2020

Examination of student learning outcomes during a musculoskeletal spine assessment course: hybrid blended model versus traditional classroom delivery in a doctor of physical therapy program

David J. Denton
drdenton33@yahoo.com

EXAMINATION OF STUDENT LEARNING OUTCOMES DURING A MUSCULOSKELETAL SPINE ASSESSMENT COURSE: HYBRID BLENDED MODEL VERSUS TRADITIONAL CLASSROOM DELIVERY IN A DOCTOR OF PHYSICAL THERAPY PROGRAM

A dissertation submitted to
the Graduate College of Marshall University
In partial fulfillment of
the requirements for the degree of
Doctor of Education
In
Leadership Studies
by
David J. Denton
Approved by
Dr. Dennis M. Anderson, Committee Chairperson
Dr. Charles Bethel
Dr. Edna Meisel

Marshall University
December 2020

APPROVAL OF DISSERTATION

We, the faculty supervising the work of David J. Denton , affirm that the dissertation, Examination of Student Learning Outcomes During A Musculoskeletal Spine Assessment Course: Hybrid Blended Model Versus Traditional Classroom Delivery in a Doctor of Physical Therapy Program meets the high academic standards for original scholarship and creative work established by the EdD Program in **Leadership Studies** and the College of Education and Professional Development. This work also conforms to the editorial standards of our discipline and the Graduate College of Marshall University. With our signatures, we approve the manuscript for publication.

Dennis M. Anderson	Dennis Anderson Dennis Anderson (Nov 13, 2020 10:15 EST)	11/13/2020
Leadership Studies	Committee Chairperson Major	Date
Charles Bethel	Charles Bethel Charles Bethel (Nov 13, 2020 10:18 EST)	11/13/2020
Leadership Studies	Committee Member Major	Date
Edna Meisel	Edna Meisel Edna Meisel (Nov 13, 2020 11:03 EST)	11/13/2020
	Committee Member External	Date

DEDICATION

I dedicate this dissertation to my father David Denton. Dad, without your advice, discipline, and supportive example I would not be in the position that I am in today; thank you for all you have taught me and for always being there for me when I needed you.

ACKNOWLEDGEMENTS

I am deeply grateful to my major advisor and dissertation committee chair, Dr. Dennis Anderson, for his honesty, guidance, and belief in me. I valued, respected, and took to heart all the suggestions and challenges which ultimately made my research questions and paper better. To the members of my committee, Dr. Charles Bethel and Dr. Edna Meisel, thank you for your insightful comments, immense and appreciated work with SPSS statistics, suggested edits, statistical guidance, and belief in my topic. To my wife (Lisa), son (Crew), and baby daughter (Jovie), I will always be grateful for your support through challenging times including a new career, new home, new baby, days gone on travel, and a pandemic. Without wanting a better life and more for all of us, I would not have been able to make it through this program. Finally, to my family, dissertation committee, friend/boss and program chair (Dr. Kerry Volansky), colleague who helped me with instruments in this study (Dr. David Griswold), and faculty at Marshall University, this quote is dedicated to all the support, belief in me, and persistence to reach the end.

"Going in one more round when you don't think you can. That's what makes all the difference in your life."

-Rocky Balboa

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

This study explored content delivery comparisons concerning a hybrid blended model versus a traditional lecture model in a Doctor of Physical Therapy Program. There is a gap in the physical therapy literature describing the intricacies of distance, online, and hybrid models used in doctoral education. Thirty students were randomly selected out of a hat to be placed into one of two groups with an n=15. The course chosen in the study was a clinical decision-making segment based on assessment and examination of level of the spine. Group 1 was instructed only using traditional methods of live in person lecture and live in person demonstration of skills competencies. Group 2 was taught using hybrid blended model delivery of course content and video demonstration of all skills competencies. Research questions were answered for significance and correlation using statistical methods of an Independent Samples t-test, Chi-Square statistic, and use of descriptive statistics data. Findings indicated that TCM and HBM groups did not significantly differ in their responses to the individual perception of satisfaction questions or in the multiple choice-test scores. However, findings suggest that the mean of Items Correct on the 8-item competency skills check-off was significantly different between the TCM and HBM categories of Group, with the HBM group scoring slightly better upon the scoring than the TCM group did. The information generated by this study may facilitate growth in health education programs that aim to expand the ability of students to attend school and increase future employment and education of those individuals in rural areas, as well as foster new interpretations of the effectiveness and perceptions of hybrid/blended learning in the current COVID-19 pandemic and social distancing culture.

CHAPTER 1: INTRODUCTION

Hybrid/blended models of education have made their way into graduate programs and, specifically for this study, into Doctor of Physical Therapy programs. Research supports the use of teaching methodologies that foster critical thinking that transcends the delivery approaches of multiple health profession fields (Veneri & Gannotti, 2014). The demand for hybrid/blended learning has increased through contemporary uses including advances in technology, increased broadband, and accessibility for a larger audience (Potter, 2015). A hybrid education approach is a model where 30–79% of the course content is delivered through utilization of various internet technologies (Mu, Coppard, Bracciano, & Bradberry, 2014). In hybrid course delivery, there is a mixture of online portions, face-to-face portions, synchronous sessions, and discussion board interaction. The blended learning approach is an innovative and progressive method of teaching that merges the best aspects of online distance education (synchronous sessions online), with "bricks and mortar" classroom methods. Like all methods, it offers both numerous positives and has its own challenges that will be considered. Nevertheless, the model boasts optimal student engagement, allows greater learner flexibility, eliminates geographical barriers, improves convenience, and fosters learning based on collaborative critical thinking (Potter, 2015). In a hybrid Doctor of Physical Therapy program model, students still attend regular live onsite lab immersions and undergo rigorous skills/competency practical exams.

Background

There is a gap in the physical therapy (PT) literature that describes the intricacies of distance, online, and hybrid/blended models used in doctoral education. Contemporary sophistication in computer assisted learning has advanced both traditional classroom teaching and online methods respectively. These additional education approaches are not geared toward

replacing the traditional classroom. The main advantage of hybrid education is the opportunity and accessibility it provides to students of many diverse circumstances. A 2009 study conducted by the U.S. Department of Education concluded that courses that deliver content using internet technology are among the fastest growing enrollment sections in higher education. It was also referenced that hybrid courses deliver approximately 30-79% of the content with computerized learning technology, leaving face to face and discussion forums making up the majority of the other classroom interaction (Mu, et al., 2014). It is anticipated that the outcomes of hybrid PT programs will not only provide students who live in rural, underserved areas the opportunity to attend graduate school, but also transform them into graduated self-directed learners. Hybrid PT programs will also provide avenues for those with an inability to relocate to attend school. The hybrid programs include synchronous methods, video projects, discussion boards, and a calendar of live lab immersions per semester where students travel to campus and meet face-to-face. Rather than daily in-person classes on campus during the semester, students travel to the designated in-person labs usually six times per year for periods of five to ten days. Research also shows that hybrid education has shown positive outcomes in optimizing student engagement since it takes the strengths of face-to-face and marries that with online supplementary material. The ability of student conversation, critical thinking, and instructor interaction remains a priority of the course delivery (Mu, et al., 2014). In a true hybrid model, content and lecture material will be learned virtually both synchronously and asynchronously, utilizing many forms of technology, live video conferences, and learning management system (LMS) capabilities. The students also still attend live in-person class and lab meetings varying in number of days and frequencies ranging quarterly to monthly depending on the program during each semester (Potter, 2015). This philosophy for the field of physical therapy resonates with the professional

organization of practice, the American Physical Therapy Association (APTA). In academia, programs are embracing the APTA vision of which, goal 13 of the APTA Education Strategic Plan reads, "collaborate with others to develop customized software/hardware applications and medical simulations to enhance on-site and distance education (Veneri, 2010).

Statement of Problem

While blended and hybrid education cannot replace traditional face-to-face programs, the model can serve as a route to diversify and expand the field of PT practice. As accreditation commission's criteria has focused on expanded curricula for the doctoral degree and emphasis being placed higher on direct access to physical therapists, educational methods continue to need evolved and grown more innovative to keep up with practice in the field. With the assistance of computers, videos, and student engagement learning platforms, students and programs now have capabilities to expand the way our future professionals critically think. The main goal of hybrid education versus online content or distance education is to optimize student engagement by adapting the best theories from face-to face, online environments, and leveraging technology to bolster synchronous collaboration and discussion. An array of numerous teaching philosophies will apply to a variety of learners and expose a multi-modal approach to content delivery. (Mu, Coppard, et al., 2014). The decision regarding the amount of online instruction versus classroom instruction percentage is at the discretion of the instructor/program director and is highly dependent on the course content. However, hybrid courses typically require students to meet face-to-face approximately 50% of the time and to utilize a learning management system, such as Blackboard or Canvas, for the organization and delivery of the course requirements. The hybrid model allows working professionals or busy graduate students an opportunity to reduce their in-class time yet maintain an effective amount of contact with faculty and peers. The model is

thought to be one of the most effective new education strategies, as it can capture the best aspects of online and face-to-face classroom instruction (Skill & Young, 2002) and employs numerous positive attributes in a student's overall education. Duijn, Swanick, and Donald (2014) reference that the cumulative effect of using both modes of instruction are apparent in student learning of these advanced psychomotor skills. Online video can be a relatively time-efficient instructional method to enhance traditional classroom experiences. Furthermore, Hyland, Pinto-Zipp, Olson, and Lichtman (2010) indicate that learning style is not a predictor or factor in a PT student's ability to perform in the final exam or to pass the course. Online video and hybrid learning principles are especially beneficial in situations in which traditional instruction is not possible due to geographic or economic reasons (Duijn, et al., 2014). Hybrid culture in education is "not an attempt to neatly bridge the gap" but to evolve, transform, and transgress traditional boundaries and dichotomies in higher education. Hybrid education asks and poses questions that cause reflection on the reasons for, value in, and purpose of the dividing lines versus our normal managerialism and standardization in common programs (Köppe, Nørgård, & Pedersen, 2017).

Purpose

The purpose of this study, "Examination of student learning outcomes during a musculoskeletal spine assessment course: Hybrid Blended Model versus Traditional Classroom Delivery in a Doctor of Physical Therapy Program" will allow for comparison of student learning outcomes between two lecture format delivery models.

Research Questions

The following research questions will guide the direction of this study:

1. Are there significant differences between perceptions of participant survey responses regarding student satisfaction in the traditional versus hybrid course module delivery?

2. Is there a significant difference between participant scores from the multiple-choice test for musculoskeletal content for participants in the traditional versus hybrid course module delivery?
3. Is there a significant difference between participant scores from the skills competency test for participants in the traditional versus hybrid course module delivery?

Significance

This study will contribute to the pedagogical knowledge in the field of PT education by determining whether there are significant differences as a result of course format (hybrid/blended versus traditional) on the results that the study methods produce. The study will facilitate growth in health education programs that aim to expand the ability of students to attend school and increase future employment and education of those individuals in rural areas, as well as foster new interpretations of the effectiveness and perceptions of hybrid/blended learning.

The literature review revealed that there is a gap in published work that describes online teaching and learning within the PT profession and the preferred methods of online technologies. The outcomes of this research will provide a summary of the differences between a traditional face-to-face format and a hybrid/blended learning format in a graduate program. The information from this research will also benefit developing PT programs currently going through the Commission on Accreditation in Physical Therapy Education (CAPTE) process, assist faculty in assessing data from satisfaction survey outcomes, and serve as a comparison for future interested schools to evaluate the hybrid approach versus other lecture delivery methods.

The study is designed to identify characteristics of hybrid/blended course delivery regarding the convenience of learning and the possibility of improving student satisfaction by

reducing commute time, allowing flexibility of learning, and promoting a better work-life balance.

Definition of Terms

The following definitions will be used in this study.

American Physical Therapy Association (APTA). A U.S.-based individual non-profit professional organization representing more than 100,000 members including physical therapists, physical therapist assistants, and students of PT.

Asynchronous online class. An online class with no real time meetings and all requirements completed online.

Distance education. A class offered outside the traditional higher education format. This may include classes delivered at off-site locations, satellites, non-traditional formats, or internet-based courses.

Doctor of Physical Therapy (DPT). In the U.S., this is an entry-level professional degree. A DPT is a practitioner who is educated in many areas of rehabilitation.

Hybrid methods (HBM). A class that utilizes face-to-face meetings, online components, and other various current technology platforms to deliver course content. Typically, these courses range from 30–80% of content delivered online, with the remainder being face-to-face or synchronous.

Physical therapy. Also known as **physiotherapy**, PT is one of the allied health professions that, by using evidence-based kinesiology, electrotherapy, shockwave modality, exercise prescription, joint mobilization and health education, treats conditions such as chronic or acute pain, soft tissue injuries, cartilage damage, arthritis, gait disorders and physical impairments typically of musculoskeletal, cardiopulmonary, neurological and endocrinological

origins. Physical therapy is used to improve a patient's physical functions through physical examination, diagnosis, prognosis, physical intervention, rehabilitation and patient education.

Synchronous online class. A course that utilizes real time virtual or video meetings online in place of face-to-face traditional classroom learning.

Traditional classroom model. A class that meets entirely face-to-face in a classroom with no online requirements.

