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This study compared traditional lecture versus a computer-based cognitive science-based approach in training 2nd year medical students to perform low back pain differential diagnosis with integrated osteopathic diagnoses and findings.

Research subjects were tested on diagnostic capabilities and outcomes were compared. Students' opinion and feedback was assessed through a computer-based questionnaire.

Although the two groups performed equally with respect to overall mean and osteopathic diagnoses, the treatment group performed better on difficult questions. Eighty percent of student attitudes were positive toward computer-based learning and its utility in uniquely osteopathic concepts.

Cognitive science-based teaching modalities may increase diagnostic competencies and positively affect learning of uniquely osteopathic concepts.

INTEGRATION OF OSTEOPATHIC MANIPULATIVE MEDICINE INTO DIFFERENTIAL DIAGNOSIS TRAINING: A STUDY EVALUATING TEACHING STRATEGIES AND THEIR INFLUENCE ON STUDENT LEARNING

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Integration of Osteopathic Manipulative Medicine into Differential Diagnosis Training: A study evaluating teaching strategies and their influence on student learning

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CHAPTER I

INTRODUCTION

The education of physicians has historically relied on long held traditions. However as the demands of the modern healthcare environment change, the demands on medical training to provide competent physicians in this changing environment increase. In osteopathic medical education the problem arises: How can educators produce competent physicians capable of meeting the challenges of the modern healthcare system while still upholding the principles and practices on which the profession was founded. Recent studies suggest that the use of osteopathic manipulative treatment (OMT) among osteopathic physicians is declining.[1-3] Studies also show a lack of integration and application of OMT into the various clinical settings where students are trained.[4-6] Since the students are exposed very little to OMT on clerkships, the students may be unsure about when and how to use osteopathic manipulative medicine (OMM) in diagnosing and treating a problem. Thus, if the students are mainly exposed to osteopathic diagnoses in the classroom, effort should be made to improve the curriculum in order to increase the understanding of the value and application of osteopathic principles and practices (OPP).

Utilizing a new teaching intervention based upon cognitive learning theory, Texas College of Osteopathic Medicine has implemented a Computer Assisted Instruction (CAI) program for low back pain (LBP) as part of a local initiative to fully integrate OPP into the curriculum.

This study aimed to evaluate the new teaching intervention, a computer-based tutorial named Knowledge Based Inference Tool (KBIT), for differential diagnosis training with reference to unique osteopathic principles and practices. The intervention was evaluated for its ability to improve diagnostic competencies as compared to traditional lecture based format through a competency quiz. It is expected that students trained to perform differential diagnosis with the aid of computer-generated cases perform the task more proficiently (are more accurate and more rapid) than students trained with a purely didactic approach. More specifically, this study tested the hypotheses that students trained on the computer-based tutorial will more accurately diagnose uniquely osteopathic diagnoses as well as difficult or atypical case presentations as compared to students trained with a traditional didactic approach.

Similar to other studies assessing the influence of learning interventions on student attitudes, student perspectives were also assessed through a questionnaire.[7-9] Specifically, the questionnaire addressed the perceived influence of KBIT on comprehension, integration, and use of OMT as well as KBIT's utility as a learning modality. The information from this project may provide support for innovative teaching strategies in the area of OPP as well as support for the integration of OPP into cases and curricula presented to students in the first two years of medical school.

This study was performed by an osteopathic medical student in order to fulfill the requirement for Master's Thesis as part of an Osteopathic Manipulative Pre-doctoral Fellowship program. This study was approved by the University of North Texas Health Science Center Institutional Review Board.

CHAPTER II

SPECIFIC AIMS

This study was guided by the following central questions.

1. *What is the difference between KBIT and traditional training on differential diagnosis competencies?*
2. *How does KBIT training influence attitudes toward the learning and application of OPP?*

More specifically this study was designed to answer the following questions.

1. Which group, KBIT trained or lecture trained students, performs better (answers more questions correctly) on a differential diagnosing test?
2. Which group, KBIT trained or lecture trained students, performs better on the osteopathic portion (answers more osteopathic diagnoses correctly) of a differential diagnosis test?
3. Which group, KBIT trained or lecture trained students, performs better on the difficult questions (answers more of the difficult questions correctly) of a differential diagnosis test?
4. Which group, KBIT trained or lecture trained students, is better able to correctly identify key signs and symptoms associated with a particular disease/disorder?
5. Do integrated cases, cases with osteopathic diagnoses and exam findings, influence the attitudes of students toward OPP by increasing appreciation for, understanding and use of OPP?

6. Does the integration of OPP into KBIT increase perceived comprehension, integration, and use of OPP in students? (Do students think KBIT increases their comprehension, integration, and use of OPP?)
7. Is KBIT useful as learning modality by increasing diagnostic capabilities, performance on exams, and representing disease in a clinical setting?

The following hypotheses were created to reflect the study questions.

Hypothesis 1: Students trained on the computer-based tutorial will perform better (answer more questions correctly) on diagnostic competency testing as compared to students trained with a traditional didactic approach.

Hypothesis 2: Students trained on the computer-based tutorial will more accurately diagnose uniquely osteopathic diagnoses as compared to students trained with a traditional didactic approach.

Hypothesis 3: Students trained on the computer-based tutorial will more accurately diagnose difficult (atypical) case presentations as compared to students trained with a traditional didactic approach.

Hypothesis 4: Integrated cases, cases containing osteopathic diagnoses and exam findings, will positively influence attitudes toward OPP.

Hypothesis 5: Using an integrated computer-based tutorial, one containing both uniquely osteopathic and traditional medical diagnoses, will increase student comprehension, integration, and use of OPP.

Hypothesis 6: Students will perceive KBIT as a useful learning modality.

CHAPTER III

BACKGROUND AND SIGNIFICANCE

The education of physicians has historically relied on long held traditions. Despite advances in cognitive research, medical education has incorporated relatively little from contemporary learning theory. However, with the rapidly changing modern healthcare environment fraught with increasing patient demands, complicated technologies, and decreased funding, future physicians must make complex decisions in less time and with fewer mistakes. Mausdsley writes "Medical educators clearly face a dilemma: to educate new doctors to make timely, valid, reliable clinical decisions, behaving like their more experienced counterparts as quickly as possible, while simultaneously subjecting decisions to critical control and in-depth consideration."[10] In fact, international recognition of the need for undergraduate medical education to adapt to changing needs has spurred recommendations for increased application of modern educational theory and curricular revisions in medical education.[10, 11] The question thus arises: How can the osteopathic profession best educate physicians to meet these demands while still maintaining traditional values so long held by the profession.

Educational Theory

Modern educational theory is composed of a diverse set of theories with different underlying assumptions about learning. These approaches include behavioral, cognitive,

social learning, humanistic, constructivist and sociocultural learning.[12] Many of these theories have common overlapping themes and applications. Mann summarizes each theory and its contribution to educational practices as follows.[12] Behaviorist theory, rooted in the influences of the environment to shape behavior, gives way to educational practices such as systemic design of instruction, use of behavioral objectives, competency-based education, skill training and use of feedback. Cognitive theory focuses on the internal process of perception, insight, and meaning and explains ways in which information is received, processed, stored, retrieved, and applied. Thus, educational practices based on cognitive theory place importance on perceptions, knowledge that is appropriately organized, the development of problem-solving skills, and learning in a meaningful context. Social learning theory focuses on how learning occurs through interactions with others and the environment and thereby placing importance on learning through observation and role models. The humanist approach views learning as potential for growth and recognizes the developmental nature of humans. Adult learning theory has its roots in the humanist approach by valuing autonomy, self-directed learning, critical reflection, experiential learning and transformative learning. Constructivism asserts learning is the process of constructing meaning from personal experience. It facilitates the use of reflection and opportunities in which individual develop their understanding of situations. Finally, sociocultural learning views knowledge as existing across individuals and in the community giving rise to situated learning and learning by participation in the community of practice.[12] Collectively, contemporary educational theories must relate to medical education requirements specifically: professional knowledge acquisition through

an appropriate depth and breadth of transferable knowledge, critical thinking, clinical problem-solving with emphasis on the role of prior knowledge, and lifelong professional learning.[10, 13] Many curricular designs and instructional methods have been suggested, developed, and refined in light of the application of educational theory to medical education including the one used in this study.

The Presentation Model

Over the past 100 years, four basic curricular models have been applied in medical education: Discipline based, Systems based, Problem based (PBL), and Presentation based (Structured Knowledge-Based). While there are ongoing arguments regarding the educational benefits of these curricular models, there is little data concerning whether one model provides substantive advantages compared to another. Using concepts key to the presentation based curriculum, this study aimed to address the issue of how presentation may affect learning and, more specifically, how presentation affects the way uniquely osteopathic concepts are learned.

Recently, the Problem Based Curriculum Model has dominated as the modern medical education break through. This model uses clinical problems to integrate basic and clinical science content into clinically useful active adult learning experiences. Vernon and Blake defined it as "a method of learning (or teaching) that emphasized (1) the study of clinical cases, either real or hypothetical, (2) small discussion groups, (3) collaborative independent study, (4) hypothetico-deductive reasoning, and (5) a style of faculty direction that concentrated on group process rather than imparting information."[14]

However, the implementation and interpretation of PBL in medical curriculum is widely varied.[15] Reviews of the literature reveal conflicting outcomes and little convincing evidence in support for PBL.[14, 16-19] The evidence consistently shows that students trained with PBL perform the same or worse on measures of knowledge such as national licensing examinations. It has also been shown that PBL has a small positive effect on clinical skills measures; however, PBL is shown to have a consistent benefit on student satisfaction measures.[16, 17] It has also been criticized for providing little difference in outcomes compared to traditional curriculums while requiring intensive resources.[17] Though possessing many advantages over traditional models, this model possesses many disadvantages including: a foundation on generic problem solving skills, mission only oriented training, a backward reasoning approach, intensive use of resources, and an inability to cover all learning objectives as shown by Papa and Harasym.[20]

The Presentation model builds off the advantages of the Problem based model but incorporates the findings of education and cognitive research to produce a model that uses clinical presentations to impart basic and clinical sciences as well as teaching expert-driven problem solving strategies that would enable forward reasoning.[21] The Clinical Presentation model was first implemented and described by Mandin, et al. with the University of Calgary Faculty of Medicine.[22] The model was developed after their curriculum was found to be lacking in such areas as basic science emphasis, clinical problem solving, and its ability to adapt to the changing needs of the healthcare system.[22] Woloschuk et al. writes " The impact of 'content specificity' initiated a careful restructuring of our curriculum with very careful attention to mastery of knowledge."[23]

The curriculum was based on the following assumptions: 1) the manner in which the human body reacts to an infinite number of insults is finite and stable; and 2) the clinical presentation, the mode in which patients present to the physician, represents problems that a graduating physician must manage. The faculty members at Calgary identified 120 clinical presentations representing the range of problems encountered clinically and terminal objectives were developed for each medical school discipline based upon four criterion. The criterion included: organizing the terminal objectives according to six categories (1. history; 2. physical examination; 3. differential diagnosis; 4. appropriate investigations; 5. prognosis and complications of the condition; and 6. prevention, treatment, and management of complications); writing general objectives that enabled the student to choose the correct presentation; utilizing six to nine prototypical diseases for the differential of the presentation; and organizing the terminal objectives into a scheme that experts use in problem solving.[22] The enabling objectives were developed subsequently by the respective departments empowering them in the educational process. The schemes were developed in such a way that they could be easily enhanced, modified, and used as experience and clinical knowledge increased. The small amount of literature regarding this new curricular model has shown a positive effect on the retention of basic science knowledge by students. In addition, it has shown that student stress related to the volume and complexity of information and difficulty of examinations was decreased while overall stress levels were comparable to traditional models..[23, 24] One osteopathic school using the system reported increased performance on national board exams with good overall student satisfaction and increased utilization of learning resources.[25]

In implementation, it works such that "terminal objectives define the problem space by signs, symptoms and investigational differences between causes of the presentation; the enabling objectives define the relevant content; the schemata are simplified pictorial representations that assist in both learning about and diagnosing cases."[21] With this model in mind, instructional tools have been developed to enhance areas of medical education including diagnostic capabilities in novices.

Theoretical Framework

For over a century, medical curriculum designers and faculty members have consistently believed that clinical competence is dependent upon the development of generalizable problem solving skills.[26] However, over the past 30 years research into cognitive factors underlying the development of competence has revealed that problem-specific knowledge plays a primary role in development of competence, and, in fact, generalizable problem solving skills have little to do with competence.[27-29] For instance, diagnostic performance in one topic area such headache does not predict performance in another topic area such chest pain.[21] Further research has determined that diagnostic competence, in particular, depends upon the development of a 'categorization-oriented' knowledge base. Also, categorization is not dependent upon the quantity of the learner's problem-specific knowledge; rather, it depends upon how that categorization-oriented knowledge base is organized and presented.[30] Based on Abstraction theory, the development of diagnostic capabilities relies heavily on the order and manner in which

cases that parallel and diverge from a prototypical case created by a summarized representation of the relative weights of signs/symptoms are presented.[27, 31]

As more recent research has further determined, this organization of a problem-specific knowledge base supports categorization via 'pattern recognition'. Pattern recognition (diagnostic) proficiency is in turn developed via the refinement of a knowledge base that enables practitioners to perform: 1) pattern matching, and 2) pattern discrimination tasks with increasing accuracy.[32] Additional research has suggested that training exercises explicitly designed to support the development of pattern matching and pattern discrimination are a more efficient and effective means of developing pattern recognition (diagnostic) capabilities than the approaches clinicians traditionally utilize in the classroom and clinical environment.[32] It has also been demonstrated that a significant correlation exists between diagnostic performance and case prototypically whereby decision making is based upon a match between patient data and disease prototypes.[31, 33] Most current approaches to differential diagnosis training involve teaching schema or general systematic approaches with which to construct a differential.[34-36] There is little reason to believe that educators and clinicians are generally aware of how cognitive sciences research could be utilized to design and implement more efficient and effective instructional approaches to the development of diagnostic competence. One study by Papa et al has shown that instructional methods based upon these principles provides a significant advantage over traditional lectures in teaching diagnostic competency.[56] However, there is little evidence to show how newly developed instructional approaches

based on cognitive research influence the learning and attitudes of students utilizing these tools.

Computer Assisted Instruction

The use of technology as instructional and organizational tools in education and learning has increased especially with respect to medical education. Further integration of technologies and medical informatics into medical education is predicted to increase in the future. This should effect changes in the organization and delivery of medical education. [37] Medical educators and administrators are increasingly concerned with how to best integrate technology into medical curriculum as demonstrated by the literature.[37-41] A literature review by Valcke and Wever on this subject matter suggested that information and communication technologies have a positive impact on the presentation, organization, and integration of information.[41] For example, the use of computerized case simulations to repeatedly expose students to key concepts, presenting complaints, and illness has been suggested to aid in the acquisition of generalizable and transferable knowledge. Authors of these findings also stressed the importance of prior knowledge and the need for practical experiences.[41] Several studies have shown that previous exposure to computers as well as current level of use are significant factors influencing the efficacy of technologies in learning. [42, 42, 43 44-48] Studies have also assessed student attitudes concerning the use of computer-assisted instruction, and they have shown that students regard CAI as an important adjunct to traditional educational tools.[45, 49, 50] While reports of the use of CAI in uniquely osteopathic curricula is sparse, those modalities

that have been developed have shown promise in assessing and encouraging students' application of osteopathic principles as well as facilitating and enhancing educational experiences of students on rural clinical rotations. [49, 50] Chamberlain and Yates describe using a computer-assisted clinical case to provide an active learning experience and to evaluate students' application of OMT in treatment plans.[49] However, this exercise involved only one clinical case representing one disease entity: chronic pneumonia. Furthermore, the use of technologies to teach and evaluate clinical problem solving skills has only been described by a few authors. [42, 43, 49, 51, 52] These CAI tools attempt to assess the overall problem solving process of students to a limited number of cases with differential diagnosis only representing a portion of the program. In the literature, the only program that has been described for the specific application of teaching differential diagnosis skills is the one used in this study as described by Papa, F.J.[53-56] Notably, the application of this program to uniquely osteopathic concepts represents a new and innovative approach to teaching these concepts.

