 X 7 Seating Plan, 54% of participants preferred an action seat while 46% of participants preferred non-action seats, as seen in Table 14. In the 10 X 5 Seating Plan, 58% of subjects preferred action seats while 42% of subjects preferred non-action seats.

Table 14. Preference Frequency for Action/Non-action Seats

Seating Plan		*N*
4 X 7	Non-action seat	111
	Action seat	132
	Total	243
10 X 5	Non-action seat	103
	Action seat	142
	Total	245

Note: N = sample size

In Table 15, the achievement scores for the two seating plans are presented. As previously reported, the achievement score data for ten subjects were unavailable for analysis thus accounting for the discrepancies between counts in Tables 14 and 15.

Table 15. Achievement Score for Action versus Non-action Seats in 4 X 7 and 10 X 5 Seating Plans

Seating Plan		*N*	*M (SD)*	95% CI
4X7	Non-Action	105	77.99 (8.61)	[76.32, 79.66]
	Action	128	79.16 (8.57)	[77.67, 80.66]
	Total	233		
10X5	Non-Action	96	77.29 (8.67)	[75.54, 79.05]
	Action	137	79.58 (8.44)	[78.15, 81.00]
	Total	233		

Note: *N* = sample size; *M (SD)* = Mean (standard deviation); CI = confidence interval.

Summary of the Results

Research Question

How and to what extent do the variables of seat preference, past profession, and learning style account for variances in student achievement as measured by grade score in traditional osteopathic part-time education?

In a robust regression analysis using a model of seat preference (10 X 5 Action/Non-action), past profession, and learning style, the model accounted for 10% of the variance in student achievement as measured by grade score.

Hypotheses

In the robust regression analysis, the statistical tests supported rejecting the null hypotheses $H_0$1, $H_0$2, $H_0$3, and $H_0$4. In the cluster by location regression analysis, the statistical tests supported rejecting the null hypothesis $H_0$4.

$H_0$1. There is no statistically significant ($p < .05$) predictive relationship among the variables of seat preference, learning style, and past profession, and student achievement as measured by grade score.

$H_1$1: at least one $b \neq 0$

A significant robust regression model using the 10 X 5 Action/Non-action seat preferences, learning styles, and past professions was found $F(10, 217) = 2.33$, $p = .01$, with an $R^2 = .10$, $RMSE = 8.41$. This finding had sufficient power (.92) to consider an $R^2 = 0.10$ as a substantive finding with a sample size of $N = 228$. The null hypothesis was rejected.

A significant robust regression model using the 4 X 7 Action/Non-action seat preferences, learning styles, and past professions was found $F(10, 215) = 2.60$, $p = .01$, with an R^2 of .09, $RMSE = 8.49$. The null hypothesis was rejected. This finding lacked sufficient power (.88) to consider an $R^2 = .09$ as a substantive finding. The caveat is that the 4 X 7 regression results are limited to cursory discussion.

$H_0$2. There is no statistically significant ($p < .05$) predictive relationship between the variable of seat preference and student achievement as measured by grade score.

$H_1 2$: $b_{1\ 10X5AS} \neq 0$

In the robust regression analysis, the 10 X 5 action seat preference was found to have a significant contribution to the prediction of grade score $b_{1\ 10X5AS} = 2.91$, $t(217) = 2.51$, $p = .01$. The null hypothesis was rejected with respect to the 10 X 5 action seat preference.

$H_0$3. There is no statistically significant ($p < .05$) predictive relationship between the variable of learning style and student achievement as measured by grade score.

$H_1 3$: $b_{5\ \text{diverging}} \neq 0$

In the robust regression 10 X 5 Action/Non-action model, the diverging learning style was found to have a significant contribution to the prediction of grade score $b_{5\ \text{diverging}} = -3.03$, $t(217) = -2.13$, $p = .03$. The null hypothesis was rejected with respect to the diverging learning style.

$H_0$4. There is no statistically significant ($p < .05$) predictive relationship between the variable of past profession and student achievement as measured by grade score.

$H_1 4$: $b_{2\ AT} \neq 0$

$H_1 4$: $b_{2\ NURSE/KIN/OT} \neq 0$

$H_1 4$: $b_{2\ OTHER} \neq 0$

In the robust regression 10 X 5 Action/Non-action model, the past professions of AT $b_{2\ AT} = 4.60$, $t(217) = 2.77$, $p = .01$, NR/KIN/OT $b_{2\ NR/KIN/OT} = 4.10$, $t(217) = 2.54$, $p = .01$, and Other $b_{2\ OTHER} = 3.48$, $t(217) = 2.26$, $p = .03$, were found to have a significant contribution to the prediction of grade score. The null hypothesis was rejected with respect to the professions of AT, NR/KIN/OT, and Other.

In the cluster (location) regression analysis, the past profession of AT $b_{2\ AT} = 4.60$, $t(4) = 2.77$, $p = .05$, was found to have a significant contribution to the prediction of grade score. The null hypothesis was rejected with respect to the AT profession.

Detailed Analysis

This section of the chapter provides a discussion of the data problems encountered, the solutions employed, and the analyses performed. Analyses were performed as follows:

- Non-responders and responders to determine if there was a responder bias in the convenience sample.
- Education by grade to determine if there were differences between educational levels.
- Locations by grade, by profession, by learning style, and by language to determine if there was a need to address potential differences between locations.
- Learning style and profession to respect findings in the literature that were not considered in the hypotheses but addressed as a point of interest.

- Multiple regression analyses to fit the predictive equation:
    - Primary regression analysis related to the fitted regression models of the 4 X 7 and 10 X 5 Action/Non-action seat preference plans using the robust and cluster (location) options.
    - Secondary regression analysis related to the fitted regression models of the 10 X 5 and 4 X 7 Individual seat preferences using the robust and cluster (location) options.

Data Issues

Prior to the analysis, the data were reviewed for missing information, incorrect data, and outliers. There were five subjects with grade scores that were determined to be outliers: KC13 (DC/PT); and KC24, 97, 171, and 202 (RMT). Upon review of the data, it was determined that the data were true and representative of the subjects. The outlier data and the subjects' characteristics are discussed in Chapter 5. As outliers violate the assumption of normality and homoscedasticity necessary for the application of regression modeling it was felt that SPSS Release 19 lacked the necessary robust regression modeling algorithms as compared to Stata Version 13. As such Stata Version 13 was used for the regression model.

Prior to the actual fitting of the regression models, it was determined that there was an issue of multicollinearity with Variance Inflation Factors (VIF) that were above 10. This was resolved by setting the largest category of Profession: RMT as the base category. The use of RMT as base category decreased the individual variable and level VIF scores to less than 1.38 and *M*VIF = 1.18 for all categories indicating that multicollinearity was no longer an issue (Meyers et al., 2006). The levels of profession were compared to the RMT data. Of note, this was not the preferred model; the

prediction model discussed in Chapter 3 with the Other profession as the base category was favored as the Other profession was expected to score the lowest of all of the professions studied.

Non-Responders and Responders Data Analysis

As a convenience sample can be problematic with respect to responder bias when attempting to generalize the results of a survey to the population, it is imperative to address the issue by comparing responder to non-responder data. As previously stated in Chapter 3, there were 508 students enrolled in 2013-2014 in the sampled colleges; however, data were not available for all non-responders. A challenge arose in the collection of non-responder characteristics, as not all data were readily available from the locations due to the method by which demographic information at the colleges and campuses is processed. In particular, thesis writers (TW) totaled 147: 26 responders; and 121 non-responders, as seen in Table 6. Data of 19% of TW non-responders were available for comparison with responders. There were observation size discrepancies due to issues of grade data being inaccessible due to limited contact of TW students with the colleges' administration, dropouts, deferrals, and students with incomplete academic years.

Data were collected on non-responders regarding grade score and gender. As such, data from 109 non-responders were available for comparison. The data of 151 non-responders were unavailable. In order to determine if the responders in the convenience sample differed from the non-responders, the following analyses were performed.

In Tables 16 and 17, the mean achievement scores for responders and non-responders, and gender were compared. The Levene test $F(3, 343) = 2.587$, $p = .053$ was not statistically significant indicating homogenous variances.

Table 16. Gender and Responder/Non-Responder Mean Achievement Scores

Gender	Responder			Non-Responder		
	N	*M (SD)*	95% CI	*N*	*M (SD)*	95% CI
Male	68	77.28 (9.84)	[75.18, 79.38]	31	72.20 (11.58)	[69.09, 75.32]
Female	170	79.07 (8.08)	[77.74, 80.40]	78	78.21 (8.15)	[76.25, 80.18]
Total	238	78.56 (8.64)	[76.93, 79.42]	109	76.50 (9.60)	[73.37, 77.05]

Note: *N* = sample size; *M (SD)* = Mean (Standard Deviation); CI = confidence interval.

Table 17. Gender Mean Achievement Scores

Gender	*N*	*M (SD)*	95% CI
Male	99	75.69 (10.63)	[72.86, 76.62]
Female	248	78.80 (8.10)	[77.46, 79.83]

Note: *N* = sample size; *M (SD)* = Mean (Standard Deviation); CI = confidence interval.

In Table 18, a between subjects Analysis of Variance (ANOVA) compared the mean achievement scores of males and females, responders and non-responders, and male and female responders and non-responders, to determine if there were any interactions among the variables. The fit of an ANOVA model was statistically significant $F(1, 343) = 6.90$, $p = .001$, $R^2 = .05$. The effect was considered small $R^2 = .05$ (Acock, 2012; Field, 2009). There was a significant ($p < .01$) interaction of mean scores

between responders (M = 78.56, SD = 8.64), and non-responders (M = 76.50, SD = 9.60). There was a significant (p = .001) interaction between mean scores of Genders. There was no interaction effect gender versus responders $F(1, 343) = 3.94$, $p = .06$. The effect of gender on mean grade score for those responding and not responding was the same.

Table 18. Gender, Population, and Gender by Population Analysis by Mean Achievement Score

Source	Type III *SS*	*df*	*MS*	*F*
Corrected Model	1273.38[a**]	3	424.46	5.46
Intercept	1433046.75***	1	1433046.75	18431.36
Gender	927.36**	1	927.36	11.93
Population	536.32**	1	536.32	6.90
Gender by Population	271.66	1	271.66	3.49
Error	26668.42	343	77.75	
Total	2134365.64	347		
Corrected Total	27941.79	346		

Note: *SS* = Sum of Squares; *df* = degrees of freedom; *MS* = Mean Square.
a. R Squared = .046 (Adjusted R Squared = .037).
** $p < .01$, *** $p < .001$

Education

In the observed data there appeared to be differences between educational levels as mean achievement scores ranged from 72.50 to 84.00. A one-way ANOVA was fit to test if mean grade score differences between levels of education were significant. The fit of a one-way ANOVA model was not statistically significant $F(6, 230) = 1.80$, $p = .10$. Mean achievement scores were not different between levels of education.

Location

In the observed data there appeared to be differences in mean achievement scores, professions, and languages between locations that could confound the results. As such, analyses were performed between location and mean grade score, profession, learning style, and language.

A one-way ANOVA was fit to test if mean grade score differences between locations were significant. The fit of a one-way ANOVA model was statistically significant $F(4, 233) = 7.75$, $p < .001$. Mean achievement scores were different between locations. A multiple comparison analysis with post hoc Bonferroni adjustment is presented in Table 19. The interaction between location and grade occurred between Location 5 ($M = 71.12$, $SD = 11.08$, 95%CI[66.55, 75.96]) and Locations 1 ($M = 81.21$, $SD = 7.04$, 95%CI[79.25, 83.17]), 3 ($M = 78.98$, $SD = 7.83$, 95%CI[77.45, 80.51]) , and 4 ($M = 81.28$, $SD = 8.43$, 95%CI[77.80, 84.76]).

Table 19. Multiple Comparisons: Grade by Location

(I) Campus	(J) Campus	Mean Difference (I-J)	*SE*	95% CI
Location 5	Location 1	-10.09***	1.99	[-15.73, -4.45]
	Location 2	-5.52	2.17	[-11.66, 0.63]
	Location 3	-7.86***	1.82	[-13.03, -2.69]
	Location 4	-10.16***	2.31	[-16.72, -3.60]

Note: ***. The mean difference is significant at the 0.001 level.
SE = standard error; *CI* = confidence interval.

A chi-square test of independence was calculated comparing the results of location and profession. A significant relationship was found $\chi^2(24, N = 248) = 56.14$, $p < .001$, $\phi = .48$, $p < .001$. Location and profession are not independent in this sample.

A chi-square test of independence was calculated comparing the results of location and learning style. No significant relationship was found $\chi^2(12, N = 239) = 12.52$, $p = .41$, $\phi = .23$, $p = .41$. Location and learning style are independent in this sample.

A chi-square test of independence was calculated comparing the results of location and language. A significant relationship was found $\chi^2(8, N = 248) = 104.21$, $p < .001$, $\phi = .65$, $p < .001$. Location and language are not independent in this sample.

A one-way ANOVA was fit to test if mean grade score differences between languages were significant. The fit of a one-way ANOVA model was statistically significant $F(2, 235) = 11.22$, $p < .001$. Mean achievement scores were different between languages. A multiple comparison analysis with post hoc Bonferroni adjustment is presented in Table 20. The interaction between language and grade occurred between subjects who speak English as a first language and subjects who speak a language other than English or French as a first language.

Table 20. Multiple Comparisons: Mean Achievement Score by Language

(I) Language	(J) Language	Mean Difference (I-J)	*SE*	95% CI
English	French	4.99	2.47	[-0.95, 10.94]
	Other	6.72***	1.51	[3.08, 10.35]

Note: ***. The mean difference is significant at the 0.001 level.
SE = standard error; *CI* = confidence interval.

As a result of the significantly different mean achievement scores between locations and languages, the differences in sample sizes, and the significant relationship between profession and location, and language and location, the cluster (location) regression was justified. The use of the cluster (location) analysis acknowledged that students within a location are more alike than students between locations. In order to adjust for the differences between locations, cluster (location) regressions were performed and are presented in the regression analyses.

Learning Style and Profession

Authors of learning style research have presented data related to correlations between learning styles and professions. Although not presented in the research question, an added analysis was performed to determine if there was a correlation between learning styles and professions in this sample. A chi-square test of independence was calculated comparing the results of learning style and profession. No significant relationship was found $\chi^2(18, N = 239) = 20.40$, $p = .31$, $\phi = .29$, $p = .31$. Learning styles and professions are independent in this sample.

Multiple Regression Analyses

Multiple regression analyses were performed to determine the amount of variance in student achievement explained by the variables of seat preference, past profession, and learning style. The three independent variables had multiple levels. The 10 X 5 and 4 X 7 Action/Non-action seat preferences had two levels each. The profession variable had seven levels, and the learning style variable had four levels. The RMT profession, the

non-action seat, and the assimilating learning style were set as base level zero for the analyses.

A chi-square test of independence was calculated comparing the results of the 10 X 5 and 4 X 7 Action/Non-Action Seating arrangements. A significant interaction was found $\chi^2(1, N = 243) = 57.81, p < .001$. The 10 X 5 and 4 X 7 Action/Non-Action Seating arrangements are not independent. There was a significant correlation between the two seating arrangements $rho(243) = .47, p < .001$, indicating that those subjects who preferred an action seat in the 4 X 7 seating plan also preferred an action seat in the 10 X 5 seating plan. Due to the significant correlation between the seating arrangements, both seating plans were used in the regression models independently in the primary analysis.

The individual seats in each seating plan were of interest in the study; as such, two regression models were fitted for the individual seats in the 4 X 7 and the 10 X 5 seating plans. The secondary analysis included the regression models fitted with the individual seats in the cluster (location) and robust options. These models are offered for interest of the individual seat effects, but were secondary to the primary analysis as the *F* statistic and *p* value were unavailable for the models due to the large number of dummy coded variables in robust analyses. Despite this, the estimates are still valid and of interest when considering grades in relation to seat preferences.

