Improving Body Mechanics Using Experiential Learning and Ergonomic Tools in Massage Therapy Education

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Introduction: **Current industry data suggest that the rise in occupational injuries for massage therapists is contributing to a significant number leaving the profession after a few short years. While many massage therapists are taught methods for proper body mechanics and self-care within their career educational programs, there are few consistencies in the theoretical approaches to these concepts, even though it is a required component in massage therapy career training.**

Purpose: **This study demonstrates a measurable and effective teaching method using a combination of experiential and transformative learning theory models and authentic ergonomics measurement tools to teach effective body mechanics in entry level career training that may be sustainable for new massage therapists entering the field.**

Methods: **Four cohorts of students (N = 17) enrolled in a kinesiology course for massage therapists were studied using a mixed-methods time series experimental design. A pre- and post-test was conducted by utilizing two industry standard ergonomics risk factor assessment tools as measurable data for score comparison, to denote improvements in each student's risk factor tendencies and provide evidentiary support of learning transfer. Between the pre- and post-test, students participated in a series of experiential learning exercises within class sessions during the semester and completed two reflection journals discussing their experiences.**

Results: **The results showed that there was a statistically significant reduction in ergonomics risk factor scores for all students studied.**

Conclusion: **The success of this study demonstrates that the instructional design using experiential and transformative educational theory and general ergonomics concepts is an effective approach to teaching proper body mechanics to massage therapy students which can be adopted into universally accepted curriculum on many levels and could eventually contribute to reduction of occupational injury in the future.**

KEY WORDS: massage therapy; transformative learning; body mechanics; self-care; ergonomics; experiential learning

INTRODUCTION

The massage therapy profession has a strong outlook for employment growth for the next several years.[1] However, even with this projected trend and changes to work environment models nationwide, the increase in occupational injury sustained by massage therapy professionals is contributing to shorter career spans.[2] While there are massage therapy educational resources available that address body mechanics in general terms and guidelines, none emphasize the essence of workplace ergonomics principles, which recommend a customizable approach to reduce risk factors in the workplace.[2,3] Consistent results-based pedagogical practices and instructional design in therapist self-care awareness concepts and foundational body mechanics knowledge derived from actual ergonomics principles are needed to create a proactive approach to massage therapist injury prevention.

A recent study showed that, while most currently practicing massage therapists use self-care regimens, 83% reported work-related pain in the wrist or thumb at some point during their careers, with 57% experiencing pain with the last 30 days.[4] Comprehensive massage skills and theory textbooks contain a chapter of information about general body mechanics principles, but lack some specificity in adapting the work to the individual.[2] There are three relatively current textbooks specific to the topic of body mechanics and self-care that many massage therapy schools use nationwide; the fourth book is currently out of print, but is still used in some schools.[5–8] These textbooks lack some consistency and efficacy in their instructional design, recognizable learning theory, and employable methods to teach body mechanics for massage therapists.

Recently completed action research in massage therapy foundation education used and measured the effects of an instructional design incorporating applicable educational theory and basic ergonomics concepts to help students develop safe and effective body mechanics and personal kinesthetic awareness skills. The purpose of this manuscript is to provide context through a literature review and critique, a description of the educational interventions used, and a report of the methods and results from the educational

action research's mixed-methods time series experimental study of four cohorts of entry-level massage therapy students.

Literature Review

There is little research acknowledging a specific instructional design for body mechanics and self-care principles for massage therapy students and professionals; however, there are a few studies that measured risk factors in massage therapy work. Ample research outcomes support the need for a deeper understanding of risk factor dynamics in massage therapy work tasks in order to adequately establish injury prevention measures.[9–15]. Two specific studies contained information that can be applied to massage therapy educational framework. Mohr used ergonomic measurement tools such as the 3DSSPP software for 3D modeling with anthropometric parameters of median demographics of massage therapists and an Ergo-FET palm force gauge, to demonstrate how "poor" techniques have a very direct correlation to impacting the health and well-being of massage therapists.[2] The study further suggests that very few schools teach students how to use their bodies in a way that minimizes fatigue and injury risk. The conceptual definition of body mechanics must involve consideration of the physical movement of the human body viewing its structural design through engineering and biological lenses.[2] Mohr's discoveries support the concept of an improved instructional approach to body mechanics beyond the basics, since the rate of work-related injury occurrence is still impacting the profession and has not improved.[16]