The CAI used in this study is Knowledge Based Inference Tool (KBIT), the product of over 20 years of research into the cognitive factors underlying the development of diagnostic competence. The KBIT computer-assisted instruction program is based upon five principles derived from cognition and assessment research: 1) instruction in differential diagnosis within a specific problem area, 2) numerous case presentations, 3) cases selected to represent a range of typical through atypical presentation for each disease class under instruction to construct a robust concept for the

disease, 4) immediate personalized feedback on performance, and 5) time efficiency.[54] Papa describes,

> "Kbit consists of three components: (1) a knowledge-based acquisition module, (2) a knowledge-based transformation module, and (3) an inferencing (decision-making) module. KBIT acquires knowledge from subjects in the form of conditional probability estimates for a predefined number of disease/symptom relationships in a given problem area. KBIT's second module transforms the subject's estimates into weights for each symptom associated with a given disease class. These weights are, in turn, used to construct a single prototypical representation for each disease class in the problem area.... [In the third module] KBIT determines the degree to which a given test case matches each disease-class prototype in the problem area. KBIT selects as its diagnosis the disease-class prototype which best matches the given test case."[33]

Briefly stated, KBIT is an artificial intelligence tool designed in part, to capture the knowledge base that experts use to diagnose a specific problem (e.g., chest pain). Once this knowledge base is isolated, KBIT can be manipulated so that a number and variety of training and testing case are generated from the expert's knowledge base. These cases can then be further manipulated by other KBIT subroutines to provide individually tailored instruction to students. These subroutines assist students in the development of the types of pattern matching and pattern discrimination oriented knowledge bases that are utilized during pattern recognition (diagnostic) tasks.

Osteopathic Considerations

Osteopathic medicine is a unique and distinctive full-service healthcare profession characterized by the application of their unique philosophy to the art and science of medicine. The profession emerged in the 1800s when its founder, AT Still, became disenchanted with the practices of medicine during his time.[57] Spurred by the inadequacies of medicine in his time, Still sought to develop a new philosophic approach to medicine. This philosophy is based upon 4 main principles:

1) The human being is a dynamic unit of function consisting of body, mind and spirit.

2) The body possesses self-regulatory mechanisms that are self-healing in nature making it capable of health maintenance.

3) Structure and function are reciprocally interrelated at all levels.

4) Rational treatment is based on these principles.[57]

Still's ideas were grounded in palpatory diagnosis and a manipulative therapeutic approach to health and disease that is now referred to as osteopathic manipulative treatment (OMT). [57] It has been argued that along with this unique philosophy, OMT and its emphasis on structure and somatic dysfunction is the most identifiable and distinguishing characteristic of the profession.[58] Recently the osteopathic profession has come into an identity crisis. The acceptance of the once marginalized and persecuted profession has increased through full licensing of practitioners in all 50 states, acceptance of its graduates into allopathic residencies, and appointment of D.O.s to university faculty and government positions.[59] With the efforts to gain this acceptance and recognition the

osteopathic profession has become much like the allopathic profession through increased specialization, increased number of osteopathic graduates seeking allopathic postgraduate training and the de-emphasis and decline of OMT usage.[2, 4, 60] An extensive number of articles have been written addressing the osteopathic identity and the questionable need for two medical professions if no distinction exists. [2, 61-68] Studies show that osteopathic physicians consider the osteopathic philosophy as a distinct advantage and identify themselves as practicing different from allopaths; however, new generations of osteopathic physicians are less concerned with the autonomy and viability of a distinct profession.[66, 69, 70] Fitzgerald reports that less than half of students surveyed at the West Virginia School of Osteopathic medicine agreed that the osteopathic medical profession needs to remain distinct from the allopathic profession.[71] It has been shown that a physician's motivation for applying to osteopathic medical school, their post-graduate training, year of graduation, and specialization all influence their perceptions of the profession, loyalty to OPP and usage of OMT.[5, 66, 69, 72-75]

There has been a call to redefine and reestablish the mission and identity of the osteopathic profession; however, much debate exists over how the profession should define its distinctiveness through primary care focus, OPP or its patient-centered holistic approach.[4, 59, 60, 69, 72, 73, 76-82] Though no definitive solution has been found, the answer most likely lies in the emphasis of all osteopathic characteristics in reestablishing the professions' unique identity.

In light of this identity crisis, the osteopathic profession is very concerned with the apparent decreased usage of its most distinguishing feature, OMT. This decline in use

of OMT has been considered a major contributing factor to loss of distinctiveness in the profession.[1, 4] Gevitz writes "...the more you actually practice distinctively the greater the likelihood that you will continue to exist and thrive."[77] Recent studies found that between 6% and 14% of osteopathic physicians used OMT for more than half of their patients, a drop from 34% in the 70's.[1-5] Johnson et al found that over half of osteopathic physicians surveyed used OMT on less than 5% of their patients, and nearly one-quarter did not use any OMT at all for their patients. This is similar to results reported by Stoll et al..[4, 69, 83, 84] A survey conducted by Fry found that 71% of 100 randomly selected osteopathic physicians across the country used OMT with 5% or more of their patients.[1] In a survey of 661 osteopathic graduates of the class of 1992, Aguwa and Liechty found that 60.4% of osteopathic physicians used OMT for fewer than 5% of their patients.[73] In a survey performed by Yates and Johnson concerning Oklahoma osteopathic physicians, 91% used OMT in 1984, and but only 79% did so in 1999.[85] Finally, in a 2003 study by Spaeth, 75% of the respondents had not or had rarely used OMT, and 44% of the respondents had not used any OMT.[86] The results of this survey also suggest that OMT use by physicians declined over the course of their careers.[3] OMT is most widely used amongst family practitioners and manipulative medicine specialists, but many of the sub-specialists rarely use it.[83, 85-88] Recent surveys have shown that graduates from AOA-accredited post-graduate training programs are more likely to use OMT in their clinical practice compared to physicians trained in non-AOA programs for both family practice and specialty residencies.[4, 73, 89] Studies by Johnson et al indicate that today's osteopathic medical school graduates are less likely to use OMT in their practice than more

experienced practitioners.[4, 5] Factors that may be attributed to the use or non-use of OMT include: time constraints, the nature of the physician's practice, the patient population, poor reimbursements, unsuitable physical facilities, the physician's skill level, obstacles toward clinical training in OMT, increased allopathic postgraduate training of osteopathic students and the physician's attitude toward OMT specifically a decreased perception of the utility of OMT.[4, 5, 8, 75, 84, 89]

Several authors have addressed the relationship between attitudes toward OPP, OMT usage and osteopathic medical training. Chamberlain and Yates looked at the use of OMT by students throughout medical training as well as the attitudes that influence that usage.[90] They found that application of palpatory diagnosis and OMT in treatment of patients as well as estimated usage of OMT in clinical practice decreased as the students progressed from didactic years to the clinical years of their medical education.[90, 91] In justification of this decrease the authors state "it appears that most of these students were afforded few opportunities to use osteopathic palpatory skills and OMT during their clinical rotations."[90] Studies showed a lack of integration and application of OMT into the various clinical settings where students and residence are trained.[4-6] A survey of osteopathic interns by Shlapentokh reported an average of 82% of respondents reported little exposure to either osteopathic philosophy or OMT.[92] Gamber et al also found that 65.9% of students used OMT on clinical rotations "sometime" to "never," and with reference to specific rotations, OMT was used and taught significantly less on other rotations compared to family medicine.[6] When students were asked to specify reason for not using OMT, lack of time followed by discouraged by attending and uncomfortable

with skill level were cited as the most frequent reasons.[6] It has been postulated by Chamberlain and Yates the belief that only particular patient problems, i.e. musculoskeletal problems, are appropriate for diagnosis and treatment using OMT as another influence in the decline of OMT usage.[90] A majority of osteopathic physicians felt too few hours were spent in OMT training at the intern (67%), resident (56%) and CME (59%) levels in a survey conducted by Gamber et al.[88]

Students consistently report that they feel adequately educated in OMT and yet once they enter clinical rotations application of OMT declines rapidly revealing a disconnect between knowledge and application.[3, 6, 90] In support of this, Chamberlain and Yates indicated "that students are willing to acknowledge the structural findings but have yet to realize the utility of applying these findings to patient care."[49] The lack of role models and OMT application in the clinical years leave students without a clear understanding of OPP in practice.[93-95] Similarly Shlapentokh reports when surveyed osteopathic interns note little effort by their professors to help them integrate either osteopathic philosophy or OMT into clinical practice.[92] Since the students are exposed very little to OMT on clerkships, the students may be unsure about when and how to use osteopathic manipulative medicine (OMM) in diagnosing and treating a problem.

Integration of OPP in the preclinical years has also been shown to be lacking especially with respect to basic science and clinical faculty.[96-98] Acunto writes "In the first year of osteopathic medical school, osteopathic medicine is presented as a separate entity from other classes. As classes become more clinical, few clinicians bring little, if any, osteopathic outlook to lectures."[96] A recent study surveying biomedical faculty at

osteopathic medical schools implied that if biomedical scientists did not incorporate osteopathic principles into their teaching or research, it was not because they were unaware of the principles but because they believed it was not appropriate to do so.[99] Thus, if the students are mainly exposed to poorly integrated OPP in the classroom, how do educators improve curriculum to increase the understanding of the value and application of osteopathic principles and practices.

One unifying theme in the osteopathic literature concerning identity is the need to recruit, instill, educate, and foster students' and physicians' dedication to OPP and OMT throughout their educational journey. Johnson writes "The osteopathic medical doctrine should be promoted and disseminated by college policy makers at the highest administrative levels, and osteopathic principles should be continuously articulated and integrated within each organizational echelon to include all teaching components."[65] Gevitz continually stresses the importance of restructuring the educational process around the central and defining osteopathic philosophy as seen when he writes " If the undergraduate osteopathic medical education experience imbues students with the belief – throughout the 4 year curriculum – that there is something distinctive and important about osteopathic medicine and, if the postdoctoral education experience promises to extend and reinforce that belief, then you would be adding something very significant to student decision-making ."[77]

Accordingly, as OMM usage declines the osteopathic community is increasingly concerned about the development of educational strategies to influence the usage and attitudes toward OMT.[100] Numerous strategies to increase integration of OPP into

curricula have been suggested and implemented. These strategies encompass both the pre-clinical and clinical years and include themes such as educating and encouraging basic science faculty to integrate OPP into their courses, requiring OMM rotations or clinical experiences, conducting workshops or distance video-learning programs to reinforce concepts in the clinical years, identifying role models and mentors who use OMT, redistributing responsibility for OPP training, allocating faculty and resources to teach and integrate OPP, establishing requirements and criteria for evaluating schools' integration.[93, 94, 101-106] For instance, some colleges have implemented core OMM rotations in order to provide an environment where these skills may be modeled and practiced.[102] Encouragingly, studies show that structured clinical curriculum in OMT increases attitudes, skills, and confidence in the use of OMT.[107-109]

Integration of OPP into the pre-clinical curriculum refers to the inclusion of uniquely osteopathic diagnoses, exam findings, and treatments in case presentations and clinical exercises. One strategy addressed the integration of OMM into cases both used in the 2nd year OMM class as well as written exams in clinical courses.[101] Besides the benefit of increased exposure, this strategy seems appropriate considering that NBOME exam questions are increasingly integrating OPP into case vignettes. The integrated computer assisted clinical case described by Chamberlain and Yates encouraged students to begin applying their knowledge of OMT and helped them better integrate their knowledge.[49] Remarkably, case integration throughout osteopathic education seems to be lacking. In preparation for this research study, a small survey to assess problem areas in OMM education was given to 3rd year medical students on their OMM core rotation at

TCOM. The survey confirmed that about 10% of cases presented throughout their medical education contained osteopathic exam findings and even fewer (5%) differential diagnoses incorporated uniquely osteopathic diagnoses. The majority of the students commented that they would like to see OMM integrated into the other courses taught in school. It is postulated that lack of integration of OMM into clinical application training contributed to these attitudes toward OMT.

Clinical Focus

Low back pain is one of the most common and disabling complaints with which patients present to physicians. More specifically, it is the second most common symptom-related reason for seeing a physician with a lifetime incidence of 60-90%.[110] Several of these common/important disease differentials causing low back pain are chronic and debilitating effecting the functional status and quality of life of the patient and costing billion in healthcare expenses.[110] The estimated costs of back pain in America reaches in excess of $50 billion annually due to both high healthcare utilization as well as substantial productivity losses.[111] As much as 97% of low back pain is described as "mechanical" attributing the etiology to anatomic or functional abnormality which is uniquely amenable to OMT.[111] Studies also show that low back pain is the number one patient problem treated with OMT by osteopathic physicians, which points to significance of the osteopathic approach in diagnosis and treatment of this disorder.[83, 88] The clinical guidelines from the Agency for Health Care Policy and Research recommended that spinal manipulation can be helpful in acute low back pain without

radiculopathy when used in the first months of onset.[112] Manipulation as a therapy for low back pain is considered safe with little evidence of risk for adverse events.[113] Studies have shown that OMT for low back is beneficial in the early course of the disease and is efficacious in decreasing usage of other co-treatments.[114-117] Osteopathic physicians must develop a fundamental competence with this patient problem to identify and appropriately treat these problems. Fogel comments, "The curriculum for osteopathic practice should emphasize the differential diagnosis and appropriate manual treatment [for common problems like] low back pain, joint pain, and headaches."[97] The differential for low back pain contains musculoskeletal and osteopathic diagnoses as well as medical diagnoses which offers a unique opportunity to integrate all concepts taught in osteopathic medical education.

Considering the significance and utility of low back pain differential diagnosing as a teaching case, the Low Back Pain (LBP) KBIT module was developed using expert experience to construct the data set. Integration of OPP into the KBIT module was accomplished by adding osteopathic diagnoses and exam findings to the data set. The differential diagnosis module consisted of nine diagnoses: 1) Psoas syndrome, 2) Degenerative Joint Disease of the Spine, 3) Nephrolithiasis (kidney stones), 4) Degenerative Disk Disease, 5) Lumbar Somatic Dysfunction, 6) Pelvic/Sacral Somatic Dysfunction, 7) Prostatitis, 8) Lumbar Sprain/Strain, and 9) Spinal Stenosis. Of these nine diagnoses, three are considered to be uniquely osteopathic: Psoas syndrome, Lumbar Somatic Dysfunction and Pelvic/Sacral Somatic Dysfunction, These are considered uniquely osteopathic because they are described and taught within the osteopathic

profession but not the allopathic profession. Also, uniquely osteopathic physical exam findings were added to each of the nine diagnoses with an average of three osteopathic findings per case. The expert then reviewed examples cases to ensure quality and accuracy. Once the LBP KBIT module was complete it was pilot tested on thirty-two 3rd year medical students during their core OMM rotation at TCOM to ensure its utility.

CHAPTER IV

RESEARCH DESIGN AND METHODS

INTRODUCTION

In order to study both the effects and influence of a new integrated computer assisted instruction program on diagnostic competencies and learning, the research design was divided into two parts. The first part compared two approaches to teaching differential diagnosis, lecture vs. a computer-based tutorial, by comparing scores on a 45-item paper and pencil quiz. The second part of the study assessed the influence of the computer-based tutorial on the comprehension, integration and use of OPP as well as KBIT's utility as an instructional tool through a questionnaire. The following discussion is thus divided into two parts, the first addressing the comparison of student performances and the second addressing the student attitudes toward the intervention. Figure 1 summarizes the research design.

Study Population

Since this study compares two different teaching approaches to certain aspects of osteopathic medical education, the population of interest was all students enrolled and participating in osteopathic medical education. Specifically, the study targeted all osteopathic students at the level of medical training for learning differential diagnosis skills. This typically occurs in the 2nd year. According to the 2004 Annual Report on

Osteopathic Medical Education issued by the American Association of Colleges of Osteopathic Medicine, there were 20 osteopathic colleges with 23 campuses at the time of the study. Estimated enrollments in the 2003-2004 academic year reached almost 12,000 students. The 2003-2004 first year enrollments exceeded 3,300 students.[119] Enrollments have been reported to steadily increase with each incoming year. However, this may be used as an approximate estimate for the number of second year medical students enrolled in osteopathic schools.

Study sample

Due to the scope and resources of this study, subjects were all students (n=129) in the second year of medical school at TCOM (Class of 2008). This sample was selected for a few reasons. First, the second year curriculum focuses on disease entities and differential diagnosis skills offering the most appropriate opportunity to practice these skills. Second, students in their 2nd year at TCOM were easily and readily accessible as compared to students out on rotations and students at other osteopathic schools located throughout the nation. Finally, the whole class was included in order to maximize the number of subjects in each study group. Participation in the experiment was completely voluntary.

Protection of Human Subjects

Though this study involves student performance on a quiz as well as survey, the data were collected, stored, and de-identified through the Academic Information Services

Department, which routinely handles all student academic information throughout the course of studies at UNTHSC. Since no identifiers were linked or reported to investigators throughout any part of the study, the researcher asked for and received an expedited review from the University of North Texas Health Science Center Institutional Review Board (UNTHSC IRB). Informed consent was obtained prior to the study. This study was reviewed and approved by the UNTHSC IRB on April 4th, 2006.

Experimental Design

Part 1

This part of the study replicated portions of and built upon previous studies on KBIT differential diagnosis training such as the Congestive Heart Failure study performed by Papa et al.[56] The class was randomly assigned to two groups, A and B, with assignment based upon randomly drawing the names of the students out of a hat and alternatively assigning them to a group. It should be noted that in smaller sample sizes randomization may produce unbalanced groups. However, the two groups were compared in terms of gender, age, grade point average, OMM course grade point average, and attitude towards OMM to help ensure both a random and balanced sample.