Limitations

This study is focused on a Doctor of Physical Therapy program in West Virginia. While it could provide valuable information for faculty and administrators at other higher education institutions, it may be difficult to generalize the findings to other regions of the country or to other healthcare fields of study. To be consistent with the dimensions of non-experimental research, this study will use a sample of convenience.

The first limitation to be noted is that a non-experimental research study does not provide any allowance for the random assignment to groups for manipulation or for the manipulation of independent variables (Johnson & Christensen, 2000), as is the case with this study. The results will be limited to the environment in which the study is conducted, utilizing second-year students in the program cohort, rather than being generalizable to the larger population of DPT educators or students. While the researcher's own professional experience as a DPT faculty member may constitute a source of empathy and provide an experiential background that enhances effectiveness in interpreting results, it may also be viewed as a limitation in that it is a potential source of bias.

Other limitations include the participants' willingness, accuracy of response, and time needed to complete the survey. The student survey and the quantitative quiz scores will vary

depending on the allotted time and the content covered in this second year of the DPT program. In addition, the number of students participating will be below 50, which is also a limitation of the study. Students who do not wish to participate or who do not complete the survey could possibly offer information that would change the outcome of the study.

Methods

The design of this study is a voluntary randomized experimental design using quantitative methods. The study will be a sample of convenience. Approval for this study will be obtained from Marshall University's Human Subjects Committee. Thirty students were randomly selected out of a hat to be placed into one of two groups with an n=15. Students additionally were notified that the study was voluntary and were given the chance to assent to participation in the study or elect to opt-out. For subject anonymity, the faculty instructor from the university privatized all information gathered from the subjects onto a secured password protected computer drive.

The course chosen in the study was a clinical decision-making segment based on assessment and examination of level of the spine. This course was preceded by basic foundational sciences, human anatomy, and prior clinical decision-making modules. The objectives and content were the same for both groups of students. Group 1 was instructed only using traditional methods of live in person lecture and live in person demonstration of skills competencies. Group 2 was taught using hybrid blended model delivery of course content and video demonstration of all skills competencies. Both groups consisted of similar demographics and participant size.

Data collection on learning outcomes will include quantitative scores from a 20-item written exam, eight item lab skills check, and scores from a 25 - item validated Student

Satisfaction Questionnaire. Permission to utilize, adapt, and edit the questionnaire was written from the author of the survey to the researcher.

Data analysis involved the utilization of the Statistical Package for Statistical Sciences (SPSS) to analyze each research question. Each of the research questions was answered for significance and correlation using statistical methods of an Independent Samples t-test, Chi-Square statistic, non-parametric tests (Mann-Whitney and Kruskal-Wallis), and use of descriptive statistics data and outcomes.

Summary

In summary, current higher education graduate programs, including some DPT programs, have evolved from traditional face-to-face instruction of course and lab content to various hybrid/blended deliveries. As technology has advanced, so have the teaching methods, largely aided by computer-assisted technology. Faculty and students have learned how to navigate learning management systems, online scholarly resources, email, publicly available streaming media, online surveys, and online asynchronous discussions.

Most of the recent research reveals that student performance with the use of hybrid/blended instruction is comparable to face-to-face instruction (Adams, 2013). One caveat is included in the study by Green, Whitburn, Zacharias, Byrne, & Hughes, D. (2017), which found that the quality of the online course instruction matters, as "student learning outcomes in a blended anatomy course can be predicted by level of engagement with online content." Cadaver anatomy courses serve as a basis and foundation of knowledge in PT school. Green, & Whitburn, (2016) found that "blended learning appears to be well-suited to gross anatomy teaching on the proviso that face-to-face practical classes are maintained but may result in higher perceived workloads." Although there is some variation in delivery, curriculum, and program length,

research has been favorable with regard to hybrid/blended formats, with results indicating support for interactions and relationships in the clinical environment (Coe Regan, & Youn, 2008).

Although there are numerous instructional methods used to teach hands-on skills in an online environment, there is a lack of published work that describes hybrid/blended outcomes of coursework in a DPT program that can support the current technological climate and needs of PT students.

CHAPTER 2: REVIEW OF LITERATURE

Physical Therapy (PT) practice and the teaching methods utilized in PT education are constantly evolving. Thus, the purpose of this study is to compare student learning outcomes between two lecture format delivery models during a Doctor of Physical Therapy program musculoskeletal spine examination class. Late in the 20th century, as is consistent with many other graduate programs, the principles of passing on knowledge were primarily accomplished through the use of textbook reading, notetaking during traditional lectures, and observation of live demonstrations. As technology advanced, some introduced the utilization of projector slides, the use of film reels, and the early implementation of computer-assisted learning (Duijn, et al., 2014). With the advancement of computerized technology, the ability to save information and text in various formats and, currently, the use of video, students can now access course content at their convenience. One recent study examined the effectiveness of video podcasts in an online orthopedic course format. The study, by Greenberger and Dispensa (2015), concludes that a live demonstration of skills and techniques is comparable to video podcasts for teaching orthopedic "hands-on" skills. However, these advances and technology innovations have also presented challenges for students wanting to gain a high-quality, cost-effective education. These challenges have inspired educators to find alternative approaches to teach the contemporary student (Boucher, Robertson, Wainner, & Sanders, 2013). Events such as legislation from accreditation bodies, pandemics, and financial aid changes have placed challenges on programs and schools to attract and retain students.

The current landscape of higher education is changing due to the overhaul of application processes and procedure legislation. Institutions are under pressure to attract students in a competitive admissions market and will continue to allow students more freedom of choice as admissions standards continue to change. With the opportunity of expanded air travel and the

availability of online content programming and video platforms, students who face traditional barriers, such as living in rural areas or with a restrictive personal situation, now have increased opportunities to obtain an education. The effect of these advancements has affected PT education as well. These technological and travel advancements have fostered flexibility in both the teacher and learner: location of learning is no longer the limitation it once was. Within the PT profession, one study found that the majority of PT programs reported the use of some form of computer-assisted learning, regardless of whether the program was traditional or had online components (Baumgartner, 2012). These advancements in technology and delivery method of material has been evolving through numerous programs, degrees, and recently is being adapted to graduate level health professions.

This chapter will discuss the various models of hybrid education theory, explore effectiveness, as well as a historical background of the model. After the review of hybrid theory, the satisfaction, perceptions, and outcomes will be examined. The hybrid model will lastly be referenced through literature against other models of content delivery, such as a traditional classroom approach.

The advancements and growth in educational content delivery methods have also affected programs outside the health science and medical fields as well. In a study by Sciarappa, Quinn, & Ward (2016), current challenges presented within a horticulture program while adapting a distance education component. The addition of a distance education component was to ensure time friendly learning, reasonable expense, cultivating technical skills, and maintaining a quality curriculum. Sciarappa et al. (2016) wanted to analyze outcomes in an "Organic Farming and Gardening" course through their study titled, "Comparing Conventional, Hybrid, and Distance Learning Courses in Horticulture." The goals for the study were to reach diverse

audiences in hopes of program growth, foster educational relevance, and create some options for programs limited by physical space availability. The study methods involved modified learning objectives which were compared to the conventional course. The course objective changes were geared at including online instruction and technology in organic farming and gardening classes. The distance learning option was now able to foster utilization of advanced objectives. The new objectives encouraged creative thinking during agricultural problem solving within various field applications and sparked effective communication of complex concepts (Sciarappa et al.). Digital delivery methods incorporated video modules recorded from past conventional sessions. Hybrid and entirely online formats were crafted through E-College templates for two different sections in a two-credit course titled ‘‘Organic Farming and Gardening.” The hybrid courses had seven live, double-period sessions (2.5 h each) and seven online learning modules compared to the online courses which totaled 21 learning modules online (Sciarappa et al.). Course workload, assignments, evaluation rubrics, and grading categories were structurally consistent in both formats. Internet searches for reliable sources of evidence including journals, websites, and publications were used in place of textbooks. In addition, the e-College platform included posts of videos, readings, and books in horticulture made available for class assignments. Other components of the courses included independent experiments that could be visits to a farm, garden, agriculture operation, or greenhouse site. During execution of the individual experiments, students were permitted to work hands-on with members of the hybrid course session during greenhouse projects that studied the effect of five organic fertilizers on growth of vegetables. Attendance and verification of students at the project site was through camera image evidence embedded into PowerPoint. After all assignments, projects, and objectives for each class were completed, the final grades were tabulated by the e-College system and analyzed

using analysis of variance (ANOVA). Interaction of yearly class format was assessed via the MIXED procedure tool within SAS analytic and used to fit a two-way ANOVA that assessed yearly data, including satisfaction and instructor performance on class formats (Sciarappa et al.). Grading standards for both groups were comprised and assessed in 3-year spans including: written report grades; individual projects; extra credit; open-ended questions; chat rooms; and measures of in-class or online participation (Sciarappa et al.). Time of student engagement, which counted for 30% of the grade was also tracked and recorded within the e-College system. Results of the study involving a sophomore level course entitled ‘‘Organic Farming and Gardening,’’ included 114 undergraduate students registered from years 2007 to 2009 (Sciarappa et al.). The study was brought to fruition secondary to a high demand for classroom space which lead to shortages in available areas to hold class on campus. The numbers included 361 students registered from years 2010 to 2012 and 336 students from 2013 to 2015. The conventional instruction course was compared to a hybrid and fully online version. Overall, 811 students were observed during the 9-year period, finding few significant differences in final grades involving the 811 students. Examination of final class grades from 2010 to 2012 over all formats ranged from 85.5% to 89.6% (Sciarappa et al.). Including the years of 2013 to 2015, the timeframe rolled up final class averages in all three formats at 89.6%. Regarding the component of student evaluation surveys, faculty performance was measured through eight questions on a five-point Likert scale. From the years 2012 to 2014, no significant difference existed between teaching in person vs. remotely. Roll-up of an additional eight questions looking at methodology, technology, student confidence, and class satisfaction resulted in 4.35 for the hybrid and 4.17 for the online sections (Sciarappa et al.). Student responses indicated a significant preference for hybrid and online course formats compared with conventional methods. Overall conclusions by

the authors noted that both the hybrid and totally online course formats were found to be improved approaches over a conventional format in terms of class numbers, scheduling, student satisfaction, time-shifting flexibility, travel time savings, and efficient use of university classroom facilities (Sciarappa et al.). This study within a horticulture program concluded that the students involved "can benefit with a wider choice of both hybrid and totally online classes by integrating online systems, digital devices, and independent study projects stressing student centered, faculty guided instruction" (Sciarappa et al.).

Regarding graduate programs such as a Doctor of Physical Therapy, how do these concepts apply to adult learners? Christine Stevens (2016) has a paper published entitled "Hybrid Program Design: What Works for Adult Learners in a Professional Degree Program?" Similar issues to physical therapy school were discussed that affected working adults with aspirations of going back to school, but face life challenges and complicating circumstances. Colleges are trying to find ways to supplement their financial revenues in a competitive marketplace that offer non-traditional programs which allow scheduling freedom, ability to continue working, individuals with families with more scheduling flexibility, allowing adult learners to manage multiple work, family, and other obligations while attending school (Stevens, 2016). Advancements in technology, learning management platforms, and apps are avenues to foster the flexible curriculum, adult friendly programs, while upholding the main benefits in traditional classroom instruction (Stevens, 2016). The hybrid blended model can bridge the gap between ensuring flexibility and utilizing video platforms to maintain face-to-face communication. Stevens (2016) goes on to describe the task of teaching adults in professional degrees through the research question, "How do adult learners in a professional studies degree program delivered in a hybrid format describe their academic experience?" The study was a multiphase qualitative study

that probed the adult learner experience while enrolled in a hybrid master's degree program at a private college (Stevens, 2016). There were three phases of the study which included: phase one - observation of (*N=2)* classes apprized subsequent phases for data collection; phase two - collection and exploration of program documentation (*N*=20); phase three - in-depth interviews (*N=6)* along with dyadic interviews (*N=3)* with adult learners in the program; and phase four concluded data collection through completion of reflective questionnaires (*N*=11) with the same sample. Results through qualitative data analysis were seen including: choice of a hybrid program; design and delivery of hybrid program; management of school/life/work; student learning; online learning communication approaches; and utilization and importance of technology (Stevens, 2016). The relevance of this study is the data that can be provided to similar adult hybrid courses and programs. Applications can be taken from the study to advance existing distance education programs, evolve existing hybrid courses, and guide marketability and attractiveness of hybrid programs (Stevens, 2016). This study gave a glimpse of the experience in hybrid education that adults undergo. These findings can be valuable and translatable to what the adults enrolled in contemporary hybrid models of Doctor of Physical Therapy programs encounter.

Recently, a new model of education has guided a contemporary learning strategy and has found its way into allied health professions. A true hybrid approach to teaching involves blending of face-to-face and online learning, in which the ratio varies depending on the curriculum, program length, and degree specificities (Potter, 2015). Hybrid education offers many advantages, including flexibility, allowing busy professionals or graduate students to reduce traditional live class time and yet foster, in some cases, added peer contact and discussion. These new hybrid graduate programs appeal to students who have families, have jobs

that restrict relocation, and benefit students that live in more rural areas of the country that do not have schools with their program of interest nearby. The hybrid option can apply to and differ between numerous environments and degree types. Thus, it is an excellent option that is familiar with technological advancement, even though there is no "one size fits all" approach for optimizing learning outcomes (Milanese, Grimmer-Somers, Souvlis, Innes-Walker, & Chipchase, 2014).

