Anatomical Dissection and Demonstration: Effects on Student Learning Outcomes and Confidence

This research was part of a UNMC Master's in Medical Anatomy thesis, *Analysis of Graded Gross Anatomy Dissections and Demonstrations as a Supplemental Educational Tool*.
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ABSTRACT

The quantifiable and perceived values of student cadaveric dissection in anatomy education are essential to discussions evaluating curricular reform in medical and allied health curriculums. Content experts, students, and clinicians agree that cadaveric dissection concurrent with learning gross anatomy holds many positive roles in both the knowledge of anatomical structures and as an introduction to the inner workings of the human body and medicine. But when faced nationally with decreasing contact hours and increasing demands on the energies of students and faculty, the amount of time and effort spent on dissection must be assessed. This pilot study used mixed methods to assess the effect of dissection and demonstration on student practical examination grades and student confidence and comfort with the course material. Fifteen students in the Master of Science in Medical Anatomy program completed eight additional dissections and brief individual presentations when compared to their physician assistant and physical therapy colleagues enrolled in the same course in fall of 2016. The performance of the individual anatomical structures covered in the dissections on the four unit practical exams was compared both to the previous year's cohort of graduate students and to the current year's physician assistant and physical therapy cohorts. Surveys and two focus groups were conducted to collect the graduate students' feedback on the efficacy and impact of the dissections on their education. Qualitative results displayed that the majority of students noted positive effects on their confidence in and comfort with anatomical knowledge during examinations and subsequent clinical shadowing experiences. The quantitative results showed no statistically significant correlation between the dissections and demonstrations and the students' unit practical examination scores and final course grade. This study is continuing with data from the 2017 course and cohort.

Dissection in Anatomy Education

The tradition of human cadaveric dissection in anatomy education has existed for hundreds of years. Although health professions curriculums and pedagogical methods undergo fairly frequent revision, the practice of dissection often persists. The reasons for this are diverse and well documented:

- Provides essential perspectives for understanding anatomical structures, their relationships, and interactions [1 7 8 10 11 13 14]
- Displays anatomic variations relevant to clinical practice [4 8 10 11 14]
- Promotes professionalism, teamwork, and communication [2 5 12 13]
- Prepares students for practical clinical skills (e.g., palpation of superficial structures) [5 9 13]
- Donor acts as "the first patient" and helps form attitude of clinical compassion [5 6 12]

When surgeons were asked what they felt was the most useful resource to learn anatomy in medical school, the majority of surgeons, regardless of specialty, stated that no matter the stage of career, both dissection and prosection (previously dissected specimens used to demonstrate anatomical structures) were the most useful anatomy education tools.[14] The results of another study showed that students perform better on practical anatomy exams if they have participated in cadaver dissection compared with students who do not. On the other hand, the study also found that medical students who dissected did not exhibit significantly better performances on the National Board of Medical Examiners subject exam taken months after the completion of the course and dissection experience when compared to their non-dissecting peers.[15]

This mixed methods study, approved through IRB# 844-16-EX, assessed whether graded student dissections and demonstrations at UNMC affected student practical examination grades and course performance when compared to peers in the course. This study also performed a qualitative thematic analysis to surveys and focus group transcriptions regarding student perceptions of these activities.

Methods

In UNMC's anatomy curriculum, allied health (PA, PT) students and anatomy graduate students are enrolled in the same lectures and laboratories for their gross anatomy content. Throughout the semester of fall 2016* **Master's of Medical Anatomy graduate students (n = 15)** performed **eight additional dissections, ~2 per unit (4 units total)**. Upon completion of these dissections, students were **assessed based on the quality of their dissections and were also required to demonstrate the cadaveric dissections to anatomy faculty members**. This study compared practical exam and course grades of the 2016 MMA students to the PA and PT students as well as the MMA cohort enrolled in the course in fall 2015. Students then participated in one of two focus groups and completed a survey.

Hypothesis (H_1): If the MMA students complete additional dissections and demonstrations, then their practical exam grades on that content and course grades will be higher than other allied health and graduate cohorts who did not perform the additional dissections and demonstrations.

*The data from fall 2017 is being collected and analyzed as this research continues.

Acknowledgements

Thank you to Stephanie Cummings for undertaking this research idea as her MMA graduate thesis project and doing a fantastic job, Karen Gould for statistical analysis assistance, the MMA Class of 2017 for being willing and active participants, and the UNMC Interprofessional Academy of Educators for hosting the 2018 Education Showcase.

TABLE 3.2: ASSOCIATED QUESTIONS ON UNIT EXAMS

UNIT	Number of Associated Questions	Number of Total Exam Questions	Percent of Associated Questions per Number of Exam Questions
1	13	60	21.67%
2	9	75	12%
3	8	70	11.43%
4	27	65	41.54%

Table 3.2: Each unit had a designated number of questions associated with the additional dissections and demonstrations that MMA students completed. The percentage of associated questions on each unit exam is calculated to be: Exam 1 – 21.67%, Exam 2 – 12%, Exam 3 – 11.43%, and Exam 4 – 41.54%.

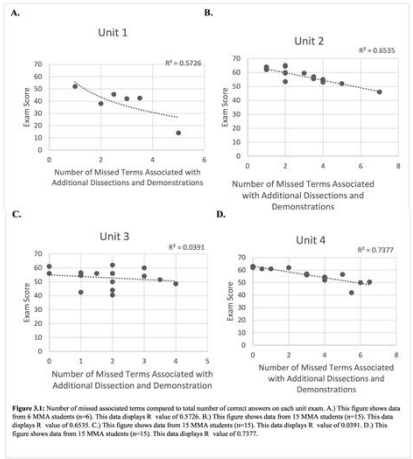


Figure 3.1: Number of missed associated terms compared to total number of correct answers on each unit exam. A.) This figure shows data from 6 MMA students (n=6). This data displays R value of 0.5726. B.) This figure shows data from 15 MMA students (n=15). This data displays R value of 0.6535. C.) This figure shows data from 15 MMA students (n=15). This data displays R value of 0.0391. D.) This figure shows data from 15 MMA students (n=15). This data displays R value of 0.7377.

- **Unit 1 R^2 value = 0.5726** very little correlation
- **Unit 2 R^2 value = 0.6535**
- **Unit 3 R^2 value = 0.0391** essentially no correlation
  Note: Unit 3 had the lowest number of associated terms at 11.43%
- **Unit 4 R^2 value = 0.7377** strongest correlation in this data set
  Note: Unit 4 had the highest number of associated terms at 41.54%
- More notable than the individual R^2 values is the range of the values: 0.0391 to 0.7377, with Unit 3's R^2 value being 0.6986 smaller than Unit 4's R^2 value.
- This data was assessed for normality and found not normally distributed, so the Kruskal-Wallis nonparametric test was used next.

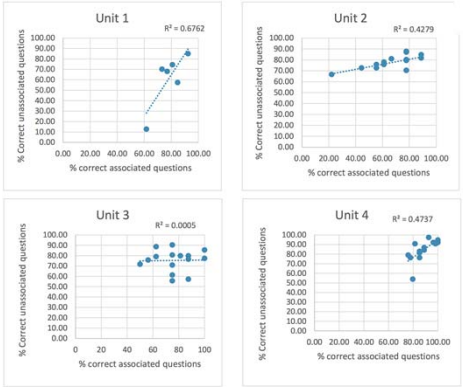


Figure 3.2: Relationship between percentage of correctly answered questions associated with the additional dissections and demonstrations and the percentage of correctly answered questions associated with the other exam questions. Kruskal-Wallis nonparametric test was performed and resulted in p-values that are not statistically significant for all four unit exams.

- **Unit 1: 5/6** students performed better on the associated questions compared with the unassociated questions.
- **Unit 2: 4/15** students performed better on the associated questions compared with the unassociated questions.
- **Unit 3: 10/15** students performed better on the associated questions compared with the unassociated questions.
- **Unit 4: 12/15** students performed better on the associated questions compared with the unassociated questions.

Results

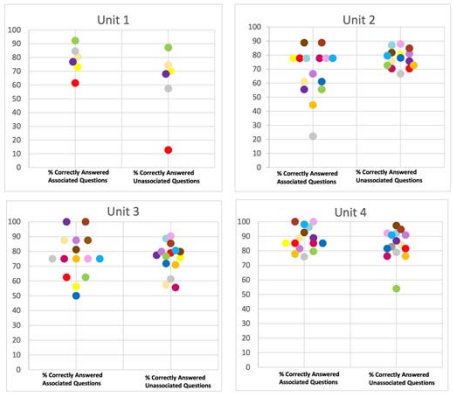
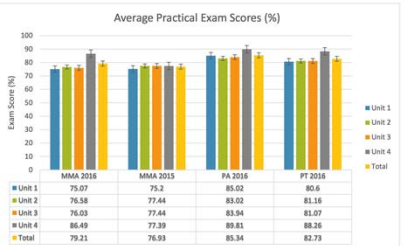


Figure 3.3: MMA16 students were compared on an individual basis comparing their percent correctly answered associated questions to their percent correctly answered unassociated questions. Each color represents one of the fifteen MMA16 students.

- In another analysis not shown here, PT students performed better on the unassociated questions on Units 1 and 2, and similarly on all questions in Units 3 and 4. PA students performed similarly on all questions in all 4 units.



	MMA 2016	MMA 2015	PA 2016	PT 2016
Unit 1	75.07	75.2	85.02	80.6
Unit 2	76.58	77.44	83.02	81.16
Unit 3	76.03	77.44	83.94	81.07
Unit 4	86.49	77.39	89.81	88.26
Total	79.21	76.93	85.34	82.73

Figure 3.5: The average practical exam scores for MMA16, MMA 2015, PA16, and PT16 were compared. The average score for the course is also displayed for each class. The PA16 students, on average, scored higher on all unit exams and total course grade compared with the other students. Unit 4 exam average grades are significantly higher for all class cohorts except for the MMA 2015. The MMA 2015 class compared with MMA16 class had similar scores, about 1 grade point higher on unit two and three, but lower on unit 4. The MMA 2015 also had less variance between the grades than did the MMA16 students.

Tukey's Post hoc Test Results

Treatment Pairs	Tukey HSD Q statistic	Tukey HSD p-value	Tukey HSD inference
MMA16 vs MMA15	7.7662	0.0010053	** p<0.01
MMA16 vs PA16	4.7454	0.005521	** p<0.01
MMA16 vs PT16	2.9579	0.160816	insignificant
MMA15 vs PA16	14.5353	0.0010053	** p<0.01
MMA15 vs PT16	12.8134	0.0010053	** p<0.01
PA16 vs PT16	2.8655	0.1830901	insignificant

Table 3.3 Analysis of relationships between the samples using Tukey's post hoc test. Four relationships (MMA16 vs MMA15, MMA16 vs PA16, MMA15 vs PA16, and MMA15 vs PT16) were calculated to be statistically significant.

- ANOVA was performed to compare this data to the other student populations. The 15 students from each of these 3 cohorts were selected based on having a final course grade as close to the sample students as possible. The p-value for the single factor ANOVA when comparing MMA15, MMA16, PA16, and PT16 was 8.52E-18 and it was found to be statistically significant with a confidence interval of 95%.
- This data was then analyzed using Tukey's post hoc test to establish which relationships were significant. Four relationships were statistically significant with a 99% confidence interval. In addition, t-tests were ran to evaluate the relationship between each of the three classes and the MMA16 class, which confirmed that we were unable to reject the null hypothesis.
- Therefore, the quantitative data shows that **there is not a statistically significant correlation between students' assessment performance on each unit practical examination and total course score when compared with MMA15, PA16, and PT16.**

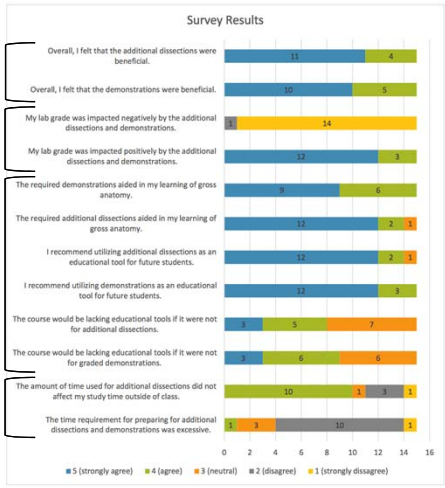


Figure 3.7: These survey results were completed by all 15 MMA students evaluated. Notably, most students self-reported that they felt that the additional dissections and demonstrations were beneficial with an average score of 4.73 (dissections) and 4.67 (demonstrations).

- In the focus groups, most students agreed the additional dissections and demonstrations **helped them perform better on exams (both practical and written).** The majority said that the activities should remain part of the curriculum and were a **positive addition** to the anatomy curriculum.
- Many students noted that performing additional dissections **increased their confidence in course material and their proficiency in the kinesthetic aspects** of anatomical dissection.

Evidence-based Recommendations for Dissection in Anatomy Education

The quantitative results showed **no statistically significant correlation between the additional dissection and demonstrations and the 2016 MMA students' unit practical exams and overall course grade.** Therefore, we fail to reject the null hypothesis. However, the qualitative results displayed that the majority of students had a **positive opinion about the additional dissections and demonstrations**, and **the increase in confidence and perceptions of individual competence suggest there is benefit to including dissection** – graded or not, placebo effect or otherwise – in anatomy education.

The following are evidence-based recommendations formed through this analysis:

- ✧ Anatomical dissection tasks must be deliberate and target the learning objectives of the laboratory session.
- ✧ Intensive student dissection should be utilized especially for content that requires a thorough understanding of spatial relationships and anatomical planes.
- ✧ Hold students to a high standard of anatomical knowledge and professionalism that is appropriate to their college's chosen career path(s) and clinical relevance.
- ✧ Graded dissections and demonstrations are beneficial particularly to anatomy graduate students, as budding experts in the field, to gain confidence in their skills.

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