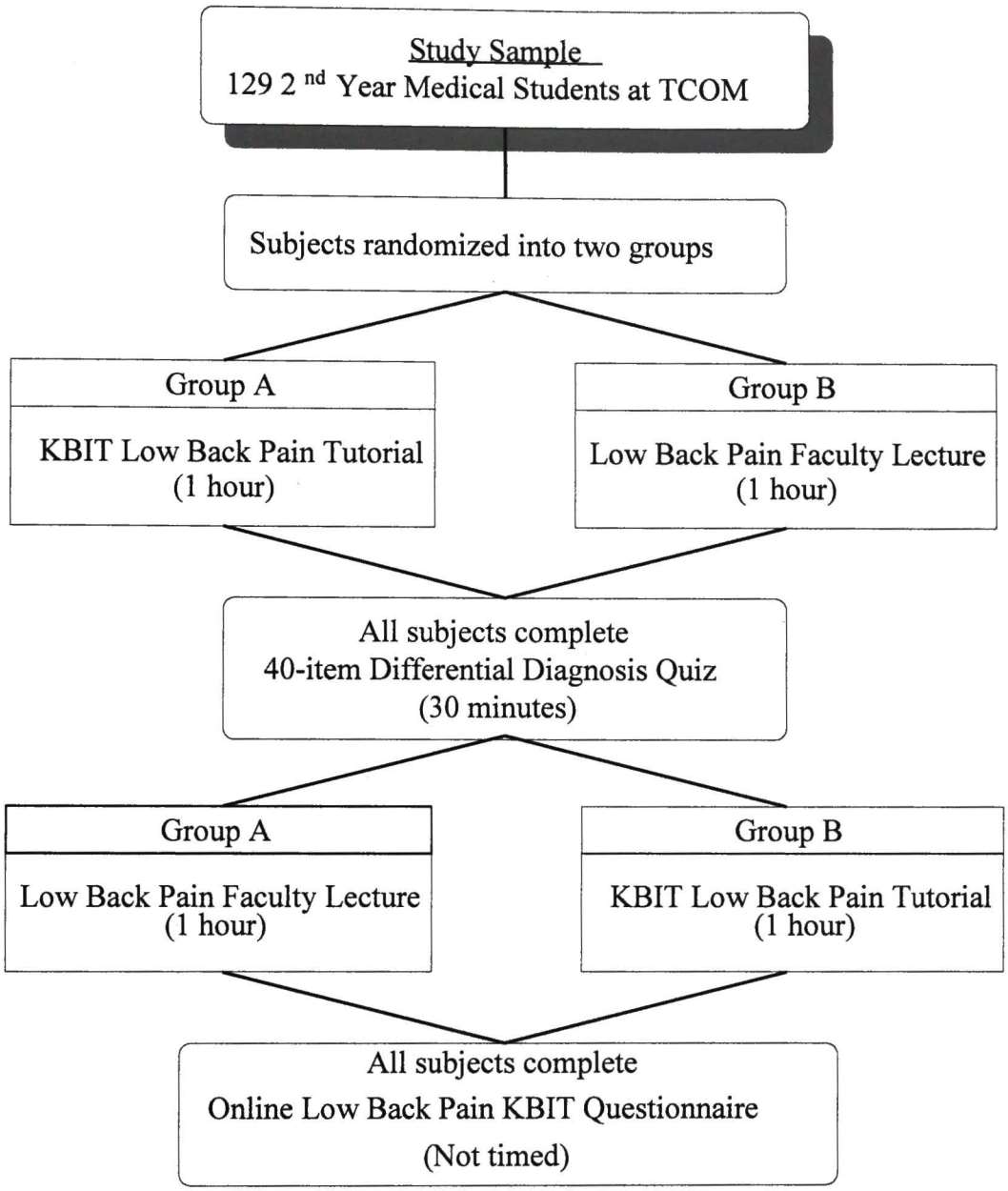
The two groups were assigned to a separate teaching approach for the differential diagnosis training, either lecture with an expert (Gamber, a neuromuscular medicine specialist) or the KBIT computer program. Group A was assigned to begin with the computer-based approach in which KBIT technology was utilized to both tutor the various syndromes and provide practice problems for the students to diagnose. Examples

of KBIT generated prototypical cases for low back pain utilized by the students as well as explanation of student interaction with the program can be found in Appendix B. Group B was assigned to begin with a lecture provided by Gamber in which key signs and symptoms of each disease were addressed, with emphasis upon those aspects of each syndrome that help to differentiate it from the other syndromes.

Before the activity began, a description of the study, the voluntary nature of participation in the study, risk/benefits, and potential conflicts of interest were given to the subjects verbally and through the written form of the cover letter. The activity took place from 3:00 to 5:30 on April 5th. For 60 minutes, Group A practiced differential diagnosis of low back pain using KBIT in the library computer labs and Group B received expert instruction from Gamber on differential diagnosis of low back pain in the students normal lecture hall. The expert lecture gave the disease differentials for the problem, presented prototypical sign/symptoms and example cases for each differential. There was also an opportunity for the students to practice selecting a differential on a few cases with facilitated discussion/feedback from the lecturer. Both Groups then took a short break. Immediately upon completion of these activities (at 4:00), students took an approximate 45 item quiz lasting 30 minutes to determine their accuracy and proficiency at performing differential diagnosis. The quiz was comprised of 40 case vignettes of low back pain, briefly stated and following a standardized sequential format, with variability in difficulty of the cases.[56] Preliminary research suggested that 40 total test cases were need to produce a reliable measure of students diagnostic capability for a given problem.[21, 56, 120] The students were to choose the correct diagnosis out of the nine taught

in the study. The remaining five items were multiple choice items asking the students to choose the most distinguishing sign or symptom for a particular diagnosis. Following the quiz, the two groups were "crossed-over" (Group B worked with the KBIT system; Group A received Gamber's lecture). Thus, both groups received the same degree of instruction, differing only in the sequence (computer or expert first). From the students' perspective, the exercise and quiz was a self-assessment/learning tool. Performance on the quiz did not impact the grade received in Musculoskeletal 2 course or OMM 4 course.

Figure 1: Research Design Flowchart



With the exception of the timing of the quiz, all aspects of this study took place within the normal context of the Manipulative Medicine 2 course. The study occurred in conjunction with the Musculoskeletal 2 course so that students may maximally benefit from the education exercise. The educational philosophy is that 1) it is important for students to practice differential diagnosis and 2) it is important that they hear an expert

describe key findings that differentiate diseases. Because of limitations of numbers of computers (up to 66 are available at the Learning Resource Center); the class must be split to achieve the first of these objectives. Thus, both objectives were achieved by the basic design outlined above. The experimental portion of the study was in the administration of a quiz at the mid-point of training rather than waiting until all students have finished both KBIT and didactic training to administer a quiz. However, once students completed both KBIT and didactic sessions, supplemental access to KBIT was maintained such that all students could continue to practice their differential diagnosis skills. These efforts were undertaken to ensure that every student received the same amount and type of instruction and therefore was not at any disadvantage academically. Also, the participation in the study did not affect the students' grades in Musculoskeletal 2 course or OMM 4 course in any way.

Part 2

Following completion of both the educational interventions and the course, the students were given a questionnaire concerning their KBIT experience. The questionnaire is shown in Appendix C. The questionnaire was given online in conjunction with course evaluations available on the web at http://eval.hsc.unt.edu/. The link to the questionnaire was available at the course/instructor evaluation website (http://eval.hsc.unt.edu). This is a website maintained by Academic Information Services through which students are accustomed to submitting confidential and anonymous evaluation data. The KBIT questionnaire was an available link on the online course evaluation site in such a way that

the questionnaire was an optional link for the students to select separate from selecting a course for evaluation. Selection or non-selection of the link in no way affected the students' ability to complete other online course evaluations. Once the students selected the link, they were presented with a cover letter prior to beginning the questionnaire which briefly described the questionnaire and its purpose as well as reiterated the voluntary nature of participation. There were also two boxes available for selection: one that consented to participation in the questionnaire and one that declined participation in the questionnaire. This action acted as double verification that the students had consented to participating in part of the study. If subjects did not select the link or select the option not to participate, they were automatically dropped from the questionnaire form and no data were recorded or reported for that student.

Data collection

De-identified demographic data for each group as well as the overall class were provided by Academic Information Services. In order to determine the overall attitudes toward OMM in each group, all students anonymously took the Attitudes Toward Osteopathic Principles and Practice Survey (ATOPPS) prior to the study. ATOPPS was developed by David Russo D.O. as his Master thesis project.[118] The survey items were statistically analyzed for performance and as such it is considered a reliable instrument for ascertaining attitudes toward OMM. The survey uses a modified Likert scale format in which 25 statements regarding OMM reflect a continuum of positive and negative attitudes toward OPP. The survey is shown in Appendix A.

Part 1

The students recorded their answers to the 45 item quiz in scantron format. Students were asked to provide their Social Security Number on this quiz, as is the format for all quizzes and exams scored by Academic Information Services. Scantron forms along with consent forms were collected, scored, and recorded by UNTHSC's Academic Information Services (AIS) ensuring that no one saw the names outside the normal testing practices conducted at UNTHSC. AIS then linked the hard-copy consent to the data collected through the students' names and Social Security Numbers. It should be noted that AIS routinely collects, records, analyzes, and reports academic data securely including grades and course evaluations as a part of their function on the UNTHSC campus. The students' names and ID number were not referenced in data summaries provided to the investigators by Academic Information Services. AIS also removed the data of students who chose not to have their data used in the study from the data summaries reported to the investigators. AIS recorded data by group assignment only such that data could be analyzed between the two experimental groups, A and B. The quizzes were scored as follows: variable 1) percent of answers correct, variable 2) number of answers correct, variable 3) percent of osteopathic diagnoses answered correctly, variable 4) mean number of osteopathic diagnoses answered correctly, variable 5) percent of difficult questions answered correctly, variable 6) mean number of difficult questions answered correctly. The first two variables determined the overall differential diagnosis accuracy. The next two variables determined the diagnostic accuracy for the osteopathic test items, and the final two variables determined the diagnostic accuracy of

the difficult test items.. Analyzing specifically the scores of the osteopathic diagnoses determined the mastery of this specific set of material. In addition some of the items on the quiz tested the students' ability to identify the key signs/symptoms that are associated with specific disorders within the differential. Analysis of this portion of the quiz according to above parameters addressed the specific component of differential diagnosis skills. Secondary analyses determined the effect of KBIT training on the spread of scores (do students trained on KBIT have a different distribution of grades from those trained by didactic methodology). The scores obtained were in no way used to affect the grades of their courses.

Part 2

The online questionnaire was given to the students concluding the study and was reported anonymously in electronic format with no identifiers attached in accordance with UNTHSC online course evaluation procedure. The questionnaire focused on the need for overall integration of cases presented to students, the perceived influence of the KBIT exercise on the comprehension, integration, and use of osteopathic principles and practices as well as its utility as a learning modality. For closer evaluation of the questionnaire please see Appendix C. This instrument was developed by the researcher in order to meet the specific needs of the research question it addresses. The instrument included 18 modified Likert scale responses in which the respondent indicated how much they agreed or disagreed with the statements with 1 being strongly disagree and 5 being strongly agree. The Likert scale format was chosen because the online evaluation system

uses this format making it both familiar to the student and easy to format to the online system. Also, it easily quantifies opinions into analyzable data. One question asked the respondents to estimate the percentage of integrated cases present in the curriculum. The questionnaire also included 4 open-ended comment type questions addressing the utility and improvement of the instruction tool.

The survey instrument was reviewed, modified, and ultimately approved by a committee comprised of researcher experienced with the CAI tool, an OMM expert, and a survey researcher. The committee reviewed the formatting and content to assure that the survey instrument was user-friendly and appropriately addressed the research objectives. To ensure utility, the questionnaire was pre-tested in a pilot program in which thirty-two 3rd year medical students on their core OMM rotation answered the questionnaire after utilizing the LBP KBIT module. The results of the questionnaire were only accessible to the course director and to the researcher for data analysis.

Data Analysis

Demographic and academic data for the two groups were compared by direct comparison and independent samples t-test.

Part1

Statistical analysis was done using SPSS. Descriptive statistics such as frequencies and means were used to characterize the data. Data were evaluated between the two groups on measures of 1) percent of answers correct, 2) mean number of answers correct, 3) percent of osteopathic diagnoses answered correctly, 4) mean number of

osteopathic diagnoses answered correctly, 5) percent of difficult questions answered correctly, 6) mean number of difficult questions answered correctly. Data were analyzed by independent sample t-tests for the difference in mean between the two groups for mean number of answers correct, mean number of osteopathic diagnoses answered correctly, and mean number of difficult questions answered correctly. Significance was set at $\alpha<0.05$.

Part 2

Statistical analysis was done using SPSS. Descriptive statistics such as frequencies and means were used to characterize the data. The Likert scale questions were then evaluated by grouping Strongly Agree and Agree responses into one group labeled "Agree" and Neutral, Disagree, and Strongly Disagree in another group labeled "Did not agree". The two groups were then compared for each question using Chi Square analysis to find significant differences in those that agree with the statement and those that did not agree. Significance was set at $\alpha<0.05$. The open response questions were analyzed for common recurring themes.

CHAPTER V

RESULTS

INTRODUCTION

Results of this study are reported in two parts in accordance with the research design. Comparisons of diagnostic competencies for each group are reported in the first part. Student responses to the online questionnaire are reported in the second part.

Part 1

Of the 126 2nd year medical students at TCOM, 116 students consented to and participated in the study, 60 in Group A and 56 in Group B. However, it was later found that 12 students from Group B logged onto the KBIT tutorial while in lecture. These 12 students were placed into their own group labeled C and called the combination group since they had exposure to both teaching modalities. The data were analyzed both with and without the Group C students as a component of Group B in order to prevent bias from skewing the results. The final group numbers were 60 in Group A, 44 in Group B, and 12 in Group C. The average age of students participating in the study was 26.23. The average Grade Point Average (GPA) of the students participating in the study was 86.27and the average OMM GPA was 83.4. Data concerning gender, age and GPA for each group can be seen in Table 1.

Table 1: Demographics of Student Participants by Group

	All Participants	Group A- KBIT	Group B- Gamber	Group C- Combo
Male	55 (47%)	25 (42%)	24 (55%)	6 (50%)
Female	61 (53%)	35 (58%)	20 (45%)	6 (50%)
Avg. Age	26.23±3.16	25.94±2.78	26.78±3.84	25.67±1.69
Avg. OMM GPA	85.44±5.71	85.08±5.69	85.62±6.01	86.56±4.66
Avg. GPA	86.27±4.27	86.08±4.28	86.12±4.53	87.72±3.03

The class and groups were compared for difference in attitude toward OPP by the use of the ATOPPS survey. One hundred surveys out of possible 126 were returned giving a response rate of 79%. Group A returned 44 questionnaires and Group B returned 46. Ten surveys were not labeled by group and were removed from the data to be analyzed due to the lack of this information. The overall scores on the ATOPPS survey did not differ significantly between groups. ($p=0.71$) For each question individually, only four questions had significantly different scores, p value less than 0.05, between the two groups. For Question 4, Group A had a mean response of 4.18 ($sd=0.62$) and Group B had a mean response of 4.30 ($sd=0.79$) with a p value of .01. Question 6 had a mean response of 2.34 ($sd=1.49$) for Group A and 1.93 ($sd=1.16$) for Group B at a p value of $<.01$. Question 11 had a mean response of 4.86 ($sd=0.35$) for Group A and 4.74 ($sd=0.49$) for Group B with a p value of .01. For Question 21, Group A had a mean response of 4.64 ($sd=0.49$) and Group B had a mean response of 4.74 ($sd=0.44$) with a p value of .04. Table 2 summarizes the results from the ATOPPS survey.

Table 2: ATOPPS survey results by Group and Total Class

ATOPPS questions	Group A (n=44)	Group B (n=46)	Total Class (n=100)
1	4.57±0.73	4.59±0.53	4.58±0.62
2	1.57±0.87	1.57±0.86	1.56±0.86
3	2.16±1.31	1.87±1.11	2.03±1.17
4	4.18±0.62	4.30±0.79	4.24±0.71
5	3.50±0.98	3.70±1.05	3.57±0.99
6	2.34±1.49	1.93±1.16	2.16±1.34
7	3.93±0.87	4.04±0.97	3.96±0.95
8	2.91±1.16	2.80±1.02	2.83±1.09
9	4.27±0.73	4.33±0.73	4.32±0.70
10	4.50±0.63	4.57±0.54	4.5±0.62
11	4.86±0.35	4.74±0.49	4.75±0.48
12	4.20±0.88	4.33±0.70	4.24±0.82
13	4.41±0.79	4.39±0.71	4.4±0.72
14	2.02±1.00	1.98±1.14	2.02±1.08
15	3.48±1.23	3.57±1.15	3.47±1.16
16	4.14±0.73	4.22±0.63	4.17±0.69
17	3.80±1.05	3.82±1.09	3.86±1.01
18	4.82±0.58	4.67±0.52	4.7±0.58
19	3.93±0.90	4.15±0.73	4.03±0.79
20	1.64±0.87	1.57±.078	1.61±0.82
21	4.64±0.49	4.74±0.44	4.65±0.50
22	2.89±1.22	2.54±1.24	2.74±1.22
23	2.36±1.16	2.22±1.03	2.32±1.11
24	2.05±1.10	2.02±1.06	2.07±1.10
25	3.86±1.03	3.87±1.11	3.89±1.01
Total Score	**87.02±5.51**	**86.43±5.61**	**86.63±5.44**

Performance on the 45 item quiz was compared between the groups through mean overall score, mean osteopathic score, and mean difficult score using independent samples t-test. The mean overall score for Group A and Group B with Group C students were 25.85 (sd=4.74) and 24.96 (sd=4.22), respectively, with a p value of .40. Whereas, the mean overall score for Group A and Group B without Group C students were 25.85 (sd=4.74) and 25.25 (sd=4.19), respectively, with a p value of .25. Comparison of means

for each group is shown in Figure 2. The percentage of students that answered correctly is reported for each question according to group in Table 3. Group A had a higher percentage of students than Group B answering correctly on 23 out 40 of the questions.