Primary Analysis. In Chapter 3, a priori predictions were made regarding interactions of profession, learning style, and action seat, and student achievement as reported by grade score. The subjects with DC/PT and AT professions were predicted to score higher than the remaining professions, and the subjects with Other professions were

expected to score the least. As discussed previously in the data issues section, it would have been preferable to set the Other profession as the base category so that the remaining professions could be compared against the Other professions; this was not possible due to the issue of multicollinearity. The students with an assimilating learning style preference were expected to score the highest among the learning style variable. Students who preferred action seats were expected to score higher than those who preferred non-action seats. In making these predictions the use of pair-wise comparisons without post hoc adjustments for multiple comparisons is permitted (Field, 2009). The robust regression and the pair-wise comparisons of profession and learning style are presented in Tables 21, 22, and 23. The cluster (location) regression and the pair-wise profession comparisons are presented in Tables 24 and 25.

Robust regression. To answer the research question and the hypotheses, robust regression analyses were performed for each of the 4 X 7 and 10 X 5 Action/Non-action seat preference models. A significant regression equation for the 4 X 7 model was found $F(10, 215) = 2.60$, $p = .01$, with an R^2 of .08. The variables that made significant contributions to the prediction equation were the professions AT $b_{2\ AT} = 3.74$, $t(215) = 2.21$, $p = .03$; NR/KIN/OT $b_{2\ NURSE/KIN/OT} = 4.02$, $t(215) = 2.49$, $p = .01$; and Other $b_{2\ OTHER} = 3.82$, $t(215) = 2.45$, $p = .02$; and the diverging learning style $b_{5\ diverging} = -3.07$, $t(215) = -2.18$, $p = .03$. The seat preference $b_{1\ 4X7AS} = 1.15$, $t(215) = 1.00$, $p = .32$, failed to reach statistical significance. With an R^2 of .08, a sample size of $N = 270$ was required to have a power of .90. As the study's respondents with usable data numbered 226, the analysis did not have the power to state that the amount of variance (8%) explained by

the model was substantive. This analysis was not considered for testing the null hypotheses or answering the research question. Analysis of the residuals was not performed on the regression model of the 4 X 7 seat preference. The failure to reject the null hypothesis related to the 4 X 7 seating preference is discussed in Chapter 5 and is addressed with the caveat that power for the model was not achieved.

As such, the regression analyses used for interpretation employed the 10 X 5 seat preference model, which did have sufficient power (.92). A robust regression was calculated to predict grade score based upon action/non-action seat preference in a 10 X 5 Action/Non-action seating plan, past professional experience, and learning style, which accounted for a 10% variance in grade score, as seen in Table 21.

A significant regression equation was found $F(10, 217) = 2.33$, $p = .01$, with an $R^2 = .10$. Predicted academic achievement grade score is equal to $76.44 + b_1X_1 + b_2X_2 + b_5X_5$; Grade = 76.44 + b_1(Seat preference) + b_2(Past profession) + b_5(Learning style), where Seat preference was coded as 0 = Non-action seat, 1 = Action seat; Past profession was coded as 0 = RMT, 1 = MD/DO/DDS, 2 = ND/HD, 3 = DC/PT, 4 = AT, 5 = NR/KIN/OT, 6 = Other; and Learning style was coded as 0 = Assimilating, 1 = Accommodating, 2 = Diverging, 3 = Converging. Action seats, AT, NR/KIN/OT, and Other professions, and diverging learning styles were significant predictors in the regression analysis. Subjects preferring action seats ($M = 79.53$, $SD = 8.42$, 95%CI[78.11, 80.95], had grade scores that were significantly ($p = .01$) different to those subjects who preferred non-action seats ($M = 77.22$, $SD = 7.79$, 95%CI[75.48, 78.96]).

Table 21. Robust Model: Achievement Score by 10 X 5 Action/Non-action Seat Preference, Profession, and Learning Style

Variable	Coefficient	Robust *SE*	*t*	95% CI
Constant	76.44***	1.25	61.26	[73.98, 78.90]
10 X 5 Seat Plan compared to Non-Action				
Action	2.91**	1.16	2.51	[0.63, 5.20]
Profession compared to RMT				
MD, DO, DDS	-1.40	2.42	-0.58	[-6.18, 3.38]
ND, HD	5.15	3.56	1.45	[-1.86, 12.16]
DC, PT	3.14	2.35	1.34	[-1.50, 7.77]
AT	4.60**	1.66	2.77	[1.33, 7.86]
Nurse, Kin, OT	4.10*	1.61	2.54	[0.92, 7.27]
Other	3.48*	1.54	2.26	[0.45, 6.52]
Learning Style compared to Assimilating				
Accommodating	-2.42	1.44	-1.68	[-5.25, 0.42]
Diverging	-3.03*	1.42	-2.13	[-5.83, -0.23]
Converging	-1.00	1.66	-0.60	[-4.27, 2.27]
R^2	.10			
F	2.35*			
RMSE	8.41			
M VIF	1.18			

Note: RMT = registered massage therapist; MD = medical doctor; DO = osteopathic physician; DDS = dentist; DC = chiropractor; PT = physical therapist; AT = athletic therapist; Kin = kinesiologist; OT = occupational therapist; CI = confidence interval.
*$p < 0.05$, ** $p < 0.01$, ***p < .001; $df(10, 217)$; $N = 228$.

The AT profession (M = 80.32, SD = 7.05, 95%CI[77.41, 83.23]), Other profession (M = 80.51, SD = 7.94, 95%CI[77.87, 83.16]), and the NR/KIN/OT (M = 80.32, SD = 8.34, 95%CI[77.41, 83.23]), had grades scores that were significantly (p < .05) different from the RMT profession (M = 76.56, SD = 8.71, 95%CI[74.92, 78.00]). The subjects who preferred a diverging learning style (M = 76.67, SD = 9.88, 95%CI[74.37, 78.98]), had grade scores that were significantly (p = .03) different from the subjects who preferred an assimilating learning style (M = 80.24, SD = 7.26, 95%CI[78.58, 81.90]).

In Table 22, the pair-wise comparisons of professions are presented. In addition to the significant differences discussed in relation to Table 21, the AT profession (M = 80.32, SD = 7.05) had grade scores that were significantly (p < .05) different from the MD/DO/DDS profession (M = 76.00, SD = 2.83, 95%CI[50.59, 101.41]). As this pair-wise prediction was made a priori, a post hoc adjustment for multiple comparisons was not required (Field, 2009). To discuss the significant pair-wise comparison of MD/DO/DDS and NR/KIN/OT that was not considered a priori would require post hoc adjustment that would render the result not statistically significant.

In Table 23, the pair-wise comparisons by learning style are presented. The assimilating and diverging learning styles differed significantly in mean achievement scores (p = .03) as previously presented in Table 21. The accommodating and converging learning styles were not significantly different from the assimilating and diverging learning styles (p > .05).

Table 22. Robust Model: Pair-wise Comparison of Profession Estimated Marginal Means

Profession	Margin	*SE*	Unadjusted Groups
MD, DO, DDS	74.89	2.23	AB
ND, HD	81.43	3.38	ABC
DC, PT	79.42	2.32	ABC
AT	80.88	1.37	C
NR/KIN/OT	80.38	1.32	C
RMT	76.29	0.92	A
Other	79.77	1.29	BC

Note: Margins sharing a letter in the group label are not significantly different at the 5% level.
SE = standard error; RMT = registered massage therapist; MD = medical doctor; DO = osteopathic physician; DDS = dentist; DC = chiropractor; PT = physical therapist; AT = athletic therapist; Kin = kinesiologist; OT = occupational therapist.

Table 23. Robust Model: Pair-wise Comparisons of Learning Style Estimated Marginal Means

Learning Style	Margin	*SE*	Unadjusted Groups
Assimilating	80.62	0.97	B
Accommodating	78.20	1.32	AB
Diverging	77.59	1.29	A
Converging	79.62	1.45	AB

Note: Margins sharing a letter in the group label are not significantly different at the 5% level.

Cluster regression. In Table 24, the regression analysis was repeated using the option cluster (location). The use of cluster (location) acknowledged that students within a location are more alike than students between locations. As already stated, location and profession, and language were not independent.

Table 24. Cluster (Location) Model: Achievement Score by 10 X 5 Action/Non-action Seat Preference, Profession, and Learning Style

Variable	Coefficient	Robust *SE*	*t*	95% CI
Constant	76.44***	1.60	47.91	[72.01, 80.87]
10 X 5 Seat Plan				
Action	2.91	1.11	2.62	[-1.69, 6.00]
Profession compared to RMT				
MD, DO, DDS	-1.40	1.32	-1.06	[-5.06, 2.26]
ND, HD	5.15	3.06	1.68	[-3.34, 13.64]
DC, PT	3.14	3.51	0.89	[-6.61, 12.89]
AT	4.60*	1.65	2.78	[0.00, 9.19]
Nurse, Kin, OT	4.10	1.87	2.19	[-1.09, 9.29]
Other	3.48	2.08	1.68	[-2.27, 9.24]
Learning Style compared to Assimilating				
Accommodating	-2.42	1.38	-1.75	[-6.24, 1.41]
Diverging	-3.03	1.52	-1.99	[-7.26, 1.20]
Converging	-1.00	1.89	-0.53	[-6.25, 4.26]
R^2	.10			
F	Not available			
RMSE	8.41			
M VIF	1.18			

Note: RMT = registered massage therapist; MD = medical doctor; DO = osteopathic physician; DDS = dentist; DC = chiropractor; PT = physical therapist; AT = athletic therapist; Kin = kinesiologist; OT = occupational therapist; CI = confidence interval
*$p < 0.05$, ** $p < 0.01$, ***p < .001; $df(3, 4)$; $N = 228$.

There were five locations in the study with varying numbers of respondents from each: Location 1 (n = 60), Location 2 (n = 33), Location 3 (n = 103), Location 4 (n = 27), and Location 5 (n = 25). The overall standard error was calculated taking into account the standard error from each location. Unfortunately, an overall F statistic and p value was not available. It is thought that this was due to the small number of locations, five, versus the number of coefficients, eleven, being estimated with the use of the cluster option. Despite this the estimates are still valid.

A cluster (location) regression was calculated to predict grade score based upon action/non-action seat preference in a 10 X 5 seating plan, past professional experience, and learning style. The AT profession $b_{2\,AT} = 4.60$, $t(4) = 2.78$, $p = .05$, was the only significant contributor to the equation.

In Table 25, the pair-wise comparisons of professions are presented. The AT profession's marginal mean scores were significantly ($p < .05$) different from the MD/DO/DDS and RMT professions. The Other profession's marginal mean scores were significantly ($p < .05$) different from the MD/DO/DDS. The remaining pair-wise comparisons are presented with the caveat that they were not predicted a priori. Therefore, to include these comparisons would require post hoc multiple comparison procedures that would render these results not statistically significant.

Table 25. Cluster Model: Pair-wise Comparison of Profession Estimated Marginal Means

Profession	Margin	*SE*	Unadjusted Groups
MD, DO, DDS	74.89	0.54	A
ND, HD	81.43	2.62	BC
DC, PT	79.42	4.36	ABC
AT	80.88	1.19	C
NR/KIN/OT	80.38	1.54	BC
RMT	76.29	1.24	AB
Other	79.77	1.75	BC

Note: Margins sharing a letter in the group label are not significantly different at the 5% level.
RMT = registered massage therapist; MD = medical doctor; DO = osteopathic physician; DDS = dentist; DC = chiropractor; PT = physical therapist; AT = athletic therapist; Kin = kinesiologist; OT = occupational therapist.

Secondary Analysis. Robust and cluster analyses were performed in relation to individual seats to determine if there were seats of interest in each of the classroom seating plans. As there was no overall *F* statistic or *p* value available for the models, these analyses have limited generalizability. However, as there was a paucity of literature regarding the effect of individual seat preferences in the osteopathic educational community, the findings are offered with caution from a curiosity perspective.

10 X 5 seating plan. A robust regression analysis of individual seats in the 10 X 5 seating plan was performed. The overall model explained 30% of the variance, $F(47, 171)$, $R^2 = .30$, $RMSE = 8.34$, with Constant $b_{constant} = 71.94$, $t(171) = 13.42$, $p < .001$.

The significant contributors to the prediction of grade score were:

- Seat 21 $b_{1\ 10X5\text{-}21} = 11.96$, $t(171) = 2.07$, $p = .04$;
- Seat 26 $b_{1\ 10X5\text{-}26} = 12.31$, $t(171) = 2.09$, $p = .04$; and
- Seat 30 $b_{1\ 10X5\text{-}30} = -21.30$, $t(171) = -4.17$, $p < .001$.

A cluster (location) regression analysis of individual seats in the 10 X 5 seating plan was performed. The overall model $F(3, 4)$, $R^2 = .30$, $RMSE = 8.34$, with Constant $b_{constant} = 71.94$, $t(4) = 17.37$, $p < .001$, did not produce an F statistic or p value as previously explained. The significant contributors to the prediction of grade score were:

- Seat 26 $b_{1\ 10X5\text{-}26} = 12.31$, $t(4) = 2.87$, $p = .05$;
- Seat 30 $b_{1\ 10X5\text{-}30} = -21.30$, $t(4) = -4.72$, $p = .01$;
- Seat 50 $b_{1\ 10X5\text{-}50} = -11.40$, $t(4) = -3.05$, $p = .04$; and
- ND/HD $b_{2\ ND/HD} = 6.86$, $t(4) = 4.27$, $p = .01$.

4 X 7 seating plan. A robust regression analysis of individual seats in the 4 X 7 seating plan was performed. The overall model explained 17% of the variance, $F(34, 189)$, $R^2 = .17$, $RMSE = 8.62$, with Constant $b_{constant} = 78.85$, $t(189) = 25.61$, $p < .001$. The significant contributors to the prediction of grade score were:

- Seat 22 $b_{1\ 4X7\text{-}22} = -15.60$, $t(189) = -5.28$, $p < .001$;
- NR/KIN/OT $b_{2\ NR/KIN/OT} = 3.96$, $t(189) = 2.42$, $p = .02$; and
- Other $b_{2\ OTHER} = 4.28$, $t(189) = 2.39$, $p = .02$.

A cluster (location) regression analysis of individual seats in the 4 X 7 seating plan was performed. The overall model $F(3, 4)$, $R^2 = .17$, $RMSE = 8.62$, with Constant

$b_{constant} = 78.85$, $t(4) = 21.49$, did not produce an F statistic or p value as previously explained. The significant contributors to the predictive of grade score were:

- Seat 22 $b_{1\ 4X7\text{-}22} = -15.60$, $t(4) = -4.39$, $p = .01$;
- ND/HD $b_{2\ ND/HD} = 3.96$, $t(4) = 3.57$, $p = .02$.

Residuals. In Table 26, the predicted academic achievement scores and residuals that deviated from the actual year-end grade score by more than 15 points are observed. There were thirteen predicted scores that fit this criterion. When all the residuals were reviewed, 112 of the 228 (49%) were within ± 5 of the actual year-end grade score and 223 of the 228 (98%) were within ± 15 of the actual year-end grade score. Figure 5 provides an overview of the residuals with a fitted line of zero for the actual grade scores and reference lines at 15, 20, -15, and -20. The five residuals that exceeded the -20 point margin are identified with asterix and were the original five outliers.

Table 26. Robust 10 X 5 Action/Non-action Model: Mean Grade Score Linear Predictions with Residuals (Condensed to residual > 15 or < -15)

ID Code	Campus	Profession	Learning Style	Action seat	Grade	Predicted Grade	Residual
2	4	DC/PT	Diverging	Yes	96	79.78	16.22
13*	5	DC/PT	Converging	No	50	78.33	-28.33
24*	5	RMT	Diverging	No	40	73.15	-33.15
64	3	NR/KIN/OT	Diverging	Yes	61	80.32	-19.32
97*	3	RMT	Diverging	No	48	73.15	-25.15
114	3	NR/KIN/OT	Accommodating	No	62	77.05	-15.05
164	2	RMT	Accommodating	Yes	95	76.19	18.81
171*	2	RMT	Diverging	Yes	51	76.70	-25.70
177	2	Other	Diverging	Yes	63	80.21	-17.21
202*	3	RMT	Assimilating	Yes	55	79.67	-24.67
221	1	Other	Assimilating	Yes	65	83.18	-18.18
230	5	RMT	Converging	No	60	75.25	-15.25
233	5	NR/KIN/OT	Accommodating	Yes	62	79.81	-17.81

Note: * Subject was identified as an outlier at the beginning of the analysis.