Veneri (2010) published a systematic review that examined the role and effectiveness of computer-assisted learning in PT education. The literature search included studies that reported a 30% return on survey responses with a minimum sample size of 50 replies (Veneri, 2010). Overall, 23 studies were reviewed, of which six addressed the frequency and use of computer-assisted learning, and 17 examined the effectiveness of online learning in PT education. The results of the six studies revealed that the early use of computer-assisted learning when teaching human anatomy resulted in reduced cost due to needing fewer cadavers, ease of specimen maintenance cost, and decreased annual storage cost of cadavers (Veneri, 2010). The most common mode of instruction was CD-ROMs in the form of optional tutorials to help supplement traditional in-person instruction, and two studies reported an even higher score for computer-assisted learning (CAL) versus traditional learning (Veneri, 2010). Finally, two of the 17 studies addressed retention, with both reporting higher retention with CAL than traditional learning. Educators' personal opinions expressed value regarding the use of computer-assisted technology, but the number of instances and frequency of use remained low (Veneri, 2010). One other positive finding in one of the studies was that CAL and live demonstrations were more effective than textbook learning regarding psychomotor skills and overall retention. Due to the small number of studies included in the systematic review, the author recommends that future studies

revolve around larger studies and broader applications, in addition to the use of simulation activities to avoid classroom redundancy (Veneri, 2010).

A study by Iwata and Doi (2017) examined whether hybrid education activities for team- and problem-based learning programs were effective for Japanese medical students. Their Hybrid Educational Activities of Team Based Learning and Problem Based Learning (HEATAPP) were provided to fourth-year medical students. The teams consisted of six students each, and each team reviewed one case per day for five days. The overall results and conclusions included that hybrid learning was effective in active learning, group discussion, and developing a hypothesis and questions relevant to a medical case.

Duijn et al. (2014) compared two randomly selected groups of students using either online video instruction or face-to-face instruction in a course designed to teach cervical spine evaluation follow-up treatment approaches. Course video content was posted into the Angel Learning Management System (ALMS). Group A students attained examination content skills via the ALMS, and then the complement of intervention skills via a face-to face laboratory approach. Group B used the face-to-face laboratory instruction for the examination skills and then course video content through the ALMS for the intervention skills. To limit any bias and variability, the creation of the videos and the laboratory components were taught consistently by the same instructor. This study determined that there was equivalent student performance regardless of whether video or face-to-face instruction was elected to deliver the orthopedic lab skills.

A similar study by Duijn and Bevins (2005) examined the relationship between the clinical performances of PT students in problem-based, mixed-model, and traditional curricula. Data were examined using statistical methods (ANOVA) to examine scores on the mid-term

Clinical Performance Instrument (CPI). The study did not find any statistically significant difference among grades on the CPI involving professional behaviors, clinical problem-solving, or clinical skill.

Literature has shown promising results regarding effectiveness of the hybrid model versus more traditionally accepted approaches in education. The next section will address a historical background on the early uses of hybrid and blended education theory. A look into the growth, popularity, and adaptation into the field of graduate school physical therapy will be discussed.

Mącznik, Ribeiro, and Baxter, (2015) completed a systematic literature review researching the prevalence of studies related to teaching PT using online delivery. Twenty-two studies were found by primarily searching the following databases: ERIC, CIHAHL, Web of Science, Academic Search Complete, ProQuest Nursing and Allied Health Source, Medline, Embase, and Scopus. The results analysis gathered data from 14 case studies, three controlled trials, and five randomized controlled trials. The study found numerous levels of education among the licensed physical therapists. Figure 1, below, serves as reference for the technologies used, the subject matter, and the authors.

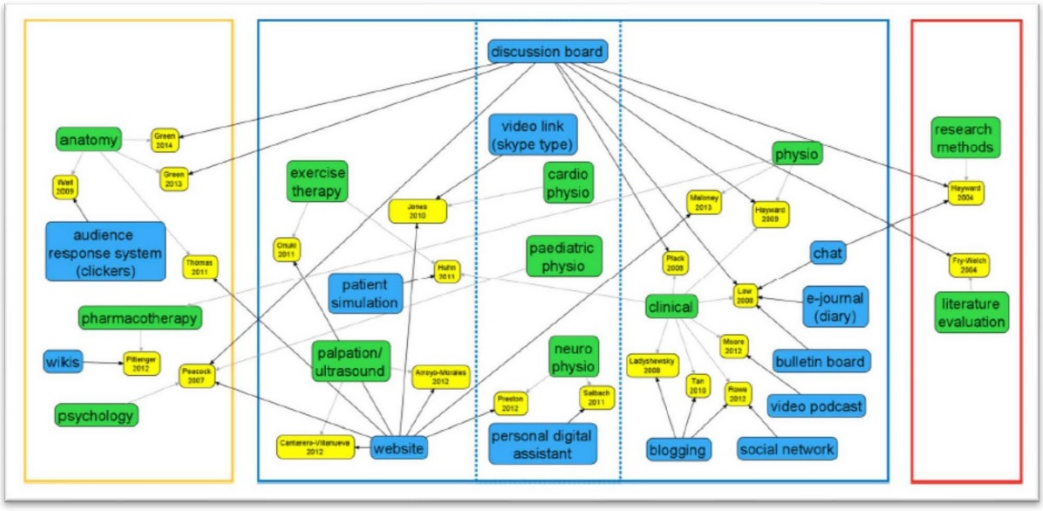


Figure 1

Map of Technologies Used in Physical Therapy (2015).

Adapted from "Online Teaching in Physiotherapy Teaching and Learning: A Systematic Review of Effectiveness and Users' Perceptions," by Mącznik, Ribeiro, & Baxter (2015, September 28).

Retrieved from https://link.springer.com/article/10.1186/s12909-015-0429-8

Colors/Symbols and Definitions:

Green – subject matter within PT

Blue – technologies used.

Yellow – supportive literature.

Arrows denote the relationship between subject matter, technologies used, and authors.

The results reveal that websites and discussion boards were the most frequent computer-assisted technologies used, followed by multiple studies reporting the utilization of video podcasts, wikis, and blogging (Mącznik et al., 2015). Additionally, five studies revealed a preference for the use of websites in improving lab psychomotor skills, as well as a number of studies summarizing how less time was spent when using the internet to perform the required

class task. One study, discussing the use of the internet, suggests that it provides more time to learn; whereas, two studies found no difference in time but stated that fewer costs are associated with website simulations (Mącznik et al., 2015). Regarding discussion boards, the results found, in seven cases, their use to improve knowledge acquisition and critical and reflecting thinking, though not specifically in any isolated content area.

A 2012 survey study of PT program directors and faculty by Baumgartner (2012) sought to determine the styles and variations of computing technologies that were being utilized in PT education. The study analyzed how computer-based learning impacted translation and carry-over into clinical practice. Overall, 904 faculty responded, comprising 193 various programs. Technology from 28 sources was represented, which was organized into the following seven categories within the survey: contact and communication, social learning, active learning, feedback and reflection, problem-solving, content knowledge and deep understanding, and diversity issues. The response rate results of the study summarized that the percentage of areas involving problem-solving during exercise prescription while using corresponding patient home exercise education software was 43%. Other categories of response included the use of virtual reality at 9%, and telehealth technology at 8%. The study supported the use of learning management systems among the respondents (79%), web-based literature review databases (76%), email communication (76%), and online reference technology (50%). The author's conclusions include a high frequency of use and importance in PT education of computer-based technology, including learning management system platforms, streaming media and text sources, online and app surveys, and online asynchronous discussion boards.

This chapter highlighted research regarding prevalence of hybrid education. In summary, it was found that the Mącznik (2015) study does not support the notion that collaborative wikis

improve grades but does support blogging to improve clinical reasoning and metacognitive skills. One randomized controlled trial also found no difference between groups using podcasts to improve written or practical scores. The next section will aim to build on this, gaining insight to student satisfaction in hybrid education models.

In 2013, a survey study by Adams compared student performance and preferred instruction mode between a hybrid model PT program using CAL modules and a traditional lecture-based model. The design was a post-test-only control that used mixed methods to compare class cohorts in the program for the years 2011 and 2012. After completing the data collection, the results analysis concluded that the mean for the written quiz grades for Cohort 2 (86.1) was higher than those for Cohort 1 (80.4). Regarding the results assimilated from the final exam, the data revealed that final course grades displayed a statistically significant difference, with $p<0.01$. The authors state that the hybrid models were valuable to the course delivery and that, in the future, innovative, interactive, and multimodal course structures will advance and engage students along their postgraduate education journey.

Another study conducted upon PT students that examined the differences between hybrid delivery models, in addition to flipping the classroom, was conducted by Boucher et al. (2013). The methodology concerned first-year Doctor of Physical Therapy (DPT) students undergoing a "hybrid flipped" model classroom when learning musculoskeletal content. The students learned the content on their own prior to class, and then gathered in a class session to discuss, engage, and practice clinical decision-making and active-learning competency. The study, similar to that of Adams (2013), found overall satisfaction among the students, according to the web-based survey results. Faculty opinion was also measured, and this was positive as well, in addition to the overall class outcomes when compared with traditional delivery methods.

Literature in this section researched satisfaction but did not address student perceptions or outcomes. Thus, these areas will be discussed in the next chapter as well as research comparing the hybrid outcomes to other instructional approaches.

Veneri and Gannotti (2014) developed a post-test-only control design that used mixed methods to assess successive PT program cohorts. Cohort 1 used only traditional methods; whereas, Cohort 2 used a hybrid model consisting of a mixture of both live delivery and computer-assisted technology. The results indicate that the hybrid Cohort 2 had higher test scores than Cohort 1. Additionally, regarding the perceptions, the one-minute survey papers found encouraging responses for the hybrid model. The students favored flipped classrooms and additional uses of technology, including clickers. The faculty surveys indicate that they felt Bloom's Taxonomies were better developed in the hybrid model.

Lazinski (2016) describes utilizing video technology for the instruction of hands-on palpation skills in a blended course format. The palpation skills via video were adapted and designed as a substitute for traditional course delivery. The study included 123 first-year PT students over the class years of 2012-14 (Lazinski, 2016). The semester assignments included introduction of the video modules along with four required campus class visits to practice skills competencies. Course instruction included a blended approach comprising live face-to-face class and video instruction, as well as class discussion, feedback critique, and skills assessment. The results regarding student outcomes showed all but one of the students passing all three first-year classes. Additional study results were among the outcome areas of student perceptions, including responses indicating student satisfaction/engagement, assessment, teaching, cognitive criteria, and social presence. Only one of the six criteria did not have a positive perception, which was the area concerning assessment due to slight inconsistencies among graders.

Table 1

Student Performance, Course Evaluation, and Student Perception.

Results are included below (Lazinski, 2016)

Student Performance on Skills Assessments

	Cohort		
Student Performance (%)	*A (n = 39)*	*B (n = 39)*	*C (n = 45)*
Skill Assessment 1	98.00 (88–100)	86.00 (65–91)	86.00 (74–91)
Skill Assessment 2	98.00 (89–100)	93.50 (78–100)	96.00 (82–100)
Skill Assessment 3	98.00 (91–100)	95.00 (87–100)	97.00 (89–99)
Skill Assessment 4 (cumulative)	96.67 (91–100)	95.79 (78–99)	96.97 (81–99)
Final Course Grade	97.85 (93–100)	91.53 (78–94)	96.50 (91–99)

Note: Student performance score reported as median (range).

Course Evaluation Section Scores

	Cohort			
Course Evaluation Section	*A (n = 39)*	*B (n = 39)*	*C (n = 45)*	*3-Year Mean*
Course Organization	3.64, 0.84	3.83, 0.58	3.57. 0.86	3.68
Course Activities	3.69, 0.73	3.84, 0.54	3.58, 0.80	3.70
Grading	3.68, 0.73	3.80, 0.56	3.56, 0.82	3.68
Preparation of Course Material	3.80, 0.56	3.93, 0.25	3.64, 0.79	3.79
Delivery of Instruction	3.77, 0.58	3.89, 0.31	3.62, 0.80	3.76
Student-Instructor Interaction	3.76, 0.58	3.89, 0.25	3.62, 0.79	3.76
Overall mean score				

Note: Section items ranked on a 4-point Likert Scale: 1 = *strongly disagree*; 2 = *disagree*; 3 = *agree*; 4 = *strongly agree*. Section values reported as mean, standard deviation.

Course Evaluation Comment Themes

Themes	*Descriptors (Comment Count)*
Satisfaction/engagement	General positive comments (33)
Teaching presence–course design	Organization, expectations, time management, instruction (33) Teaching
presence—responsiveness	Feedback and face-to-face interaction (21)
Cognitive presence	Learning, hands-on practice, and course assignments (24)
Social presence	Peer interaction and peer benchmarking (5)
Assessment	Grader consistency and fairness (5)

Note: Major themes with comment descriptors from analysis of comments of three successive cohorts.