A study by Page used ergonomic evaluation and survey tools, such as the Strain Index (SI), Rapid Upper Limb Assessment (RULA), Occupational Repetitive Actions (OCRA), and Rapid Entire Body Assessment (REBA), and found that all tools tested were accurate in determining repetitive stress injury risk; no specific tool was preferable in measuring risk.[4] Video recordings were used as a supporting data collection method to further verify the scoring on the SI tool in determining their work-related musculoskeletal concerns.[4] Page's outcomes showed that other factors such as inadequate rest periods, lack of technique variation, and repetitive static working positions all had a significant impact on the massage therapist subjects in contributing to their noted work-related injuries and pain even with consistent use of personal self-care regimens conjunctively.[4]

Both studies suggest that using ergonomics tools as measurement gauges, ergonomics concepts in identifying risk factors, and foundational principles in learning activity construction for massage therapy education may offer some new ideas in teaching body mechanics and may be a key element to improvement.

Comparison of Current Resources

There are three current textbooks that are available to massage therapy educators that specifically cover body mechanics and self-care: *Career Longevity: The Bodywork Practitioner's Guide to Wellness and Body Mechanics*[5] by Jean E. Freeman and Sandra K. Anderson; *Body Mechanics for Manual Therapists: A Functional Approach to Self-Care*[6] by Barbara Frye; and *Save Your Hands!: The Complete Guide to Injury Prevention and Ergonomics for Manual Therapists*[7] by Lauriann Greene and Richard Goggins. A fourth textbook, *Body Mechanics and Self-Care Manual*[8] by Marian Wolfe Dixon, is out of print and not widely used. Each textbook has its own unique approach in the presentation and application of the topic area influenced by the authors' training backgrounds and experiences. While some areas are similar in their presentation, there are some differences in emphasis of concepts.

Some similar elements in all content include addressing basic body mechanics principles such as:

- avoiding movement beyond perpendicularity;
- stacking joints or keeping joints in straight alignment;[2]
- supporting tools;
- proper spinal alignment;
- table height recommendations; and
- proper foot placement and stances.[5–8]

All textbooks specify content with some pictorial demonstrations in the utilization of self-care techniques including:

- stretching recommendations and exercises;
- hydrotherapy use;
- rest period duration;
- Eastern influences; and
- emotional and personal aspects.[5–8]

Physical science concepts are also included with definitions of base of support, center of gravity, and lever mechanisms.[5–8]

There are some distinct differences in learning assessments and theoretical approaches among the textbooks. Freeman and Anderson, and Frye use a form of reflection exercise with wellness plan development or journaling; both include a digital video disc (DVD) with supplemental materials.[5,6] Dixon also utilizes a similar reflection method with no video support.[8] Freeman and Anderson, and Frye suggest some experiential exercises to emphasize kinesthetic knowledge and awareness; however, some of these activities do not draw a direct correlation in its application to massage therapy practice.[5,6] Dixon, however, does attempt to engage learners with exercises that spark kinesthetic awareness of certain key elements as it relates to massage therapy application.[8] Greene

and Goggins are the most specific in the coverage of repetitive stress injuries common to massage therapists, but have minimal learning activities relating to massage practice.[7] The differences in the authors' backgrounds also have influential rationale in their instructional viewpoints. Frye, in addition to massage therapy training, is Feldenkrais-certified,[6] a form of kinesthetic re-education theory that uses gentle movement sequences to improve overall function.[17] Freeman and Anderson have foundations in fitness training and Asian bodywork therapy.[5] Greene and Goggins come from the ergonomics perspective with certifications in these areas beyond their massage therapy perspective of knowledge.[7] One distinction of Greene and Goggins is the inclusion of a true definition of ergonomics, stating that it is not parallel to body mechanics because of its mention of adaptation.[7]

Educational Theory and Massage Therapy Education Framework

Studies in instructional design suggest that the practices of experiential and transformative learning are very effective with adult learners.[18] While the reviewed textbooks mentioned above have content that attempts to emphasize specific learning approaches, there is no documentation to support that any methods have been specifically employed or tested. Philosopher John Dewey and sociologist Jack Mezirow developed educational theories that can be applied. Dewey suggests we do not learn from all experiences; however, the ones that generate quality are lasting and influential.[18] Furthermore, Mezirow states with transformative learning that our reality is shaken when our habitual ways of viewing things no longer exist.[18] The goal of an instructional design for body mechanics would be to create meaningful learning experiences that can contribute to viable skill development. Stemming from recommendations by Albert et al.,[9] and Mohr[2] recommendations for the need for further investigation of postural and self-care training, using an educational method employing both experiential and transformative learning models could provide the needed shift in massage therapy education to potentially translate into reduced future incidences of work-related musculoskeletal injury and, subsequently, fewer massage therapists leaving the industry.[2]

