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ORIGINAL ARTICLE

Interactions between the sex of the clinician grader and the sex of the chiropractic student intern on spinal manipulation assessment grade

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ABSTRACT

Objective: The purpose of this project was to determine if there was any relationship between the sex of the clinician grader and the sex of the chiropractic student intern on student spinal manipulation assessment grades.
Methods: Twelve thousand six hundred and thirty-one supervised patient adjustments by student interns were analyzed over a 3-year data collection window. Student interns were assessed by multiple male and female clinicians in a teaching clinic using a modified Dreyfus model scoring system on a 1–4 scale (1 = *novice*, 4 = *proficient*). A Mann-Whitney U test was used to compare the relationship between grader sex and student grade as well as student sex and student grade.
Results: Sex of the grader had a statistically significant effect on spinal manipulation assessment grade, $p < .001$, with male clinician graders assigning average scores of 2.81 ± 0.39 (mean ± SD) and female clinician graders scores of 3.01 ± 0.52, $r = .18$. Sex of the student had a statistically significant but negligible ($r = .08$) effect on spinal manipulation assessment grade, $p < .001$, with male students averaging slightly higher scores (2.93 ± 0.47) than females (2.86 ± 0.44) on the modified Dreyfus scale.
Conclusion: Male clinicians tended to assign lower grades on spinal manipulation assessments than female clinicians. Male students on average received slightly higher scores than female students on spinal manipulation assessments.

Key Indexing Terms: Health Occupations Students; Sex Characteristics; Clinical Competence; Task Performance and Analysis; Chiropractic

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INTRODUCTION

There are differences in performance between male and female students. Research demonstrates that female college students on average tend to have higher grades than male students, but they tend to perform slightly lower on standardized tests.[1–2] There are many theories as to why this occurs with some involving the students and others involving their instructors.

Teachers can subconsciously express biases that may affect student performance.[3] This has been shown to be the case with teachers inducing self-fulfilling prophecies,[4] affecting students' interest in subject matter,[5,6] and affecting students' future effort level beyond their course.[3,7] Furthermore, instructors have been shown to demonstrate implicit bias for or against students if they know the sex of the student (eg, being a pro-male grader or being a pro-female grader).[3,8–11] This has been demonstrated in experiments where teachers were given items to grade with female names and then again later with male names with similar answers to questions. For example, 1 study found that only 15% of teachers had no gender bias at all when grading.[3]

Some studies demonstrate that there are differences in how stringently examiners assess students.[12] Research suggests that female examiners have a small tendency to assign higher scores than male examiners.[13–15] Griffith et al[13] theorized that this may have to do with female teachers craving greater acceptance by students than male teachers. Evidence further demonstrates that when students complete evaluations of their instructors, they tend to evaluate female instructors lower than male instructors on average, lending some rationale to Griffith's theory.[16,17]

An integral skill set that must be learned to become a chiropractor is how to perform spinal manipulation. It is a complex psychomotor skill that can be taught in several ways.[18]

Two common ways by which spinal manipulation is taught is through using either a (1) "complete practice" manipulation with thrust or (2) a patient–doctor position-

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ing practice setting without thrust.[18] Studies further suggest that students with a sports background tend to learn how to perform psychomotor tasks faster;[19,20] spinal manipulation is a psychomotor task. Evidence demonstrates that males are more likely to be engaged in sports throughout their youth, and this may have some effect on their learning new psychomotor skills.[21–24]

The objective of this study was to determine any relationship between the sex of the clinician grader and the sex of the student intern on student spinal manipulation assessment grade. Hypothesis 1: Male graders may tend to assign lower grades than female graders. Hypothesis 2: Male chiropractic students would score slightly higher on average than female students on spinal adjusting assessments.

METHODS

This research experiment was reviewed and approved by the Texas Chiropractic College institutional review board for human subjects in accordance with the Declaration of Helsinki. Spinal manipulation in this study took place in the college's outpatient clinic by upper-trimester students in their final year at the college.

Chiropractic student interns perform several spinal manipulations each trimester during patient encounters. At the time of those encounters, the chiropractic interns are graded on their ability to perform spinal manipulation correctly by an attending clinician on a 1–4 scale using a modified Dreyfus model.[25] For this model, 1 represents *novice*, or unlikely to be satisfactory unless closely supervised. A 2 represents *advanced beginner*, where straightforward tasks are likely to be completed to an acceptable standard. A grade of 3 represents *competent*, where the action is fit for the purpose, though it may lack refinement. Finally, a 4 is *proficient*, representing a fully acceptable standard that can be achieved routinely. A score of 5 was not used in this study because it represents an *expert* with years of experience, which is not a characteristic the students would possess at this time in their career.

Spinal manipulation was performed by student interns and graded by clinicians. This metric falls under the Council on Chiropractic Education's (CCE) Meta-Competency 2: Management Plan and Meta-Competency 7: Chiropractic Adjustment/Manipulation.[26] Researchers were specifically measuring Meta-Competency 2 Outcome 4, "Deliver appropriate chiropractic adjustments/manipulations and/or other forms of passive care as identified in the management plan" and Meta-competency 7 Outcome 4, "Apply chiropractic adjustment/manipulation to patients while ensuring patient safety."[26]

Data were collected using a convenience sample of 12,631 supervised patient spinal adjustments by student interns between May 2018 and May 2021 input by their clinician grader via Survey Monkey (Momentive, San Mateo, CA, USA) and then exported to Excel (Microsoft Office, Redmond, WA, USA). For data inclusion, chiropractic interns needed to be trimester 8–10 out of a 10-trimester program. The following attributes were collected for each student spinal manipulation graded activity: trimester, student name, student sex, grader sex, adjusting score, class designation (clinic I–IV class level of the student), and date. For this study, student names were deidentified by replacing their names with randomly generated numbers.

We analyzed the data to determine 2 relationships. The first was the potential effect of the sex of the doctor on the student spinal manipulation assessment grade (asking, "Who assigns higher assessment grades, male or female doctor graders?"). The second was the effect of the sex of the student intern on the student spinal manipulation assessment grade (asking, "Who scores higher on average on adjusting tests, male or female student interns?").

Data were analyzed in SPSS version 20.0 (IBM, Armonk, NY, USA). Results were reported as mean ± SD unless otherwise specified. A Mann-Whitney test was used to compare the relationship between grader sex and student score as well as student sex and student score. An alpha level of $p < .05$ was considered statistically significant for all data analyses. Effect size was reported as absolute value.

RESULTS

Sex of the grader had a statistically significant effect on spinal manipulation assessment grade, $U = 15{,}592{,}525.00$, $z = -19.96$, $p < .001$, with a small effect size of $r = .18$. Male clinician graders assigned average scores of 2.81 ± 0.39 and female clinician graders assigned average scores of 3.01 ± 0.52 out of 12,631 graded occurrences on the 1–4 modified Dreyfus scale.

Sex of the student on student grade had a statistically significant effect on spinal manipulation assessment grade, $U = 18{,}145{,}049.00$, $z = -8.83$, $p < .001$, with a negligible effect size of $r = .08$. Males' average score was 2.93 ± 0.47, while females' average score was 2.86 ± 0.44 on the modified Dreyfus scale.

DISCUSSION

Male clinicians tended to grade students lower than female clinicians. In an ideal world, any variance in student score would be due to the student's performance alone. Evidence suggests that this is not the case, with assessor bias compromising 80–90% of the small variance in student performance due to circumstances outside of the student.[27–29] A study by Griffith and Sovero[13] found that female instructors with greater job uncertainty were more likely to grade students more leniently. They did not find a similar trend for male instructors. The role that perceived job stability plays in grader scoring of students warrants further exploration. For example, is a grader more likely to grade students more leniently in the hope that they like them and give them favorable reviews?

In this study, males scored slightly higher than females on their adjusting assessment. This is similar to the trend noticed in the research by Harvey et al.[18] In their publication, they found that male students were more likely to demonstrate a fast rate of force production similar

to those of a field chiropractor. In their article, they described how learning spinal manipulation is a psychomotor skill. Evidence suggests that individuals that engage in more sports growing up tend to excel at other psychomotor skills, resulting in a carryover effect.[19,20] Studies further demonstrate that males are more likely than females to engage in sport activities in their youth prior to matriculating to a chiropractic college.[21–24] This unique effect on male student performance; however, appears to be temporary. Experienced male versus female field chiropractors do not demonstrate significant differences in assessed biomechanical parameters for spinal manipulation.[30]

Possible directions of future research that could stem from this study are (1) determining the relationship between the sex of an adjusting class instructor in relation to student scores in adjusting classes and subsequent scores in the student clinic, (2) developing a set objective grading checklist of universal criteria involving input from several chiropractic colleges to quantify an ideal spinal manipulation and determining the checklist's validity, and (3) surveying students on their background in sports and determining any correlation with spinal manipulation assessment grades since spinal manipulation is a similar psychomotor skill. With regard to possible directions of future research topic 1, studies do demonstrate that the sex of the teacher can affect student performance. For example, when a female student has a female teacher, that has been shown to increase their motivation to learn.[31] A further analysis of this longitudinal effect on the learning and test performance of students should be pursued.

A strength of this study is the large data set collected over 3 years involving thousands of student intern spinal manipulation assessments. This study did not determine the relationship between grades of the student in prior lower-level adjusting classes in relation to their current grades in the clinic. Evidence does demonstrate a significant correlation between prior grades and student academic self-concept, which are predictive of future achievements.[32,33] We cannot rule out small increases in male student scores related to challenging their clinician grader and requesting a grade change. Evidence demonstrates that college male students are more likely to request grade changes or to challenge grades that they feel are unfair.[34] Additionally, male students are more likely to receive grade changes than female students.[34]

The students taught at the college where this study was performed are taught using a "complete practice" manipulation setting with thrust as opposed to a patient–doctor positioning practice setting without thrust as described by Harvey et al.[18] As a result, the external validity of the findings in this study may not necessarily apply to the students taught in all chiropractic college programs.

CONCLUSION

The findings of this research study were twofold. First, male clinicians tended to assign lower grades on spinal manipulation assessments than female clinicians. This begs for the future implementation of standardized grading rubrics across all chiropractic colleges to evaluate student performance of spinal manipulation to remove any small amount of unintentional bias. Second, male students on average scored slightly higher than female students on spinal manipulation assessments. This may be due to spinal manipulation being a psychomotor skill and male students being more likely to have a history of engaging in organized sports. Countermeasures to help female chiropractic students more rapidly approach the skill set of female field chiropractors should be pursued.

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Author Contributions

Concept development: MS, SJ. Design: MS, SJ, JW. Supervision: MS, SJ, VQ. Data collection/processing: MS, SJ, VQ, JW. Analysis/interpretation: MS, SJ, JW. Literature search: MS, JW. Writing: MS, SJ, JW. Critical review: MS, SJ, JW.

REFERENCES

1. O'Dea R, Lagisz M, Jennions M, Nakagawa S. Gender differences in individual variation in academic grades fail to fit expected patterns for STEM. *Nat Commun*. 2018;9(1):3777. doi:10.1038/s41467-018-06292-0
2. Voyer D, Voyer S. Gender differences in scholastic achievement: a meta-analysis. *Psychol Bull*. 2014; 140(4):1174–1204. doi:10.1037/a0036620
3. Lavy V, Megalokonomou R. Persistency in teachers' grading bias and effects on longer-term outcomes:

university admissions exams and choice of field of study. *NBER Working Paper Series*. 2019; No. 25021.
4. Jussim L, Eccles J. Teachers expectations II: construction and reflection of student achievement. *J Pers Soc Psychol*. 1992;63(6):947–961. doi:10.1037/0022-3514.63.6.947
5. Trautwein U, Ludtke O, Marsh H, Koller O, Baumert J. Tracking, grading, and student motivation: using group composition and status to predict self-concept and interest in ninth-grade mathematics. *J Educ Psychol*. 2006;98(4):788–806. doi:10.1037/0022-0663.98.4.788
6. Bonesrønning H. The effect of grading practices on gender differences in academic performance. *Bull Econ Res*. 2008;60:245–264. doi:10.1111/j.1467-8586.2008.00278.x
7. Mechtenberg L. Cheap talk in the classroom: how biased grading at school explains gender differences in achievements, career choices and wages. *Rev Econ Stud*. 2009;76(4):1431–1459.
8. Klein R, Julian K, Snyder E, et al. Gender bias in resident assessment in graduate medical education: review of the literature. *J Gen Intern Med*. 2019;34(5):712–719. doi:10.1007/s11606-019-04884-0
9. Axelson R, Solow C, Ferguson K, Cohen M. Assessing implicit gender bias in medical student performance evaluations. *Eval Health Prof*. 2010;33(3):365–385. doi:10.1177/0163278710375097
10. Ross D, Boatright D, Nunez-Smith M, Jordan A, Chekroud A, Moore E. Differences in words used to describe racial and gender groups in medical student performance evaluations. *PLoS One*. 2017;12(8):e0181659. doi:10.1371/journal.pone.0181659
11. Klein R, Ufere N, Sowmya R, et al. Association of gender with learner assessment in graduate medical education. *JAMA Netw Open*. 2020;3(7):e2010888. doi:10.1001/jamanetworkopen.2020.10888
12. Homer M. Pass/fail decisions and standards: the impact of differential examiner stringency on OSCE outcomes. *Adv Health Sci Educ*. 2022;27:457–473. doi:10.1007/s10459-022-10096-9
13. Griffith A, Sovero V. Under pressure: how faculty gender and contract uncertainty impact students' grades. *Econ Educ Rev*. 2021;83(C):102126. doi:10.1016/j.econedurev.2021.102126
14. Donohoe C, Reilly F, Donnelly S, Cahill R. Is there variability in scoring of student surgical OSCE performance based on examiner experience and expertise? *J Surg Educ*. 2020;77(5);1202–1210. doi:10.1016/j.jsurg.2020.03.009
15. Chong L, Taylor S, Haywood M, Adelstein B, Shulruf B. The sights and insights of examiners in objective structured clinical examinations. *J Educ Eval Health Prof*. 2017;14:34. doi:10.3352/jeehp.2017.14.34
16. Mitchell K, Martin J. Gender bias in student evaluations. *Political Sci Polit*. 2018;51(3):648–652. doi:10.1017/S104909651800001X
17. Boring A, Ottoboni K, Stark P. Student evaluations of teaching (mostly) do not measure teaching effectiveness. *ScienceOpen Res*. 2016;0(0): doi:10.14293/S2199-1006
18. Harvey M, Wynd S, Richardson L, Dugas C, Descarreaux M. Learning spinal manipulation. *J Chiropr Educ*. 2011;25(2):125–131. doi:10.7899/1042-5055-25.2.125
19. Descarreaux M, Dugas C. Learning spinal manipulation skills: assessment of biomechanical parameters in a 5-year longitudinal study. *J Manipulative Physiol Ther*. 2010;33(3):226–230. doi:10.1016/j.jmpt.2010.01.011
20. Descarreaux M, Dugas C, Lalanne K, et al. Learning spinal manipulation: the importance of augmented feedback relating to various kinetic parameters. *Spine J*. 2006;6(2):138–145. doi:10.1016/j.spinee.2005.07.001
21. Deaner R, Balish S, Lombardo M. Sex differences in sports interest and motivation: an evolutionary perspective. *Evol Behav Sci*. 2016;10(2):73–97. doi:10.1037/ebs0000049
22. Deaner R, Geary D, Puts D, Ham S, Kruger J, Fles E. A sex difference in the predisposition for physical competition: males play sports much more than females even in the contemporary U.S. *PLoS One*. 2012;7(11):e49168. doi:10.1371/journal.pone.0049168
23. Lunn P. The sports and exercise life-course: a survival analysis of recall data from Ireland. *Soc Sci Med*. 2010;70(5):711–719. doi:10.1016/j.socscimed.2009.11.006
24. Ferrar K, Olds T, Walters J. All the stereotypes confirmed: differences in how Australian boys and girls use their time. *Health Educ Behav*. 2012;39(5):589–595. doi:10.1177/10901981114239
25. Peña A. The Dreyfus model of clinical problem-solving skills acquisition: a critical perspective. *Med Educ Online*. 2010;15:10.3402. doi:10.3402/meo.v15i0.4846
26. Council on Chiropractic Education. *CCE Accreditation Standards—Principles, Processes and Requirements for Accreditation*. Council on Chiropractic Education; July 2020.
27. Downing S. Threats to the validity of clinical teaching assessments: what about rate error? *Med Educ*. 2005;39(4):353–355. doi:10.1111/j.1365-2929.2005.02138.x
28. Wilkinson T, Frampton C, Thompson-Fawcett M, et al. Objectivity in objective structured clinical examinations: checklists are no substitute for examiner commitment. *Acad Med*. 2003;78:219–223.
29. McManus I, Thompson M, Mollon J. Assessment of examiner leniency and stringency ("hawk-dove effect") in the MRCP (UK) clinical examination (PACES) using multi-facet Rasch modelling. *BMC Med Educ*. 2006;6(1):42. doi:10.1186/1472-6920-6-42
30. Forand D, Drover J, Suleman Z, et al. The forces applied by female and male chiropractors during thoracic spinal manipulation. *J Manipulative Physiol*

Ther. 2004;27(1):49–56. doi:10.1016/j.jmpt.2003.11.006
31. Gong J, Lu Y, Song H. The effect of teacher gender on students' academic and noncognitive outcomes. *J Labor Econ*. 2018;36: doi:10.1086/696203
32. Möller J, Pohlmann B, Köller O, Marsh H. A meta-analytic path analysis of the internal/external frame of reference model of academic achievement and academic self-concept. *Rev Educ Res*. 2009;79(3):1129–1167. doi:10.3102/0034654309337522
33. Owen A. Grades, gender, and encouragement: a regression discontinuity analysis. *J Econ Educ*. 2010; 41(3):217–234.
34. Li C, Zafar B. Ask and you shall receive? Gender differences in regrades in college. *NBER Working Paper Series*. 2020; No. 26703.