Overall discussions and conclusions from this study described the hybrid transformation of a traditional course using the Community of Inquiry (CoI) model. The outcomes demonstrate a reduced face-to- face instructional time in areas that can be completed online with favorable learning outcomes and student satisfaction. Students for the most part, had positive perceptions of using educational technology and blended approaches. Accessibility, flexibility, and time to reflect and prepare included the positive features of the hybrid course design that were reported. In a hybrid course, challenges often revolve around maintenance of student engagement online due to competing time and attention demands outside the physical classroom with an inability for the instructor to observe students when they are traditionally seated in class. However, the study's favorable results toward hybrid learning were not without areas that could be improved upon. Lazinski (2016) noted that social presence was the weakest theme to emerge from student responses but was evidenced by blog participation rates. It is note-worthy that the course feedback survey lacked items related to social presence, which may have contributed to its under-representation in the comments. Lastly, the study limitations included context within described course being uniquely situated within a completely hybrid delivered DPT program. These said limitations may limit generalizability and potentially introduces a selection bias. A tie-in between this study and the Lazinski study was the need for more in-depth qualitative analysis including focus groups. Further studies are needed to explore possible constructive feedback or negative perceptions. Also, quantitative research is needed to compare outcomes of psychomotor objectives when taught with hybrid models versus traditional teaching methods to illustrate the most effective and efficient teaching methods.

In summary, the referenced literature indicated a gap in the research. Further research is needed on the use, effectiveness, impact on student perception, and satisfaction of hybrid

blended education in Doctor of Physical Therapy graduate programs. Although there are numerous instructional methods used to teach hands-on skills in an online environment, there is a lack of published work that describes hybrid/blended outcomes of coursework in a DPT program that can support the current technological climate and needs of PT students.

CHAPTER 3: RESEARCH METHODS

Graduate-level education in the field of physical therapy has continued to evolve its curricular content and delivery methods to foster innovation. This study explores content delivery comparisons concerning a hybrid blended model versus a traditional lecture model. The study will employ a quasi-experimental design using quantitative methods. The sample of convenience will represent an entire enrolled cohort within a Doctor of Physical Therapy program at an accredited program in West Virginia during a musculoskeletal spine examination course. This chapter will include thorough descriptions of research design, participants, research questions, study instrumentation, data collection, and data analysis.

Research Design

This study employs a quasi-experimental design using quantitative methods. The independent variable of the study was the method of instruction, which included either a traditional classroom model (TCM) lecture delivery or hybrid/blended model delivery (HBM). The dependent variables were the numeric scores from the multiple-choice test, the numeric scores from the practical skills competency check-off, and the responses from the Likert-scale ratings based upon data provided on the Student Satisfaction Questionnaire.

The course module and lecture component chosen for the study involved a clinical decision-making segment during the second year of the program based upon the assessment and examination of the level of the spine. This course was preceded by basic foundational sciences, human anatomy, and clinical decision-making modules. The entire course content in lecture, skills during laboratory competency, and test questions were derived from a peer-reviewed and published best-evidence systematic review from the American Physical Therapy Association titled, “Neck Pain: Revision 2017 - Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the

American Physical Therapy Association" (Blanpied et al., 2017). The participants in each group were chosen through a sample of convenience, comprised of admitted students representing a second year Doctor of Physical Therapy program cohort totaling 30 students. The objectives, data instruments, and content were the same for both groups of students, but the lecture delivery method, lab skills practice, and instructor feedback varied between the two groups. Group one, traditional classroom model (TCM) received a live in-classroom lecture content and live demonstration of lab skill techniques. Group one (TCM) students participated in the skills laboratory following lecture with subsequent instructor feedback for technique critique. Group two, hybrid/blended model (HBM) received the same lecture content, but delivery of the lecture content was accessed via recorded video presentation. Group two (HBM) also received the same lab skills techniques demonstration by the instructor through accessed recorded video content. Group two (HBM) students were to show lab practice of these skills through upload of video showing demonstration of their technique facilitated by the VoiceThread App. Instructor feedback for skill technique and critique was communicated back to the student through text comment fields within the uploaded student lab practice video on the VoiceThread app. The VoiceThread app is a learning tool for enhancing student engagement and online presence. VoiceThread was utilized for feedback in the competency lab skills practice portion for the HBM Group two lecture. Group 2 students created and shared video demonstrations of the hands-on lab techniques and were provided feedback through text comments by the course faculty to facilitate skill improvement which is tested in the Skills Competency Checkoff component. Data collection took place at the same point and on the same material covered for both Group 1 and Group 2. Each group was taught the exact same material and shown the exact same skills demonstrations. The only difference was the method of course lecture content and lab

skill content delivery in the course module that concerned musculoskeletal spine assessment and examination.

Participants

Thirty subjects were recruited from an accredited Doctor of Physical Therapy (DPT) Program in West Virginia. The students were everyone in this DPT program for this cohort, currently enrolled in their sixth academic semester, and in good academic standing. This sample of convenience represents students within a DPT program. All students recruited were given the choice of whether to participate in the study. Thirty students were randomly selected to be placed into one of two groups, each with n=15. Students were notified that participation in this study was voluntary and were given the choice to assent to participation or opt out, due to the chance of being in a TCM group or HBM group. For subject confidentiality, the faculty member was notified about group selection and stored all the information gathered from the subjects on a secure, password-protected computer drive. Of the thirty students chosen, a total of 21 were able to participate in the full study. The TCM group was represented by 11 students and the HBM group was represented by 10 students. Both groups consisted of students recently graduated with an undergraduate degree, were in their second year of the DPT program, and had similar group participant size.

Data collection took place at the same point and on the same material for both groups. Each group was taught the exact same material, and the only variable was the delivery method of the content, which concerned musculoskeletal spine assessment and examination. The pathway of group 1 (TCM) included traditional in-class lecture assessed by multiple choice test (Appendix F), in-person group skills practice with assessment by an in-person skills competency skills check-off (Appendix G) with peer lab partner to demonstrate, and completion of a student

satisfaction questionnaire (Appendix E). The pathway of group 2 (HBM) included a virtual video lecture assessed by multiple choice test (Appendix F), asynchronous video skills practice with assessment accomplished by an in-person skills competency skills check-off (Appendix G) with peer lab partner to demonstrate, and completion of a student satisfaction questionnaire (Appendix E).

Research Questions

1. Are there significant differences between perceptions of participant survey responses regarding student satisfaction in the traditional versus hybrid course module delivery?
2. Is there a significant difference between participant scores from the multiple-choice test for musculoskeletal content for participants in the traditional versus hybrid course module delivery?
3. Is there a significant difference between participant scores from the skills competency test for participants in the traditional versus hybrid course module delivery?

Instrumentation

The course involved three main instruments for data collection. Each group's lecture content mastery was assessed on a 20-point Multiple Choice Test (Appendix F) which was the same for both groups. The content demonstrated during lab portion demonstrations for both groups were assessed for competency mastery on the 8 item Competency Skills Check-Off Instrument (Appendix G) which included the same items for each group. The 20-item multiple-choice test and the 8-item Skills Competency check-off were reviewed by the faculty that teach this course in the department. The course faculty at this University in West Virginia had influence through expertise and contemporary experience to approve the items being asked, skills assessed, and ensured consistency with their contemporary knowledge typically taught in

other years that they have instructed this course subject area. Test items were drafted and then peer reviewed to ensure the correct knowledge domain and level were reflected in question writing, appropriate skill level was taught in the course for competency check-off, and that there were components of questions that challenged clinical decision-making. The final Competency Skills Check-Off and Multiple-Choice test were endorsed by the course faculty at the University. The course content lecture and lab material content of which the multiple-choice test and lab skills check-off tested, was directly referenced and derived from a peer-reviewed publication that is regarded within the field of physical therapy as the best evidence for practice. This, "Neck Pain: Revision 2017 - Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health from the Orthopaedic Section of the American Physical Therapy Association" was published and disseminated by the American Physical Therapy Association (Blanpied et al., 2017).

The post-course "Student Satisfaction Questionnaire," (Appendix E) authored and validated by R.R. Aman (2009), consisted of 25 Likert scale questions. Four choices described below were chosen to ensure an even number of responses and will serve to adequately represent opinions on satisfaction. The author of the questionnaire tool granted the researcher permission to edit and modify the questions for this study as needed (attestation and written permission are contained in the Appendix C). The response choices were as follows: 1. Strongly Disagree; 2. Disagree; 3. Agree; 4. Strongly Agree. In the case of validity regarding the questionnaire, the author R.R. Aman (2009) describes the process below: "the draft questionnaire was reviewed preliminarily by a panel of experts in either online learning or Quality Matters. This group provided multiple suggestions. The list of questions was revised at least eight times based on this expert feedback and preliminary testing. This process provided suggestions and served to create

a prototype questionnaire that was pilot tested on two treatment and two control groups. After adjustments to the instrument were made a questionnaire similar to the study questionnaire along with a check-sheet of criteria was provided to a second panel of six experts. Individuals who reviewed the study questionnaire were: John Sener, Sener Learning Services; Professor Jurgen Hilke, Director of Distance Learning, Frederick Community College; Ron Smith, Senior Analyst, Institutional Effectiveness, Portland Community College; John Sneed, Director of Distance Learning, PCC; and Mary Wells, Co-Director, Quality Matters and an online student from PCC." The input from this panel was the basis for the final study questionnaire included in the Aman study which is referenced.

A second method utilized to check validity of the questionnaire was through construct validity. Aman (2009) described this process of validation as follows: "The review of literature was used to develop the conceptual framework of factors found in previous research to relate to student satisfaction and retention in online instruction. Construct validity was addressed in developing the questionnaire by structuring questions around the constructs in the conceptual framework. A principal component factor analysis was run on the questionnaire based on five factors of quality instruction."

Data Collection

The data components for this study were collected following Institutional Board Review approval at Marshall University. Data collection commenced in the summer of 2020 and lasted over three days. Faculty at the university sent an email to all students who opted into the study. The participant letter (Appendix D) described details of the research, including instructions, meeting times, and assessments of the objectives learned. To protect the participants, access to data was only available to the faculty instructor and the researcher. There was no content

delivery between the researcher and the participants, and participation was voluntary. In total, there were 21 participants with 11 representing the TCM group and 10 representing the HBM group. Only quantitative aggregate data were collected.

Data were collected for lecture content mastery via the 20-item multiple choice test scores. Both groups of content delivery received the same exact multiple-choice test (Appendix F) and were tested one-day post lecture, in a proctored environment by DPT faculty. The skills competency check-off (Appendix G) was completed two days-post lecture and the day following the written multiple-choice exam. All eight items on the skills check off were graded as Satisfactory (Full 1 point), Partial Completion (1/2 point), or Unsatisfactory (0 Point) increments and rolled up into a final score representative of the eight items. Finally, on the third day, upon completion of the Skills Competency Check-off, students completed the 25-item Student Satisfaction Questionnaire (Appendix E) and aggregate data totals were saved as data for subsequent quantitative analysis.

Data Analysis

The data analysis utilized version 25 of the Statistical Package for Social Sciences (SPSS) to analyze each research question. Each of the research questions was examined for significance at the .05 level of significance. Research Question 1 was analyzed using the non-parametric Chi-Square statistic for each of the participant perception of satisfaction questions to examine frequencies between the traditional and hybrid delivery groups concerning the ordinal Likert Scale responses of *Very Satisfied, Satisfied, Unsatisfied,* and *Very Unsatisfied*. Research Question 2 was analyzed using the parametric t-test for Independent Groups to compare mean multiple-choice test scores between the traditional and hybrid delivery groups. Research Question 3 was analyzed using the parametric t-test for Independent Groups to compare mean

competency skills test scores between the traditional and hybrid delivery groups. Research Question 4 was analyzed using non-parametric Mann-Whitney U and Kruskal-Wallis tests to compare satisfaction responses between the traditional and hybrid delivery groups using demographics as independent variables.

Conclusion

This study explores content delivery comparisons concerning a hybrid blended model versus a traditional lecture model. There was a significant amount of literature describing the hybrid method as well as a nice gap in the literature for which my methods would be based upon. This study will involve Doctor of Physical Therapy students at an accredited program in West Virginia during a musculoskeletal examination course. The overall cohort being divided equally into two groups of students (n=15) is a sufficient representative sample to gain data in the written exam for content and skills check off data in competency. The course content multiple-choice test and competency check offs were chosen as the method to pair with the consistency of familiarity of scored exams and skills checks, that physical therapy students are accustomed to. The survey was chosen rather than questionnaires to gain more numeric responses and eliminate open-ended questions. By having the study within the same musculoskeletal course and maintaining the exact content during lecture and lab competency material, it fostered a way to maintain consistency while varying the delivery of material and method of lab.

CHAPTER 4: PRESENTATION AND ANALYSIS OF DATA

This study proposed to investigate student learning outcomes during a musculoskeletal spine assessment course: Hybrid Blended Model versus Traditional Classroom Delivery in a Doctor of Physical Therapy. Findings are organized accordingly: (a) data collection, (b) participant characteristics, and (c) major findings.

Data Collection

The data components for this study were collected following Institutional Board Review approval at Marshall University. Data collection commenced in the summer of 2020 and lasted over three days. Faculty at the university sent an email to all students who opted into the study. The participant letter (Appendix D) described details of the research, including instructions, meeting times, and assessments of the objectives learned. To protect the participants, access to data was only available to the faculty instructor and the researcher. There was no content delivery between the researcher and the participants, and participation was voluntary. Overall there were 21 participants with 11 comprising the TCM group and 10 representing the HBM group. Only quantitative aggregate data were collected.