Inconsistent delivery methods in massage therapy education may pose another difficulty in effective body mechanics instruction. The Entry Level Analysis Project (ELAP), a formal document that attempts to create standardization in entry-level massage therapy education, constructs three objective levels across cognitive, psychomotor, affective, and interpersonal learning domains in all content areas of massage therapy education: Level 1—Receive and Respond, Level 2—Apply, and Level 3—Problem Solve.[19] Under the main topic heading of "Personal Health, Body Mechanics, and Self-Care", ELAP recommends that students complete a total of 20 hours of hands-on practice during which "the integration of body mechanics principles into hands-on work, including the regular use of a self-care warm-up and correct body mechanics during the application of massage, on an additional practical evaluation" is demonstrated.[19] Further examination of the ELAP under the subtopics of "Body Mechanics Principles" and "Work-Injury Prevention" shows there are no learning objectives for the third level of problem solving in the cognitive domain, but requires competency in the psychomotor domain through ongoing practice sessions in other classes, with the expectation of students being able to "perfect body mechanics during the application of massage methods", but no proficiency for work-injury prevention.[19]

METHODS

This study's design classification mostly aligns with the definition of a mixed-methods time series experimental study design since the same testing methods, interventions, and data analysis were applied to the study groups for a similar time period, with no control group comparative but using pre- and post-testing as covariates.[20] Authentic ergonomic assessment tools were used purposefully for outcome measurability, in combination with effective classroom assessment techniques, to determine if learning transfer occurred after student progression through the specific learning objectives. A sequential and intentional data collection method was used by first completing a pre-test, then monitoring qualitative comments through reflection journal entries, and concluding with a post-test as a quantifiable scoring comparative. The outline of the action research process is shown in Figure 1. Since human subjects were studied, institutional review board approval was obtained.

Participants

The sample criteria in this study included all students who enrolled and fully completed the massage therapy course, MASS 212—Kinesiology for Massage Therapists, across four cohort groups: Spring 2016 (n = 6), Summer 2016 (n = 5), Spring 2017 (n = 3), and Summer 2017 (n = 3), for a total of 17 students (N = 17). Three students were excluded from the study because they did not fully complete the course for various reasons unrelated to the study and, therefore, self-selected out of the study. The instruction of proper body mechanics is part of the MASS 212 prescribed course content,[21] as well as the overall study of human movement to establish basic foundational skills in client assessment and

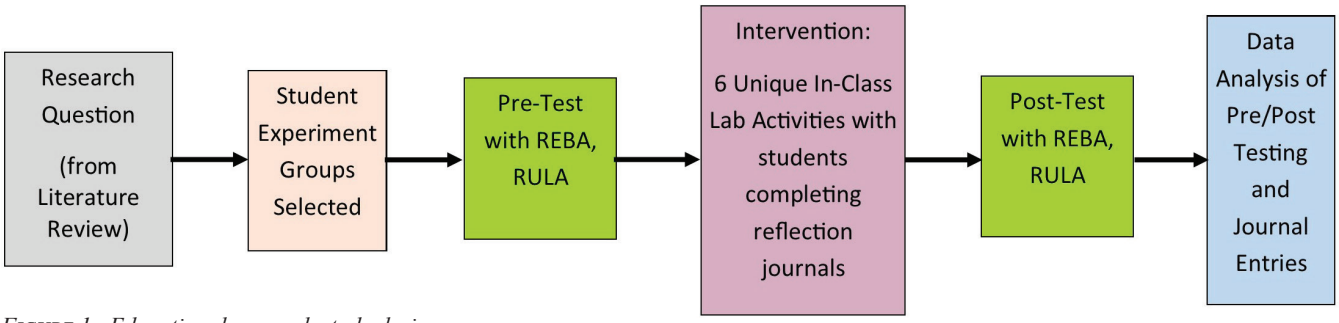

Figure 1. Educational research study design.

employ the use of self-care techniques contributing to career longevity. Students taking this course expected to learn body mechanics and self-care techniques as part of their core training for the associate of applied science degree in massage therapy. The researcher served as the instructor for all four cohort groups and collected the data as part of the course requirements; the researcher also had ergonomics assessment certification training and applicable experience, in addition to several years of massage therapy practical and educational experience.