Figure 2: Comparison of Overall Group Means for Test

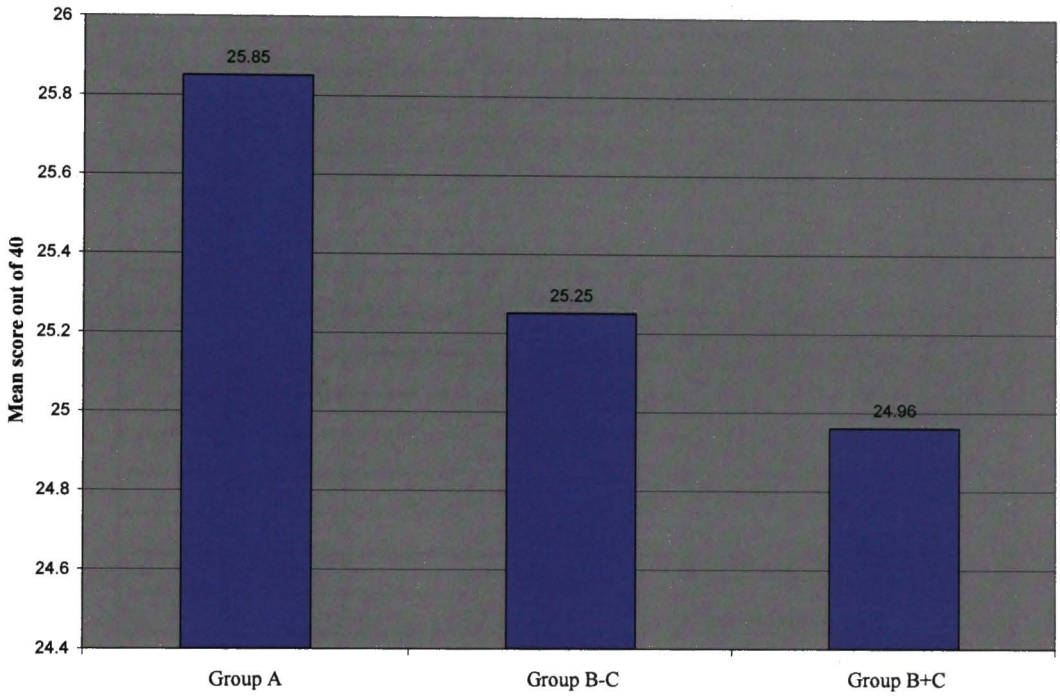


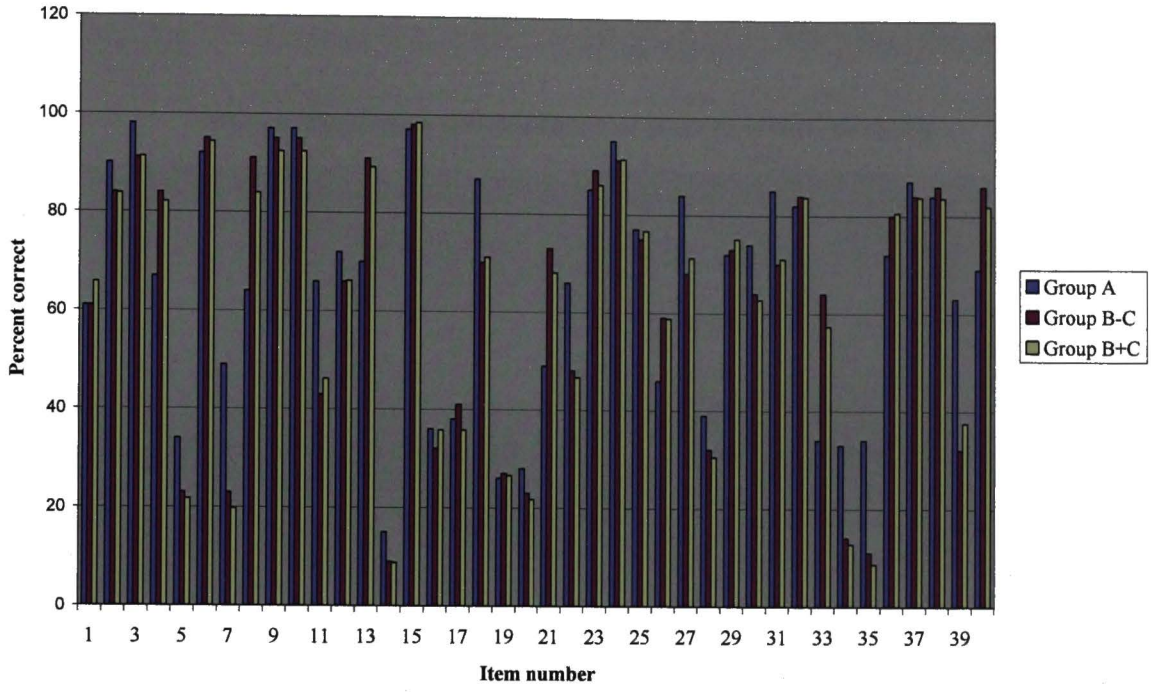
Table 3: Number and Percent Correct for each Test Item according to Group

Test Item #	Group A # (%) Correct	Group B # (%) Correct	Group C # (%) Correct
1	37 (61)	27 (61)	10 (83)
2	55 (90)	37 (84)	10 (83)
3	60 (98)	40 (91)	11 (92)
4	41 (67)	37 (84)	9 (75)
5	21 (34)	10 (23)	2 (17)
6	56 (92)	42 (95)	11 (92)
7	30 (49)	10 (23)	1 (8)
8	39 (64)	40 (91)	7 (58)
9	59 (97)	42 (95)	10 (83)
10	59 (97)	42 (95)	10 (83)
11	40 (66)	19 (43)	7 (58)

Table 3: Continued

Test Item #	Group A # (%) Correct	Group B # (%) Correct	Group C # (%) Correct
12	44 (72)	29 (66)	8 (67)
13	43 (70)	40 (91)	10 (83)
14	9 (15)	4 (9)	1 (8)
15	59 (97)	43 (98)	12 (100)
16	22 (36)	14 (32)	6 (50)
17	23 (38)	18 (41)	2 (17)
18	53 (87)	31 (70)	9 (75)
19	16 (26)	12 (27)	3 (25)
20	17 (28)	10 (23)	2 (17)
21	30 (49)	32 (73)	6 (50)
22	40 (66)	21 (48)	5 (42)
23	52 (85)	39 (89)	9 (75)
24	58 (95)	40 (91)	11 (92)
25	47 (77)	33 (75)	10 (83)
26	28 (46)	26 (59)	7 (58)
27	51 (84)	30 (68)	10 (83)
28	24 (39)	14 (32)	3 (25)
29	44 (72)	32 (73)	10 (83)
30	45 (74)	28 (64)	7 (58)
31	52 (85)	31 (70)	9 (75)
32	50 (82)	37 (84)	10 (83)
33	21 (34)	28 (64)	4 (33)
34	20 (33)	6 (14)	1 (8)
35	21 (34)	5 (11)	0 (0)
36	44 (72)	35 (80)	10 (83)
37	53 (87)	37 (84)	10 (83)
38	51 (84)	38 (86)	9 (75)
39	38 (63)	14 (32)	7 (58)
40	42 (69)	38 (86)	8 (67)

Figure 3: Group Comparison for each Test Item by Group



The osteopathic quiz item, specifically items 7, 9, 12, 14, 16, 20, 21, 23, 26, 33, 37, were separately compiled and scored. The mean osteopathic score was 6.82 for both Group A and Group B with Group C (p=.45) and standard deviations of 1.84 and 1.81 respectively. The mean osteopathic scores without Group C in Group B were 6.82 (sd=1.84) for Group A and 7.02 (sd=1.73) for Group B (p=.23). Table 4 summarizes the data and Figure 1 demonstrates the comparison between groups with regards to percent correct on the uniquely osteopathic questions. Group A had a higher percentage of students answering correctly on 7 out of the 12 osteopathic test items. For items 21, 23, 26, 33, and 38 Group B had a higher percentage of students answering correctly. Notably, pelvic/sacral somatic dysfunction was three of five of these questions along with psoas syndrome and lumbar S/D. Also, the difficult test items, those items deemed

moderate to advanced level of difficulty by the program, were separately compiled and scored.

Figure 4: Comparison of Osteopathic Test Items Total Score by Group

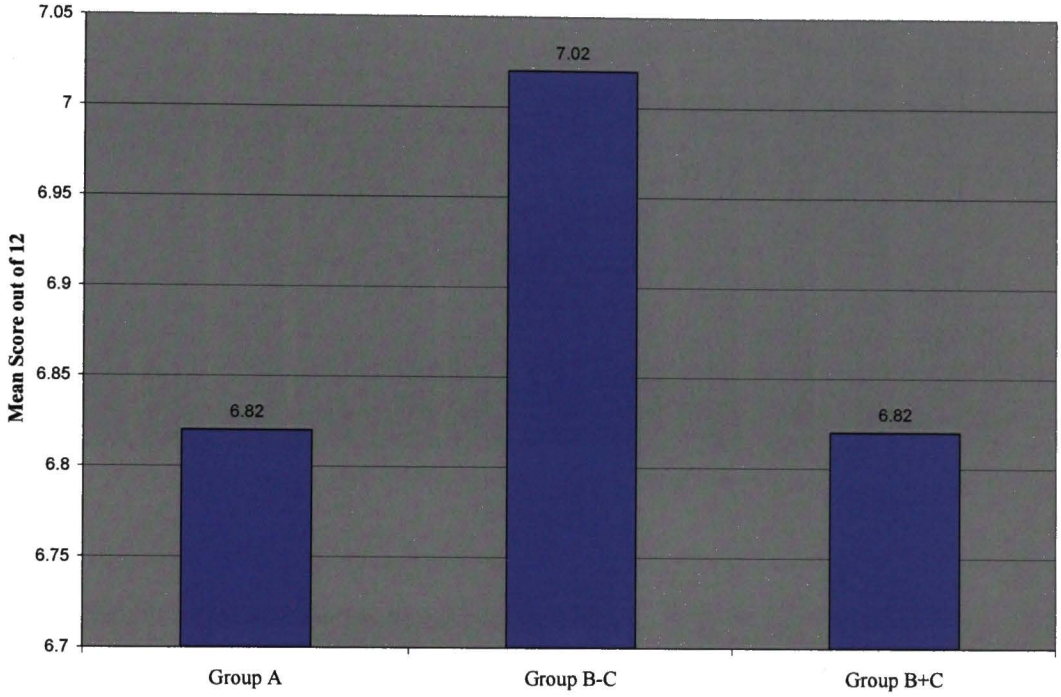
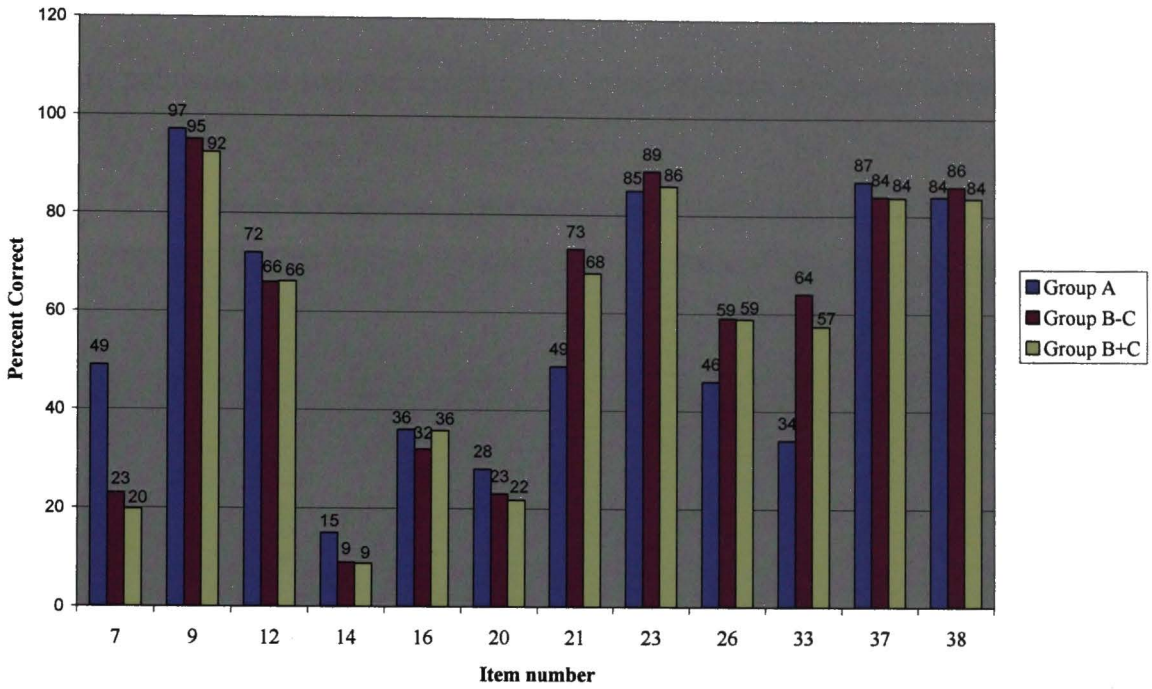


Table 4: Number and Percent Correct for the Osteopathic Test Items according to Group

Test Item #	Group A # (%) Correct	Group B # (%) Correct	Group C # (%) Correct
7	30 (49)	10 (23)	1 (8)
9	59 (97)	42 (95)	10 (83)
12	44 (72)	29 (66)	8 (67)
14	9 (15)	4 (9)	1 (8)
16	22 (36)	14 (32)	6 (50)
20	17 (28)	10 (23)	2 (17)
21	30 (49)	32 (73)	6 (50)
23	52 (85)	39 (89)	9 (75)
26	28 (46)	26 (59)	7 (58)
33	21 (34)	28 (64)	4 (33)
37	53 (87)	37 (84)	10 (83)
38	51 (84)	38 (86)	9 (75)

Figure 5: Comparion of Osteopathic Test Items by Group



The difficult test items, specifically items 1, 5, 7, 8, 11, 12, 13, 14, 16, 17, 18, 19, 20, 21, 28, 29, 31, 32, 33, 34, 35, 38, 40, comprised a little over half of the quiz questions, 23 out of 40 questions. The distribution of difficult questions was spread over the nine differentials so that two to four questions per differential diagnosis were difficult. Comparison of the mean difficult items scores, 12.33 (sd=3.39) for Group A and 11.66 (sd=2.55) for Group B+C, showed a statistical significance at a p value of .04. However, with Group C removed there was no statistical significance in the difference of the means, 12.33 (sd=3.39) for Group A and 11.93 (sd=2.61) for Group B, at a p value of .07. Table 5 summarizes the student performance on these test items, and Figure 2 compares the percent correct for each difficult question by group. Group A had a higher percentage of students answering correctly for 13 out of 23 difficult questions. Test items

8, 13, 17, 19, 21, 29, 32, 33, 38, and 40 had a higher percentage of correct answers in Group B. Notably, these questions involved the diagnoses lumbar sprain/strain, DJD, prostatitis, pelvic/sacral somatic dysfunction, spinal stenosis, and psoas syndrome.

Figure 6: Comparison of Diificult Test Items Total Score by Group

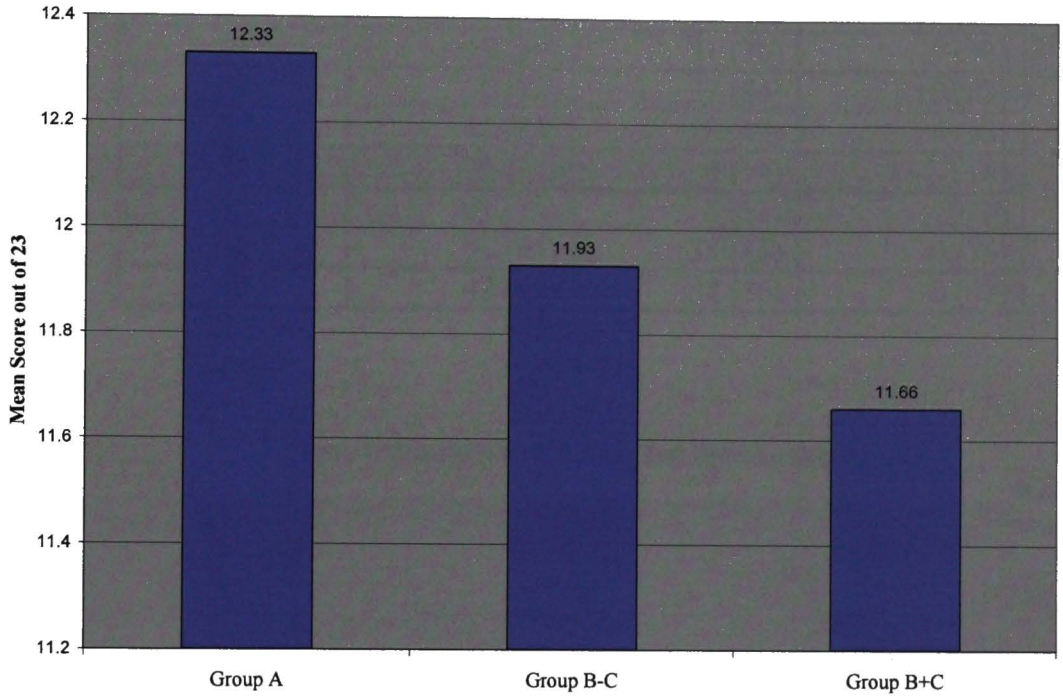


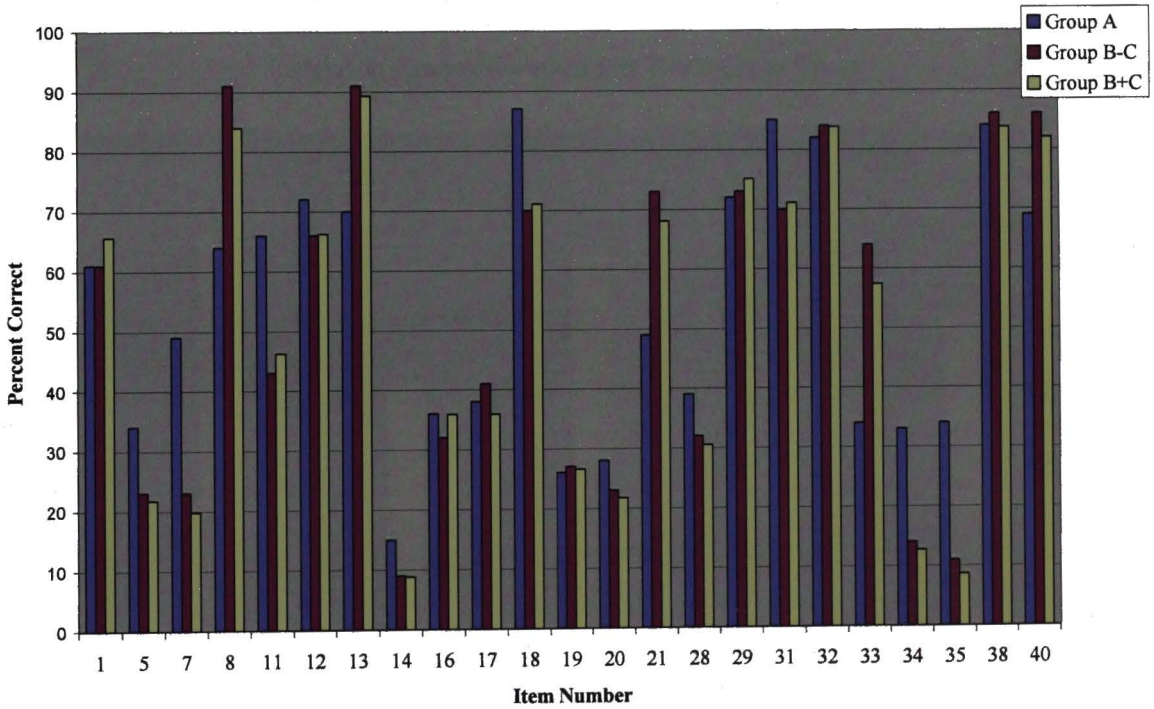
Table 5: Number and Percent Correct for the Difficult Test Items according to Group

Test Item #	Group A # (%) Correct	Group B # (%) Correct	Group C # (%) Correct
1	37 (61)	27 (61)	10 (83)
5	21 (34)	10 (23)	2 (17)
7	30 (49)	10 (23)	1 (8)
8	39 (64)	40 (91)	7 (58)
11	40 (66)	19 (43)	7 (58)
12	44 (72)	29 (66)	8 (67)
13	43 (70)	40 (91)	10 (83)
14	9 (15)	4 (9)	1 (8)
16	22 (36)	14 (32)	6 (50)
17	23 (38)	18 (41)	2 (17)
18	53 (87)	31 (70)	9 (75)

Table 5: Continued

Test Item #	Group A # (%) Correct	Group B # (%) Correct	Group C # (%) Correct
19	16 (26)	12 (27)	3 (25)
20	17 (28)	10 (23)	2 (17)
21	30 (49)	32 (73)	6 (50)
28	24 (39)	14 (32)	3 (25)
29	44 (72)	32 (73)	10 (83)
31	52 (85)	31 (70)	9 (75)
32	50 (82)	37 (84)	10 (83)
33	21 (34)	28 (64)	4 (33)
34	20 (33)	6 (14)	1 (8)
35	21 (34)	5 (11)	0 (0)
38	51 (84)	38 (86)	9 (75)
40	42 (69)	38 (86)	8 (67)

Figure 7: Comparison of Difficult Test Items by Group



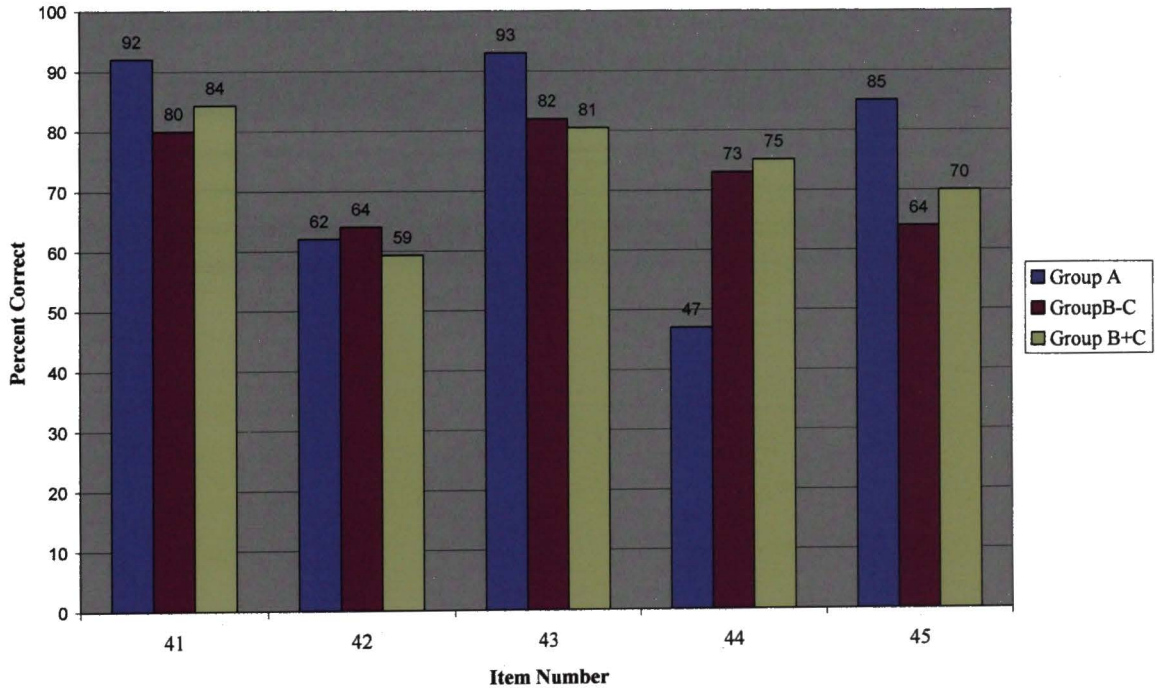
The last 5 quiz items specifically tested the students on the ability to correctly identify the sign or symptoms most associated with a specific diagnosis. Table 6 and

Figure 3 respectively summarize and compare the percent correct for each of these questions according to group. A higher percentage of students in Group A answered correctly for each question compared to Group B except for question 44. On question 44 Group B had a higher percentage of students answering correctly.

Table 6: Number and Percent Correct for the Last Five Test Items according to Group

Test Item #	Group A # (%) Correct	Group B # (%) Correct	Group C # (%) Correct
41	56 (92)	35 (80)	12 (100)
42	38 (62)	28 (64)	5 (42)
43	57 (93)	36 (82)	9 (75)
44	29 (47)	32 (73)	10 (83)
45	52 (85)	28 (64)	11(92)

Figure 8: Comparison of last Five Test Items by Group



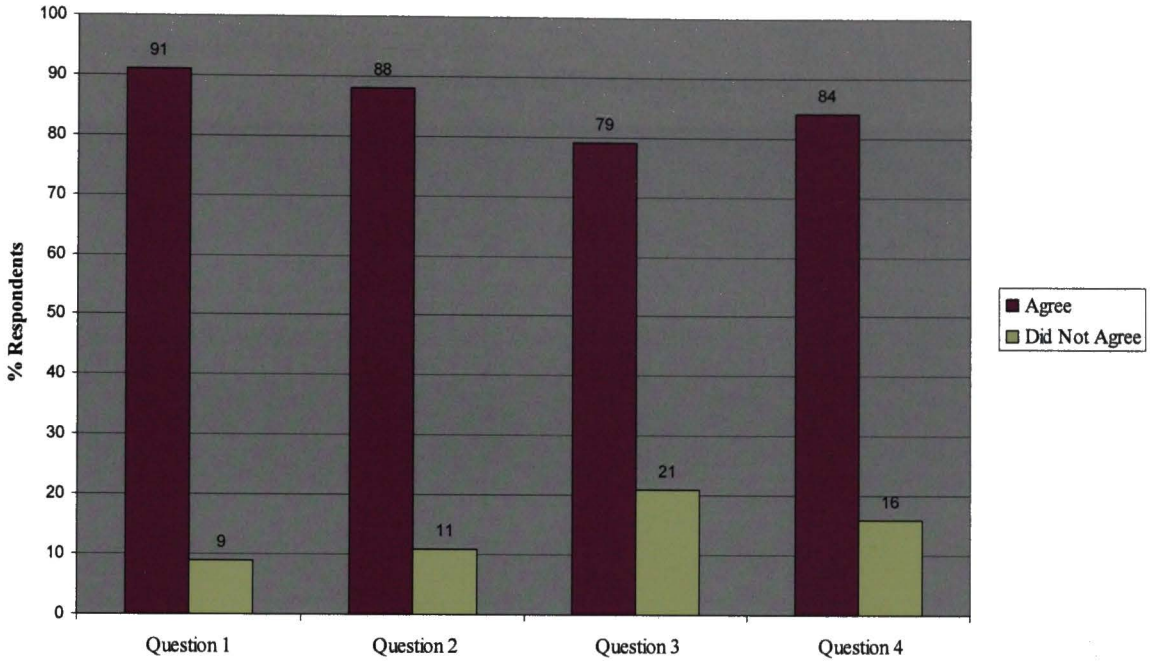
Part 2

Ninety-eight out of a possible 126 students participated in the online survey for a response rate of 78%. A large majority of respondents strongly agreed or agreed with all statement in the questionnaire. Results of the questionnaire are reported by grouping them into categories according to subject matter/content. Questions 1-5 addressed the need/utility of integrated cases throughout all courses. Table 7 summarizes the responses for Questions 1-4 and Figure 6 compares the response of those who "Agree" with those who "Did not agree". Student responses were most positive for Question 1 in this group with 89 respondents agreeing and 9 respondents not agreeing.

Table 7: Percent Student Reponses for Question 1-4 addressing the need/utility of integrated cases in curriculum

Question	SA %	A %	N %	D %	SD %
1	30	61	6	3	0
2	30	58	8	3	0
3	25	54	15	3	3
4	28	56	14	1	1

Figure 9: Comparison of Responses for Influence of Case Integration throughout Curriulum



Chi square analysis of the "Agree" with the "Did Not Agree" for each question showed statistical significance as reported in Table 8.

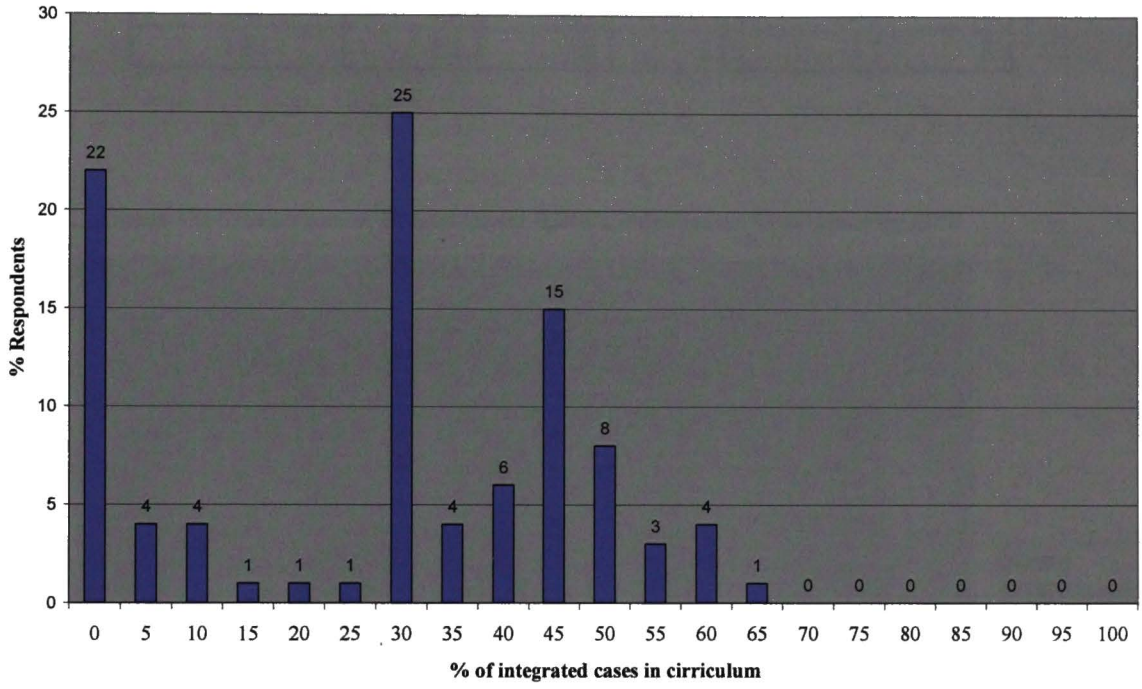
Table 8: Statistical Comparison of "Agree" to "Did Not Agree" Number of Responses for Questions 1-4

Question	"Agree"	"Did Not Agree"	χ^2	df	p value
1	89	9	65.31	1	**<0.001**
2	87	11	58.94	1	**<0.001**
3	77	21	32.00	1	**<0.001**
4	82	16	44.45	1	**<0.001**

The results for Question 5 which asked the students to estimate the percentage of cases with osteopathic manipulative exam findings integrated into them are reported in Figure

7. Notably, the majority of students (58%) reported that less than 1/3 of cases presented throughout their education had osteopathic exam findings or diagnoses included.

Figure 10: Estimated % of Integrated Cases



Questions 12, 13, 16, 18 and 19 as reported in Table 9 ascertained the students' perceived benefit in understanding of OPP through the use of KBIT. The "Agree" and "Did Not Agree" response were compared, Figure 8, for these questions and a significant difference was found as reported by Table 10. For question in this group, Question 13 was agreed with the most with 87 "Agree" responses and 11 "Did Not Agree" responses. Question 16 was least agreed with in this group with 70 "Agree" responses and 28 "Did Not Agree" responses.

Table 9: Percent Student Reponses for Questions 12, 13, 16, 18, and 19 addressing KBIT's influence on understanding of OPP

Question	SA %	A %	N %	D %	SD %
12	28	46	17	8	1
13	30	58	7	3	1
16	24	49	18	7	3
18	27	54	10	10	0
19	22	56	15	3	3

Figure 11: Comparison of Responses for KBIT's influence on Understanding OPP

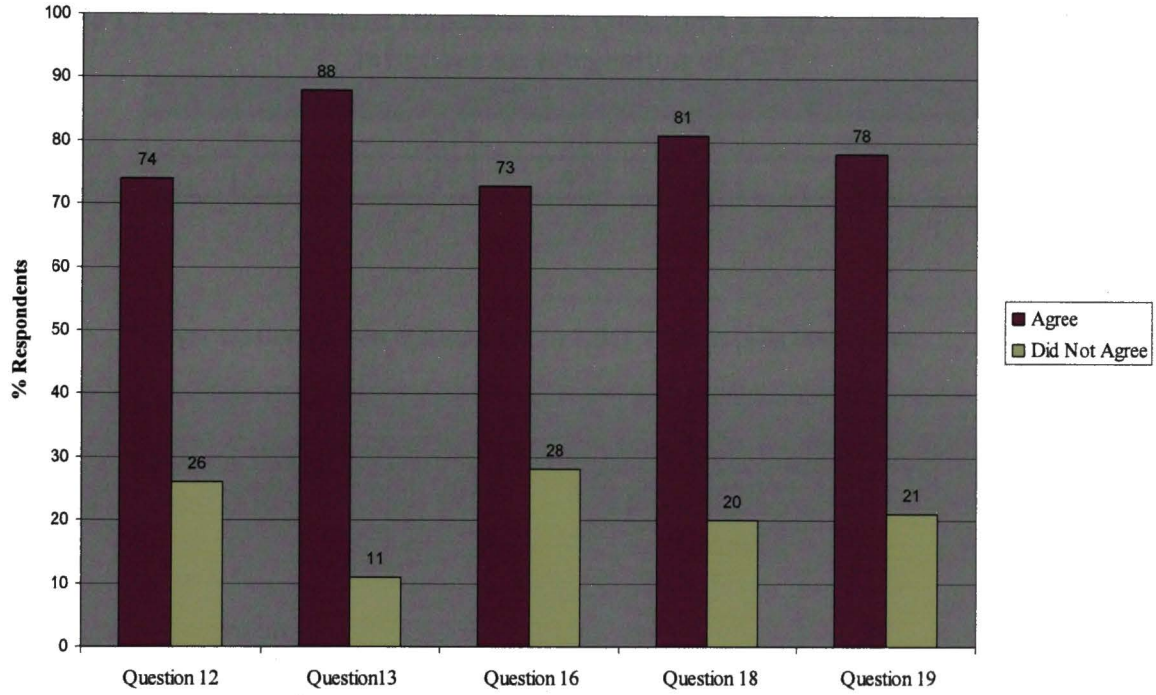


Table 10: Statistical Comparison of "Agree" to "Did Not Agree" Number of Responses for Questions 12, 13, 16, 18, and 19

Question	"Agree"	"Did Not Agree"	χ^2	df	p value
12	72	26	21.59	1	**<0.001**
13	87	11	58.94	1	**<0.001**
16	70	28	18.00	1	**<0.001**
18	78	20	34.32	1	**<0.001**
19	77	21	32.00	1	**<0.001**

Question 6 and 15 addressed the perceived benefit of KBIT on the students' ability to integrate OPP. Table 11 summarizes the response and Figure 9 compares the "Agree" with the "Did Not Agree". The difference between "Agree" responses and "Did not Agree" responses for these questions were statically significant. (Table 12) Both questions had similar response rates 79 and 75 respondents agreeing.

Table 11: Percent Student Reponses for Questions 6 and 15 addressing KBIT's influence on integration of OPP

Question	SA %	A %	N %	D %	SD %
6	22	58	15	4	0
15	27	49	18	4	1

Figure 12: Comparison of Responses for KBIT's influence on Integration

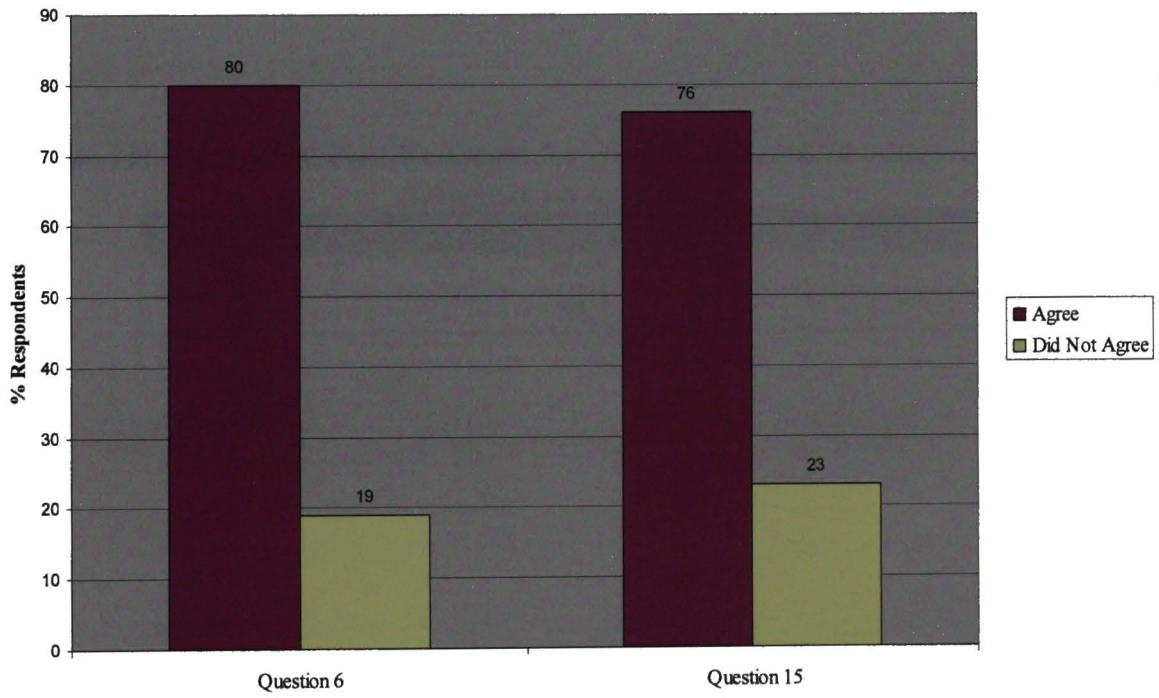


Table 12: Statistical Comparison of "Agree" to "Did Not Agree" Number of Responses for Questions 6 and 15

Question	"Agree"	"Did Not Agree"	χ^2	df	p value
6	79	19	36.74	1	**<0.001**
15	75	23	27.59	1	**<0.001**

Questions 9 and 10 allude to the influence of the learning exercise on perceived utilization of OPP. Table 13 summarizes responses to these questions and Figure 10 compares "Agree" and "Did Not Agree" responses. A statistically significant difference was found between the "Agree" and Did Not Agree" responses for these questions.(Table 14) This group of questions had similar responses though students agreed more with Question10, 80 "Agree" and 18 "Did Not Agree" as compared with responses for Question 9, 71 "Agree" and 27 "Did Not Agree".

Table 13: Percent Student Reponses for Questions 9 and 10 addressing KBIT's influence on use of OPP

Question	SA %	A %	N %	D %	SD %
9	19	54	17	10	0
10	21	61	11	6	1

Figure 13: Comaprison of Responses for KBIT's influence on use of OPP

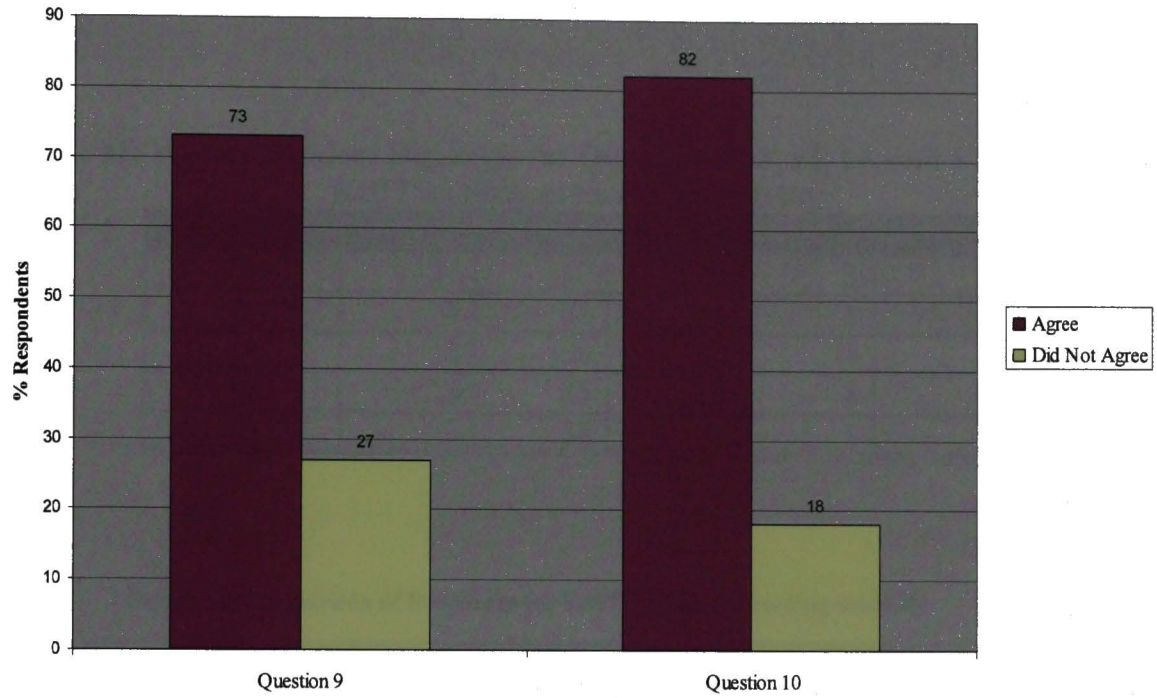


Table 14: Statistical Comparison of "Agree" to "Did Not Agree" Number of Responses for Questions 9 and 10

Question	"Agree"	"Did Not Agree"	χ^2	df	p value
9	71	27	19.76	1	**<0.001**
10	80	18	39.22	1	**<0.001**

The Low Back Pain KBIT's usefulness as a learning modality was addressed in Questions 7, 8, 11, 14, and 17. The summary of responses is found in Table 15 and comparison of the "Agree" response with "Did Not Agree" responses is found in Figure 11. A statistical difference in the "Agree" and "Did Not Agree" responses for each question were found as reported by Table 16. For this group, Question 17 was agreed with the most with 92 "Agree" respondents and 6 "Did Not Agree" respondents and

Question 11 was agreed with the least with 65 "Agree" respondents and 34 "Did Not Agree" respondents.

Table 15: Percent Student Reponses for Questions 7, 8, 11, 14, and 17 addressing KBIT's utility as learning modality

Question	SA %	A %	N %	D %	SD %
7	24	67	8	1	0
8	24	61	13	3	0
11	8	58	30	3	1
14	29	45	15	8	3
17	35	58	4	1	1

Figure 14: Comparison of Responses for KBIT's utility as learning modality

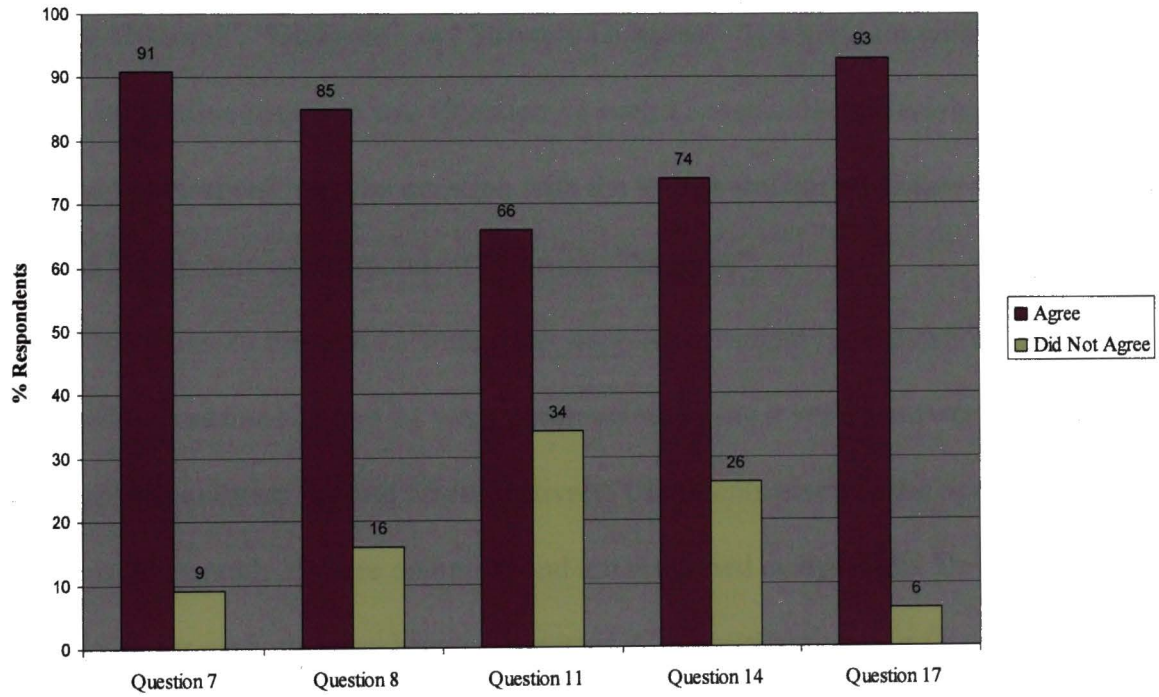


Table 16: Statistical Comparison of "Agree" to "Did Not Agree" Number of Responses for Questions 7, 8, 11, 14, and 17

Question	"Agree"	"Did Not Agree"	χ^2	df	p value
7	89	9	65.31	1	**<0.001**
8	82	16	44.45	1	**<0.001**
11	65	34	10.45	1	**<0.001**
14	72	26	21.59	1	**<0.001**
17	92	6	75.47	1	**<0.001**

The question with the highest % of respondents in agreement was Question 17 with 92 students choosing "Strongly Agree" or "Agree" and 6 choosing "Neutral", "Disagree", or "Strongly Disagree". Question 11 had the lowest amount of agreement compared to the other questions with 65 students choosing "Strongly Agree" or "Agree" and 34 students choosing "Neutral", "Disagree", or "Strongly Disagree". The question with the highest amount of negative response was Question 14 with 11 respondents choosing "Disagree" or "Strongly Disagree" and the question with the lowest amount of disagreement was Question 7 with only one respondent choosing "Disagree".

Questions 20 through 25 were open response comment type questions. More specifically, Questions 22 and 24 were questions requiring a yes/no answer linked to an open response question, 23 and 25 respectively. Comments given in the open response to Questions 20 through 25 were compiled and are presented in Appendix D. Certain themes in responses for each question became apparent after examination. For Question 20, many (5) students commented that they would like to have more than one OMM KBIT module to cover more topics. One student specifically wrote "All systems should have OMM KBITs". Several (3) students commented that explanations and pictures would be

helpful. There were a few comments suggesting specific changes for improvement such as change to paragraph format, decrease the number of differential diagnoses, and more treatment questions. A number of students (8) didn't have a suggestion for improvement and only commented on the modules' good quality and utility. Question 21 concerning the way in which the KBIT influenced how to learn, organize and approach OPP had a wide variety of responses. Several students (3) said that the KBIT helped them to organize diseases and find major point of differentiation between the diseases. Others (5) said that the KBIT helped to associate/correlate specific findings and their relative importance with a particular diagnosis. One student commented "I am more confident about the different OMM findings concerning low back and how each finding correlate to specific diseases or somatic dysfxns." A couple of students (2) commented that it provided good practice of differential diagnosing skills. One student said that it reinforced the typical findings like those found on board exams. Two students allude that the tutorial program encouraged them to reason differently. Question 23 asked in what way did the KBIT module influence the students understanding of concepts in OMM and many students (5) thought it help to integrate osteopathic concepts with clinical diagnoses. Again some students (3) said it stressed the distinctive feature of each diagnosis. Others (5) thought it helped apply the concepts clinically. For instance, one comment was "It clarified why some treatments are used over others in certain disorders." Repetition and reinforcement of concepts were also given as answers (2). A comment for both Question 21 and 23 was it expanded the differential. Student responses for Question 25 which asked about KBIT's influence on their thinking of the use of

OMM, centered on the idea that the learning modality made them consider OMM more clinically (8). For instance, "Introduced problems that can be addressed by OMM which I originally thought was not treatable by OMM" and "it showed that it is very easy to integrate OMM into everyday practice" were a couple of comments. Conversely, some (3) did not think that it influenced their thinking about the use of OMM. One student commented on the lack of integration of OMM in the curriculum and its perceived consequences by stating "It drew my attention to the fact that the only time anyone mentions osteopathy or related topics is in OMM. It would be a shame to graduate a bunch of DO's who don't practice osteopathic medicine." Overall responses concerning the experience were positive and encouraging

CHAPTER VI

DISCUSSION

SUMMARY OF FINDINGS

A new educational intervention was utilized to teach uniquely osteopathic differential diagnosis training for low back pain to 2nd year medical students at TCOM. This computer assisted instruction tool was evaluated as a learning modality by comparison with traditional lecture through competency testing and by student opinion through a questionnaire. One hundred and sixteen subjects completed the competency portion of the study and ninety-eight subjects completed the questionnaire.

Part 1

For demographic comparison, the gender distribution and average age and GPA for each group did not differ significantly from each other or from the overall average of the class. Comparison of the groups' attitudes toward OPP through the ATOPPS survey showed no statistical difference in overall scores on the survey. However, four questions showed a significant difference in responses between two groups. Group A had significantly higher scores, signifying more agreement, than Group B for Questions 6 and 11. Group B had significantly higher scores for Questions 4 and 21. For these questions, Group A showed less agreement that OMT will give them an advantage over MDs and that it is helpful to have a big picture of the patients history when planning treatment;

however, they had more agreement that they would have not attend osteopathic school if they had chosen. This points to slightly less positive attitudes toward OPP in Group A than Group B. However, considering overall scores were similar and showed positive attitudes toward OPP, this slight difference probably had minimal impact on their scores for diagnostic competency and responses to the questionnaire.

The comparison of the two groups, Group A being the CAI trained group and Group B being the lecture trained group, showed no statistical difference between the two groups for overall score on the competency quiz. However, the mean for Group A was shown to be higher than that of Group B with or without the Group C students considered. This could show a trend toward increased competency in Group A. For the uniquely osteopathic diagnoses, the two groups performed the same with no statistical difference between the two. The means of the two groups were not significantly different with Group C considered apart of Group B, but Group B had a higher mean than Group A when Group C was removed from the data comparison. This suggests that the intervention was not influential in increasing competencies for the uniquely osteopathic diagnoses. The comparison of the two groups on the difficult test items showed a statistically significant higher score of Group A compared to Group B when Group C was combined with Group B. When the Groups were compared with Group C removed from data, the difference in the means was no longer statistically significant at a p value of .05; however, it trended closely toward it having a p value of .06. This suggests that the CAI tool had an influence on the diagnostic competencies for more difficult cases. When evaluating the performance of the two groups on each question, Group A consistently

performed better on a little over half of the test items for all areas observed, i.e. overall, osteopathic test items, and difficult test items. Accordingly, Group A performed better than Group B on the last 5 test items which tested the students' ability to associate specific signs and symptoms with specific diagnoses by having a higher percentage of students answering correctly on 4 out of the 5 questions.

Part 2

Student responses to the questions were overwhelmingly positive toward the need/utility of integrated cases throughout curriculum and toward the CAI learning tool and its utility in teaching uniquely osteopathic concepts. A statistically significant difference in responses for the "Agree" and the "Did Not Agree" response was found for each Likert type response question with a higher proportion of respondents choosing "Strongly Agree' or "Agree" than respondents choosing "Neutral", "Disagree", or "Strongly Disagree". In fact very few respondents chose "Disagree" or "Strongly Disagree" throughout the questionnaire so that the majority of the responses in the "Did Not Agree" group were comprised of "Neutral" responses. Accordingly, the amount of respondents choosing "Strongly Disagree" was very low with 3 being the maximum number for any given question. This pattern of responses suggests that students are strongly in favor of the CAI tool as a learning modality and its influences on the student learning of uniquely osteopathic concepts. Students especially agree that KBIT increases their diagnostic competencies as seen by responses for Question 17 which had the most amount of agreement and Question 7 which had the least amount of disagreement.

Interestingly, the question with lowest amount of agreement, Question 11, and the question with the highest amount of disagreement, Question 14, both concern the students perceived influence of KBIT on exams. This suggests that students do not as strongly agree that KBIT represents cases found on exams such as the boards or that it would help them perform better on exams. The results for questions grouped according to subject matter showed trends in student responses which clarified student opinions concerning those subjects. For Questions 1-4 concerning the utility of integrated cases throughout curriculum students agreed most that integration of cases would give them an increased appreciation for OPP and agreed least that integration of cases would increase their performance of exams/boards. For the questions addressing KBIT's influence on the comprehension of OPP, students agreed most that it reinforced concepts taught in the course and least that KBIT enabled them to more easily understand OPP than traditional lectures/PTR sessions. The questions concerning KBIT's influence on the students' integration of OPP had very similar response rates suggesting consistent responses and stable opinions toward its influence on the integration of OPP. Question 9 and 10 also had similar response rates however students tended to agree more that the integrated KBIT made them view the patient more holistically than it changed the way they would treat the patient. The students' responses for the questions concerning KBIT utility as a learning modality were discussed above in reference to their overall pattern of agreement or disagreement.

The open-ended comment type questions showed several patterns of responses which reinforced the responses given on the Likert type response questions. Students

thought that KBIT helped them to organize the information, associate key sign/symptoms with particular diagnoses, practice their differential diagnosing skills, and to integrate OPP into their thinking. Interestingly, as result of this experience, the students noted the lack of integration of OPP into their current curriculum and expressed a desire to have increased integration. Students requested more integrated KBIT modules within both the OMM course and the system courses. Students also suggested specific methods for improving the quality of the module in order to increase KBIT's ability to meet their learning needs. However, many positive comments were made concerning the superior quality and uniqueness of the integrated KBIT module. A concern that this type of training was beneficial only as an adjunct to the hands-on training was also expressed.

LIMITATIONS

Limitations of the study were addressed prior to the study through study design and rational as well as after the study due to compounding variables influencing outcomes. Several limitations were addressed prior to the study through study design and rational. First, the randomization process may have produced unrepresentative groups being unbalanced in terms of gender, age, grade point average, and attitude towards OMM. However, the two groups were compared concerning these variables to help ensure both a random and balanced sample and no significant difference was found between the two groups concerning age, gender, grade point average or attitude toward OPP. Also, the design of the study lacked a pretest and post test analysis. However, considering that the students had never been presented with this material prior to the

study it may be assumed that their ability to perform differential diagnosis before the study was negligible. Therefore, the pretest/posttest analysis would have likely shown improvement in both groups. Also, test practice bias was eliminated by omitting this type of analysis.

The study focused on the tests scores and opinions of the students in their 2nd year at TCOM. This focus limited the generalizability of the findings in several ways. Since the students that were studied were only from TCOM, the results cannot be generalized to the students at other osteopathic schools with different curriculum. The other osteopathic colleges of medicine are located throughout the country with differing applicant pools, curriculum models, and emphasis and integration on OPP. Future studies could expand to include multiple campuses in order to increase potential generalizability. Also, only the 2nd year medical students were included in this study which reduces generalizability across other levels of medical education. However, this sample population was chosen because the student were at a level in their training in accordance with learning differential diagnosing skills though students at higher levels of education such 3rd and 4th year medical students and residents and interns utilize these skills throughout their training. Thus students at higher levels of training could be included in future studies to ascertain the influence of KBIT on differential diagnoses skills at differing levels of medical education.

For Part 1 of the study, a few confounding factors influenced the outcomes of the study for which the researcher was unaware until the completion of the study. First, a group of students in Group B, the lecture group, failed to follow directions by logging

onto the KBIT system via their laptops while in lecture and completing the KBIT prior to the quiz. This group was identified after the completion of the study and their data was grouped into a separate Group C. Data were analyzed both with and without this group. However, this breach of study design had untold influences on the outcomes of the study. Group C performed consistently worse on diagnostic competencies which may be explained by their divided attention between KBIT and lecture while trying to participate in both at the same time. Second, it was discovered following the study that some of the students spent inadequate time utilizing the KBIT module, i.e. spending only 5 minutes utilizing KBIT when mastery of skills requires 30-60 minutes. This apathy of the students toward KBIT usage may be due to several factors including timing of study and lack of incentive. This study was scheduled near the end of the year in conjunction with their Musculoskeletal course; however, this is also a time in which the students' enthusiasm and participation in academic activities wane due to fatigue and spring fever. Also, the study was schedule at the end of the day which again is subject to student apathy secondary to fatigue. Incentives for completing the KBIT were lacking in additional ways. Due to the experimental use of KBIT, the incentives the students normally receive, points for participation, were excluded to ensure there was no coercion of the students to participate. Also a required level of mastery on the KBIT cases which provides incentive for the students to perform their best was not set for this study. Future studies should take into account students who may jeopardize the study by failure to follow directions or participate fully and meaningfully in the learning modalities. One such way to guard against this is to restrict student access to the CAI to only those assigned to the KBIT

group until completion of the study. Also, timing of the study and incentives for meaningful participation should be considered in the study design.

A major limitation to this study was the use of a piloted but non-validated survey instrument. A non-validated survey instrument was used in this study because no existing survey was found that suited the purposes of the study. The survey was piloted on a group of 3rd year medical students who completed the LBP KBIT module followed by the questionnaire. Responses were similar to those occurring in the study. Suggestions concerning survey structure and content were influential in the development and modification of the instrument. Accordingly a committee comprised of researcher experienced with the CAI tool, an OMM expert, and a survey researcher reviewed and revised the instrument. However, the questionnaire was worded positively for all statements. It could be argued that the overwhelmingly positive responses were due to pattern responses rather than true feelings. In order to prevent this, the questionnaire could be modified to included negatively stated items requiring a different response for the same opinion.

IMPLICATIONS

The implications for this study involve advancement of diagnostic competency training and the integration of OPP into innovative teaching strategies. Though the results from the diagnostic competency quiz were not statistically significant, trends in performance support an increase in competencies with use of CAI especially for difficult cases, cases that are not typical in presentation, which supports results found by Papa et

al.[56] This study along with other studies on this type of training contributes to medical literature and evidence based support for CAI differential diagnosis training. As support increases for this type of training, medical school curricula are more likely to demonstrate influences of the education literature by implementing and increasing usage of training modalities such as this. For instance, technologies such as this could be implemented in the 3rd year to supplement student case load and ensure diagnostic competency in a practical application setting.[55] Due to the success of this learning modality at TCOM, the 2nd year curriculum has changed significantly to reflect the educational theory and technologies supported by KBIT. Since the development of the CAI tool represents applied theories in learning, increased support and utilization of it, like that seen with this study, demonstrates successful implementation of learning theory in medical education which may encourage other leaders in medical education to apply learning theory science to curricula.

The overwhelmingly positive response by students toward KBIT as a teaching tool and to the integration of OPP into differential diagnosis training lends further support for this intervention. The questionnaire demonstrated student support for KBIT as a useful learning modality due to its ability to integrate cases, provide practice and repetition, and show relative importance on signs/symptoms in choosing a diagnosis. As these specific attributes of KBIT were defined as contributing to student learning as well as specific suggestion for improvement, the CAI tool can be further modified and enhanced to better meet learning needs. With evidence of effectiveness and utility, learning modalities such as this can be further developed and utilized in differential

diagnosis training and medical curriculum. The questionnaire showed that integrated cases presented throughout the curriculum were considered needed and desired by the students. The utility and appreciation of the unique LBP KBIT module expressed by the students shows that it is possible as well as helpful to the students to integrate these concepts into differential diagnoses training. This supports previous work and efforts to fully integrate OPP into medical school curriculum as well as shows a new and innovative way in which integration is possible.

CHAPTER VII

CONCLUSIONS

In this study, the researcher sought to evaluate a computer assisted instruction tool developed through applied cognitive sciences on diagnostic competencies and perceived influences on student learning. More specifically, the new learning modality was used to integrate and teach uniquely osteopathic concepts. Overall, the computer-based tutor increased perceived student understanding, integration, and use of osteopathic principles and practices. The tool also showed trends toward increased diagnostic competencies. Improvements in the diagnostic capabilities of medical students early on during their training could lead to increased performance on both examinations and clinical applications such as utilization of OMM skills in clinical practice. This study is revealing concerning osteopathic medical education and helps to point out areas of further OMM research.

FUTURE DIRECTIONS

Future studies could expand on this study in many ways. The implication of increased diagnostic competencies can be evaluated further through serial testing of the subjects, correlating KBIT performance with course and board performance, and quantifying changes in practice patterns. Serial testing of the subjects could evaluate the retention of diagnostic skills related to different teaching strategies as well as monitor the

way in which diagnostic competency changes over time with added experiences. The implication of increased diagnostic competency could also be correlated with changes in practice patterns. For instance, diagnostic competency can be correlated to the amount and types of labs and imaging ordered, which are often used to find a diagnosis. Furthermore, the influence of an integrated learning tool could be correlated with subsequent attitudes and usage of OMT. To broaden the scope and generalizability of the study, additional studies could evaluate students from other osteopathic institutions and of varying levels of education. Since diagnostic competency is problem-specific disease-specific, addition studies should evaluate other clinical problems. Especially of interest, studies should evaluate problem areas that combine uniquely osteopathic concepts including both musculoskeletal complaints such as neck and arm pain and systemic complaints such abdominal pain which may have manifestations in the musculoskeletal system. To further understand the ways in which KBIT influences student learning the questionnaire can be expanded to evaluate the relative importance of specific aspects of KBIT on learning such large number of practice cases or individualized feedback. Studies such as this one that evaluate learning and attitudes influenced by instructional methods may describe "the interactive effect between the nature of the attitude toward osteopathic medicine and the instructional methods by which OPP are delivered."[7] Future research can also address how to effectively implement CAI into the curriculum such blending CAI with faculty instruction and deciding at what level in the educational process to use it. Research in the area of implemented educational strategies especially with respect to diagnostic competency promises to provide applicable insights into medical education.

SIGNIFICANCE

Though this study has certain limitations, the scope of this study represents an advancement of previous studies in the area of computer based differential diagnosis training. It addressed group comparison and student perceptions of the training program. More specifically, the study applied unfolding educational theories and technology to a unique aspect of osteopathic medical education. The potential benefits of integrated differential diagnosis training within the scope of osteopathic practices are increased awareness of osteopathic approaches to common problems and increased utilization of osteopathic principles and practices as the students recognize when and how to use them.

APPENDIX A:

ATTITUDES TOWARD OSTEOPATHIC PRINICPLES AND PRACTICES SURVEY

ATOPPS

Attitudes Toward Osteopathic Principles and Practices Survey (ATOPPS)

INFORMATION FOR RESPONDANT: Group _____

Please circle the number which best corresponds to your opinion toward the statements below.

SITUATION	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. I believe that the application of osteopathic principles is useful in medical practice.	1	2	3	4	5
2. Manipulation and OMT aren't real medicine.	1	2	3	4	5
3. Overall, I think that I would have been happier if I pursued my medical education at a MD school.	1	2	3	4	5
4. OMT will give me an advantage over MD's when it comes to patient care.	1	2	3	4	5
5. I intend to keep current about advances in OMT.	1	2	3	4	5
6. If things had gone my way, I would not have chosen to attend an osteopathic medical school.	1	2	3	4	5
7. I anticipate using my manipulative skills.	1	2	3	4	5
8. Attending OMM lectures and labs took away valuable time that could have been better spent studying for other classes.	1	2	3	4	5
9. I have a lot of respect for physicians who use OMT.	1	2	3	4	5
10. I think that manipulative medicine is a useful tool for a primary care physician.	1	2	3	4	5

11. Approaching the human body as a unified biological machine is helpful when it comes to understanding patient care issues.	1	2	3	4	5
12. I plan to apply osteopathic principles in my practice.	1	2	3	4	5
13. I'm convinced that exposure to osteopathic principles help medical students learn better patient care skills.	1	2	3	4	5
14. In all likelihood, after I graduate I won't ever use OMT in my daily practice.	1	2	3	4	5
15. I think that there exists a substantial scientific basis for osteopathic principles.	1	2	3	4	5
16. Looking for neuromuscular symptoms or somatic manifestations of disease can assist in forming a differential diagnosis.	1	2	3	4	5
17. I'm convinced that osteopathic principles distinguish D.O.'s form their M.D. counterparts.	1	2	3	4	5
18. Patients are more than the sum of their physical parts.	1	2	3	4	5
19. I'm sure I could learn new osteopathic techniques easily.	1	2	3	4	5
20. I knew that I probably wouldn't like learning OMT even before I started medical school.	1	2	3	4	5
21. It is helpful to have a "big picture" perspective of a patient's history when planning treatment.	1	2	3	4	5
22. In general, men have an advantage over women when it comes to performing OMT.	1	2	3	4	5
23. A certain body type is needed in order to perform OMT competently.	1	2	3	4	5

24. Students who enjoy and excel at OMM are strange.	1	2	3	4	5
25. I'm convinced that osteopathic practice distinguishes D.O.'s from their M.D. counterparts.	1	2	3	4	5

APPENDIX B:

PROTOTYPIC CASE EXAMPLES AND EXPLANATION OF THE LOW BACK PAIN KBIT MODULE

Prototypic Training Cases and Explanation of the Low Back Pain KBIT module

Low back pain has a variety of causes. For each of these causes, there are multiple signs and symptoms that may be present. In the first part of the KBIT session, students are introduced to an expert's opinion (Russell Gamber, a neuromuscular medicine specialist in the Department of Manipulative Medicine) as to the most likely signs and symptoms associated with each disease. In addition, Gamber's estimate of the frequency of these signs and symptoms is given. These data are provided below for two prototypic causes of low back pain (Psoas syndrome and degenerative joint disease), where numbers refer to the percent of patient likely to show the sign or symptom. These frequencies are then used by the computer to generate cases that have all (or only some) of the signs and symptoms.