Data was collected for lecture content mastery via the 20-item multiple choice test scores. Both groups of content delivery received the same exact multiple-choice test (Appendix F) and were tested one-day post lecture, in a proctored environment by DPT faculty. The skills competency check-off (Appendix G) was completed two days-post lecture and the day following the written multiple-choice exam. All eight items on the skills check off were graded as Satisfactory (Full 1 point), Partial Completion (1/2 point), or Unsatisfactory (0 Point) increments and rolled up into a final score representative of the eight items. Finally, on the third day, upon completion of the Skills Competency Check-off, students completed the 25-item Student

Satisfaction Questionnaire (Appendix E) and aggregate data totals were saved as data for subsequent quantitative analysis.

The pathway of group 1 (TCM) included traditional in-class lecture assessed by multiple choice test (Appendix F), in-person group skills practice with assessment by an in-person skills competency skills check-off (Appendix G) with peer lab partner to demonstrate, and completion of a student satisfaction questionnaire (Appendix E). The pathway of group 2 (HBM) included a virtual video lecture assessed by multiple choice test (Appendix F), asynchronous video skills practice with assessment accomplished by an in-person skills competency skills check-off (Appendix G) with peer lab partner to demonstrate, and completion of a student satisfaction questionnaire (Appendix E).

Participant Characteristics

Introduction

Thirty subjects were recruited from an accredited Doctor of Physical Therapy (DPT) Program in West Virginia. The students were everyone in this DPT program for this cohort, currently enrolled in their sixth academic semester, and in good academic standing. Of the thirty students chosen, a total of 21 were able to participate in the full study. The 21 participants were divided randomly into two groups of either TCM group or HBM group. TCM group was represented by 11 students and the HBM group was represented by 10 students. Both groups consisted of students recently graduated with an undergraduate degree, were in their second year of the DPT program, and had similar group participant size.

Raw demographic data was collected on each group and placed into Table 2. Frequencies, percentages, and summary statistics were calculated for each variable on gender, range in number of online courses taken in the past, and age of all participants.

Summary Statistics for Demographic Data

The most frequently observed category of Gender was Female (n = 14, 67%). The observations for the range of Number of Courses Taken in the Past had an average of 5.86 (SD = 3.35, Min = 1.00, Max = 12.00). The observations for Age had an average of 24.00 (SD = 1.58, Min = 22.00, Max = 29.00).

Table 2

Table for Raw Demographic Data

Group	Gender	Number of Online /Blended Courses Taken in the Past	Age
Traditional Classroom Model (TCM)	Male	4	26
	Female	6	25
	Female	6	23
	Female	2	23
	Female	1	23
	Female	3	24
	Male	10	24
	Male	3	22
	Male	4	23
	Female	3	23
	Female	1	26
Hybrid Blended Model (HBM)	Male	9	23
	Male	3	29
	Male	12	25
	Female	10	25
	Female	11	24
	Female	7	23
	Female	5	23
	Female	9	24
	Female	7	23
	Female	7	23

Major Findings

Major findings from this study are presented within the framework of the research questions proposed in the first chapter of this study. Those questions explore significance of differences by group (TCM and HBM) on the survey responses regarding satisfaction, score from the multiple choice-test, scores from the skills competency test, and overall differences between dependent variables due to demographics of each group. Figures or tables summarizing the data appear after each narrative description.

Research Question 1: Are there significant differences between perceptions of participant survey responses regarding student satisfaction in the traditional versus hybrid course module delivery?

Chi-square tests of independence were conducted to determine if the TCM and HBM groups differed in their responses to the Student Satisfaction Questionnaire which was completed after the test and skills check-off. Four response choices were based on a Likert scale consisting of *1 - Strongly Disagree, 2 – Disagree, 3 – Agree, or 4 - Strongly Agree.*

The Student Satisfaction Questionnaire Statistical Results (Appendix B) displays Chi-square test data comparing the TCM group versus the HBM group for Research Question 1 (RQ1). The one question that showed a significant difference (p= .049) was question six. Question six asked the level of satisfaction upon which course assessment methods were provided at the beginning of the course. All the remaining questions however, showed that no results were significant (all *p*-values > .05). This finding indicates that the TCM and HBM groups did not significantly differ in their responses to the individual perception of satisfaction questions.

Research Question 2: Is there a significant difference between participant scores from the multiple-choice test for musculoskeletal content for participants in the traditional versus hybrid course module delivery?

Introduction

Each group's lecture content mastery was assessed on the same 20-point multiple choice test with each question having four answer choices (Appendix F). Questions were directly referenced and discussed in each lecture delivery. Both groups took the test in a typical classroom proctored environment. A two-tailed independent samples *t*-test was conducted to examine whether the mean of scores in the Multiple-Choice Test (Appendix F) was significantly different between the TCM and HBM categories of Group.

Results

The result of the two-tailed independent samples *t*-test (Table 3) was not significant based on an alpha value of 0.05, $t(19) = 0.966$, $p = .346$. This finding suggests the mean of Score was not significantly different between the TCM and HBM categories of Group.

Table 3

Multiple Choice Test

	Group	N	Mean	Std. Deviation	t	df	Sig. (2-tailed)
Scores	Traditional	11	16.9091	2.07145	.966	19	.346
	Hybrid	10	16.1000	1.72884			

Significance tested at p < 0.05

Research Question 3: Is there a significant difference between participant scores from the skills competency test for participants in the traditional versus hybrid course module delivery?

Introduction

A two-tailed independent samples *t*-test was conducted to examine whether the mean of items correct on the Competency Skills Check-Off were significantly different between the TCM and HBM categories of Group. This Competency Skills Check-Off (Appendix G) was scored on the number of correct observations out of eight skill items in lab. Students arrived at specific scheduled times in pairs with one student serving as patient and the other the clinician. Students would then reverse roles in order for the other student's skills to be assessed. Grading with a total maximum score of 8/8 was done using the following parameters of scoring: satisfactory (scored 1 point), partial (½ point), or unsatisfactory (scored 0 point).

Results

The result of the two-tailed independent samples *t*-test was significant based on an alpha value of 0.05, $t(19) = -2.164$, $p = .043$. This finding suggests the mean of items correct on the Competency Skills Check-Off was significantly different between the TCM and HBM categories of Group. The results are presented in Table 4.

Table 4

Skills Competency Check-Off

	Group	N	Mean	Std. Deviation	t	Df	Sig. (2-tailed)
Skills	Traditional	11	7.2273	.71985	-2.164	19	.043 *
	Hybrid	10	7.7500	.26352			

Significance attained at p < 0.05

CHAPTER 5: SUMMARY, DISCUSSION OF FINDINGS, AND RECOMMENDATIONS

The purpose and methods of this study are summarized in Chapter 5. Also included in the chapter is a discussion of the findings for each of the study's research questions, implications, limitations, and recommendations for future research.

Purpose

The purpose of this study was, "Examination of student learning outcomes during a musculoskeletal spine assessment course: Hybrid Blended Model versus Traditional Classroom Delivery in a Doctor of Physical Therapy." This study contributes to the pedagogical knowledge in the field of PT education by determining whether there are significant differences as a result of course format (hybrid/blended versus traditional) on the results that the study methods produce. Most of the recent research reveals that student performance with the use of hybrid/blended instruction is comparable to face-to-face instruction (Adams, 2013). Although there is some variation in delivery, curriculum, and program length, research has been favorable with regard to hybrid/blended formats, with results indicating support for interactions and relationships in the clinical environment (Coe Regan, & Youn, 2008).

It is hoped that this study will facilitate growth in health education programs that aim to expand the ability of students to attend school and increase future employment and education of those individuals in rural areas, as well as foster new interpretations of the effectiveness and perceptions of hybrid/blended learning.

The literature review revealed a gap in published work that describes online teaching and learning within the PT profession and the preferred methods of online technologies. The information from this research will also benefit developing PT programs currently going through the Commission on Accreditation in Physical Therapy Education (CAPTE) process, assist

faculty in assessing data from satisfaction survey outcomes, and serve as a comparison for future interested schools to evaluate the hybrid approach versus other lecture delivery methods. The study allowed for comparison of student learning outcomes between two lecture format delivery models.

Methods

This study had three main data collection goals. After the lecture content delivery and skills competency practice, both the TCM and HBM groups needed to complete the 20 question Multiple Choice Test (Appendix F), the eight item Competency Skills Checkoff (Appendix G), and the Student Satisfaction Questionnaire (Appendix E).The population of this study consisted of an initial 30 participants all enrolled in a Doctor of Physical Therapy cohort at Marshall University in their second year of the program. Data collection commenced in the summer of 2020 and lasted over three days. Overall, after students elected whether to participate in the study there were 21 participants who opted in, leaving the two groups comprised of 11 students in the TCM group and 10 representing the HBM group. A few possible reasons for deferment provided by students that resulted in a 70% yield of participation was a pandemic, recent return of the University being open for in-person classes, and make-up work that students were finishing from the previous semester. These along with additional limitations will be discussed later in this chapter.

In summary, the pathway of group 1 (TCM) included traditional in-class lecture assessed by a multiple-choice test taken in a controlled classroom testing environment (Appendix F). Participants in the TCM group had time to practice competency skills in the classroom which were then assessed the following day during an in-person partnered skills competency skills check-off (Appendix G). The group on the final day completed the student satisfaction

questionnaire (Appendix E). The pathway of group 2 (HBM) included a virtual video lecture assessed by multiple choice test (Appendix F), asynchronous video skills practice with assessment accomplished by an in-person skills competency check-off (Appendix G) with peer lab partner to demonstrate, and completion of a student satisfaction questionnaire (Appendix E).

After the data collection was completed, the findings were organized, tabulated, and transferred to a raw data spreadsheet to utilize in statistical data analysis. Data analysis involved the utilization of the Statistical Package for Statistical Sciences (SPSS) to analyze each research question. Each of the research questions was answered for significance and correlation using statistical methods of an Independent Samples t-test, Chi-Square statistic, and use of descriptive statistics data and outcomes. The research questions were:

1. Are there significant differences between perceptions of participant survey responses regarding student satisfaction in the traditional versus hybrid course module delivery?
2. Is there a significant difference between participant scores from the multiple-choice test for musculoskeletal content for participants in the traditional versus hybrid course module delivery?
3. Is there a significant difference between participant scores from the skills competency test for participants in the traditional versus hybrid course module delivery?

Findings

Research Question 1: Are there significant differences between perceptions of participant survey responses regarding student satisfaction in the traditional versus hybrid course module delivery?

Chi-square tests of independence were conducted to determine if the TCM and HBM groups differed in their Likert responses of *Strongly Disagree, Disagree, Agree, and Strongly*

Agree to the individual perception of satisfaction questions. Only one question showed a significant difference (p= .049) which was question six. Question six asked the level of satisfaction upon which course assessment methods were provided at the beginning of the course. All the remaining questions however, showed that no results were significant (all *p*-values > .05). This finding indicated that the TCM and HBM groups did not significantly differ in their responses to the individual perception of satisfaction questions. All participants as an ancillary result did demonstrate score levels that would be consistent with a passing score on a course exam.

A possible justification for the lack of significance in more questions than only question six could be due to a few main reasons. The student Doctor of Physical Therapy participants were all in their second year and were instructed on material presentation similar to what is generally seen in each course. The course module and lecture component chosen was preceded by basic foundational sciences, human anatomy, and clinical decision-making modules. The entire course content in lecture, skills during laboratory competency, and test questions were derived from a peer-reviewed and published best-evidence systematic review from the American Physical Therapy Association titled, "Neck Pain: Revision 2017 - Clinical Practice Guidelines Linked to the International Classification of Functioning, Disability and Health From the Orthopaedic Section of the American Physical Therapy Association" (Blanpied et al., 2017). It is likely that to this point in the curriculum, these students have been accustomed to and expect to see objectives presented, assessment processes spelled out, and modes of content mastery provided at a start of a course similar to what was done in this study. Secondly, the doctoral students by this far along in their schooling are conditioned to answer post-course surveys regarding assessing a course relevant to satisfaction. Lastly, the last half of questions on the

survey revolved around resources being provided, satisfaction with the level of technology utilized, and instructor interaction/feedback during skills competency. Justification and possibilities for the lack of significance in these areas could be due to the students in this program already using cutting edge technology, contemporary equipment, and are appropriately provided all resources that encourage content mastery at the start of a course. Typically, the students are conditioned to process and interpret similar lecture content, are given ample time in lab to practice skills competencies, and are provided with group and instructor feedback to refine their psychomotor skills and technique.

The one question which did show significance between the TCM and HBM groups was question 6 on the Student Satisfaction Survey. The question was, "The course assessment methods for this course module were provided at the beginning of the course." The TCM group had 1 response of "Disagree," 2 responses of "Agree," and 8 responses of "Strongly Agree," The HBM group had 0 responses of "Disagree," 7 responses of "Agree," and 3 responses of "Strongly Agree." One possible justification for the Chi-square test resulting in a significance of .049 in this question was the mode of delivery of the assessment methods. In both lectures, the assessment methods were verbally delivered the same way, but differed slightly in viewability. The TCM group had the assessment methods verbalized and shown on a screen which may have been hard to read for students not in the front row. The HBM group in contrast has the same slide but possibly much easier to read on their own individual video screen.