Measurement Tools

A viable approach to analyzing risk factors in a work environment is through using industry-standard ergonomic assessment tools recognized by the Occupational Safety and Health Administration (OSHA).[22] Two specific measurement tools were selected to assess job tasks and body positions while performing massage therapy work: the Rapid Entire Body Assessment tool, or REBA,[23] and the Rapid Upper Limb Assessment tool, or RULA.[24] The REBA tool contains a series of body positioning pictures for each body area in which a trained ergonomics analyzer would select based on what accurately depicts the analyzer's observations of the job tasks of an individual worker being observed. The pictorial selections correlate to a section score which is totaled into a final assessment score. The score scale indicates whether a need for ergonomic investigation and change in performing job tasks is warranted or needs further analysis and resolution to reduce potential injury risk to the worker. The final score on the REBA indicates risk level or potential for injury in the following scale:

- 1 = negligible risk;
- 2–3 = low risk, change may be needed;
- 4–7 = medium risk, further investigate, change soon;
- 8–10 = high risk, investigate and implement change; and
- 11+ = very high risk, implement change.[23]

The RULA, which uses a similar scoring premise and trained observation tool mechanism, is focused on effects to the upper limbs and postures primarily, with the pictorial scoring sections geared towards those elements of body movement while performing job tasks. The scoring scale on the RULA is as follows:

- 1–2 = acceptable posture;
- 3–4 = further investigation, change may be needed;
- 5–6 = further investigation, change soon; and
- 7 = investigate and implement change.[24]

From an ergonomic standpoint, the use of the REBA and RULA is to provide an estimated quantification of potential injury risk as artifactual components to an overall job task analysis. The intent of ergonomics assessment and analysis is to depict the current manner in which a job task is physically performed, to identify problem areas that create unnecessary risk, and to promote the creation of solutions to help minimize risk for a job task.[23,24] In some cases, the inherent nature of the work being performed may not be able to achieve a REBA or RULA score below a low-to-medium risk scoring range and, therefore, other ergonomic factors such as work design, working capacity, and task demands must be considered in job-task analysis and improvement.[3] The use of these ergonomic tools as a measurement component for this study supported the overarching premise of depicting potential injury risk to massage therapy students and the importance of developing good body mechanics skills.

Intervention

The two ergonomic assessment tools, REBA and RULA, were used as a pre-test to measure the students' ergonomic risk factors towards the beginning of the semester prior to any in-class activities or interventions, and then again as a post-test near the end of the semester after a series of in-class lab activities were assigned over a period of seven weeks within the semester. After the pre-test and post-test sessions, students were presented with their scores in the next class session to discuss their outcomes. Discussion of the pre-test score and observation comments gave students an understanding of what elements in their body mechanics were of concern and/or were performed

well. After the post-test scoring and observation comments, students had another opportunity to discuss their outcomes and compare results in the last class session of the semester. The pre-testing scores were compared to the post-test scores to see if students made any significant improvements. In addition, students were offered the option of taking a pre- and post-digital video recording during the pre- and post-testing sessions as supplemental visual evidence along with their scoring results. Videos were shared via two methods: (1) either through a link to a shared Dropbox[25] with restricted access for the instructor and the enrolled students only from the course page in the Blackboard Learning Management System (LMS)[26] used by the college, or (2) using the student's own personal electronic device with video capabilities. The videos were not used as primary data collection items because they were not a written course requirement and could not be mandated according to college policies regarding students' rights;[27] moreover, to comply with these institutional policies, students were given the option to video as an additional reference to enhance their experiential learning processes. All optional video recordings in the shared Dropbox were deleted at the conclusion of each semester.

A series of six unique in-class activities were designed to help students refine and improve their body mechanics while performing massage. The activities were educationally constructed to target specific elements of body mechanics principles which included the following:

- limitation of use of anterior hand (palm) while performing massage;[8]
- preventing arm reach beyond perpendicularity through use of string tied to wrists to denote the span of acceptable range;
- tai chi and energetic principles to emphasize balance in stances and flow of movement while performing massage;[8]
- development of a personalized self-care plan for functional use;
- using supportive manual tools to help with fatigue; and
- variability with massage table height without the ability to customize height adjustment.