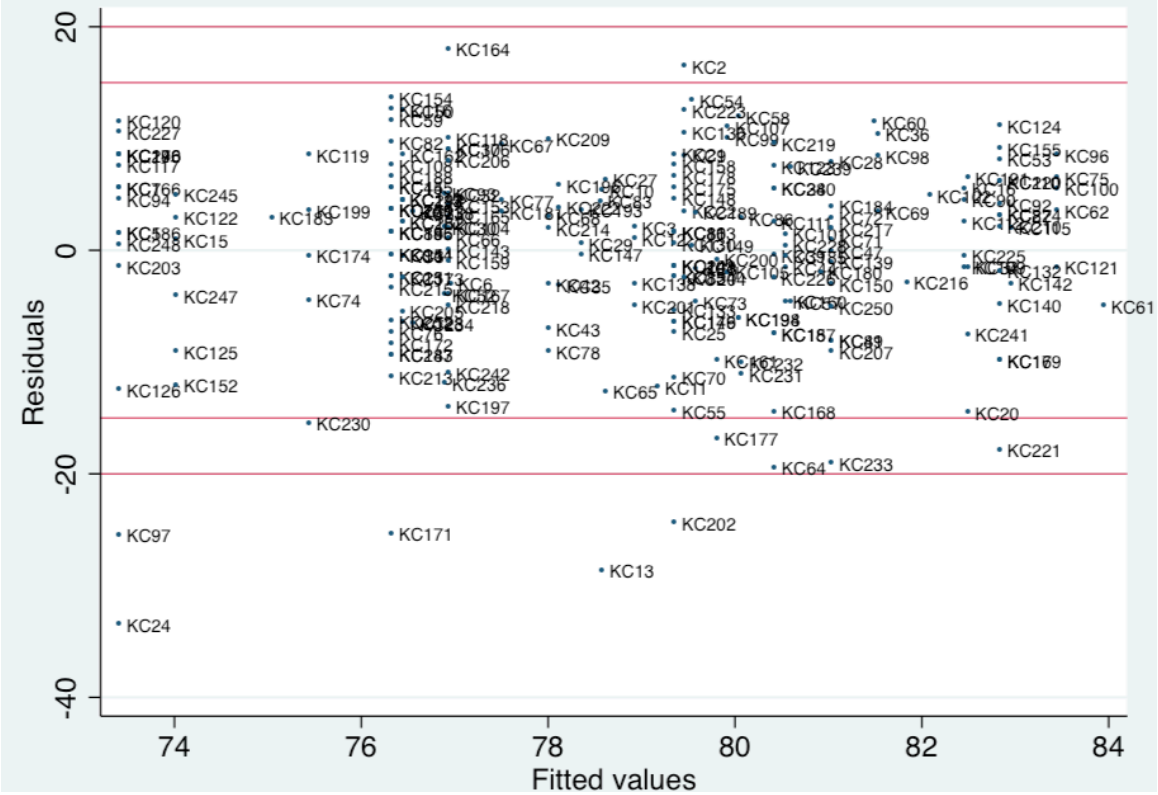

Figure 5. Residual versus fitted values graph by location

Chapter 4 Summary

Chapter 4 presented the sample and the characteristics of the respondents with respect to age, language, location, education, profession, learning style, and seat preferences. The descriptive statistics were reported for each when appropriate regarding frequency, percentages, means, standard deviations, and confidence intervals. The respondents and non-respondents were compared to determine if there was a respondent bias. The regression model was analyzed and presented.

There was a 49% response rate to the study. Of a convenience sample of 508 students, data were obtained from 248 respondents from the five English-speaking

accredited part-time traditional manual osteopathic program locations at three osteopathic colleges. The subjects ranged in age from 20 – 69 with 42% of the subjects aged 30 – 39. English as a first language described 80% of the sample with 5 % being French-speaking, and 15% speaking other languages. The educational backgrounds ranged from high school to PhD with 47% of the sample having a bachelor's degree, 16% having a minimum master's level education, and 36% having high school to college level diplomas. The past professions of the sample were diverse in the healthcare fields as well as other occupations and professions. Massage therapists made up 46% of the sample while non-healthcare professions made up 16% of the sample. All learning styles were represented in the sample with 81, 75, 51, and 32 subjects preferring an assimilating, a diverging, an accommodating, and a converging style, respectively. Action seats were preferred by 53% and 57% of the subjects in the 4 X 7 and 10 X 5 seating plans, respectively.

To deal with the concern of a potential responder bias, a between subjects ANOVA to compare males and females, and respondents and non-respondents was performed. There was no interaction effect gender x respondents $F(1, 343) = 3.49$, $p = .06$. The effect of gender on mean scores for those responding and not responding was the same. There was no responder bias in the study.

From the observed data there appeared to be differences between locations regarding mean achievement scores, professions, learning styles, and languages. A fitted one-way ANOVA found a significant main effect between grade and location $F(4, 233) = 7.75$, $p < .001$. Post hoc analysis revealed significant differences between Location 5 and

Locations 1, 3, and 4. A similar analysis was fitted to test differences between locations and language. A fitted one-way ANOVA found a significant interaction between location and language $F(2, 235) = 11.22$, $p < .001$. The interaction between language and grade occurred among subjects who speak English as a first language and subjects who speak a language other than English or French as a first language. Chi-square tests of independence revealed that profession and location, and location and language were not independent in this sample. A chi-square test of independence revealed that location and learning style were independent in this sample.

In the literature reviewed in preparation for this study, researchers expressed an interest in determining if there is a relationship between learning styles and profession. In a chi-square test of learning style and professions, no significant relationship was found $\chi^2(18, N = 239) = 20.40$, $p = .31$, $\phi = .29$, $p = .31$. In this sample, learning styles and professions are independent of each other.

The research question was answered from the regression analysis. A model fitted with the variables of seat preference (10 X 5 Action/Non-action), past profession, and learning style accounted for 10% of the variance in student achievement as measured by grade score. A significant regression equation was found $F(10, 217) = 2.33$, $p = .01$, with an $R^2 = .10$, $RMSE = 8.41$. The regression equation had sufficient power (.92) to consider an $R^2 = .10$ as a substantive finding with a sample size of $N = 228$. The null hypothesis $H_0 1$ was rejected.

The second null hypothesis was rejected as the coefficient 10 X 5 action seat made a significant contribution to the prediction of grade score $b_{1\ 10X5AS} = 2.91$, $t(217) = 2.51$, $p = .01$, and was significantly different from the base level non-action seat.

The third null hypothesis was rejected as the coefficient diverging learning style made a significant contribution to the prediction of grade score $b_{5\ diverging} = -3.03$, $t(217) = -2.13$, $p = .03$, in the 10 x 5 seating plan and was significantly different from the base level assimilating learning style.

The fourth null hypothesis was rejected as the coefficients of the past professions AT $b_{2\ AT} = 4.60$, $t(217) = 2.77$, $p = .01$, NR/KIN/OT $b_{2\ NURSE/KIN/OT} = 4.10$, $t(217) = 2.54$, $p = .01$, and Other $b_{2\ OTHER} = 3.48$, $t(217) = 2.26$, $p = .03$, contributed significantly to the prediction of grade score in the robust regression and were significantly different from the base level RMT profession. The professions MD/DO/DDS, ND/HD, and DC/PT did not contribute significantly to the prediction equation. In the cluster (location) regression, the coefficient of the AT profession $b_{2\ AT} = 4.60$, $t(4) = 2.78$, $p = .05$, contributed significantly to the prediction of grade score.

In addition to the robust regression findings, pair-wise comparisons predicted a priori in the robust regression model were presented. The AT profession had significantly different marginal means from the MD/DO/DDS profession.

Pair-wise comparisons, predicted a priori, in the cluster (location) regression model were presented. The AT profession had significantly different marginal means from the MD/DO/DDS profession. The Other profession's marginal mean scores were significantly ($p < .05$) different from the MD/DO/DDS. In pair-wise comparisons of

learning styles there were no significant interactions ($p > .05$). In pair-wise comparisons of action and non-action seats there was no significant difference in marginal mean scores ($p > .05$) between action and non-action seats.

Secondary analyses of models using individual seats revealed three seats in the 10 X 5 seating plan with significant contributions: 21, 26, and 30 in the robust regression; and 26, 30, and 50 in the cluster regression. In the 4 X 7 individual seating plan in both the regression and cluster models, Seat 22 made a significant contribution to the equation.

Analysis of the residuals of the regression model 10 X 5 Action/Non-action seating plan, past profession, and learning style revealed thirteen subjects who had residual scores greater than 15 grade points from the actual year-end grade score; five subjects had residual values of greater than 20. These five subjects were identified as outliers in the original review of the data. Overall, 49% of residuals of the fitted model were within 5 points from the actual year-end grade score.

Chapter 4 has provided the reader with a description of the sample, the results of the detailed analyses, and a summary of the findings. In Chapter 5 a thorough discussion and interpretation of the findings are presented. The interpretation is extrapolated to application of the findings in relation to the research problem.

CHAPTER 5. CONCLUSIONS AND DISCUSSION

Introduction

The purpose of this study was to predict and understand the interrelationships among seat preference, past professional experience, and learning style as measured by Kolb's LSI; and between these predictors and student achievement as measured by grade score. The statistical analyses provided evidence for a statistically significant relationship between grade score and seat preference, past professional experience, and learning style. The hypothetical equation was found to be predictive and could be used proactively to identify and assist students who may be at risk of academic underachievement in the traditional manual osteopathic part-time program in accredited English language private colleges in Canada and Switzerland.

This study employed a quantitative methodology. Survey instruments were used to gather data in order to understand interactions between each of the independent variables seat preference, learning style, and profession, and the criterion variable academic achievement. The research question asked how and to what extent did the independent variables account for variances in the criterion variable. The findings were statistically significant and are addressed in the discussion of the results.

This chapter presents the reader with a summary of the results from the statistical analyses of the data gathered. A discussion of the results follows with an interpretation

of the findings with respect to the research question and hypotheses. These findings are then discussed in relation to the literature; refuting, augmenting, or furthering knowledge concerning the predictive nature of the variables of seat preference, past professional experience, and learning style. The limitations of the study are reported and contemplated in retrospection. As this study was designed with a scholar-practitioner model premise, implications of the results for education practices and osteopathic admission criteria are considered. Recommendations for further research are made.

Summary of the Results

The summary of results is presented to provide the reader with a clear understanding of the characteristics of the sample, the results of the statistical analysis as related to the research question and hypotheses, and the predictive equation developed as a compilation of the data.

Sample

There was a 49% response rate to the study. Of a convenience sample of 508 students, data were obtained from 248 respondents from the five English-speaking accredited part-time traditional osteopathic program locations at three osteopathic colleges. The subjects ranged in age from 20 – 69 with 42% of the subjects aged 30 – 39. Genders were represented in the respondents in the exact proportion to the data available for the sample, with females generating 71% of the responses and males generating 29% of responses. English was a first language for 80% of the sample with 5 % being French-speaking, and 15% speaking other languages. Education level achieved ranged from high school to PhD, with 36% having high school to college level diplomas; 47% of the

sample having a bachelor's degree; and 16% having at least a master's level education. The past professions represented in the sample were diverse and included the healthcare fields as well as other occupations and professions. Massage therapists made up 46% of the sample while non-healthcare professions made up 16% of the sample. All learning styles were represented in the sample with 81, 75, 51, and 32 subjects preferring an assimilating, a diverging, an accommodating, and a converging style, respectively. Action seats were preferred by 53% and 57% of the subjects in the 4 X 7 and 10 X 5 seating plans, respectively.

Responder Bias

To deal with the concern of a potential responder bias, a between-subjects ANOVA comparing males and females, and respondents and non-respondents was performed. There was no interaction effect of gender by respondents $F(1, 343) = 3.49$, $p = .06$. The effect of gender on mean scores for those responding and not responding was the same. There was no responder bias in the study.

Location and Language

From the observed data there appeared to be differences between locations regarding mean achievement scores, professions, learning styles, and languages. A fitted one-way ANOVA found a significant main effect between grade and location $F(4, 233) = 7.75$, $p < .001$. Post hoc analysis revealed significant differences between Location 5 and Locations 1, 3, and 4. A similar analysis was fitted to test differences between locations and language. A fitted one-way ANOVA found a significant interaction between grade and language $F(2, 235) = 11.22$, $p < .001$. The interaction between language and grade

occurred between subjects who speak English as a first language and subjects who speak a language other than English or French as a first language. Chi-square tests of independence revealed that profession and location, and location and language were not independent in this sample. A Chi-square test of independence revealed that location and learning style were independent in this sample.

Learning Style and Profession

In the literature reviewed in preparation for this study, researchers expressed an interest in determining if there is a relationship between learning styles and profession. In a chi-square test of learning style and professions, no significant relationship was found $\chi^2(18, N = 239) = 20.40$, $p = .31$, $\phi = .29$, $p = .31$. In this sample, learning styles and professions are independent of each other.

Research Question and Hypotheses

The research question was answered from the regression analysis. A model fitted with the variables of seat preference (10 X 5 Action/Non-action), past profession, and learning style accounted for 10% of the variance in student achievement as measured by grade score. A significant regression equation was found $F(10, 217) = 2.33$, $p = .01$, with an $R^2 = .10$, $RMSE = 8.41$. The regression equation had sufficient power (.92) to consider an $R^2 = .10$ as a substantive finding with a sample size of $N = 228$. The null hypothesis $H_0 1$ was rejected.

The second null hypothesis was rejected as the coefficient 10 X 5 action seat made a significant contribution to the prediction of grade score $b_{1\ 10X5AS} = 2.91$, $t(217) = 2.51$, $p = .01$, and was significantly different from the base level non-action seat.

The third null hypothesis was rejected as the coefficient diverging learning style made a significant contribution to the prediction of grade score $b_{5\ \text{diverging}} = -3.03$, $t(217) = -2.13$, $p = .03$, in the 10 x 5 seating plan and was significantly different from the base level assimilating learning style.

The fourth null hypothesis was rejected as the coefficients of the past professions AT $b_{2\ \text{AT}} = 4.60$, $t(217) = 2.77$, $p = .01$, NR/KIN/OT $b_{2\ \text{NURSE/KIN/OT}} = 4.10$, $t(217) = 2.54$, $p = .01$, and Other $b_{2\ \text{OTHER}} = 3.48$, $t(217) = 2.26$, $p = .03$, contributed significantly to the prediction of grade score in the robust regression and were significantly different from the base level RMT profession. The professions MD/DO/DDS, ND/HD, and DC/PT did not contribute significantly to the prediction equation. In the cluster (location) regression, the coefficient of the AT profession $b_{2\ \text{AT}} = 4.60$, $t(4) = 2.78$, $p = .05$, contributed significantly to the prediction of grade score.

In addition to the robust regression findings, pair-wise comparisons predicted a priori in the robust regression model were presented. The AT profession had significantly different marginal means from the MD/DO/DDS profession.

Pair-wise comparisons, which were predicted a priori in the cluster (location) regression model, were presented. The AT profession had significantly different marginal means from the MD/DO/DDS profession. The Other profession's marginal mean scores were significantly ($p < .05$) different from the MD/DO/DDS. In pair-wise comparisons of learning styles, no learning styles had significantly different marginal mean scores ($p > .05$). In pair-wise comparisons of action and non-action seats, there was

no significant difference in marginal mean scores ($p > .05$) between action and non-action seats.

Secondary analyses of models using individual seats revealed three seats in the 10 X 5 seating plan with significant contributions: 21, 26, and 30 in the robust regression; and 26, 30, and 50 in the cluster regression. In the 4 X 7 individual seating plan in both the regression and cluster models, Seat 22 made a significant contribution to the equation.

Analysis of the residuals of the regression model 10 X 5 Action/Non-action seating plan, past profession, and learning style revealed thirteen subjects who had residual scores greater than 15 grade points from the actual grade score; five subjects had residual values of greater than 20. These five subjects were identified as outliers in the original review of the data. Overall, 49% of residuals of the fitted model were within 5 grade points from the subjects' actual grade score.

Predictive Equation

The predictive equation for the thesis is presented as:

$$Y_{predicted2} = \text{constant} + b_1X_1 + b_2X_2 + b_5X_5$$

$$Y_{predicted2} = 76.44 + b_1X_1 + b_2X_2 + b_5X_5$$

Where X_1 is the seat preference, X_2 is the past profession, and X_5 is the learning style. As previously stated in Chapter 3, as the AERO X_3 and ACCE X_4 scores were embedded within the variable learning style, AERO and ACCE were removed from the equation.