Literature and a study of students in a Horticulture program found the following results in the course delivery style upon student satisfaction. The horticulture program study mirrored the findings of this study regarding student evaluation surveys and faculty performance that was measured on a five-point Likert scale. From the years 2012 to 2014, no significant difference

upon post-course satisfaction surveys existed between teaching in person vs. remotely (Sciarappa et al., 2016). It is worth noting that a different finding occurred in the study related to questions assessing methodology, technology, student confidence, and class satisfaction. Overall conclusions by the authors noted that both the hybrid and totally online course formats were found to be improved approaches over a conventional format in terms of class numbers, scheduling, student satisfaction, time-shifting flexibility, travel time savings, and efficient use of university classroom facilities (Sciarappa et al., 2016).

Research Question 2: Is there a significant difference between participant scores from the multiple-choice test for musculoskeletal content for participants in the traditional versus hybrid course module delivery?

A two-tailed independent samples *t*-test was conducted to examine whether the mean of scores in the Multiple-Choice Test (Appendix F) was significantly different between the TCM and HBM categories of Group. The result of the two-tailed independent samples *t*-test was not significant based on an alpha value of 0.05, $t(19) = 0.966$, $p = .346$, mean of score was not significantly different between the TCM and HBM categories of Group. The TCM group answered on average 16.9/20 questions correctly. The HBM group on average answered 16.1/20 questions correctly. Acknowledging the standard deviation aspect, this is one main reason why the statistical analysis did not find any significance between the two groups on the Multiple Choice Test. The researcher can speculate, but there are justifications as to why the scores between groups was not significant on the multiple Choice Test. The students are doctoral students who typically in programs are placed on probation if they earn a score in a final grade less than a "B." These doctoral students typically score very well in multiple methods of instruction in order to prepare for the clinical environment. During physical therapy schooling,

these students are tested in lab practical during anatomy classes, tested on patient examination during lab practical tests, and typically take exams that are similar to the National Physical Therapy Examination for state licensure. These students are relatively conditioned to taking high stakes and high stress examinations on similar content in their schooling.

This finding of no significant difference in mode of lecture content delivery in TCM or HBM mirrors the similar research conducted within the field of physical therapy education. The students in both groups did demonstrate skills that would satisfy requirement levels on a lab practical assessment. The study by Duijn and Bevins (2005) examined the relationship between the clinical performances of PT students in problem-based, mixed-model, and traditional curricula. Data were examined using statistical methods (ANOVA) to examine scores on the mid-term Clinical Performance Instrument (CPI). The study did not find any statistically significant difference among grades on the CPI involving professional behaviors, clinical problem-solving, or clinical skill.

Research Question 3: Is there a significant difference between participant scores from the skills competency test for participants in the traditional versus hybrid course module delivery?

A two-tailed independent samples *t*-test was conducted to examine whether the mean of items correct on the Competency Skills Check-Off were significantly different between the TCM and HBM categories of Group. This Competency Skills Check-Off (Appendix G) was scored on the number of correct observations out of eight skill items in lab. Grading with a total maximum score of 8/8 was done using the following parameters of scoring: satisfactory (scored 1 point), partial (½ point), or unsatisfactory (scored 0 point).

The result of the two-tailed independent samples *t*-test was significant based on an alpha value of 0.05, $t(19) = -2.164$, $p = .043$, suggesting the mean of items correct on the Competency

Skills Check-Off was significantly different between the TCM and HBM categories of Group. The TCM group demonstrated on average 7.23/8 skills correctly. The HBM group demonstrated on average 7.75 skills correctly.

The researcher can speculate, but there are justifications as to why the scores between groups was significantly different on the Competency Skills Check-Off. The students in TCM and HBM group received the exact same demonstration on the same exact skills examinations. One thought as to why the HBM group scored higher is through the instructional method itself. The HBM group had the capability to see clearly how the test was demonstrated by the instructor without any visual or sound volume limitations. The HBM group also was able to practice in their assessment method multiple times before sending a video of skills practice techniques in through the VoiceThread app. Lastly, the HBM group if they recorded the lecture, were able to watch the video for clarity and understanding multiple times. The TCM however, only saw the demonstration one time and could have been impacted by visual or sound clarity depending on where they were seated in the room. Lastly, the TCM group during lab practice, may only have taken one turn at practicing each technique or elected to only observe others perform the technique rather than attempting to practice as the clinician themselves.

This finding of significance on the Competency Skills Check-Off is slightly different than a similar study in the literature review. The study by Duijn et al. (2014) compared two randomly selected groups of students using either online video instruction or face-to-face instruction in a course designed to teach cervical spine evaluation follow-up treatment approaches. Course video content was posted into the Angel Learning Management System (ALMS). Group A students attained examination content skills via the ALMS, and then the complement of intervention skills via a face-to face laboratory approach. Group B used the face-to-face laboratory instruction for

the examination skills and then course video content through the ALMS for the intervention skills. To limit any bias and variability, the creation of the videos and the laboratory components were taught consistently by the same instructor. This study determined that there was equivalent student performance regardless of whether video or face-to-face instruction was elected to deliver the orthopedic lab skills. This study possibly varied versus the results in this study due to methodological differences, variances in video content delivery methods, and assessment and feedback mechanisms during skills practice sessions.

Implications

A very important implication emerged from the data collection, analysis, and results of this study; due to the limited and small sample size of 21 participants, this study serves as a model for a larger study across multiple institutions.

This study is one of only a few attempts to gather pedagogical knowledge in the field of PT education by determining whether there are significant differences as a result of course format (hybrid/blended versus traditional) on curricular content within a program of study. Findings indicate that TCM and HBM groups did not significantly differ in their responses to the Student Satisfaction Questionnaire or in the Multiple Choice-Test scores. However, findings suggest that the mean of Items Correct on the 8-item Competency Skills Check-Off was significantly different between the TCM and HBM categories of Group, with the HBM group scoring slightly better upon the scoring than the TCM group did.

Currently, there are very few published resources that describes online teaching and learning within the PT profession and the preferred methods of online technologies. However, this research reiterates the summary of previous reviews of the literature regarding the capability and value of hybrid programs in the field of physical therapy education. Review of the literature

showed that hybrid education has shown positive outcomes in optimizing student engagement since it takes the strengths of face-to-face and marries that with online supplementary material. The ability of student conversation, critical thinking, and instructor interaction remains a priority of the course delivery (Mu et al., 2014). In a true hybrid model, content and lecture material will be learned virtually both synchronously and asynchronously, utilizing many forms of technology, live video conferences, and learning management system (LMS) capabilities (Potter, 2015). This philosophy for the field of physical therapy resonates with the professional organization of practice, the American Physical Therapy Association (APTA). In academia, programs are embracing the APTA vision of which, goal 13 of the APTA Education Strategic Plan reads, "collaborate with others to develop customized software/hardware applications and medical simulations to enhance on-site and distance education (Veneri, 2010).

The outcomes of this research will provide a summary of the differences between a traditional face-to-face format and a hybrid/blended learning format in a graduate program. This study at the very least provides a starting point; more research into these hybrid programs may begin to serve as useful tools in assessment processes. Continued research and input from developing PT programs currently going through the Commission on Accreditation in Physical Therapy Education (CAPTE) process, assessment of data from satisfaction survey outcomes, and comparisons of schools implementing the hybrid approach versus other lecture delivery methods will be needed to grow and refine these content delivery methods. Hybrid education is relevant now more than ever in today's COVID-19 and social-distancing world.

The information generated by this study has three main effects on the field of physical therapy education. Findings may facilitate growth in health education programs that aim to

expand the ability of students to attend school. Growth, accessibility, and attendance in hybrid DPT programs may lead to increased opportunities for future employment and education of those individuals living in rural areas. Lastly, the study may foster new interpretations of the effectiveness and perceptions of hybrid/blended learning previously mentioned in the feasibility of further studies similar to this but across multiple programs and areas of the country.

Limitations

Several limitations were inherent in this study. The first limitation to be noted is that a non-experimental research study does not provide any allowance for the random assignment to groups for manipulation or for the manipulation of independent variables (Johnson & Christensen, 2000), as was the case with this study. The results were limited to the environment in which the study was conducted, utilizing second-year students in the program cohort, rather than being generalizable to the larger population of DPT educators or students.

Other limitations required the participants to be admitted doctoral students in a physical therapy program that have not been exposed to cervical musculoskeletal spine content in the program at the time of data collection. As a result, limitations with external validity were possible, namely in students who have read literature, looked at research studies, or participated in other course work related to the subject matter. The small sample size of 21 participants, though rich enough to achieve saturation for the research questions in this study, is another major limitation.

Limitations with this study's measures and methods also require discussion. For example, participants' willingness to rate their satisfaction completely and thoroughly on the questionnaire may have varied, resulting in challenges with validity and reliability. Students who did not wish to participate or who did not complete the survey could have possibly

offered information that would have changed the outcomes of the study. The conceivable limitations of COVID-19 on participation, stress levels while studying course materials, and social distancing during lab practice also deserve attention.

Recommendations for Future Research

- Replications of this methodology and data collection process should be conducted within hybrid DPT programs throughout diverse geographic locations to check the reliability and credibility of this study's findings.
- Studies testing the validity and reliability of the Clinical Practice Guidelines methods of teaching and skills mastery should be completed to build stronger, more accurate assessments.
- A similar study utilizing the methodological parameters could be conducted with a much larger sample size. A study could gain further insight into the testing score data, competency skill psychomotor ability, and demographic analysis using additional statistical methods if conducted across multiple institutions across the country.
- Encourage faculty and programs to infuse aspects of blended learning into its culture. An application that results at the time that this research was conducted is the feasibility of the hybrid learning environment during a health pandemic. Faculty in educational institutions had to flip on a dime to emergency online instruction rather than be trained in effective hybrid teaching. Hybrid teaching staff forums and education are an avenue to tie into an institution's spirit of innovation and does not have to be limited to one specific degree or area of study. There are numerous educational opportunities for professional development for faculty to educate and apply the principles of hybrid teaching and learning into their curriculum.

In-depth studies of hybrid curriculum planning, content mastery, and ultimate board license exam pass rates in hybrid DPT programs should be conducted to learn more about planning for CAPTE accreditation, effectiveness of hybrid DPT education, and content mastery of a hybrid curriculum.

REFERENCES

Adams, C. L. (2013). A Comparison of Student Outcomes in a Therapeutic Modalities Course Based on Mode of Delivery: Hybrid Versus Traditional Classroom Instruction. *Journal of Physical Therapy Education,27*(1), 20-34. doi:10.1097/00001416-201310000-00005

Aman, R. R. (2009). Improving Student Satisfaction and Retention with Online Instruction through Systematic Faculty Peer review of Courses. Retrieved from https://ir.library.oregonstate.edu/concern/graduate_thesis_or_dissertations/6q182q48q

Baumgartner, M. (2012). Instructional technologies in graduate physical therapy courses. *Journal of Applied Learning Technology, 2*(4), 25-33.

Blanpied, P. R., Gross, A. R., Elliott, J. M., Devaney, L. L., Clewley, D., Walton, D. M., Sparks, C., and Robertson, E. K. (2017). Neck Pain: Revision 2017. *Journal of Orthopaedic & Sports Physical Therapy,* 47(7). doi: 10.2519/jospt.2017.0302

Boucher, B., Robertson, E., Wainner, R., & Sanders, B. (2013). "Flipping" Texas State University's Physical Therapist Musculoskeletal Curriculum: Implementation of a Hybrid Learning Model. *Journal of Physical Therapy Education*, *27*(3), 72–77. doi: 10.1097/00001416-201307000-00010

Coe Regan, J. A. R., & Youn, E. J. (2008). Past, present, and future trends in teaching clinical skills through web-based learning environments. *Journal of Social Work Education, 44*(2), 95-115.

Duijn, A. J. V., & Bevins, S. I. (2005). Clinical Performances of Physical Therapist Students in Problem-Based, Mixed-Model, and Traditional Curricula. *Journal of Physical Therapy Education*, *19*(2), 15–21. doi: 10.1097/00001416-200507000-00003

Duijn, A. J. V., Swanick, K., & Donald, E. K. (2014). Student Learning of Cervical Psychomotor Skills Via Online Video Instruction Versus Traditional Face-to-Face Instruction. *Journal*

of Physical Therapy Education, *28*(1), 94–102. doi: 10.1097/00001416-201410000-00015

Green, R. A., & Whitburn, L. Y. (2016). Impact of introduction of blended learning in gross anatomy on student outcomes. *Anatomical Sciences Education*, *9*(5), 422–430. doi: 10.1002/ase.1602

Green, R. A., Whitburn, L. Y., Zacharias, A., Byrne, G., & Hughes, D. L. (2017). The relationship between student engagement with online content and achievement in a blended learning anatomy course. *Anatomical Sciences Education*, *11*(5), 471–477. doi: 10.1002/ase.1761

Greenberger, H. B., & Dispensa, M. (2015). Usage and Perceived Value of Video Podcasts by Professional Physical Therapist Students in Learning Orthopedic Special Tests. *Journal of Physical Therapy Education*, *29*(3), 46–57. doi: 10.1097/00001416-201529030-00007

Hyland, M. R., Pinto-Zipp, G., Olson, V., & Lichtman, S. W. (2010). A Comparative Analysis of Computer-Assisted Instruction and Traditional Lecture Instruction for Administration and Management Topics in Physical Therapy Education. *Journal of College Teaching & Learning (TLC)*, *7*(7). doi: 10.19030/tlc.v7i7.133

Iwata, K., & Doi, A. (2017). Can hybrid educational activities of team and problem-based learning program be effective for Japanese medical students? *International Journal of Medical Education*, *8*, 176–178. doi: 10.5116/ijme.591b.2bc8

Johnson, B., & Christensen, L. (2000). Educational research: Quantitative and qualitative approaches. Needham Heights, MA, US: Allyn & Bacon.