Twice during the semester the students were asked to write a reflection journal on their activity experiences with some of the exercises, discussing the following questions:

- how challenging was the exercise;
- how were other massage tools used to accomplish the same tasks;
- how did the student determine what tools were easier and harder to use;
- how did the student try to overcome the limitation of the experience;
- how will the student incorporate the awareness gained into their work moving forward;
- when did the student notice any discomfort while working;
- did the massage partner notice any differences in effectiveness when the student made ergonomic adjustments to their movement techniques to improve risk factors;
- was adjusting to the student's new movements very difficult and why; and
- how did the student feel after doing the exercise.

Analysis

The pre-test and post-test ergonomics assessment scores provided quantifiable data measures in body mechanics, while the journal entries yielded descriptions of the students' critical thinking processes in response to in-class activities. Comments from each student were monitored by the researcher by reading over the journal entries to determine if critical thinking and learning transfer were taking place. A simple codebook of recurring phrases was used as indicators of learning with each student monitored. The qualitative comments from the students' journal entries served as supporting data to coincide with the pre-and post-test REBA and RULA scores, both showing evidence of progression towards achieving the learning of course objectives.

Data analysis of the pre- and post- REBA and RULA scores was conducted by the researcher using Minitab 17 software for educational purposes.[28] The researcher selected the use of Minitab as a convenience since the software was readily available at the college where the data collection occurred. Statistical improvement in REBA and RULA scores combined with positive student commentary from journals would suggest that the proposed approach impacted students' body mechanics in a positive way. A comparison of descriptive statistical measures of central tendencies and inferential parametric testing of the REBA and RULA scores as covariates demonstrates if a reduction in potential injury risk has also taken place.[20] All data from the pre-and post-testing, as well as student comments, were kept in spreadsheets delineating each cohort group on a personal flash drive and computer owned by the researcher.

RESULTS

A convenience sample of N = 17 students who were enrolled and completed the MASS 212 course were used, encompassing four separate cohorts. Table 1 shows outcomes for each student's REBA and RULA scores organized by cohort. A paired *t* test and confidence interval was conducted for each group of REBA and RULA scores to compare differences in

scoring to denote improvement in decreasing ergonomic risk factors. The means, standard deviations, and standard errors for both REBA pre- and post-tests and RULA pre- and post-tests are reported in Table 2. The REBA and RULA values were measured according to standard scoring scales as per the analyses tools indicated. Table 3 demonstrates the results of the paired *t* test and confidence interval for both REBA and RULA scores. The significant mean differences in the pre- and post-testing scores for both REBA and RULA measures (4.294, 2.353) indicate that the teaching methods utilized in emphasizing proper body mechanics while performing massage therapy had an impact in the overall improvement of each student's ergonomic risk factors. Additionally, the results extrapolated from the data were indeed significant and did not occur by chance ($p < .05$).

Table 1. Pre- and Post-Testing Results

Individual Students	*Cohort*	*REBA Pre-Score*	*REBA Post-Score*	*RULA Pre-Score*	*RULA Post-Score*
1Sp	Spr 16	7	4	5	3
2Sp	Spr 16	10	6	7	4
3Sp	Spr 16	11	6	7	4
4Sp	Spr 16	10	6	6	4
5Sp	Spr 16	10	6	6	4
6Sp	Spr 16	6	4	4	3
1Su	Sum 16	8	5	4	4
2Su	Sum 16	10	6	7	4
3Su	Sum 16	11	7	7	4
4Su	Sum 16	10	5	6	4
5Su	Sum 16	12	7	7	4
1SP	Spr 17	10	5	7	3
2SP	Spr 17	11	5	7	4
3SP	Spr 17	10	5	7	4
1SU	Sum 17	10	5	6	4
2SU	Sum 17	12	5	7	4
3SU	Sum 17	11	9	7	6

Table 2. Descriptive Statistical Factors of Pre- and Post-Test Scores

	N=17	*Mean*	*SD*	*SE Mean*
REBA Pre-Score		9.941	1.600	0.388
REBA Post-Score		5.647	1.222	0.296
RULA Pre-Score		6.294	1.047	0.254
RULA Post-Score		3.941	0.659	0.160

Table 3. Paired *t* Test and Confidence Interval of Samples

Paired Samples	*t Value*	*p Value*[a]	*Estimate for Difference (SD)*	*95% CI*
REBA Pre-Score vs. REBA Post-Score	13.50	0.000	4.294 (1.312)	Lower: 3.620 Upper: 4.969
RULA Pre-Score vs. RULA Post-Score	9.74	0.000	2.353 (0.996)	Lower: 1.841 Upper: 2.865

[a]Significance of p value < .05

Further support in learning transfer is shown in the qualitative data collection from the students' reflection journals completed during the interim seven-week period between the pre- and post-test scores. In response to the first question, all 17 students in the study commented that the in-class exercises were difficult at first, but then became easier by the end of the class period, using phrases such as "really hard", "exceptionally challenging", or "a bit challenging" to describe their experiences. Modifications and adaptations to their body mechanics were provided by the researcher and were unique to the individual based on their body shape, size, and gender; however, all students made some manner of adjustment to their techniques based on the experiential discovery of the in-class exercises. Some examples of this commentary included their descriptions of using different massage skill application tools than they originally selected at the beginning of an in-class exercise, and indications such as "I realized I could do [this]" or "I liked how I felt when I did [this]". Finally, all students commented that their bodies experienced less discomfort and were more at ease in addition to exhibiting critical thinking of awareness of their body mechanics as brought to light in these in-class exercises, again with individual modification and personal insight. Summarized comments here included "my body did not hurt afterwards", "this exercise has brought this to my attention", or "I have gained more [tools, techniques] while helping me to keep me from burning out".[26]

The majority of the students opted to have videos taken of their pre- and post-assessments (15 out of 17); however, of the students who did have videos taken, none commented that watching the videos had any impact on their learning experiences or individual results and, therefore, did not confound the resulting data. Since the measurable outcomes were favorable from both quantitative and qualitative aspects, the null hypothesis is rejected; the data support the alternative.

DISCUSSION

The results of this study were significant in identifying useful teaching methods for proper body mechanics for massage therapists. All subjects realized improvement in their measurable ergonomic risk factor scores, developed individual kinesthetic awareness, and applied the knowledge to create personal adaptation that created some reduction in potential injury risk. The findings further emphasize the need

for not only the inclusion of more substantive ergonomic principles and tools as part of skills training development, but also the understanding that personal adjustments to technique utilization may be needed due to limitations in body shape, size, and function, as well as the fact that these adjustments are acceptable if they minimize risk. There are many instances in massage therapy education on the foundational level which are predicated on specific, rigid, and methodical teaching of protocols. While this instructional approach is sometimes necessary for skill building, it can perpetuate a fixed mindset in students where they will demonstrate the skills with poor body mechanics in an attempt to simply mimic the instructional method shown without considering their own ergonomic risks. It is important to help students master basic skills. However, they must also learn the permissibility to apply critical thinking to their own individual needs to reduce risk, which will enable them to work full-time as massage therapists and safely handle the rigors of day-to-day professional work. Safe ergonomic adaptation should be exercised regularly in any massage therapy practice setting.

The success of this study demonstrates that teaching methods designed with experiential and transformative learning concepts are a more effective approach to teaching proper body mechanics. To help foster this methodology, these concepts could be adopted into a universally accepted curriculum model, such as the ELAP project, to fill in the gap that the current version has in this subject area, and eventually contribute to overall reduction of occupational injury of massage therapists in the future.

Limitations

There were some limitations to this study regarding involvement of the researcher, expertise in training, and the timing of the course offering within their educational program. Since the researcher was the instructor of the course for all cohorts, there was a vested interest in witnessing improvements in the students. Additionally, the researcher analyzed the data using Minitab software; an alternative approach would be to employ the use of an independent data analysis by another researcher to reduce bias. A proposed duplicate study, whereby the researcher would only conduct the pre- and post-testing ergonomic assessments, but a different instructor in another school teaching a similar course would employ the same educational methods used here and possibly another contributor would conduct the data analysis, would result in a stronger study. The researcher had additional specialized training in ergonomics assessment skills which was applied in the discovery of this study. Not all massage therapists and educators have this skill set, and the tools utilized in the study would have some challenges and margins for error without proper training in their use. Both of these elements were necessary limitations in the study so that some foundational work could be accomplished. Further research in developing these concepts needs to be conducted. Moreover, expansion of knowledge in ergonomics for massage therapy practice is an overarching theme resulting from this study.