The variable coefficients used for the equation are:

- $b_{1\ 10X5AS} = 2.91$; the non-action seats are base variables and have a coefficient of 0; whereas in the prediction equation a student preferring an action seat in the 10 X 5 seating plan is represented as:

  $Y_{predicted2} = 76.44 + b_{1\ 10X5AS}X_1 + b_{1\ 10X5NONAS}X_1 + b_2X_2 + b_5X_5$

  $Y_{predicted2} = 76.44 + 2.91(X_1) + 0(X_1) + b_2X_2 + b_5X_5$

  $Y_{predicted2} = 76.44 + 2.91(1) + 0(0) + b_2X_2 + b_5X_5$

  $Y_{predicted2} = 79.35 + b_2X_2 + b_5X_5$

- $b_{2\ MD/DO/DDS} = -1.40$, $b_{2\ ND/HD} = 5.15$, $b_{2\ DC/PT} = 3.14$, $b_{2\ AT} = 4.60$, $b_{2\ NURSE/KIN/OT} = 4.10$, $b_{2\ OTHER} = 3.48$, $b_{2\ RMT} = 0$ (base); whereas in the prediction equation a student who is a naturopath is represented as:

  $Y_{predicted2} = 76.44 + b_1X_1 + b_2X_2 + b_5X_5$

  $Y_{predicted2} = 76.44 + b_1X_1 + 5.15(1) + (-1.40)(0) + 3.14(0) + 4.60(0) + 4.10(0) + 3.48(0) + 0(0) + b_5X_5$

  $Y_{predicted2} = 76.44 + b_1X_1 + 5.15(1) + b_5X_5$

  $Y_{predicted2} = 81.59 + b_1X_1 + b_5X_5$

- $b_{5\ accommodating} = -2.42$, $b_{5\ diverging} = -3.03$, $b_{5\ converging} = -1.00$, $b_{5\ assimilating} = 0$ (base); whereas in the prediction equation a student with an accommodating learning style is represented as:

  $Y_{predicted2} = 76.44 + b_1X_1 + b_2X_2 + b_5X_5$

  $Y_{predicted2} = 76.44 + b_1X_1 + b_2X_2 + (-2.42)(1) + (-3.03)(0) + (-1.00)(0) + 0(0)$

  $Y_{predicted2} = 76.44 + b_1X_1 + b_2X_2 + (-2.42)(1)$

  $Y_{predicted2} = 74.02 + b_1X_1 + b_2X_2$

Discussion of the Results

The results are interpreted with consideration of the literature and the research problem. In the absence of supporting literature postulations are offered.

Sample and Population

In this section the sample characteristics are discussed followed by the respondents' characteristics. Although language was not a variable considered in the research question, language offers insight into practice considerations; as such, it was deemed relevant to the dissertation and discussion. An explanation of the results in relation to the characteristics of the subjects is presented. The explanation is furthered in the results in relation to the literature and the implications to practice sections of the chapter.

The sample constituted subjects who are described in the literature as adult learners (Kasworm, 2012; Phipps, Prieto, & Ndinguri, 2013). With 75% of the sample aged 30 and above, and all venturing on a new career, there is no dispute as to categorizing these subjects as adult learners. They bring a multitude of educational, learning, and professional experiences to the classroom.

In the colleges, females comprise 71% of the population and had mean grades scores (M = 78.80, SD = 8.10, 95%CI[77.46, 79.83]) that were significantly higher $F(1, 343) = 11.93$, $p < .01$ than males (M = 75.69, SD = 10.63, 95%CI[72.86, 76.62]). Although gender was not considered for the regression analysis, it is apparent that gender represents a factor in student achievement in the osteopathic classroom. To make a generalization of gender as a factor beyond this sample would be in error, as there are

discrepancies reported within the literature regarding gender difference with respect to achievement and motivation (Downing, Sui-Wah, Woo-Kyung, Kwong, & Lam, 2008; Khwaileh & Zaza, 2011; Shekhar & Devi, 2012). As there are a multitude of factors in how achievement is measured and what factors contribute to achievement, further investigation is warranted with respect to gender differences; however, a discussion of this nature is beyond the scope of this study.

Language. Subjects with English as a first language (M = 79.83, SD = 7.61, 95%CI[78.80, 80.91]), scored higher than French as a first language subjects (M = 74.83, SD = 13.53, 95%CI[66.24, 83.43]), and significantly higher ($p < .001$) than other languages as a first language subjects (M = 73.11, SD = 9.54, 95%CI[69.88, 76.34]). As the language of instruction and assessment was English in this study, this information is useful in determining the need for academic accommodations for non-English speaking students (Din Yan et al., 2003; P. Miller & Peleg, 2010). This is discussed further in the chapter in the implications for practice section.

Location. In the descriptive statistics of the sample, observations revealed that there were significant differences in mean achievement scores and sample sizes between the campuses. Location 3 was the largest campus with 258 students followed in descending order by Location 1, 5, 2, and 4 with 103, 59, 49, and 39 students, respectively. Significant mean grade score differences were established between Location 5 and Locations 1, 3, and 4. Location 5 (M = 71.12, SD = 11.08, 95%CI[66.55, 75.96]), scored significantly lower than Locations 1 (M = 81.21, SD = 7.04, 95%CI[79.25, 83.17]), 3 (M = 78.98, SD = 7.83, 95%CI[77.45, 80.51]) , and 4 (M =

81.28, *SD* = 8.43, 95%CI[77.80, 84.76]), and lower than Location 2 (*M* = 76.64, *SD* = 8.21, 95%CI [73.72, 79.55]).

It appears that the size of the college is not the only contributing factor to differences by location. As stated in the Language section above, subjects who spoke a first language that was not English or French scored 6.72 lower than their English-speaking colleagues. Location 5 had the most subjects, 20 of 25 (80%) responders, who spoke a language other than English or French as their first language. In a Chi-square analysis, language and location were not independent. This interpretation is discussed further in the implications for practice section. As a result of this implication, the employment of the cluster (location) analysis was further justified.

In Table 27, a summary of each of the four analyses for the 10 X 5 seating plan is offered in order to distill the results for ease of comparison. The findings of the cluster (location) analyses were quite different to the robust analyses as seen in the summary. Although the 4 X 7 seating plan did not reach the established a priori statistical power (.88), the result of the model was significant. A summary is presented in Table 27 to contrast the larger 10 X 5 seating plan classroom with the smaller 4 X 7 seating plan for discussion purposes.

In the 10 X 5 cluster (location) analysis, only the AT profession made a significant contribution to the predictive equation. When reviewing the data, there were no AT responders attending Location 4 or 5. Of the AT responders (*n* = 25), fourteen attended Location 3, nine attended Location 1, and two attended Location 2. Thus,

location is a factor to be considered with respect to predicting student achievement when assessing the variable of past profession.

In the 10 X 5 individual seating plan cluster (location) analysis, the ND/HD profession made a significant contribution to the equation and had mean achievement scores significantly different from the RMT base level profession. Of the ND/HD responders (n = 5), two attended Location 3, one attended Location 4, and two attended Location 5.

The NR/KIN/OT profession was strongly represented in Locations 1 (n = 13), and 3 (n = 14), which when combined corresponded to 77% of the profession. Locations 2, 4, and 5 had a combined 23% of the NR/KIN/OT profession in the sample. A similar pattern was seen with the Other profession; Locations 1 (n = 11), and 3 (n = 16) represented 71% of the profession, while Locations 2, 4, and 5 had a combined 29%, (n = 11) of the profession in the sample.

Table 27. Summary of Significant Regression Contributors in 10 X 5 and 4 X 7 Seating Plan Models

	10 X 5 Action/Non-action Seat		10 X 5 Individual Seat	
	Robust	Cluster	Robust	Cluster
Constant	76.44	76.44	71.94	71.94
R^2	.10	.10	.30	.30
Seat Preference	Action Seat *b* = 2.91	No significant seat	21 *b* = 11.96 26 *b* = 12.31 30 *b* = -21.30	26 *b* = 12.31 30 *b* = -21.30 50 *b* = -11.40
Profession	AT *b* = 4.60 NR/KIN/OT *b* = 4.10 Other *b* = 3.48	AT *b* = 4.60	No significant profession.	ND/HD *b* = 6.86
Learning Style	Diverging *b* = -3.03	No significant Learning Style	No significant Learning Style	No significant Learning Style

	4 X 7 Action/Non-action Seat		4 X 7 Individual Seat	
	Robust	Cluster	Robust	Cluster
Constant	77.63	77.63	78.85	78.85
R^2	.08	.08	.17	.17
Seat Preference	No significant seat	No significant seat	22 *b* = -15.60	22 *b* = -15.60
Profession	AT *b* = 3.75 NR/KIN/OT *b* = 4.02 Other *b* = 3.82	No significant profession	NR/KIN/OT *b* = 3.96 Other *b* = 4.28	NR/KIN/OT *b* = 3.96
Learning Style	Diverging *b* = -3.07	No significant Learning Style	No significant Learning Style	No significant Learning Style

The cluster (location) analyses provided an opportunity to consider that students in one location are more alike within that location than students in other locations. Language and professions were observed to be contributing factors in the data regarding locations. Further study is warranted as to what and how differences between the locations may influence the methods of teaching and assessing learners. This concern is addressed in the implications for practice section.

Past Profession. Observation of the mean achievement scores by profession indicated that the MD/DO/DDS and RMT professions scored in the mid 70s while all of the other sampled professions scored approximately 80. In the Action/Non-action seating plans robust regression analyses, the AT ($p < .01$), and the NR/KIN/OT and Other professions ($p < .05$) scored significantly higher than the RMT profession. In the 10 X 5 Action/Non-action cluster regression, only the AT profession contributed significantly ($p < .05$) to the predictive equation. The results of the AT profession were predicted and are discussed in the individual profession sections that follow. The NR/KIN/OT and in particular, the success of the Other professions were unexpected. In the pair-wise comparisons following the robust regression, the profession MD/DO/DDS ($M = 76.00$, $SD = 2.83$), scored significantly ($p < .05$) lower than the AT profession ($M = 80.32$, $SD = 7.05$). Again, this was a predictable finding and is discussed in the paragraph below.

Doctors and registered massage therapists. In the regression analyses, the MD/DO/DDS profession made the least contribution $b_2 = -1.40$, in the predictive variable of past profession. The MD/DO/DDS ($M = 76.00$, $SD = 2.83$), and RMT ($M = 76.56$, $SD = 8.71$) professions scored the lowest of all of the professions studied when reviewing the

observed mean scores. In the regression analysis, the RMT profession was set as the base level of zero. The MD/DO/DDS profession coefficient indicated that the doctors would score the least amongst the studied professions in the fitted model in the absence of other variables. This was an unexpected finding as both professions were expected to score better than the Other profession (M = 80.51, SD = 7.94), who have no medical training or manual therapy skills.

It is postulated that although the MD/DO/DDS profession has the medical expertise, these subjects do not use their hands in a therapeutic manner, thus potentially limiting their success in the studied program. Osteopathy is an integrative therapy that requires a holistic view of the body, which may be missing in allopathic education. The low scores achieved by the RMT profession are explained in an opposite manner to the MD/DO/DDS profession. Here, the RMT professionals use their hands in a therapeutic manner; however, their basic education is lacking in comprehensive physiology, pathophysiology, and anatomy.

The observation that the NR/KIN/OT scored significantly better than the RMT profession is understandable, while the Other profession scoring significantly better is not as comprehensible. The offered explanation is the level of medical knowledge and training of the NR/KIN/OT professions exceeds that of the RMT profession. The minimum level of education for the NR/KIN/OT is a bachelor's degree and in the case of the OT profession, right of practice entry has become a master's level program in Canada since 2008; whereas, the RMT profession has a private college or college diploma as right of practice entry. Many of the RMT subjects did have degrees, but 59% of the

sampled RMTs had college level diplomas. Although educational level mean grade scores were not statistically significant, graduate level scores were 6.31 higher than college level scores.

The RMT profession is skilled with manual palpation. The NR/KIN/OT and the Other professions do not have manual therapy backgrounds. In some instances, it is simpler to learn new skills without the prejudice of previous education. This is contrary to the theoretical framework of SLT and scaffolding of skills (Bandura, 1986), which incorporates building upon previous knowledge and experiences; however, is refuted when considering experts, who in simple scenarios, perform less than their predicted abilities (Kalyuga, Rikers, & Paas, 2012; Nokes-Malach, Meade, & Morrow, 2012). As a clinical instructor, it is often easier to work with a student who does not have preconceptions regarding tissue feel or tissue response and is, in essence, ignorant of expectations.

A corollary for the Other profession may be simply that they are motivated to learn as they move from a non-medical profession to a medical profession (Newton et al., 2011). The stakes are higher for the Other professionals as they are not adding new skills to an established practice, but embarking on a new career. Also, as they have no medical background, they have more studying to do. It may be that they take their course work and preparation more seriously than their classmates, who have background knowledge in anatomy and physiology, thus making them "good" students (Karakitsiou et al., 2012), and potentially more receptive of feedback (Lewallen & DeBrew, 2012). This is a hypothesis that requires further investigation and is beyond the scope of this study.

In the pair-wise comparisons following the cluster (location) regression, the AT and Other professions were significantly different from the MD/DO/DDS profession. As well, the NR/KIN/OT, and ND/HD were also significantly different to the MD/DO/DDS profession, but as these results were not predicted a priori they would require post hoc multiple comparison adjustments that would render them not statistically significant. As the cluster (location) regression adjusted for differences of subjects between locations and recognizing that the MD/DO/DDS profession was a small portion of the sample and related to two campuses; this result, although significant, may be misleading and would not stand in the face of further post hoc analysis of multiple comparisons. The explanation of the results remains as stated previously with the codicil that the AT profession has extensive medical knowledge in the musculoskeletal system and a manual therapy background.

Naturopath and homeopath. In the regression analyses, the ND/HD profession made the largest contribution $b_2 = 5.15$, ($M = 80.20$, $SD = 8.76$) in the predictive variable of past profession. Although not a significant contributor to the equation ($p > .05$), the naturopaths and homeopaths are expected to score higher than their classmates in the osteopathic program, and in particular, 5.15 grade points above the RMTs. In an attempt to explain this finding, it is proposed that the post-graduate level of education and holistic nature of these two complementary health professions provides the learners with the experience in higher education (Phan, 2012), and the anatomy and physiology knowledge necessary to be successful. Both of these professions do not have manual skills entering the program, but this can be learned (Kalyuga et al., 2012). A critical issue is the ability

to practice the skills within the subjects' daily practices in order to build success through feedback from instructors (Burke & Mancuso, 2012) and patients (Boshuizen, van de Wiel, & Schmidt, 2012). The ND/HD have the opportunity to scaffold and transfer their learning into their daily practice.

Chiropractic and physical therapy. In the regression analysis, the DC/PT profession made the second least contribution $b_2 = 3.14$, ($M = 80.16$, $SD = 10.17$) in the predictive variable of past profession and was not significant. This result was unexpected. The prediction based upon education and skill level placed the DC/PT profession as the highest academic achievers in the osteopathic program as DC/PT professionals are experts in manual therapy and have graduate level healthcare education. Instead, in the observed mean scores, the DC/PT profession scored relative to all of the professions with the exception of the MD/DO/DDS and RMTs, which scored the lowest. A potential explanation for this is the study in which there was an expertise reversal effect (Kalyuga et al., 2012). The experts scored worse than the novices, which was similar to the present case. A secondary explanation is the potential for a DC/PTs data point being an outlier with a grade score of 50. This second explanation is discussed in the residuals section below.

Athletic therapy. In the regression analysis, the AT profession made the second largest contribution $b_2 = 4.60$, ($M = 80.32$, $SD = 1.37$), in the predictive variable of past profession. This was a significant contribution ($p = .01$). The athletic therapists are expected to score 4.60 grade points above the RMTs. The AT subjects have a bachelor's degree in athletic therapy and have studied the musculoskeletal system extensively. As

ATs work in a clinical practice it is possible to incorporate the new osteopathic skills and methodology into daily work. The opportunity to practice skills and receive feedback from reassessment and patient comments demonstrates the application of SLT and ELT to the learning events (Burke & Mancuso, 2012) and self-efficacy in promoting achievement (Brady-Amoon & Fuertes, 2011).

Nurse, kinesiology, and occupational therapy. In the robust regression analysis, the NR/KIN/OT profession made the third largest contribution $b_2 = 4.10$, ($M = 80.32$, $SD = 8.34$), in the predictive variable of past profession. This was a significant contribution ($p = .01$) in the robust regression. The effect failed to reach significance in the cluster (location) analysis. The NR/KIN/OT professionals are predicted to score 4.10 grade points higher than the RMTs. Recalling Chapter 3, the expected findings envisaged that the NR/KIN/OT mean achievement scores would be similar to the other professions in which one of the competencies, medical knowledge or manual therapy skill, was present. As noted previously, the education level differences between the RMTs and NR/KIN/OTs offers further potential rationale for the significant differences in achievement scores.

Other professions. In the robust regression analysis, the Other profession made the fourth largest contribution $b_2 = 3.48$, ($M = 80.51$, $SD = 7.94$), in the predictive variable of past profession. This was a significant contribution ($p = .03$) in the robust regression. The effect failed to reach significance in the cluster (location) analysis.

As discussed in the doctors and registered massage therapy section, the success of the Other profession in the analysis was an unexpected finding. The prediction was that

the Other professions would perform the least well academically. However, this was not the case. It is postulated that these subjects are highly motivated as they are embarking on a career change, rather than simply adding new skills to an already established toolbox as their healthcare professional classmates do. The stakes are much higher for someone commencing a new profession in his/her adult life. The commitment of time and financial resources provides motivation to succeed (Newton et al., 2011).

Learning Style. In the robust regression analysis, the diverging learning style made a significant contribution b_5 = -3.03, (M = 76.67, SD = 9.88), in the predictive variable of learning style. This was a significant contribution (p = .03) in the robust regression. The effect failed to reach significance in the cluster (location) analysis.

The learners with a diverging learning style were expected to score 3.03 grade points below the learners who preferred the assimilating learning style. Observation of mean achievement scores by learning style indicated that the assimilating learning style scored highest (M = 80.24, SD = 7.26), while the diverging learning style scored the lowest (M = 76.67, SD = 9.88). The converging learning style scored second highest (M = 79.48, SD = 8.82), while the accommodating learning style scored third (M = 77.98, SD = 8.51). This result was predicted; assimilating and converging learning styles would score better than the accommodating and diverging learning styles based upon the subject matter studied and the literature reviewed (Gogus & Gunes, 2011; Lockie et al., 2013; Tulbure, 2012b).

In addition to explanations from the literature, 39% of the sampled RMT profession preferred a diverging learning style and the RMT diverging learning style

subjects made up 57% of the diverging learning style subjects. As such, with RMT mean achievement scores of 76.56, one may conclude that profession heavily influenced the diverging learning style results in this sample. As learning style and profession were considered to be independent in the statistical analysis, the explanation rests in the method of learning and is discussed further in the discussion in relation to the literature.

Seat Preference. In the regression analysis, the 10 X 5 Action seat made a significant contribution $b_2 = 2.91$, ($M = 79.58$, $SD = 8.44$), in the predictive variable of seat preference. This was significant ($p = .01$) in the robust regression. The effect failed to reach significance in the cluster (location) analysis. Those subjects who preferred an action seat were predicted to score 2.91 grade points higher than those subjects who preferred non-action seats ($M = 77.22$, $SD = 8.67$). This result was previously predicted and is in keeping with the literature related to seat self-selection (Marshall & Losonczy-Marshall, 2010; Wulf, 1976; Zomorodian et al., 2012).

Failure of seat preference to significantly contribute to the 4 X 7 Action/Non-action regression model was an unexpected result. It is postulated that in the smaller classroom, the seat preference is not as important as in the larger classroom design. One might argue that the difference between 28 and 50 seats is not a significant size difference as it might be in comparison to 128 and 150 seats in a lecture theatre. However, the nature of the material being taught is significantly different. When learning manual therapy techniques, one student is the acting patient, lying on the table, and the other student is the acting therapist, standing student. The ratio in the 4 X 7 and 10 X 5 classrooms, of professor to standing students potentially differs from 1:14 to 1:25 if there

are no assistants. As a rule, the Colleges' Standard Operating Procedures requires the assigning of a teaching assistant if the ratio of professor to standing students is greater than 1:11 ("Private Career Colleges Act," 2005). Most of the class sizes in Location 1, 2, 4, and 5 were less than 20, making for a beneficial professor to student ratio. However, a class of 24 students will have an assistant, making the ratio 1:6. This is a critical factor when considering feedback for each student during the practice of techniques and the component of time available for feedback. As such, it appears that the 4 X 7 seating plan with its higher constant $b = 77.63$ is better suited to learning manual therapy techniques in the osteopathic colleges.

In the secondary analysis of individual seat preference, seen in Figures 6 and 7, individual seats had significant *t*-tests. In the robust and cluster (location) regression analyses of the 10 X 5 seating plan model, individual seats contributed significantly to the equation:

- Seat 21 robust $b_{1\ 10X5\text{-}21} = 11.96$, $t(171) = 2.07$, $p = .04$, a non-action seat;
- Seat 26 robust $b_{1\ 10X5\text{-}26} = 12.31$, $t(171) = 2.09$, $p = .04$, and cluster $b_{1\ 10X5\text{-}26} = 12.31$, $t(4) = 2.87$, $p = .05$, an action seat;
- Seat 30 robust $b_{1\ 10X5\text{-}30} = -21.30$, $t(171) = -4.17$, $p < .001$, and cluster $b_{1\ 10X5\text{-}30} = -21.30$, $t(4) = -4.72$, $p = .01$, a non-action seat; and
- Seat 50 cluster $b_{1\ 10X5\text{-}50} = -11.40$, $t(4) = -3.05$, $p = .04$, a non-action seat.

The coefficients in the 10 X 5 seating plan ranged from Seat 44 $b_{1\ 10X5\text{-}44} = -2.33$ to Seat 17 $b_{1\ 10X5\text{-}17} = 10.12$, with extreme seats being the non-action seats and the action seat noted immediately above.

Seat 21 was significantly different from Seat 1, which was set as the base level zero. Seat 1 was also a non-action seat. Seat 21 is on the left hand side of the room and on the periphery as seen in Figure 6. The finding of an 11.96 grade score increase over the first row was anticipated, as the front row does not always score as well as the middle rows (Farnsworth, 1933; Griffith, 1921). Based upon the literature, the findings of Seats 26, 30, and 50 are consistent with action and non-action seats and center of the room versus the periphery (Marshall & Losonczy-Marshall, 2010; Zomorodian et al., 2012)

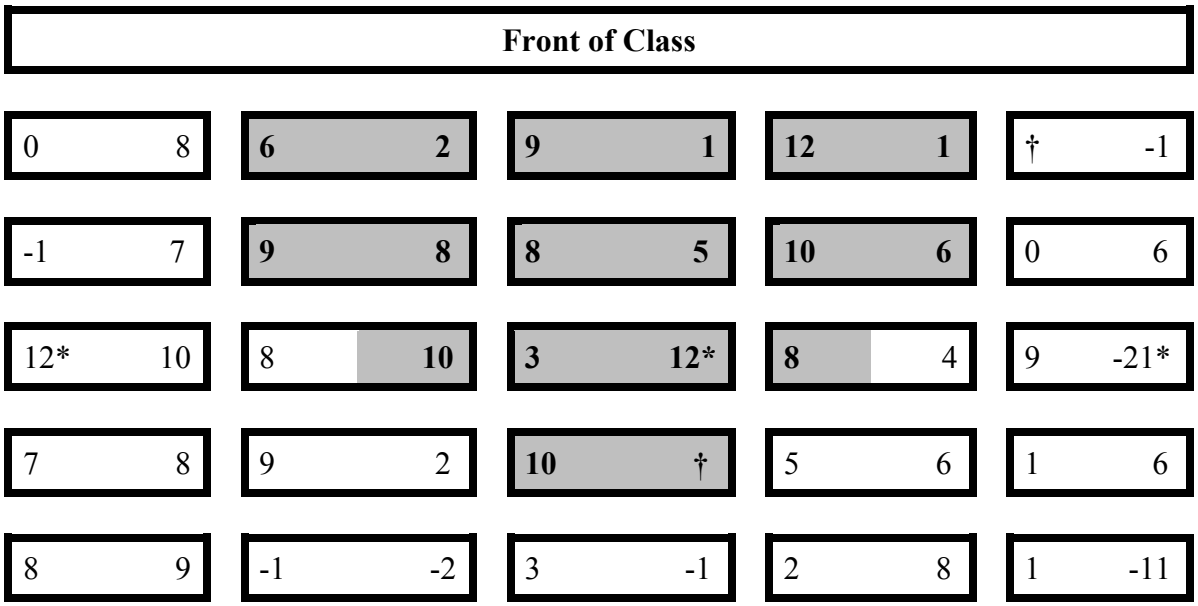

Figure 6. 10 X 5 Seating plan with coefficients rounded to the nearest whole number. * indicates $p < .05$. Shaded and bolded areas indicate action seats. †Seats 9 and 36 did not have a coefficient, as no subject preferred these seats.

In the robust and cluster (location) regression analyses of the models with the 4 X 7 seating plan, seen in Figure 7, Seat 22 robust $b_{1\ 4X7\text{-}22} = -15.60$, $t(189) = -5.28$, $p < .001$, and cluster $b_{1\ 4X7\text{-}22} = -15.60$, $t(4) = -4.39$, $p = .01$, a non-action seat, was found to have a significant contribution to the prediction of grade score. This seat is found in the second

last row and central. The coefficients in the 4 X 7 seating plan ranged from Seat 28 $b_{1\ 4X7\text{-}28}$ = -6.32 to Seat 11 $b_{1\ 4X7\text{-}11}$ = 3.08, with the only extreme seat being the significant Seat 22 $b_{1\ 4X7\text{-}22}$ = -15.60.

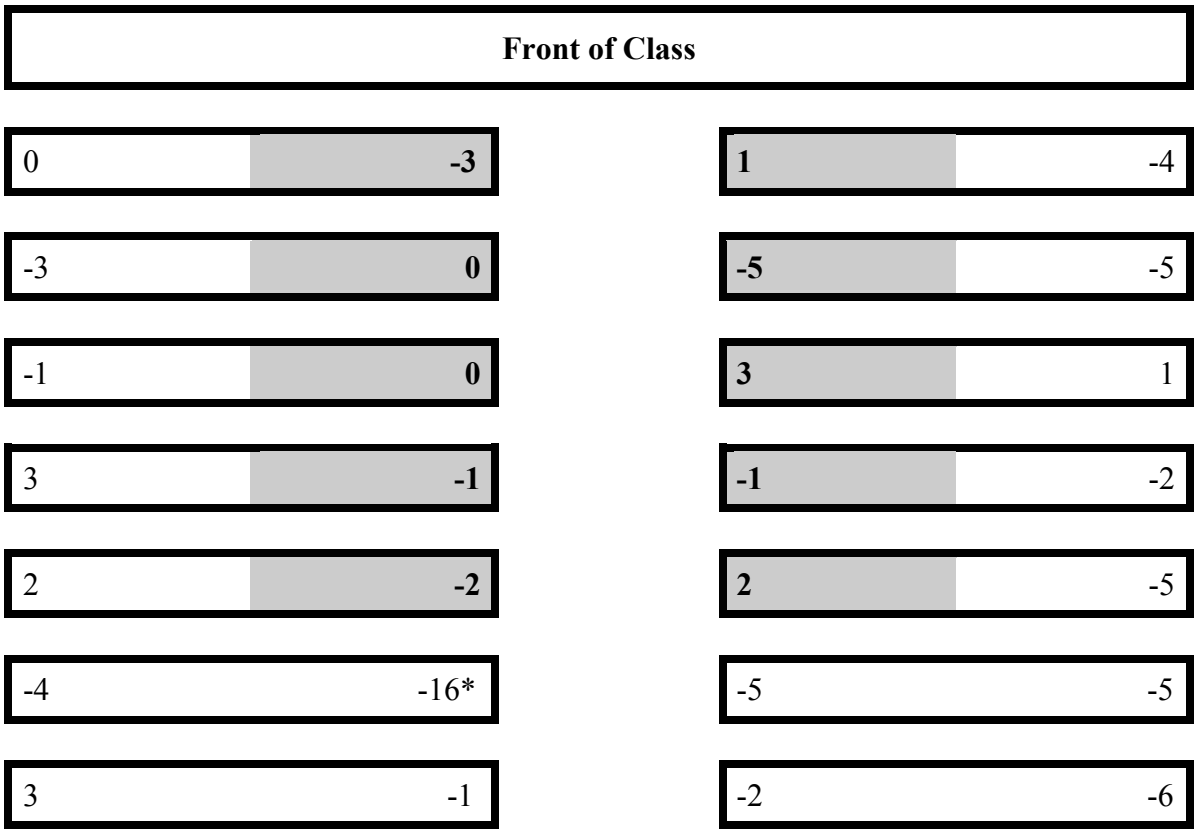

Figure 7. 4 X 7 Seating plan with coefficients rounded to the nearest whole number. * indicates $p < .05$. Shaded and bolded areas indicate action seats.

From the two seating plans, it is challenging to determine an outright preferred seat that is related to an increased grade score. Of course, that would be making an assumption that it is the seat and not the student that dictates academic achievement. To make that assumption is to render seat site and grade score as cause and effect. There are too many factors to consider in the choice of seat selection to titrate this to an equation of

first principles. Factors cited in the literature included salience (Akimoto et al., 2000), motivation (Çinar, 2010; Fernandes et al., 2011), sitting near friends (Benedict & Hoag, 2004; Tagliacollo et al., 2010), and self-esteem (Benedict & Hoag, 2004; Çinar, 2010; Dykman & Reis, 1979; Hillman & Brooks, 1991; Tagliacollo et al., 2010). In this study, respondents preferring action seats in a large classroom of 50 seats scored 2.91 grade points higher than those respondents preferring non-action seats. In the smaller classroom of 28 seats, the respondents preferring action seats scored 1.71 higher than those respondents preferring non-action seats; however, this finding was not significant. In the smaller classroom, the choice of seat is not as important as in a larger classroom.

Residuals

Why is it that some subjects did not achieve their predicted academic achievement scores in the equation? The equation was successful in predicting 49% of the subjects' academic achievement scores to within five grade points, and 94% of the subjects' academic achievement scores to within 15 grade points of their actual grade scores. The question to be answered is why did the equation fail to predict the 13 subjects whose academic achievement scores were not predicted within 15 grade points. Referring to Table 26, there were five subjects whose data were considered outliers from the initial review of the data and these subjects' data are discussed individually while still retaining confidentiality.

Subject 13 had a residual score of -28.33. In regards to the predictive variables, a DC/PT with a converging learning style preferring a non-action seat should have an academic achievement score of 78.33. The individual seats did not appear to have a

contributing factor. In discussion with the gatekeeper, it was discovered that the subject did not complete all of the requirements of the course year and was assessed with a year-end grade of 50. In reviewing the marks that were obtained, the subject had an average grade score of 70 prior to finals. Language and location were potential contributors as the first language was not the same as the language of instruction (P. Miller & Peleg, 2010), and the subject attended Location 5. Factoring in the location, which scored significantly lower than the other locations by approximately 10 grade points, the residual score is explained.

Subject 24 had a residual score of -33.15. In regards to the predictive variables, an RMT with a diverging learning style who preferred a non-action seat should have an academic achievement score of 73.15. In discussion with the gatekeeper, it was discovered that the subject did not complete all of the requirements of the course year and was assessed with a year-end grade of 40. In reviewing the obtained marks, the subject had an average of 67 prior to finals. The reasoning behind not taking the final exams was not offered; however, the subject remains a student and was actively completing the course year at the time of writing this thesis. Language and location were potential contributors as seen with Subject 13; the first language was not the language of instruction and the subject attended Location 5. Factoring in the location, which scored significantly lower than the other locations by approximately 10 grade points, the residual score is explained.

Subject 97 had a residual score of -25.15. In regards to the predictive variables, an RMT with a diverging learning style who preferred a non-action seat should have an

academic achievement score of 73.15. The subject preferred Seat 20 in the 4 X 7 seating plan $b_{1\ 4X7\text{-}20} = -4.54$ and Seat 30 in the 10 X 5 seating plan $b_{1\ 10X5\text{-}30} = -21.30$, $p < .001$. It is postulated that this subject's score had a significant impact upon the coefficient of Seat 30. In discussion with the gatekeeper, it was discovered that the subject did not complete all of the requirements of the course year and was assessed with a year-end grade of 48. The subject had been unsuccessful in obtaining a passing grade on the first three exams of the first year program. In the rules and regulations of the Location, if a student is unsuccessful on three exams in the same year, the entire year is to be repeated without the opportunity for rewrites. Language and location were not considered contributors to the residual score. Previous education of a private college diploma may have factored into the situation. Without a strong base knowledge or previous exposure to rigorous academic requirements, basic academic skills and self-efficacy may have been components in the subject's academic achievement scores. As this study was not a mixed methods design and confidentiality of subjects was maintained, it is not possible to speculate further upon the reasons this subject was unsuccessful in the program.

Subject 171 had a residual score of -25.70. In regards to the predictive variables, an RMT with a diverging learning style who preferred an action seat should have an academic achievement score of 76.70. Individual seat preference, location, language, and previous education were not considered to factor negatively for the subject. Age may be a contributor to the challenges of the program as the subject is aged 50 – 59 (Ellis, 2013; Phipps et al., 2013). Another possible explanation is the length of time between the last formal educational endeavor and the present one. Time between formal educational

pursuits was not captured in the survey. Further discussion as to the potential factors involved in this subject's academic achievement score is not possible.

Subject 202 had a residual score of -24.67. In regards to the predictive variables, an RMT with an assimilating learning style who preferred an action seat should have an academic achievement score of 79.67. Individual seat preference was not considered a factor; however, the following contributors are worthy of note: the subject's first language was labeled other (M = 73.11); the subject's educational background was private college; and the subject was 40 – 49 years of age. As seen previously, a first language other than English (M = 79.83) or French (M = 74.83) had an effect upon grade score (P. Miller & Peleg, 2010). As indicated with Subject 97, attending a private college in the past may not provide the student with the academic skills or knowledge required of a graduate level program. Age itself is not necessarily a factor, but the collateral influences of family, work, and studying may contribute to an overall effect upon grade score. Further speculation is unsubstantiated given the design of the study and data collected.

The subjects with residuals between 15 and 20 grade points who were not identified as outliers originally are discussed as a group. A DC/PT exceeded the predicted academic achievement score of 79.78 by 16.23, while an RMT with an accommodating learning style exceeded the predicted score of 76.19 by 18.81. Both preferred action seats but differed in learning styles; the DC/PT used a diverging learning style and the RMT used an accommodating learning style. In the absence of further information, the reasoning for their success escapes explanation.

Of the remaining six subjects with negative residuals, there were three NR/KIN/OT professionals, with diverging and accommodating learning styles, and preferred action and non-action seats. Of the three, two spoke first languages that were not the language of instruction. All three were from varied age categories. Only one of the three attended Location 5, which is statistically different from the other locations. One of the six was an RMT with a converging learning style, who spoke a first language that was not the language of instruction and attended Location 5, had a residual of -15.25. Education was not considered a factor in that case. The remaining two subjects were Other professionals who had assimilating and diverging learning styles, and master's degrees. Language and location were not considered as contributors to their results. One of the subjects was 50 -59 years of age.

From the discussion of the residuals, it is apparent that there were numerous factors involved with the prediction of academic achievement scores, and those were limited to the data collected in this study. The factors discussed are justified in the analyses, and learning theories (Knowles et al., 2005; Merriam et al., 2007), learning style (A. Kolb & Kolb, 2009), and seat preference literature (Tagliacollo et al., 2010; Zomorodian et al., 2012), while many are speculative and beyond the scope of this study. When considering the characteristics of adult learners with respect to education, life experiences, professions, age, and work and family commitments, distilling data to fit a predictive equation is daunting. However, it was endeavored in this study to determine if the factors of past profession, learning style, and seat preference were predictive of academic achievement as measured by grade score.

Predictive Equation

The predictive equation generated by the regression model required the use of robust statistics due to the presence of outliers and data that were not normally distributed. As previously discussed, the location data were found to be significantly different necessitating the use of a cluster (location) to assist in the data interpretation. The fitted regression model of grade, 10 X 5 Action/Non-action seat preference, past profession, and learning style yielded a significant result. The AT profession scored significantly higher than the RMT profession in both regression analyses. The NR/KIN/OT and Other professions also scored significantly higher than the RMT profession in the robust analysis. Subjects who preferred actions seats scored higher than those who preferred non-action seats and contributed significantly to the predictive equation. In the robust regression, the diverging learning style scored significantly lower than the assimilating learning style.

The $R^2 = .10$ was disappointing, yet substantive with a power of .90 (Field, 2009). To explain 10% of the variance in grade score with three variables does not bode confidence in the equation; however, given the nature of adult learners and the numerous factors involved in academic achievement, a significant model regression equation is considered useful in adding to the present literature. In addition, 49% of the residuals generated were within 5 grade points of the actual score and 94% were within 15 grade points of the actual score, thus instilling a level of assurance in the results for this sample.

As students are individuals and the predictive variables were confined within the equation, it is recommended that data continue to be collected on a yearly basis, such that

the equation undergoes incessant revisions. Updating the model annually will provide the colleges with progressive predictive information and afford the faculty the opportunity to examine some of the contributing variables to achievement and the characteristics of the learners attending the program.

Discussion of the Results in Relation to the Literature

The results of the study have been discussed in the previous pages of this chapter. In this section, the results are examined in relation to the theoretical framework and literature reviewed in Chapter 2. Specifically, the discussion revolves around the predictive variables of seat preference, past profession, and learning style and the effect of these variables upon academic achievement.

Relationship between the Results and the Theoretical or Conceptual Framework

The three theoretical frameworks that provided the reference for the study were andragogy (Knowles, 1980), social learning theory (SLT) (Bandura, 1977), and experiential learning theory (ELT) (Dewey, 1938; D. A. Kolb, 1984; Rogers, 1969; Rogers & Freiberg, 1994). These three theories combined to provide a framework within which the methods of learning osteopathy and becoming an osteopath are discussed. Andragogy represents the characteristics of the subjects in the sample. Social learning theory provides the method by which osteopathic techniques and methodology are learned. Experiential learning theory provides the method by which osteopathic learners experience, reflect upon, conceptualize, and experiment in order to develop into an osteopathic practitioner.

Andragogy. The subjects sampled representing osteopathic learners in a part-time program are the definition of and bear the characteristics of adult learners described in the literature (Kasworm, 2012; Knowles et al., 2005; Merriam et al., 2007; Newton et al., 2011; Phipps et al., 2013). In keeping with the characteristics of adult learners who come to the educational forum with myriad experiences, there is no one descriptive that can be used for all. The subjects' ages ranged from their twenties to their sixties. Educational backgrounds varied from high school to doctors of philosophy. Past professions included healthcare and non-healthcare experiences. For healthcare professionals, the program can be seen as an addition of skills and knowledge to an already established practice, whereas for the non-healthcare professionals, osteopathy is a new field of study and a complete career change. As the theory of andragogy is blended with SLT regarding motivational, self-regulated, and self-driven behaviors, the two theories combine to offer an explanation of the studied subjects who are endeavoring to improve their professional and personal skills, and knowledge. It is postulated, as this data were not gathered in the survey, that both intrinsic and extrinsic motivators cited in the literature are factored in the goals of the subjects (Ellis, 2013; Newton et al., 2011; Swain & Hammond, 2011). Knowledge of the theory of andragogy aids the reader in comprehending the characteristics and motivation of these subjects who undertake studying for a new profession, be it similar to their present occupation in healthcare or foreign as in the case of the Other professions.

Social Learning Theory. Social learning theory provides the frame within which the professional skills and methods of thinking in the osteopathic profession are taught

and learned. In particular, learning mental and motor skills in osteopathy occurs through modeling, and active and vicarious learning (Esteves & Spence, 2014; Sandhouse, 2014; Schunk, 2008). An extrapolation of the data posits that self-efficacy based upon previous learning achievement was supported in the regression analysis as the RMT profession, which has the least academic qualifications, scored significantly lower than the ATs, NR/KIN/OT, and Other professions.

The AT profession, which has manual therapy skills and musculoskeletal knowledge at a bachelor's level, made a significant contribution to the prediction equation. The past profession with unexpected results in the observed data and the analysis was the Other professions, who had no healthcare professional experience. The Other professions were described as teacher, manual therapist, social pedagogy, yoga and Pilates instructor, journalism, radiology, neural development, tool and die maker, paramedic, acupuncturist, psychology, chef, media research, PhD candidate, pedorthist, dental hygienist, chiropodist, professor, medical science, sales, investment manager, medical illustration, copywriter, equine osteopath, framer, rolfer, communications, and exercise physiologist. This group of Other professions (M = 80.51) had achievement scores that were significantly (p = .03) higher than the RMT profession (M = 76.56) in the robust regression model; in the observed data were higher than the MD/DO/DDS (M = 76.00); and were equivalent to the remaining healthcare professions (M = 80.16 – 80.32). With respect to previous academic achievement, 70% of the Other profession had minimum bachelor's degrees. From the list of the professions, it is obvious that the subjects had significant life experiences from which to draw upon in their studies. As

such, it is extrapolated from the literature that these subjects, who constituted the Other profession, had an adequate level of self-efficacy and self-regulatory skills that contributed to their success (Sandars & Cleary, 2011).

Experiential Learning Theory. The process of learning through reflection, abstract conceptualization, experimentation, and experience affords osteopathic students a methodology of learning used in the transformation of a student into a practicing professional. In the classroom, students have the opportunity to experience and experiment with the techniques modeled. Through case studies, students are afforded the opportunity to reflect, conceptualize, and experiment. Student clinic enables students to experience treating patients through implementation of a treatment plan and to receive feedback from both supervisors and patients (Esteves & Spence, 2014). For those students who are practicing healthcare professionals, working with their patients on a daily basis grants them the continuous opportunity of feedback and reflection. From reflective observation, the learners have the ability to consider abstract concepts regarding disease processes, patient physical presentations, and symptomology. Applying a treatment plan and monitoring the responses, from the tissues and the patient, represents the use of active experimentation, which through the action becomes a concrete experience. The experience gained promotes the potential for further learning to occur outside of the classroom environment through reflective observation, and the learning cycle and the strategies employed begin again.

In this study, all of the learning styles were represented in the sample. In the regression analyses, the diverging learning style ($M = 76.67$, $SD = 9.88$) scored

significantly (p = .03) lower than the assimilating learning style (M = 80.24, SD = 7.26). The accommodating learning style (M = 77.98, SD = 8.51) scored less than the converging learning style (M = 79.48, SD = 8.82), although not significantly less ($p >$ .05). The difference between the higher scoring styles and the lower scoring styles lies on the grasping experiences continuum. The grasping experiences continuum has concrete experience at one pole of the axis while abstract conceptualization is at the opposing pole. The accommodating and diverging learning styles share the preference for concrete experiences whereas the converging and assimilating learning styles share the preference for abstract conceptualization (D. A. Kolb, 1984).

The significant difference between the diverging and assimilating learning styles concerns the grasping experiences continuum. The diverging learner uses reflective observation and concrete experiences, whereas the assimilating learner uses reflective observation and abstract conceptualization as learning strategies. As diverging learners prefer reflection and concrete experiences, it may be challenging to abstractly conceptualize the interdependences of the physiological systems in the body and create appropriate treatment plans. No patient or syndrome is the same in osteopathy. One patient presenting with a tennis elbow may have a visceral primary lesion, whereas a second patient presenting with a tennis elbow may have a mechanical primary lesion. As there are many different patients, so are there many different causes for an allopathic diagnosis. The magnitude of concrete experiences required to generate a base knowledge in what could cause tennis elbow issues is astronomical. In generating treatment plans the ability to assimilate all of the information regarding a patient and formulate a theory

as to what action is going to be successful is crucial. Thus, the subjects preferring an assimilating learning style, or a preference for abstract conceptualization, have an advantage over the subjects preferring the diverging learning style, or a preference for concrete experience. The ability to conceptualize from one patient the potential issues creating the manifestation of the physical problem enables a student to extrapolate the findings to numerous scenarios. It is thus hypothesized that this skill is not as finely tuned at the concrete experience pole that opposes the abstract conceptualization pole of the grasping experiences continuum. As such, the students who prefer a diverging learning style may be challenged more than other learners who incorporate the strategy of abstract conceptualization.

The subjects who were not employed in a healthcare field that incorporates manual techniques were hypothesized to be disadvantaged in the program. It was thought that these subjects lacked the base medical knowledge and did not have the opportunity to build upon their experiences from class without a method of practice, thus limiting their exposure to the complete learning cycle (A. Kolb & Kolb, 2009). These subjects belonged to the Other professions (M = 80.51, SD = 7.94), and had equivalent achievement scores to their classmates with allied healthcare professions, while scoring higher than the MD/DO/DDS and RMT professions. Their success in scoring significantly (p = .03) higher in the robust regression than the RMT profession (M = 76.56, SD = 8.71) is posited to be twofold. First, 39% of the RMT profession preferred the diverging learning style while 32% preferred the assimilating learning style. In the Other profession, 21% preferred a diverging learning style while 46% preferred an

assimilating learning style, which employs the strategy of abstract conceptualization. Second, it may be that these subjects, with their vast experiences, being cognizant of their weaknesses, and investing in a career change in mid life, spent more time studying and shadowing osteopathic manual practitioners in order to gain the experiences they lacked compared to their classmates. As Rogers stated regarding the holistic nature of experiential learning, "*It has a quality of personal involvement*—the whole person in both his feeling and cognitive aspect being *in* the learning event" (1969, p. 5). Students who work in an allied healthcare profession may not be as invested in studying as they are adding to their treatment repertoire in a manner that may be interpreted as continuing medical education, particularly in the professions of DC, PT, ND, HD, and AT. This is in stark contrast to someone without healthcare knowledge who is investing in a complete career change.

As there was no significant correlation between learning styles and professions, it is not possible to offer an explanation of the results related specifically to professional learning style preference. The percentage of Other professionals who preferred an assimilating learning style was higher than that of the RMT profession. The ability to use abstract conceptualization is the difference between the diverging and assimilating, and converging and accommodating learning styles. In the osteopathic program, it appears that those subjects, regardless of profession, who can think abstractly, and assimilate information to formulate a treatment plan or theory will be more successful than those who rely predominantly on concrete experiences (Thomson, Petty, & Moore, 2014).

To counter the hypothesis that one learning style, assimilating, is more successful in the osteopathic classroom than the other three, it is acknowledged that only in the robust regression models of 10 X 5 and 4 X 7 Action/Non-action seats were there significant differences between assimilating and diverging styles. It is speculated that the nature by which techniques are taught, incorporating the entire learning cycle, eliminates any extensive advantage to a specific learner's preference. This conjecture is supported in the results that the only significant finding was between the diverging and assimilating learning styles and not between assimilating and accommodating or converging learning styles.

Summary. The learning theories, which provided the framework of the study, permitted the reader to consider the characteristics of the learner, the method of learning skills, and the process by which an apprentice becomes a professional. The adult learners in the graduate level study of traditional manual osteopathy in a part-time program identify with the theory of andragogy and its stated needs of the adult learner. The applications of SLT and ELT within the classroom and clinically supervised environment enable the facilitation of learning skills and development of a professional, rather than the purely technical skills of a technician. To become an osteopathic practitioner, one requires the skills necessary to physically and mentally assess, prepare, and employ a treatment plan, which is critically derived from abstract conceptualization based in anatomical and physiological knowledge (Thomson et al., 2014).

Relationship between the Results and the Literature Reviewed

The three independent variables of seat preference, past profession, and learning style contributed significantly to the regression analysis and the subsequent predictive equation of academic achievement. The results are discussed in relation to the literature reviewed in Chapter 2. The findings are consistent with the literature regarding seat selection and past professions. The literature regarding learning styles offered interesting insights when compared to the data of this study.

Seat Preference. The concept that seat was related to grade was first presented in the literature in the early 1900s (Farnsworth, 1933; Griffith, 1921). Since that time there have been articles written that concur with and refute Griffith and Farnsworth's idea that students who sit in the middle of the lecture theatre score higher than students preferring the periphery. In this study ($N = 239$), a review of the individual preferred seat coefficients in Figures 6 and 7, revealed differing results. In the 10 X 5 seating plan, the central seats had an average coefficient of 6.8; similar to the left column of seats. The front row seats had an average coefficient of 3.8. The right side and back had average coefficients of -1 and 1.6, respectively and included Seat 30, $b = -21.30$, and Seat 50, $b = -11.40$. This would indicate that the center and left peripheral column had higher overall coefficients and thus were preferred by students with higher achievement scores. This finding is consistent with seminal literature and recent work (Marshall & Losonczy-Marshall, 2010). In the 4 X 7 seating plan, there was little variability seen in the coefficients with the exception of Seat 22 which was significant with a coefficient $b = -$

16; the right side of the room had lower coefficients overall than the left, but this finding was marginal.

In the regression analysis, the 10 X 5 action seats $b = 2.91$, $t(217) = 2.51$, $p = .01$, were found to have significantly higher mean achievement scores ($M = 79.58$, SD = 8.44) than the non-action seats ($M = 77.22$, SD = 8.67). This is similar to the findings of two studies: one small classroom of 56 seats using action zones (Wulf, 1976); and one large classroom of 189 seats using high, medium, and low interaction zones (Zomorodian et al., 2012). Zomordian et al., found a weak negative correlation between distance from the professor and grade.

The subjects who preferred 4 X 7 action seats ($M = 79.16$, $SD = 8.57$) did not score significantly higher than subjects who preferred the non-action seats ($M = 77.99$, $SD = 8.61$). In the individual seats, there was minor variability between the coefficients as stated previously. It is postulated that the smaller classroom does not have an effect on achievement scores. This may be due to the accessibility to the professor, less competition for feedback, and perhaps higher levels of interaction throughout the classroom.

The results of this study are supported in the literature. Students who prefer to sit in action seats score significantly higher in the 10 X 5 classroom. The 4 X 7 Action/Non-action seats failed to have significant differences in achievement scores. It appears from the data that the subjects' seat preference in the larger classroom is more important than in the smaller classroom design.

Past Profession. Self-efficacy and past experiences in relation to academics promote positive experiences in learning (Newton et al., 2011; Phan, 2012; P. I. J. Tan, 2012). As this study considered past profession and experiences as a variable in student achievement, it was hypothesized that past profession would have a significant influence on achievement. The results of this study provide a small window through which to consider the adult learner's ability to succeed in a new career unrelated to his/her past profession. The Other professionals, who were predicted to score the lowest of all the professional categories, were successful in scoring significantly higher than the MD/DO/DDS and RMT professions and were equivalent to the remaining allied healthcare professions.

Although this study did not gather information on reasons for studying osteopathy, motivation, or self-efficacy, it is postulated, in conjunction with the literature, that the Other professionals used intrinsic and extrinsic motivators to assist in their success (Newton et al., 2011). Regarding self-efficacy and previous academic achievement, 70% of the Other professionals had a minimum bachelor level education, with 27% having graduate degrees. According to Phan (2012), prior academic achievement had a positive effect on learning and future academic achievement. In addition to academic achievement, the Other professionals had a plethora of transferable skills which could be used to promote self-efficacy, similar to the teachers in Tan's study (2012).

The Other professionals are commencing a new career. They are considered to be at a disadvantage in respect to base medical knowledge and the ability to use their new

found techniques on a daily basis as they do not have the opportunity to practice on patients in a way that the healthcare professionals do. However, based upon the mean achievement scores, the Other professionals are succeeding in their studies. Regrettably, this study did not capture data on time spent studying or attending complementary/supportive courses as this information may have been illuminating to the discussion.

It has been argued that experience in a related field is not always a benefit in learning. In a nursing specialization study that analyzed predictive variables of achievement, years of critical care nursing experience (CCNE) along with previous GPA and present GPA were considered (Burns, 2011). Burns's study presented a parallel to the healthcare professionals in this study, as they are all continuing medical training and progressing their skills. The interesting finding, which supports the success of the Other professionals, was that CCNE had a negative correlation with present GPA scores. This is the opposite of what would be expected based upon the importance given to previous experience in adult learning theories and environments. Perhaps the experience need not be domain dependent to be relevant. Perhaps it is the application and transferability of experiences by the learner that makes the experience relative to success in the new environment. As Dewey stated, "every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after" (1938, p. 35). A second interpretation may be that the CCNE also represented the number of years since formal educational training. The passage of time between

academic pursuits may also be a factor in success. Regrettably, Burns did not comment on this factor and in this research, the data were not gathered to consider this component.

In this study, it was hypothesized that a subject with a previous healthcare profession using manual therapy as a modality would be a predictor of success in the osteopathic program. The mean achievement scores of the DC/PT and AT professions were comparable to the non-manual practitioners, which included the NR/KIN/OT and ND/HD professions. The Other professionals, who were predicted to score poorly, made a significant contribution to the predictive equation and had mean achievement scores that were significantly different to the MD/DO/DDS and RMT professions and equal to the DC/PT and AT professions. Although differences in education level mean achievement scores were not significant, the compilation of experience and self-efficacy associated with higher-level education are considered important in relation to previous and future academic achievement (Newton et al., 2011; P. I. J. Tan, 2012).

Learning Style. The predicted achievement of the subjects who preferred an assimilating learning style was warranted in relation to the results. In the robust regression analysis, the assimilating learning style (M = 80.24, SD = 7.26) scored significantly higher (p = .03) than the diverging learning style (M = 76.67, SD = 9.88), and higher than the converging (M = 79.48, SD = 8.82) and the accommodating (M = 77.98, SD = 8.51) learning styles. This result is supported in the literature (Gogus & Gunes, 2011; JilardiDamavandi et al., 2011) and is unique in its finding of a significant difference between assimilating and diverging achievement scores. As previously stated,

the nature of abstract thought necessary to assess patients and formulate treatment plans is considered a skill related to the assimilating learning style.

In this study, the predominant learning style was the assimilating learning style (n = 81) followed by diverging (n = 75), accommodating (n = 51), and converging (n = 32). This ranking is similar to the nursing (D'Amore et al., 2012; El-Gilany & Abusaad, 2013; Fogg et al., 2013; Lockie et al., 2013), the medical (Adesunloye et al., 2008; Gurpinar et al., 2010; Gurpinar et al., 2011), and allied healthcare profession (Coker, 2000; Crawford et al., 2012; Hauer et al., 2005) literature in which assimilating and diverging learning styles were prevalent. Although the healthcare profession literature indicates frequency of learning styles, there were no studies reviewed that presented a significant relationship between learning style and profession. In this study, learning styles and professions were independent of each other $\chi^2(18, N = 239) = 20.40$, $p = .31$, $\phi = .31$.

Summary. The robust regression analysis was significant for the 10 X 5 Action/Non-action Seating Plan, Past profession, and Learning Style model accounting for 10% of the variance in student achievement as measured by grade score. Action seat preference, AT, NR/KIN/OT, and Other professions, and diverging learning style contributed significantly to the predictive equation. In keeping with the literature reviewed, the subjects preferring action seats scored significantly higher academically. The contribution of past professions offered insight into the potential transferability of non-healthcare experiences to support success in the osteopathic program as the Other professions were as successful as the predicted high achievers, and significantly more successful than two of the healthcare professions: RMT and MD/DO/DDS. The results

of a significant difference between grades scores of the assimilating and diverging learning styles adds to the body of knowledge regarding Kolb's learning styles.

Limitations

Reflection is a critical component of future success. Although a study is planned with great care and diligence, there are still issues that arise and confound the researcher. This study was no different. The limitations of the study are discussed in relation to the design, data collection instruments, and results.

Design

The non-experimental quantitative design was adequate to answer the research question and test the hypotheses. However, the design did not permit a thorough examination of the outliers. A mixed-methods design would have been required to collect the data. Although a design change would have lengthened the study implementation, and required further IRB approval, a qualitative examination of the outliers would have offered interesting insights regarding why some adult learners under-perform academically. The study results are unable to contribute to explanations of variances in the achievement scores beyond the quantitative data.

In the design, the researcher was blinded to subject participation, as the researcher is a professor at four of the five locations sampled. Confidentiality and the absence of coercion are necessary components of research and there should never be a breach of confidentiality or coercion on the part of the researcher. However, confidentiality imposed a restriction on answering questions of the participants as once the initial instructions were given, the researcher left the room and was then no longer able to speak

with the participants as they filled out the instruments. As such, answering qualifying questions or further explanations as were apparently necessary was not permitted, resulting in some of the data being unusable.

Data Collection Instruments

The data collection instruments included the DSPS and Kolb's LSI 3.1, both of which had independent issues that are discussed as limitations. An unexpected limitation issue arose when attempting to collect data regarding non-respondents. The three limitations are discussed in relation to data gathered and method of collection.

The DSPS was created for this study. It underwent expert field-testing with researchers and a statistician. Even with this assistance, dilemmas arose: age data, Diagram 1, and Diagrams 2 and 3.

The question regarding age was initially designed to be collected as interval data. The expert panel indicated that respondents might not wish to disclose their age, thus the age data were collected as categorical data. Given that the subjects were studying in a healthcare profession, and given that age is a factor in healthcare issues, it is unlikely that the subjects would have been offended or not answered the question of actual age. Future recommendations would be to gather the maximum amount of interval data possible. If necessary for analysis, age could be recoded to categorical data in the future, but it cannot be gathered as categorical and reverted to interval.

The DSPS Diagram 1 was a forced ranking zone preference diagram. The forced ranking of all zones created an issue of multicollinearity and as such, the data from Diagram 1 was not used in the present paper. From the surveys returned, there also

appears to have been an issue with subjects' understanding the method of filling out Diagram 1, even with a provided example. It is imperative to keep instructions simple and concise. As a result of the multicollinearity issue, Diagram 1 was unable to be used as a reliability check for the other two diagrams.

A second issue for Diagram 1 was identified when the data collection method changed from email to paper. The initial plan for data gathering was through email and Diagram 1 was color coded by zone for visual impact. This became an issue when the DSPS was printed in black and white resulting in black boxes. Future recommendation is to code diagrams by translucent patterns.

Diagrams 2 and 3 were straightforward and overall, filled out correctly. However, there were subjects who filled out only one of the diagrams as it related to the location attended. Locations 1, 2, 4, and 5 were familiar with Diagram 2, while Location 3 was familiar with Diagram 3. Evidently, some subjects were unaware that the purpose was to examine their seat preference in different classroom designs and not their actual classroom plan. In the future, it would be beneficial to explain explicitly the purpose of the exercise.

The LSI 3.1 was thought to be a straightforward instrument. This was not the case. Even with clear written instructions, numerous forms were incorrectly filled out such that the data were unusable. As above, the use of the instruments must be thoroughly explained and demonstrated prior to data collection.

When it was discovered that it was necessary to know the characteristics of the non-respondents in order to analyze for potential respondent bias, the locations were

contacted and a method of gathering the confidentially coded, non-respondent data of grade, year of study, location, and gender was devised. The issue was at the source. Many of the locations do not have databases that have the information available in a simple accessible form. The locations are presently in the midst of new database implementation. It should be ensured that the data required is accessible in a timely fashion. In the present situation, the registrars will be contacted to discuss how to design the databases in order to support future demographic research.

Results

In regards to the results, there are issues that relate back to design. The finding of differences between locations and the potential impact of language on achievement scores was considered when developing the DSPS but the impending impact was not fully appreciated. The freedom to alter the design to add in another variable would have potentially yielded interesting results. This is particularly true, since there are many variables potentially affecting student achievement. The argument against expanding the variables is the need to justify and examine each variable within the literature. To include gender, location, and language would have lengthened the study considerably. However, future studies of achievement that incorporate several locations geographically should take into consideration culture and language as potentially confounding or contributing variables.

The results of the study are interesting but only generalizable to the sampled colleges. Also, the predictive equation is relevant only to these subjects. In order to

continue to use the equation for future years continued data input is required to permit the evolution of the equation.

An $R^2 = .10$, although statistically substantive, was disappointing. Given that there are a plethora of variables that contribute to student achievement, the expectation that the use of only three variables could predict achievement scores was perhaps naïve. However, in order to preserve the feasibility of the study, ensure that the study was achievable and could be completed within a reasonable timeframe, and not extend into years of work, it was necessary to limit the current study in this manner.

If the opportunity arose to repeat the study, three changes would be implemented immediately. First, the DSPS would be revised as stated above and include questions regarding motivation for becoming an osteopath, cultural background, and study habits. Second, a single trained research assistant would be used to contact, instruct potential participants, be available to subjects for questions while filling out the instruments, and gather the data. Third, provisions would be made to interview subjects whose data presented as outliers. The addition of these changes would provide rich information regarding the subjects and enable deeper insight into the motivations of the adult learners.

Implication of the Results for Practice

Throughout the study process, implications for practice were consistently at the forefront of the researcher's thoughts. The impetus for the study was to examine if changes in the admissions criteria of the traditional manual osteopathic part-time accredited English-speaking programs was affecting student achievement. If the change in admissions criteria to permit students with non-healthcare backgrounds to study in a

part-time program with a curriculum designed for healthcare professionals assuming a strong base knowledge was detrimental to the success of students, then revision of the admissions criteria or the curriculum would be necessary. Results indicate that students with non-healthcare backgrounds are performing as well as their healthcare professional classmates. In reviewing the results, the RMT and MD/DO/DDS professions are potentially in need of academic support and should be monitored by the administration for early intervention if necessary.

There are two aspects of this study's results that should significantly impact educational practice within the osteopathic classrooms sampled. First, learning accommodations should be implemented for students whose first language is not the language of instruction. Second, instructors should be encouraged to implement learning activities that support and promote abstract conceptualization. These two implications are discussed within the frame of the colleges sampled with offered solutions.

Language and Learning Accommodations

Although not related to the research question, location and language were evident as factors requiring attention. The significant differences in achievement scores between Location 5 and Locations 1, 3, and 4 were illuminating. Location 5 has students who study in English but English is their second language (ESL). Presently, the exams are exactly the same for each campus and the only accommodation made for the students in Location 5 is that they are permitted to have a language dictionary on their desk during the exam.

Nursing literature, in the absence of osteopathic literature, regarding students learning in a second language was reviewed (Bosher & Bowles, 2008; Donnelly, McKiel, & Hwang, 2009; Olson, 2012; San Miguel, Townsend, & Waters, 2013). Recommendations to promote academic achievement of ESL students from the literature included linguistic modification (Bosher & Bowles, 2008); improved institutional support and language courses (Donnelly et al., 2009); study groups with mixed ESL and English speaking students (Olson, 2012); and integrated tutorials in the first year of study (San Miguel et al., 2013). In addition to the recommendations from the literature, from the results of this study it is strongly suggested that Location 5 students be given extra time for their exams if the exams are to remain the same, or one to two questions be removed from the one hour exams. It is also recommended that the exams be reviewed to ensure the use of simple syntax (Bosher & Bowles, 2008), as some of the exam questions are written by French speaking instructors and translated into English. The translation of French to English compounds the potential for misunderstanding challengingly worded questions.

Learning Styles

Taking into consideration the literature and the results of the study regarding the significant difference in achievement scores between the assimilating and diverging learning styles, instructors in the osteopathic program should be encouraged to promote learning activities that require abstract conceptualization. Abstract conceptualization is an approach used in problem-based learning that uses case studies; it encourages students to hypothesize broadly when defining osteopathic inter-relationships between different

body systems. Learning activities that require students to create justified hypotheses will assist both students and faculty to develop the skills necessary for successful practice. The learning cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation is present in the osteopathic classrooms, yet the theory behind the usage may not be fully understood by the faculty. As is the case in many professional programs, instructors are not necessarily educators. Learning activities and the educational foundation for the activities supporting abstract conceptualization should be offered to faculty as an adjunct to educational practice.

Recommendations for Further Research

Recommendations for further research are developed from the questions and limitations that have arisen from this study. This was the first study of accredited part-time traditional manual osteopathic programs in Canada and their international affiliated college. As such, many researchable problems were identified for the population. Further research is recommended to study:

- The differences in classroom sizes and environments.
- Learning osteopathy in a second language and possible interventions and accommodations to assist learners.
- Differences between locations within the osteopathic colleges and potential cultural, language, or geographical influences that may affect learning and critical thinking skills.
- Learning style longitudinal study to examine the stability of learning styles over a student's five-year program.
- Motivation of students to study osteopathy as an adult learner.

- The effect of time from previous formal educational experience on student achievement.
- The effect of study habits and use of metacognitive skills in adult learners studying osteopathy.

Conclusion

The research question asked how and to what extent did the independent variables of seat preference, past profession, and learning style account for variances in student achievement as measured by grade score in traditional osteopathic part-time education. In response, the fit of a robust regression model using a 10 X 5 Action/Non-action seating plan accounted for 10% of the variance in student achievement as measured by grade score.

In the robust regression analysis, the statistical tests supported rejecting the null hypotheses $H_0$1, $H_0$2, $H_0$3, and $H_0$4. In the cluster by location regression analysis, the statistical tests supported rejecting the null hypothesis $H_0$4 related to past profession.

A significant robust regression model using the 10 X 5 Action/Non-action seat preferences, learning styles, and past professions was found $F(10, 217) = 2.33$, $p = .01$, with an $R^2 = .10$, $RMSE = 8.41$. This finding had sufficient power (.92) to consider an $R^2 = 0.10$ as a substantive finding with a sample size of $n = 228$. A significant robust regression model using the 4 X 7 Action/Non-action seat preferences, learning styles, and past professions was found $F(10, 217) = 2.60$, $p = .01$, with an R^2 of .08, $RMSE = 8.51$. However, this finding lacked sufficient power (.82) to consider an $R^2 = .08$ as a substantive finding.

The following variables made significant contributions to the prediction of grade score:

- The 10 X 5 action seat preference $b_{1\ 10X5AS} = 2.91$, $t(217) = 2.51$, $p = .01$;
- The diverging learning style $b_{5\ diverging} = -3.03$, $t(217) = -2.13$, $p = .03$; and
- The past professions of
    - AT $b_{2\ AT} = 4.60$, $t(217) = 2.77$, $p = .01$,
    - NR/KIN/OT $b_{2\ NR/KIN/OT} = 4.10$, $t(217) = 2.54$, $p = .01$, and
    - Other $b_{2\ OTHER} = 3.48$, $t(217) = 2.26$, $p = .03$.

Past professional experience influenced achievement scores significantly as the athletic therapists, nurses/kinesiologists/occupational therapists, and other professionals scored significantly higher than the doctors and registered massage therapists. The chiropractors/physical therapists and naturopaths/homeopaths scored similar to the athletic therapists. It appears that subjects who do not have previous healthcare related professions are not at a disadvantage when studying osteopathy in a part-time program.

In this sample, the assimilating learning style scored significantly higher than the diverging learning style in a robust regression analysis. This finding adds to the literature as there are few studies reporting significant differences in achievement scores among learning styles measured by Kolb's LSI 3.1. A chi-square test was not significant for a relationship between learning style and profession. The learning styles were dispersed across profession with the assimilating and diverging styles being most prevalent in the sample.

Students who prefer action seats score significantly higher than students who prefer non-action seats in a 50-seat classroom. In the 28-seat classroom, seat preference does not have a significant interaction with grade score. It appears that the smaller classroom dynamics promote an environment conducive to learning better than the larger classroom, although factors responsible for this finding are beyond the scope of this paper and are worthy of future study.

It was found that location and language were dependent in the sample and that locations differed significantly with respect to mean achievement scores. In particular, Location 5 scored the lowest of the sampled sites. The majority of students studying at Location 5 are ESL students. This finding has important implications for practice, as learning accommodations should be implemented for this group of students.

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APPENDIX: DEMOGRAPHIC AND SEAT PREFERENCE SURVEY (DSPS)

Demographic and Seat Preference Survey

Instructions

In the following survey you will be asked to answer questions regarding demography and seat preferences. The survey will take approximately five minutes to answer. The initial questions are related to your background and are answered by circling a response or a short answer. The final portion is in relation to why and where you sit in class. Your responses will be numerically coded and this survey is coded with a number to ensure your confidentiality. At no time will your responses be directly related to you in the dissertation for which the information is being gathered.

Confidentiality code: _____ (researcher purposes only)

1. Present Year of study: Please circle 1 2 3 4 5 thesis writer

2. What is your first language:
    a. English
    b. French
    c. Other _____

3. Campus – please circle the campus you attend:
    i. Vancouver
    ii. Winnipeg
    iii. Toronto
    iv. Halifax
    v. Hertenstein

4. Previous/Present profession: Please circle the appropriate category
    i. Medical doctor, Osteopathic physician, Dentist
    ii. Naturopath, Homeopath
    iii. Chiropractor, Physical therapist
    iv. Athletic therapist
    v. Nurse, Kinesiologist, Occupational therapist
    vi. Massage therapist
    vii. Other (please specify) _____

5. Please circle the highest level of education you have obtained:
    i. High school
    ii. Private College Certificate or Diploma
    iii. College diploma
    iv. BSc/BA
    v. Graduate studies (chiropractic, medicine, dental, physical therapy)
    vi. Masters
    vii. PhD

6. Do you have any sensory challenges? Please circle all that are applicable:
    i. Corrective lenses, visual disabilities
    ii. Hearing aids, hearing disabilities
    iii. Attention disorders
    iv. Other: _____

7. When you sit in a class, do you: (circle the most appropriate answer)
    i. Always sit in the same seat?
    ii. Do you sit in the same area (within 2 seats)?
    iii. Do you prefer to move around the classroom (on different days or different modules)?

The following questions are related to where you choose to sit in class:

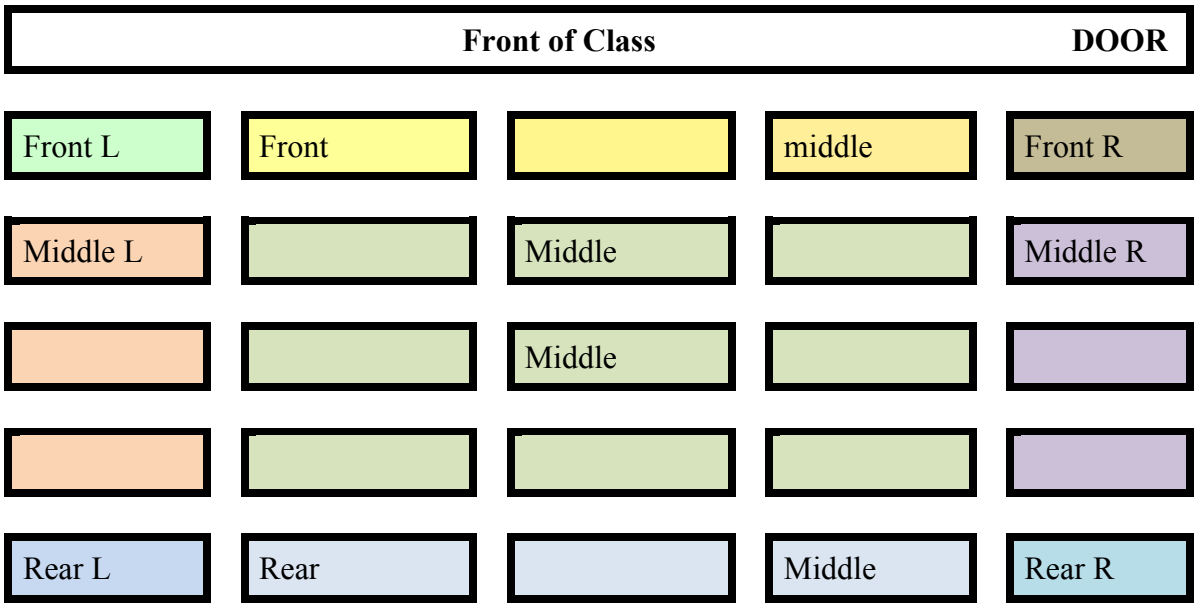
8. What factors do you consider when selecting your seat in class? Please rank the following in order of importance. The most important is number 1, the next most important will be number 2, while the least important factor is number 8. If you have another reason, please specify under "Other".
    Closeness to the professor _____
    Closeness to the windows _____
    Closeness to the door _____
    Next to your friend _____
    Ability to see the board/screen _____
    Ability to hear the professor _____
    Ability to focus on the material _____
    Other: _____

9. Please circle your age category:
    20 – 29 30 – 39 40 – 49 50 – 59 60 – 69 70+

10. Is there anything you would like to comment upon regarding how you select your seat that has not been mentioned?
    _____
    _____

There are three blank seating diagrams below in which you can indicate your preferred seat. Within each diagram please indicate your preferred seat with the letter (P) and your least preferred seat with the letters (LP). In the first diagram please rate the regions from most preferred as numb 1 to least preferred being number 9.

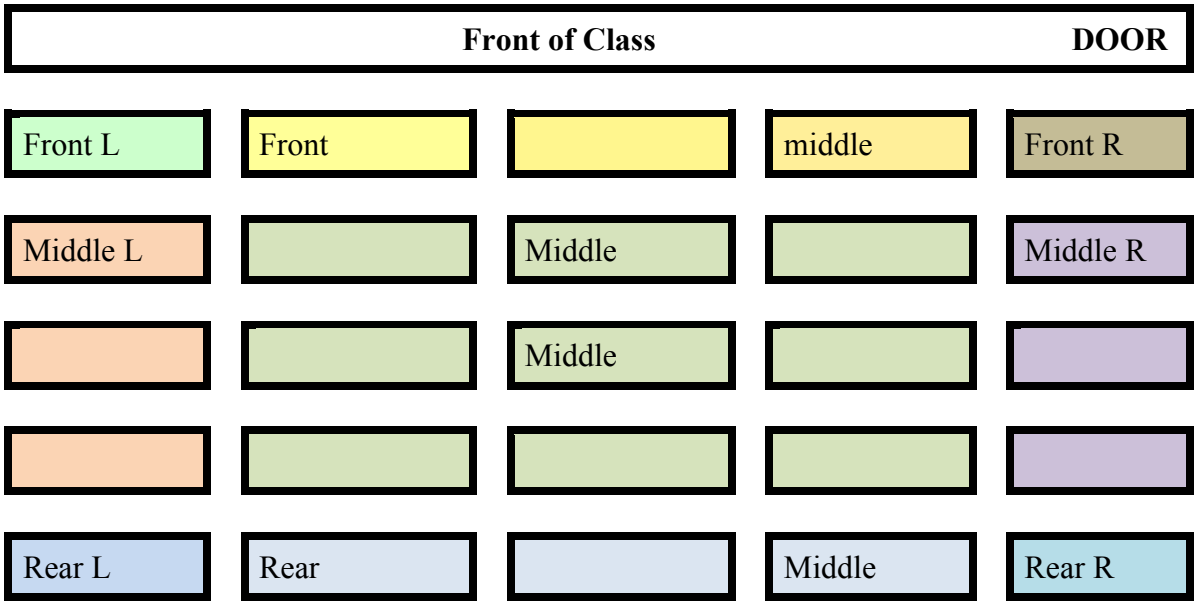
Example Diagram: In the following diagram, an example is offered to rank the seats as per a learner's preference. This is just an example. On the following page, please indicate your preferences.



AS an EXAMPLE: Please rank the following zones from 1 to 9. **Here you can see the preferred zone is in the middle and the least favourite zone is Rear Left**

Front Left – 6	Front Middle – 4	Front Right – 5
Middle Left – 3	Middle Middle – 1	Middle Right – 2
Rear Left – 9	Rear Middle – 8	Rear Right – 7

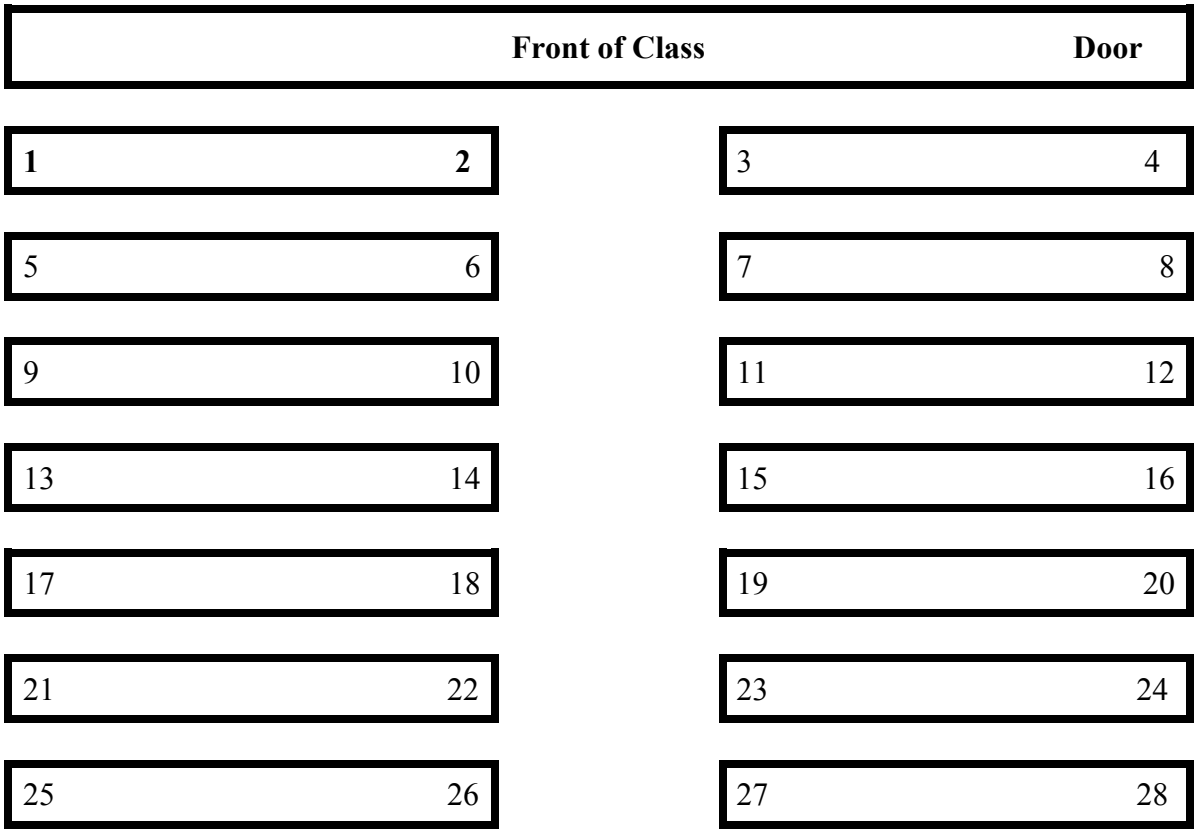
Diagram 1: In the following diagram, as per the previous example, please indicate your preferences.



Please rank the following zones from 1 to 9.

Front Left –	Front Middle –	Front Right –
Middle Left –	Middle Middle –	Middle Right –
Rear Left –	Rear Middle –	Rear Right –

Diagram 2: At the bottom of the page please indicate the seat number in this classroom that is your preferred seat as P1, second preference as P2, and your least preferred seat as LP. Also indicate your normal seat location by number. For those of you who switch seats, indicate the seats as if it was your first morning in class in the five-day module.



P1 = _____ P2 = _____ LP = _____ Normal Seat = _____

As an example answer:
P1 most preferred seat would be 10
P2 (second choice) = 6
LP (least preferred) = 28
Normal seat = 10

Diagram 3: At the bottom of the page please indicate the seat number in this classroom that is your preferred seat as P1, second preference as P2, and your least preferred seat as LP. Also indicate your normal seat location by number. For those of you who switch seats, indicate the seats as if it was your first morning in class in the five-day module.

Front of Class				**DOOR**
1 2	3 4	5 6	7 8	9 10
11 12	13 14	15 16	17 18	19 20
21 22	23 24	25 26	27 28	29 30
31 32	33 34	35 36	37 38	39 40
41 42	43 44	45 46	47 48	49 50

P1 = _____
P2 = _____
LP = _____
Normal seat position = _____

Thank you for taking the time to complete this survey.