Köppe, C., Nørgård, R. T., & Pedersen, A. Y. (2017). Towards a pattern language for hybrid education. *Proceedings of the VikingPLoP 2017 Conference on Pattern Languages of Program - VikingPLoP*. doi: 10.1145/3158491.3158504

Lazinski, M. J., (2016). Psychomotor Skills, Physical Therapy, and a Hybrid Course: A Case Study. Retrieved from https://eric.ed.gov/?id=EJ1179847

Mącznik, A. K., Ribeiro, D. C., & Baxter, G. D. (2015). Online teaching in physiotherapy teaching and learning: A systematic review of effectiveness and users' perceptions. *BMC Medical Education, 15*, 160. doi: 10.11861/s12909-015-0429-8

Milanese, S. F., Grimmer-Somers, K., Souvlis, T., Innes-Walker, K., & Chipchase, L. S. (2014, January 1). *Is a blended learning approach effective for learning in allied health clinicians?* Retrieved 1qq2from https://researchprofiles.canberra.edu.au/en/publications/is-a-blended-learning-approach-effective-for-learning-in-allied-h

Mu, K., Coppard, B. M., Bracciano, A. G., & Bradberry, J. C. (2014). Comparison of On-Campus and Hybrid Student Outcomes in Occupational Therapy Doctoral Education. *American Journal of Occupational Therapy*, *68*(Supplement_2). doi: 10.5014/ajot.2014.685s02

Potter, J. (2015). Applying a hybrid model: Can it enhance student learning outcomes? *Journal of Instructional Pedagogies, 17,* 1-11. Retrieved from: http://www.aabri.com/manuscripts/141861.pdf

Sciarappa, W. J., Quinn, V., & Ward, D. L. (2016). Comparing Conventional, Hybrid, and Distance Learning Courses in Horticulture. *HortTechnology*, *26*(5), 677–682. doi: 10.21273/horttech03377-16

Skill, T. D., & Young, B. A. (2002). Embracing the hybrid model: Working at the intersections of virtual and physical learning spaces. *New Directions for Teaching and Learning*, *2002*(92), 23–32. doi: 10.1002/tl.76

Stevens, C. (2016, November 30). Hybrid Program Design: What Works for Adult Learners in a Professional Degree Program?. Retrieved March 20, 2020, from https://eric.ed.gov/?id=ED577491

Veneri, D. (2010). The role and effectiveness of computer-assisted learning in physical therapy education: A systematic review. *Physiotherapy Theory and Practice*, *27*(4), 287–298. doi: 10.3109/09593985.2010.493192

Veneri, D., & Gannotti, M. (2014). A comparison of student outcomes in a Physical Therapy Neurologic Rehabilitation course based on delivery mode: Hybrid vs Traditional. *Journal of Allied Health, 43*(4), 75-81.

APPENDIX A: IRB APPROVAL LETTER

MARSHALL UNIVERSITY
www.marshall.edu

Office of Research Integrity
Institutional Review Board
One John Marshall Drive
Huntington, WV 25755

FWA 00002704

IRB1 #00002205
IRB2 #00003206

June 3, 2020

Dr. Charles Bethel, Ed.D
Education - Leadership Studies

RE: IRBNet ID# 1612050-1
At: Marshall University Institutional Review Board #2 (Social/Behavioral)

Dear Dr. Bethel:

Protocol Title:	[1612050-1] EXAMINATION OF STUDENT LEARNING OUTCOMES DURING A MUSCULOSKELETAL SPINE ASSESSMENT COURSE: HYBRID BLENDED MODEL VERSUS TRADITIONAL CLASSROOM DELIVERY IN A DOCTOR OF PHYSICAL THERAPY PROGRAM	
Site Location:	MU	
Submission Type:	New Project	APPROVED
Review Type:	Exempt Review	

In accordance with 45CFR46.104(d)(1), the above study was granted Exempted approval today by the Marshall University Institutional Review Board #2 (Social/Behavioral) Designee. No further submission (or closure) is required for an Exempt study unless there is an amendment to the study. All amendments must be submitted and approved by the IRB Chair/Designee.

This study is for student David Denton.

If you have any questions, please contact the Marshall University Institutional Review Board #2 (Social/Behavioral) Coordinator Anna Robinson at (304) 696-2477 or robinsonn1@marshall.edu. Please include your study title and reference number in all correspondence with this office.

Sincerely,

Bruce F. Day, ThD, CIP
Director, Office of Research Integrity

APPENDIX B: CHI-SQUARE TEST COMPARING THE TCM GROUP VERSUS THE HBM GROUP FOR RQ1

Student Satisfaction Questionnaire

Q1. I find it important to be provided with the learning objectives of a course.

		Q1					Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Strongly Disagree	Disagree	Agree	Strongly Agree	Total			
Group	Traditional	2	1	4	4	11	2.068[a]	3	.558
	Hybrid	0	1	4	5	10			
Total		2	2	8	9	21			

Significance tested at p < 0.05

+ 8 cells (100.0%) have expected count less than 5. The minimum expected count is .95.

Q2. The objectives for this course module were provided at the beginning of this course and were clearly described.

		Q2				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total			
Group	Traditional	1	4	6	11	2.777[a]	2	.249
	Hybrid	0	7	3	10			
Total		1	11	9	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q3. The course objectives for this course module were closely related to what I was expected to learn.

		Q3			Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Agree	Strongly Agree	Total			
Group	Traditional	4	7	11	2.376[a]	1	.123
	Hybrid	7	3	10			
Total		11	10	21			

Significance tested at p < 0.05

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.76.

Q4. The course objectives for this course module assisted with guiding my learning activities.

		Q4				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	2	4	5	11	2.469[a]	2	.291
	Hybrid	0	6	4	10			
Total		2	10	9	21			

Significance tested at p < 0.05

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .95.

Q5. I find it important to be provided with the course assessment methods at the beginning of a course.

		Q5				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	2	2	7	11	2.157[a]	2	.340
	Hybrid	0	3	7	10			
Total		2	5	14	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .95.

Q6. The course assessment methods for this course module were provided at the beginning of the course.

		Q6				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	1	2	8	11	6.017[a]	2	.049
	Hybrid	0	7	3	10			
Total		1	9	11	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q7. The course assessment methods for this course module were clearly described.

		Q7				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total			
Group	Traditional	1	4	6	11	2.777[a]	2	.249
	Hybrid	0	7	3	10			
Total		1	11	9	21			

Significance tested at $p < 0.05$

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48

Q8. The course assessment methods for this course module included a variety of assessment methods.

		Q8				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total			
Group	Traditional	1	4	6	11	1.355[a]	2	.508
	Hybrid	1	6	3	10			
Total		2	10	9	21			

Significance tested at $p < 0.05$

a. 5 cells (83.3%) have expected count less than 5. The minimum expected count is .95.

Q9. The course assessment methods for this course module were closely related to the course objectives.

		Q9			Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Agree	Strongly Agree	Total			
Group	Traditional	6	5	11	1.289[a]	1	.256
	Hybrid	3	7	10			
Total		9	12	21			

Significance tested at $p < 0.05$

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 4.29.

Q10. I find it important to be provided with the course resources and materials during a course.

		Q10			Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Agree	Strongly Agree	Total			
Group	Traditional	2	9	11	.011[a]	1	.916
	Hybrid	2	8	10			
Total		4	17	21			

Significance tested at p < 0.05

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 1.90.

Q11. The course resources and materials for this course module were easily accessible during the course.

		Q11				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total			
Group	Traditional	1	1	9	11	2.207[a]	2	.332
	Hybrid	0	3	7	10			
Total		1	4	16	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q12. The purpose of course resources and materials for this course module were clearly described.

		Q12			Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Agree	Strongly Agree	Total			
Group	Traditional	3	8	11	2.291[a]	1	.130
	Hybrid	6	4	10			
Total		9	12	21			

Significance tested at p < 0.05

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 4.29.

Q13. The course resources and materials for this course module helped me reach the course objectives.

		Q13				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	1	2	8	11	1.222[a]	2	.543
	Hybrid	0	3	7	10			
Total		1	5	15	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q14. The course resources and materials for this course module included a wide variety of resources and materials.

		Q14				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	1	6	4	11	.955[a]	2	.620
	Hybrid	0	6	4	10			
Total		1	12	8	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q15. I find it important to interact with the instructor during a course.

		Q15					Pearson Chi-Square		Asymptotic Significance (2-sided)
		Strongly Disagree	Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	1	2	1	7	11	3.961[a]	3	.266
	Hybrid	0	0	3	7	10			
Total		1	2	4	14	21			

Significance tested at p < 0.05

a. 6 cells (75.0%) have expected count less than 5. The minimum expected count is .48.

Q16. The course instructor for this course module interacted with me in a timely fashion regarding skill competency feedback.

		Q16				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total			
Group	Traditional	1	3	7	11	1.273[a]	2	.529
	Hybrid	1	5	4	10			
Total		2	8	11	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .95.

Q17. The course interaction/feedback with the instructor for this course module helped me reach the course objectives.

		Q17				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Strongly Disagree	Agree	Strongly Agree	Total			
Group	Traditional	1	5	5	11	2.937[a]	2	.230
	Hybrid	0	8	2	10			
Total		1	13	7	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q18. I find it important to be provided with course technology that enhances learning during a course.

		Q18				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total			
Group	Traditional	2	5	4	11	3.278[a]	2	.194
	Hybrid	0	3	7	10			
Total		2	8	11	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .95.

Q19. The course technology for this course module was readily available during the course.

		Q19			Pearson Chi-Square		Asymptotic Significance (2-sided)
		Agree	Strongly Agree	Total		df	
Group	Traditional	5	6	11	1.527[a]	1	.217
	Hybrid	2	8	10			
Total		7	14	21			

Significance tested at p < 0.05

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 3.33.

Q20. The course technology for this course module functioned very well.

		Q20				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	1	3	7	11	1.222[a]	2	.543
	Hybrid	0	2	8	10			
Total		1	5	15	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q21. The course technology for this course module was helpful in reaching the course objectives.

		Q21				Pearson Chi-Square		Asymptotic Significance (2-sided)
		Disagree	Agree	Strongly Agree	Total		df	
Group	Traditional	1	3	7	11	.955[a]	2	.620
	Hybrid	0	3	7	10			
Total		1	6	14	21			

Significance tested at p < 0.05

a. 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

Q25. Overall Satisfaction

		OverAllStsfctn				Pearson Chi-Square	df	Asymptotic Significance (2-sided)
		Somewhat Satisfied	Satisfied	Very Satisfied	Total			
Group	Traditional	1	4	6	11	1.909[a]	2	.385
	Hybrid	0	2	8	10			
Total		1	6	14	21			

Significance tested at p < 0.05

+ 4 cells (66.7%) have expected count less than 5. The minimum expected count is .48.

APPENDIX C: SURVEY QUESTIONNAIRE PERMISSION OF USE

Rick Aman <rick.aman@CEI.EDU>
Wed 9/18/2019 4:28 PM
9/17/19

Dr. Denton
I would be honored to have you utilize my dissertation instrument used for the survey of student course satisfaction.
You have my permission to use the instrument in any way you feel it would enhance your dissertation research.

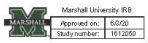
Best wishes with your work.

Regards,

Rick Aman

APPENDIX D: PARTICIPANT LETTER

Informed Consent to Participate in a Research Study



EXAMINATION OF STUDENT LEARNING OUTCOMES DURING A MUSCULOSKELETAL SPINE ASSESSMENT COURSE: HYBRID BLENDED MODEL VERSUS TRADITIONAL CLASSROOM DELIVERY IN A DOCTOR OF PHYSICAL THERAPY PROGRAM

Charles N Bethel, Ed.D, Principal Investigator

Key Information

You are invited to participate in a research study. Research studies are designed to gain scientific knowledge that may help other people in the future. You may or may not receive any benefit from being part of the study. Your participation is voluntary. Please take your time to make your decision, and ask your research investigator or research staff to explain any words or information that you do not understand. The following is a short summary to help you decide why you may or may not want to be a part of this study. Information that is more detailed is listed later on in this form.

The purpose of the study is to allow for comparison of student learning outcomes between two lecture format delivery models in a musculoskeletal spine course within a Doctor of Physical Therapy Program. You will be asked to be randomly assigned to one of two groups during your cervical spine module of your clinical decision-making course this summer in 2020. The syllabi objectives and content be the same for all participants regardless of being in group one or two. Those students in Group 1, will be instructed only using traditional methods of live in-person lecture and live in-person demonstration of skills competencies. If you are in Group 2, the course will be taught using hybrid blended model (online and live classroom instruction) delivery of course content and video demonstration of all skills competencies.
We expect that you will be in this research study for one week during usual meeting times of the clinical decision-making course. There are no risks of this study within the course and the survey or assessment values will not be counted toward your grade.