Timing of instruction was a contributing factor as well. The MASS 212 kinesiology course was offered to students in their second semester of their coursework, in conjunction with their second level of massage skills where they are learning deep tissue tools and techniques. Most students struggle with body mechanics while learning these particular skills due to the requirements of using more body parts as massage tools, the application of pressure to affect deeper musculature on a client, and the integration of these tools by using critical thinking within the framework of a basic full body massage session. While basic methodologies of using these massage tools are taught and practiced within this training level, adding ergonomics concepts on top of the unfamiliarity of the massage tools might have been overwhelming for students to fully embrace. An argument could be made that students may not gain the full effect of transformative learning principles if there are too many distractions overloading them with content. A consideration for shifting the kinesiology course offering to a later semester prior to myofascial techniques is being explored.

Further Expansion

A possible direction for future discovery to this study involves adding a longitudinal component, by evaluating the same subjects after they are actively working massage therapists. If the same subjects were surveyed within two years after entering the workforce, this data could show whether the concepts learned in their entry level education had lasting effects and if any injuries have occurred or were avoided due to this knowledge. One limitation to this longitudinal expansion would be attrition; however, this data could still provide further support of the instructional methods used in entry level massage education and their sustainability to promote career longevity.

Another viable option as briefly aforementioned is to conduct a duplication study using a group of students from a different school or program separate from the researcher. This approach would demonstrate that, even with another school environment and different instructors, if the outcomes were similarly positive, the teaching methods utilized in this study would have merit to be considered for adoption as a standard curricular component in massage therapy educational models and potentially in workplace settings. The construction of both expansion research models is currently being explored.

Massage therapists currently working in the industry know that there are many approaches to providing a quality massage therapy session to a client; the key

for the individual therapist is to explore and discover the best approaches and techniques for that therapist while still following sound ergonomic principles and minimizing risk for work-related injury. Additionally, massage therapy business owners need to gain a better understanding of acceptable parameters for massage therapy manual work, and advocate for a safe work environment for all. The initial paradigm shift for positive change in ergonomic guidelines for the massage therapy profession lies in the creation of consistent and reproducible educational methods for body mechanics that are successfully executed in entry-level training. From there, with persistent follow-through and periodic re-evaluation by both employers and massage therapists, pain-free career longevity and professional sustainability may be achieved.

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CONFLICT OF INTEREST NOTIFICATION

The authors declare there are no conflicts of interest.

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REFERENCES

1. Bureau of Labor Statistics, U. S. Department of Labor. *Occupational Outlook Handbook, Massage Therapists*. Accessed March 17, 2018. Available from: https://www.bls.gov/ooh/healthcare/massage-therapists.htm.
2. Mohr EG. Proper body mechanics from an engineering perspective. *J Bodywork Movement Therapies*. 2010;14(2):139–151.
3. Pheasant S. *Ergonomics, Work, and Health.* Gaithersburg, MD: Aspen Publishers, Inc.; 1991. pps. 4–7; 116–138.
4. Page L. *Licensed massage therapist strain index scores*. Proceedings of the Human Factors and Ergonomics Society Annual Meeting. 2012;56(1):1163-1167. doi:10.1177/1071181312561253
5. Freeman J., Anderson S. *Career longevity: The Bodywork Practitioner's Guide to Wellness and Body Mechanics*. Philadelphia, PA: FA Davis; 2012.
6. Frye B. *Body Mechanics for Manual Therapists: a Functional Approach to Self-Care*, 3rd edition. Philladelphia, PA: Lippencott, Williams & Wilkens; 2008.
7. Greene L., Goggins R. *Save Your Hands: the Complete Guide to Injury Prevention and Ergonomics for Manual Therapists*, 2nd edition. Coconut Creek, FL: Body of Works Books; 2008.
8. Dixon MW. *Body Mechanics and Self-Care Manual*. Upper Saddle River, NJ: Prentice Hall; 2001.
9. Albert WJ, Currie-Jackson N, Duncan CA. A survey of musculoskeletal injuries amongst Canadian massage therapists. *J Bodywork Movement Therapies*. 2008;12(1):86–93.
10. Albert WJ, Duncan C, Currie-Jackson N, Gaudet V, Callaghan JP. Biomechanical assessment of massage therapists. *Occupational Ergonomics*. 2006;6(1):1–11.
11. Blau G, Monos C, Boyer E, Davis K, Flanagan R, Lopez A, et al. Correlates of injury-forced work reduction for massage therapists and bodywork practitioners. *Int J Therapeut Massage Bodywork*. 2013;6(3):6–13.
12. Buck FA, Kuruganti U, Albert WJ, Babineau M, Orser S, Currie-Jackson N. Muscular and postural demands of using a massage chair and massage table. *J Manipulat Physiologic Therapeut*. 2007;30(5):357–364.
13. Jang Y, Chi CF, Tsauo JY, Wang JD. Prevalence and risk factors of work-related musculoskeletal disorders in massage practitioners. *J Occup Rehabil*. 2006;16(3):425–438. doi:10.1007/s10926-006-9028-1
14. Lunghi C, Tozzi P, Fusco G. The biomechanical model in manual therapy: Is there an ongoing crisis or just the need to revise the underlying concept and application? *J Bodywork & Movement Therapies*. 2016;20(4):784–799,
15. Murali S, Shanmugam SV, Prasaad GA, Kumar MS, Manoharan C, Devadasan SR, et al. Fatigue mitigation through the optimization of ergonomic positional parameters in massage therapy using virtual instrumentation. *Int J Adv Manuf Technol*. 2014;70(1-4):173–184, doi:10.1007/s00170-013-5259-4
16. Bureau of Labor Statistics, U. S. Department of Labor. *Incidence rates of nonfatal occupational injuries and illnesses involving days away from work by selected worker and case characteristics and occupation, all U.S., all ownerships, 2011–2016, Massage Therapists* (code 319010 & 319011). Accessed April 17, 2017. Available from: https://data.bls.gov/gqt/InitialPage
17. Feldenkrais Method of Somatic Education [Web site]. Accessed February 7, 2017. Available from: www.feldenkrais.com/about-the-feldenkrais-method/18 Boucouvalas M, Lawrence RL. Adult learning. In: Kasworm C, Rose A, Ross-Gordon J, eds. *Handbook of Adult and Continuing Education*. Thousand Oaks, California: SAGE Publications, Inc.; 2010:39–41.
19. Entry Level Analysis Project (ELAP). *The Core: Entry-level Massage Education Blueprint*. Coalition of National Massage Therapy Organizations; 2013. Accessed April 17, 2017. Available from: http://www.elapmassage.org/_files/ELAP_Blueprint.pdf
20. Creswell JW. *Educational Research: Planning, Conducting, and Evaluating Quantitative Research*, 5th edition. Upper Saddle River, NJ: Pearson; 2015:180–198, 314-315.

21. *Common Course Outline, MASS 212—Kinesiology for Massage Therapists*, 3 credits. Baltimore, MD: Community College of Baltimore County; 2016. Accessed April 17, 2017. http://www.ccbcmd.edu/~/media/CCBC/Programs%20and%20Courses/Common%20Course%20Outlines/Massage%20Therapy/MASS212.ashx?la=en
22. Occupational Safety and Health Administration, U. S. Department of Labor. *Safety and Health Topics, Ergonomics—Identify Problems*. Washington, DC: US Department of Labor. Accessed April 17, 2017. Available from: https://www.osha.gov/SLTC/ergonomics/identifyprobs.html
23. Middlesworth M. *A Step-by-Step Guide to the REBA Assessment Tool*. Carmel, IN: ErgoPlus; 2017. Accessed October 8, 2017. Available from: http://ergo-plus.com/reba-assessment-tool-guide/
24. Middlesworth, M. *A Step-by-Step Guide to the RULA Assessment Tool*. Carmel, IN: ErgoPlus; 2017. Accessed October 8, 2017. Available from: http://ergo-plus.com/rula-assessment-tool-guide/
25. *Dropbox for PC* [computer program]. Version 45.4.92. Accessed October 8, 2017. Available from: https://www.dropbox.com/
26. Blackboard Course Management System [computer program]. In: *MASS 212 – Kinesiology for Massage Therapists Course* [Internet], Spring 2016, Summer 2016, Spring 2017, and Summer 2017 class groups. Baltimore, MD: Community College of Baltimore County. Accessed August 28, 2017. Available from: http://catalog.ccbcmd.edu/preview_program.php?catoid=26&poid=12341&returnto=1587
27. *Student Recording Devices in the Classroom* [Internet]. Baltimore, MD: Community College of Baltimore County, Policy Statements. Accessed August 28, 2017. Available from: http://catalog.ccbcmd.edu/content.php?catoid=29&navoid=2024#student-recording-devices
28. *Minitab 17 for PC* [computer program]. State College, PA: Minitab Inc. Accessed October 2, 2017. Available from: http://www.minitab.com/en-us/products/minitab/education/

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