Psoas Syndrome

S/S	Percent
Thomas test +	100
L1-2 RxSx	100
Tenderness in muscle bellies/origin and insertion	95
Sudden	90
Spastic/spasms	90
Worse with standing/sitting	90
Worse with lumbar extension	90
Unilateral low back pain	90
Guarded posture	90
Inability to stand erect	90
Tenderness to palpation	90
Decreased lumbar extension	90
Anterior TP 2 inches medial to ipsilateral ASIS	90
Worse with activity	80
moderate	70
Age > 50	60
Male	50

Degenerative Joint Disease

S/S	Percent
DJD	100
Osteophytes, narrowed joint space, dense subchondral bone	100
Gradual	90
dull/ache/throbbing	90
Constant	90
Improves with NSAIDS	90
Age > 50	80
Worse with activity	80
moderate	80
Enlarged joint surfaces, foraminal/central stenosis	80
Worse with lumbar extension	70
Diffuse regional pain	70
Crepitus	60
Decreased lumbar extension	60
Male	50

Once students have looked at these data, they are provided with prototypic examples of each of the diseases in a case study format. An example of a prototypic case for low back pain caused by degenerative joint disease is provided next.

HX: A 65 year old female complains of low back pain. The pain is gradual in onset, dull, constant and tolerable. The pain is not localized. The patient also notes lumbar spinal muscle tightness, diffuse regional pain, pain worse with activity/relieved with rest, pain worse with lumbar extension and pain improves with NSAIDS. Associated findings: degenerative joint disease and guarded posturing.

PE: Musculoskeletal findings include inability to stand erect, crepitus and decreased lumbar extension/backward bending.

LABS: None yet available.

RADIOLOGY: CT/MRI - enlarged joint surfaces foraminal/central stenosis and Osteophytes, narrowed joint space, dense subchondral bone.

EMG: None yet ordered.

Degenerative Joint Disease

S/S	Percent
DJD	100
Osteophytes, narrowed joint space, dense subchondral bone	100
Gradual	90
dull/ache/throbbing	90
Constant	90
Improves with NSAIDS	90
Age > 50	80
Worse with activity	80
moderate	80
Enlarged joint surfaces, foraminal/central stenosis	80
Worse with lumbar extension	70
Diffuse regional pain	70
Crepitus	60
Decreased lumbar extension	60
Male	50

Once students have looked at these data, they are provided with prototypic examples of each of the diseases in a case study format. An example of a prototypic case for low back pain caused by degenerative joint disease is provided next.

HX: A 65 year old female complains of low back pain. The pain is gradual in onset, dull, constant and tolerable. The pain is not localized. The patient also notes lumbar spinal muscle tightness, diffuse regional pain, pain worse with activity/relieved with rest, pain worse with lumbar extension and pain improves with NSAIDS. Associated findings: degenerative joint disease and guarded posturing.

PE: Musculoskeletal findings include inability to stand erect, crepitus and decreased lumbar extension/backward bending.

LABS: None yet available.

RADIOLOGY: CT/MRI - enlarged joint surfaces foraminal/central stenosis and Osteophytes, narrowed joint space, dense subchondral bone.

EMG: None yet ordered.

After training on prototypic cases, students are presented with variants of these cases, which is where there ability to perform differential diagnosis is honed. In this portion of the exercise, students receive feedback on the correctness of their decisions. For example, a student is presented with a case showing a set of signs and symptoms. The student perhaps selects as the problem spinal stenosis, when the data are most congruent with degenerative joint disease (DJD). The computer will show the signs and symptoms selected that are in fact reflective of spinal stenosis, but it will emphasize the additional signs and symptoms that should have been considered as demonstrating DJD. By this process, the student learns quickly how to attend to the patterns of signs and symptoms characteristic of each disease.

APPENDIX C:

LOW BACK PAIN KBIT QUESTIONNIARE

Low Back Pain KBIT Questionnaire

INSTRUCTIONS TO RESPONDENT
Please circle the number which best corresponds to your reaction to each statement below: i.e. do you strongly disagree, somewhat disagree, have no opinion, somewhat agree, or strongly agree with the statement.

SITUATION	Strongly Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Strongly Agree
1. The integration of the osteopathic differentials and exam findings into practice cases presented throughout all courses would give me an increased appreciation for osteopathic principles and practices.	1	2	3	4	5
2. The integration of the osteopathic differentials and exam findings into practice cases presented throughout all courses would give me a better understanding of how osteopathic principles and practices are used.	1	2	3	4	5
3. The integration of the osteopathic differentials and exam findings into practice cases presented throughout all courses would help me perform better on tests/boards.	1	2	3	4	5
4. The integration of the osteopathic differentials and exam findings into the practice cases presented throughout all courses would help me diagnose patients in a clinical setting.	1	2	3	4	5
5. What percentage of cases presented in systems courses included osteopathic diagnosis and exam findings?	0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100				
6. When considering the LBP KBIT module, the osteopathic differentials and exam findings added to the cases encouraged me to consider other sources or etiologies of disease.	1	2	3	4	5

7. When considering the LBP KBIT module, the osteopathic differentials and exam findings added to the cases better enabled me to determine the diagnosis.	1	2	3	4	5
8. When considering the LBP KBIT module, the inclusion of both traditional and osteopathic differentials and exam findings in the cases accurately represented the disease process in a clinical setting.	1	2	3	4	5
9. When considering the LBP KBIT module, the osteopathic differentials and exam findings changed the way I would approach treatment in the patient.	1	2	3	4	5
10. When considering the LBP KBIT module, the inclusion of both traditional and osteopathic differentials and exam findings in the cases made me view the patient more holistically.	1	2	3	4	5
11. In the LBP KBIT module, the inclusion of both traditional and osteopathic differentials and exam findings in the cases accurately represented cases found in questions on exams and boards.	1	2	3	4	5
12. The LBP KBIT module gave me a better understanding of how osteopathic principles and practices fit into the general practice of medicine.	1	2	3	4	5
13. The LBP KBIT module <u>does reinforce</u> the concepts taught in OMM courses.	1	2	3	4	5
14. The LBP KBIT module <u>would help</u> me perform better on OMM written and practical exams.	1	2	3	4	5
15. KBIT <u>does enable</u> me to more easily integrate OMM type signs/symptoms and diagnosis than traditional lectures/PTR sessions.	1	2	3	4	5

16. KBIT does enable me to more easily understand OMM type signs/symptoms and diagnosis than traditional lectures/PTR sessions.	1	2	3	4	5
17. Seeing a large number of cases with OMM signs/symptoms integrated into them helps to increase my skills in making a differential diagnosis.	1	2	3	4	5
18. This KBIT training module did help me understand the relative importance of OMM signs/symptoms in disease presentations.	1	2	3	4	5
19. The KBIT case feedback concerning differentiating the cases by signs/symptoms enhanced my understanding of the utility of those signs/symptoms.	1	2	3	4	5

Please give a short response to the following questions

What percentage of cases presented in systems courses included osteopathic diagnosis and exam findings?

What percentage of patients seen in your preceptorships has had complaints for which OMT could be used?

What would better serve your learning needs in KBIT as related to osteopathic principles and practices?

How has this Low Back Pain KBIT module influenced how you learn, organize, and approach uniquely osteopathic diagnoses?

Did the integration of osteopathic principle and practices into a KBIT module influence your understanding of concepts in OMM? NO ____ YES ____:
In what way did it influence your understanding?

Did the integration of osteopathic principle and practices into a KBIT module influence your use of OMM? NO ___ YES ____
In what way did it influence your thinking about using OMM?

APPENDIX D:

STUDENT RESPONSES FOR THE OPEN RESPONSE COMMENT TYPE

QUESTIONS ON THE LOW BACK PAIN KBIT QUESTIONNIARE

Student Responses for Open Response Comment Type Questions on the Low Back Pain KBIT Questionnaire

Question	Number of Responses	Responses
20. What would better serve your learning needs in KBIT as related to osteopathic principles and practices?	20	**1) more frequent exercises** **2) short explanations of the findings would help reinforce the material** **3) Nothing. I think this kbit exercise was one of the best I have encountered all year.** **4) Having KBITs to cover more topics. Also, change up the format slightly, maybe into more of a paragraph form. That is what we would see on boards, and with this format it would take more understanding to determine the diagnosis. It is too easy to look at certain sections first- such as kidney stones, or PSA..... which 95% of the time are correct and students do not have to look at any other aspect of the case.** **5) Don't flood the KBIT with 10 different diagnoses. It leaves me with a jumbled fustration instead of a clear association/motivation to try harder.** **6) All the systems should OMM KBITS.** **7) The KBIT is presented well; it is up to the students to take it more seriously. Perhaps more emphasis on the importance of the KBIT exercises would help. But since we know that we will learn the information in class as well, then we don't have to rely on this module of teaching as much.** **8) More treatment questions** **9) I thought that the KBIT was an excellent exercise for teaching OMM principals. My learning style is geared towards this type of teaching. I do not find the lectures presented to me at the PTR help me at all. I always have to go back and learn the material on my own at my pace. I feel that this is a disadvantage to me because I do not learn anything during these lectures in the PTR. I am too distracted by my friends and have basically seen this time as a chance to socialize with my classmates. For those students that learn well in this setting puts them at an advantage over students like myself who prefer the self learning style over lecture. I have no problem with having lectures, but do not force me to attend if I already know that I do not learn well in this setting. It is a waste of my time and puts me behind my classmates that are able to learn effectively in this lecture style manner. The KBITS are excellent teaching tools that I wish were always open to the students to utilize for study. They are excellent ways to test your knowledge at different times durning the course that I feel should be available. I think that giving students points for completing the KBIT by a certain time is good because it encourages students to stay up with the material and because it is an excellent way to prepare yourself for the following days lecture and makes that learning session with the professor the following day much more meaningful and valuable to the way I learn. Please continue to utilize this style teaching tool in the future for medical students.** **10) I like KBITs they help highlight the symptoms that differentiate disease processes that are similar.** **11) It would be good to have explanations and pictures.**

		12) It definitely helps reinforce certain concepts better than can be done with a single comment in one lecture. **13) The KBIT idea may be more influencial if there is more than one per every two years** **14) Incorporate both KBIT and PTR** **15) pictures?** **16) Just having OMM findings in cases helps to see how you can use OMM in obtaining a diagnosis.** **17) I dont see why we have to do this for LaPonna. Doesn't she need our consent to participate in her research project?????** **18) Can't think of anything** **19) Nothing** **20) More than just LBP**
21. How has this Low Back Pain KBIT module influenced how you learn, organize, and approach uniquely osteopathic diagnoses?	18	**1) The collection of disorders presented in the KBIT was very useful in distinguishing one diagnosis from another.** **2) This kbit allowed me to repeatedly see how to organize information in a manner that I can view and retrieve pertenant findings to make the proper diagnosis.** **3) Good to get me used to viewing osteopathic findings as part of the seach for a diagnosis instead of just a side-finding after I know the diagnosis.** **4) It is just good practice.** **5) I am more confident about the different OMM findings concerning low back and how each finding correlated to specific diseases or somatic dysfxns.** **6) I like traditional lecture better when first learning the material, but KBIT is good to practice my differential diagnosis using what I've already learned from lecture. KBIT is analogous to using practice questions to adequately prepare for an exam.** **7) Helped me focus the physical exam from the patient's history.** **8) It reinforced the typical findings that one would find in a "textbook" patient. I think that this is great in light of how we are tested as students during the course and on our boards. We TOTALLY understand that this is not how every patient is going to present, however, at this stage of our learning the typical, normal, textbook, buzz word, if this then that, standard, board style patient is what is of importance to us at this stage of our medical careers. It is all about doing well on exams!!! The clinical real life stuff will come later in the clinics and with experience. Remember, that there are many who will never utilize any OMM ideologies in their practice of medicine at all. So please teach us what we need to know for the test and most importantly the boards!!!** **9) It is helpful for memorization of clinical presentations, but not necessarily for understanding dz process or treatment** **10) Simply makes things clerar.** **11) I enjoy knowing what is most important (pathognomonic), and what is least important in leading to a ddx.** **12) It does not help, and I prefer the traditional ways.** **13) it helped me remember the specific symptoms that were always associated with a particular diagnosis. because when i got it wrong it was always for the same reason. so after 10 times it stuck with me.** **14) Please read the answer to the question before.** **15) It helped me to mentally group diseases and find major points of differentiation between the diseases based on best evidence based medicine.**

		16) It helped me see a different method of reasoning. **17) Definite algalrhythm type of thinking** **18) Beef up my differential**
22. Did the integration of osteopathic principles and practices into a KBIT module influence your understanding of concepts in OMM?		**Yes 70%** **No 30%**
23. In what way did it influence your understanding?	21	**1) helped me apply the concepts to a clinical setting** **2) It clarified why some treatments are used over others in certain disorders.** **3) It allowed me to see complete physcial exam findings for certain diagnosis that I would find on my own patients in the future.** **4) It was good to have cases where we actually had to decide on a diagnosis, rather than just be given a case and told the answer.** **5) I usually look at clinical cases (vignettes being all I see now)as either an OMM case or not. OMM would never cross my mind in any system classes or for board study. Yet it all should fit together, and this helped me see that they could.** **6) Repetition is helpful** **7) I realize that localized findings versus unlocalized can help narrow the differential. Also, how short legs can cause LBP and the signs and symptoms the patient would be experiencing. In addition, how someone may be complaining of pain in the right butt check and low back and hunched over more to the left, but it is the piriformis that is tight bec the patient has PSOAS syndrome. This could also cause the patient may have somewhat of a low back coronal curvature (scoliosis).** **8) Showed me the importance of a good physical exam** **9) It was so much easier to see and understand OMM concepts when integrated into the case presentation. A light bulb type of experience is what I had when going through the KBIT. I was like why the hell didn't they present it to us like this before?! It was so much easier to see it this way instead of talking about a disease process and then jumping into what seems to be emphasized the most which is the treatment part. So we just blow off the case presentation and just think, "OK if I hear Psoas as the diagnosis then I will use this technique to treat." But this does nothing for our ability to diagnose the ailment. The KBIT was the difference that combined the two and helped to organize my thinking on how to treat and diagnose.** **10) just helped to learn to intergrate osteopathic differential with clinical diagnosis** **11) Just helped point out the physical findings associated with particular disease processes.** **12) expanded the differential** **13) see above** **14) relationships** **15) it stressed important symptoms (but cannot teach techiques)**

		16)NOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO **17) It allowed me to read over more cases which helped me understand the various ways a patient can present with a given disease.** **18) Numerous repetitions through case scenarios helped me to see the distinctive features of each diagnosis in the differential** **19) It was just the first time we had to make diagnoses from a purely OMM point of view.** **20) None** **21) solidify course concepts**
24. Did the integration of osteopathic principles and practices into a KBIT module influence your use of OMM?		**Yes No** **49% 51%**
25. In what way did it influence your thinking about using OMM?	16	**1) It reinforced the ability to OMM to aid in healing.** **2) No, but I am already a big fan of OMM.** **3) Now, I realize that low back findings not only tell you that the patient has low back dysfxn, but that it can actually help me narrow down the differential.** **4) Introduced problems that can be addressed by OMM which I originally thought was not treateable by OMM.** **5) As answered in the above question... "It was so much easier to see and understand OMM concepts when integrated into the case presentation. A light bulb type of experience is what I had when going through the KBIT. I was like why the hell didn't they present it to us like this before?! It was so much easier to see it this way instead of talking about a disease process and then jumping into what seems to be emphasized the most which is the treatment part. So we just blow off the case presentation and just think, "OK if I hear Psoas as the diagnosis then I will use this technique to treat." But this does nothing for our ability to diagnose the ailment. The KBIT was the difference that combined the two and helped to organize my thinking on how to treat and diagnose."** **6) it showed that it is very easy to integrate OMM into everyday practice** **7) I already plan on incorporating omm into my practice of medicine.** **8) thinking of somatic dysfunction as a differential** **9) relationships** **10) It made me more aware of the problems related to a few disease states that I never knew could be helped by manipulative medicine.** **11) It drew my attention to the fact that the only time anyone mentions osteopathy or related topics is in OMM. It would be a shame to graduate a bunch of DO's who don't practice osteopathic medicine. This is further a concern when you think about how practicals don't influence grades in OMM, so people spend their time on things that affect their grades, which is not OMM techniques. If we want TCOM graduates to use OMM, we need to integrate it into the systems courses and make OMM practicals count for a grade!** **12)NOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOOO** **13) This is where the KBITs are interesting. While KBITs help a student to understand the pathological features of a certain diagnosis, there is still**

		a tremendous need for the patient to actually touch a person and to train in the PTR in order to cement what is written down on paper. **14) I think the case based training demands the student to simulate a patient encounter, and think through how they would try to help the patient with OMT** **15) It didn't. I am supportive of using OMM anyway.** **16) Affirmed my desire to use it**

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