How Many People Will Take Part In The Study?

About thirty Doctor of Physical Therapy Students will take part in this study. A total of thirty subjects are the most that would be able to enter the study.

What Is Involved In This Research Study?

In addition to the previously described methods and procedure, data will be collected on learning outcomes from the lecture material presented. Data instruments will include numeric scores from a 20-item written exam, eight item lab skills check, and scores from a 25 - item validated Student Satisfaction Questionnaire.

Subject's Initials _____

What Are Your Rights As A Research Study Participant?

You may choose not to take part or you may leave the study at any time. Refusing to participate or leaving the study will not result in any penalty or loss of benefits to which you are entitled. If you decide to stop participating in the study we encourage you to talk to the investigators or study staff first.

The study investigator may stop you from taking part in this study at any time if he/she believes it is in your best interest; if you do not follow the study rules; or if the study is stopped.

What About Confidentiality?

We will do our best to make sure that your personal information is kept confidential. However, we cannot guarantee absolute confidentiality. Federal law says we must keep your study records private. Nevertheless, under unforeseen and rare circumstances, we may be required by law to allow certain agencies to view your records. Those agencies would include the Marshall University IRB, Office of Research Integrity (ORI) and the federal Office of Human Research Protection (OHRP). This is to make sure that we are protecting your rights and your safety. If we publish the information we learn from this study, you will not be identified by name or in any other way.

What Are The Costs Of Taking Part In This Study?

There are no costs to you for taking part in this study. All the study costs, including any study tests, supplies and procedures related directly to the study, will be paid for by the study.

Will You Be Paid For Participating?

You will receive no payment or other compensation for taking part in this study.

Whom Do You Call If You Have Questions Or Problems?

For questions about the study or in the event of a research-related injury, contact the study investigator, *Dr Charles Bethel* at *phone number 304-746-8952*.. You should also call the investigator if you have a concern or complaint about the research.

For questions about your rights as a research participant, contact the Marshall University Office of Research Integrity (ORI) at (304) 696-4303. You may also call this number if:

- You have concerns or complaints about the research.
- The research staff cannot be reached.
- You want to talk to someone other than the research staff.

You will be given a signed and dated copy of this consent form.

Subject's Initials _____

SIGNATURES

You agree to take part in this study and confirm that you are 18 years of age or older. You have had a chance to ask questions about being in this study and have had those questions answered. By signing this consent form you are not giving up any legal rights to which you are entitled.

Subject Name (Printed)

Subject Signature Date

Person Obtaining Consent (Printed)

Person Obtaining Consent Signature Date

Subject's Initials _____

APPENDIX E: STUDENT SATISFACTION QUESTIONNAIRE

Peer Review "Student Satisfaction" Questionnaire

Research Question: Is there a significant difference in levels of student satisfaction between online courses that have undergone a systematic faculty peer review process compared with non-peer reviewed courses?

	Questions 1 through 25 was based on a Likert Scale: *1 - Strongly Disagree* *2 - Disagree* *3 - Agree* *4 - Strongly Agree* *#22-24 are Write in Responses*	

	Response Choices Mark appropriate box with an "X"	Strongly Disagree 1	Disagree 2	Agree 3	Strongly Agree 4
1.	I find it important to be provided with the learning objectives of a course.				
2.	The objectives for this course module were provided at the beginning of this course and were clearly described.				
3.	The course objectives for this course module were closely related to what I was expected to learn.				
4.	The course objectives for this course module assisted with guiding my learning activities.				
5.	I find it important to be provided with the course assessment methods at the beginning of a course.				
6.	The course assessment methods for this course module were provided at the beginning of the course.				
7.	The course assessment methods for this course module were clearly described.				
8.	The course assessment methods for this course module included a variety of assessment methods.				
9.	The course assessment methods for this course module were closely related to the course objectives.				

10.	I find it important to be provided with the course resources and materials during a course.				

11.	The course resources and materials for this course module were easily accessible during the course.				
12.	The purpose of course resources and materials for this course module were clearly described.				
13.	The course resources and materials for this course module helped me reach the course objectives.				
14.	The course resources and materials for this course module included a wide variety of resources and materials.				
15.	I find it important to interact with the instructor during a course.				
16.	The course instructor for this course module interacted with me in a timely fashion regarding skill competency feedback.				
17.	The course interaction/feedback with the instructor for this course module helped me reach the course objectives.				
18.	I find it important to be provided with course technology that enhances learning during a course.				
19.	The course technology for this course module was readily available during the course.				

20.	The course technology for this course module functioned very well.				
21.	The course technology for this course module was helpful in reaching the course objectives.				
22.	What is your gender? (Female/Male)	Write in response:			

23.	How many online courses have you taken in the past? (enter number)	Enter Number Here:			
24.	What is your age?	Write in Response:			
25.	Overall, I am satisfied with this course module delivery.				

APPENDIX F: MULTIPLE CHOICE TEST

Lecture (Traditional Classroom Model Group and Hybrid/Blended Model Group) Test Item Bank – 20 Questions (1 point each)

1. For interventions related to ACUTE neck pain with mobility deficits, which is the best evidence of treatment approach?
    A. Clinicians should provide a cervical collar, mechanical cervical traction, and scapulothoracic and upper extremity strengthening to enhance program adherence.
    B. **Clinicians should provide thoracic manipulation, a program of neck ROM exercises, and scapulothoracic and upper extremity strengthening to enhance program adherence.**
    C. Refer to physician with recommendation for X-rays.
    D. Clinicians should begin by calming soft-tissue with moist heat, cervical soft-tissue mobilization, a program of neck ROM exercises, and scapulothoracic and upper extremity strengthening to enhance program adherence.

2. A 38- year-old male comes in for evaluation concerning recent onset of neck pain. Pt upon examination presents with pain upon neck movement, movement coordination deficits, and decreased ROM particularly in cervical flexion and extension. Which would be the best treatment approach to commence on first visit?
    A. **Manual mobilization techniques plus exercise including strengthening, endurance, flexibility, postural, coordination, aerobic, and functional exercises.**
    B. Perform self C1/C2 Sustained Natural Apophyseal Glides (SNAGS), and upper back muscular strengthening.
    C. Prescribe home TENS unit, application of moist heat, and resistive exercise.
    D. None of the Above

3. For interventions related to ACUTE neck pain with radiating symptoms which is the best evidence initial treatment approach?
    A. Clinicians may provide cervical joint manipulation, laser, and short-term use of a cervical collar.
    B. Clinicians may provide ultrasound, thoracic joint manipulation, and cervical range of motion exercises.
    C. Refer to physician for recommended nerve conduction velocity testing.
    D. **Clinicians may provide mobilizing and stabilizing exercises, laser, and short-term use of a cervical collar.**

4. For interventions related to CHRONIC neck pain with radiating symptoms which is the best evidence initial treatment approach?
    A. Clinicians should provide recommendations that the patient seek out surgery.
    B. Clinicians should provide postural corrective exercises, combined with other interventions such as stretching and strengthening exercise plus home exercise for patient including techniques for first rib mobilization.
    C. Clinicians should provide ultrasound for pain relief and utilize static mechanical cervical traction.
    D. **Clinicians should provide mechanical intermittent cervical traction, combined with other interventions such as stretching and strengthening exercise plus cervical and thoracic mobilization/manipulation with education and counseling.**

5. Which special test shows the highest level of evidence to detect intracranial pathology?
    A. The Spurling's maneuver
    B. X-Ray is the Gold Standard.
    C. **The Valsalva maneuver**
    D. Cervical Distraction Test

6. Which classification of neck pain do the following symptoms of "central or unilateral neck pain with cases of referred pain" derive from?
    A. Neck pain with muscle spasm
    B. **Neck pain with mobility deficits**
    C. Neck pain with radiating pain
    D. None of the above

7. Which classification of neck pain do the following symptoms of "trauma or whiplash with headache, nausea, or dizziness" derive from?
    A. Neck pain with headache (cervicogenic)
    B. **Neck pain with movement coordination impairments**
    C. Ottawa Neck Rules for fracture
    D. None of the above

8. Pt comes into the clinic with ongoing intermittent unilateral neck pain which develops into a headache typically 4-5 days per week. Which classification of the described neck pain do the following symptoms classify as?
    A. Neck pain with radiating pain (radicular)
    B. Neck pain of muscular origin
    C. Neck pain of peripheral causation
    D. **Neck pain with headache (cervicogenic)**

9. Which classification of neck pain do the following symptoms of "neck pain radiating into extremity with myotomal weakness and/or paresthesia" derive from?
    A. **Neck pain with radiating pain (radicular)**
    B. Neck pain with movement coordination impairments
    C. Neck pain positive for Valsalva intracranial pathology
    D. Neck pain secondary to recent motor vehicle accident

10. C1/C2 self-sustained natural apophyseal glides (SNAGS) are beneficial in which treatment classification of neck pain?
    A. Stiff lower cervical neck joints
    B. Neck pain with numbness and tingling down the extremity
    C. Neck pain post segment compression fracture
    D. **Neck pain with headache**

11. Which treatment classification category is it beneficial within patient presentation to utilize short term collar wearing?
    A. Neck pain derived from motor vehicle accident
    B. **Neck pain with radiating pain (radicular)**
    C. Neck pain with headache caused secondary to movement
    D. It is never beneficial to prescribe short term collar wearing

12. Which treatment classification category is it beneficial and recommended to remain active with neck motion, exercise, and minimize wearing of a cervical collar?
    A. Neck pain with acute radicular symptoms recent onset
    B. Neck pain accompanied by redness, swelling, and fever
    C. **Neck pain with movement coordination deficits (WAD)**
    D. Neck pain with postural headaches

13. Expected exam findings for this category (neck pain with mobility deficits) of neck pain classification includes:
    A. Suspicion of cervical segment fracture
    B. Limited myotomal strength grades, cervicogenic headache, and joint crepitus
    C. Severe postural kyphosis, inability to gain cervical extension, and pain at end range
    D. **Limited cervical ROM, pain at end range, and restricted cervical or thoracic joint mobility**

14. Expected exam findings for neck pain with movement coordination impairments includes:
    A. Positive Spurling's test and cervicogenic headache
    B. Positive Valsalva test and reduction in pain with cervical compression test
    C. **Positive cranial cervical flexion test or positive neck flexor muscle endurance test**
    D. None of the above

15. Expected exam findings for this category (neck pain with headache) of neck pain classification includes:
    A. Positive cervical flexion rotation test
    B. Positive cranial cervical flexion test
    C. Positive neck flexor muscle endurance test
    D. **All of the above**

16. Expected exam findings for neck pain with radiating pain includes:
    A. **Pain reproduced or relieved with upper limb nerve mobility, Spurling's test, cervical distraction or ROM**
    B. Pain reproduced with Sharp Purser test, limited cervical ROM, and pain with movement
    C. Pain upon cervical palpation, pain upon joint mobility testing, and onset of headache
    D. None of the above

17. Expected symptoms for neck pain with mobility deficits includes:
    A. **Weak cervico-scapular strength**
    B. Weak bilateral Alar ligaments
    C. Intermittent cervicogenic headaches
    D. Joint crepitus upon movement

18. Expected symptoms for neck pain with movement coordination impairments includes:
    A. Positive cervical flexion test and positive Spurling's test
    B. Positive cervical distraction test with peripheral radiculopathy
    C. **Trigger points, pain mid-range, weak endurance neck muscles**
    D. Upper extremity weakness, cervicogenic headache, and joint crepitus

19. Expected symptoms for neck pain with headache includes:
    A. Pain upon cervical muscle palpation
    B. **Restricted upper cervical spine segments and headache with provocation of cervical segments**
    C. May have upper extremity sensory, strength, or reflex deficits associated with the involved nerve roots
    D. Positive cervical flexion test and positive Spurling's test

20. Expected symptoms for neck pain with radiating pain includes:
    A. Numbness and tingling into upper extremity
    B. **May have upper extremity sensory, strength, or reflex deficits associated with the involved nerve roots**
    C. Decreased coordination of movements and intense pain
    D. Positive cervical distraction test with peripheral radiculopathy

APPENDIX G: COMPETENCY SKILLS CHECK-OFF

Grading with a satisfactory (scored 1 point), partial (½ point), or unsatisfactory (scored 0 point)

1. Demonstrate a neck flexor muscle endurance test
SCORE:
2. Demonstrate how you would instruct a patient on a C1/C2 self-SNAG for HEP
SCORE:
3. Demonstrate a cervical flexion rotation test
SCORE:
4. Demonstrate a Spurling's test
SCORE:
5. Demonstrate sharps-purser for instability
SCORE:
6. Demonstrate VBI Test
SCORE:
7. Demonstrate a C1/C2 self-sustained natural apophyseal glide (SNAG) for patient home exercise program instruction
SCORE:
8. Demonstrate assessment of cervical segment mobility at joints C4/5/6/7 including combinations of CPA, UPA, and Transverse glide
SCORE: