

# The Effectiveness of Learning Anatomy and Medical Imaging Using the Anatomage Table Compared with Prosection

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# Conflict of Interest

- No conflict of interest to declare

# Background

- Many approaches exist for teaching anatomy: dissection, prosection, models, computer software, medical imaging.<sup>1</sup>
- Each approach has strengths and weaknesses.<sup>1,2</sup>
- Virtual dissection tables represent a new method for teaching anatomy.<sup>1,3</sup>
- The College of Medicine at the University of Saskatchewan recently acquired an **Anatomage Table**, the first virtual dissection table.
- Enabled us to explore and evaluate this tool for learning anatomy at the undergraduate student level.

<sup>1</sup> Lombardi SA, Hicks RE, Thompson KV, Marbach-Ad G. Are all hands-on activities equally effective? Effect of using plastic models, organ dissections, and virtual dissections on student learning and perceptions. *Adv Physiol Educ.* 2014 Mar;38(1):80-6.

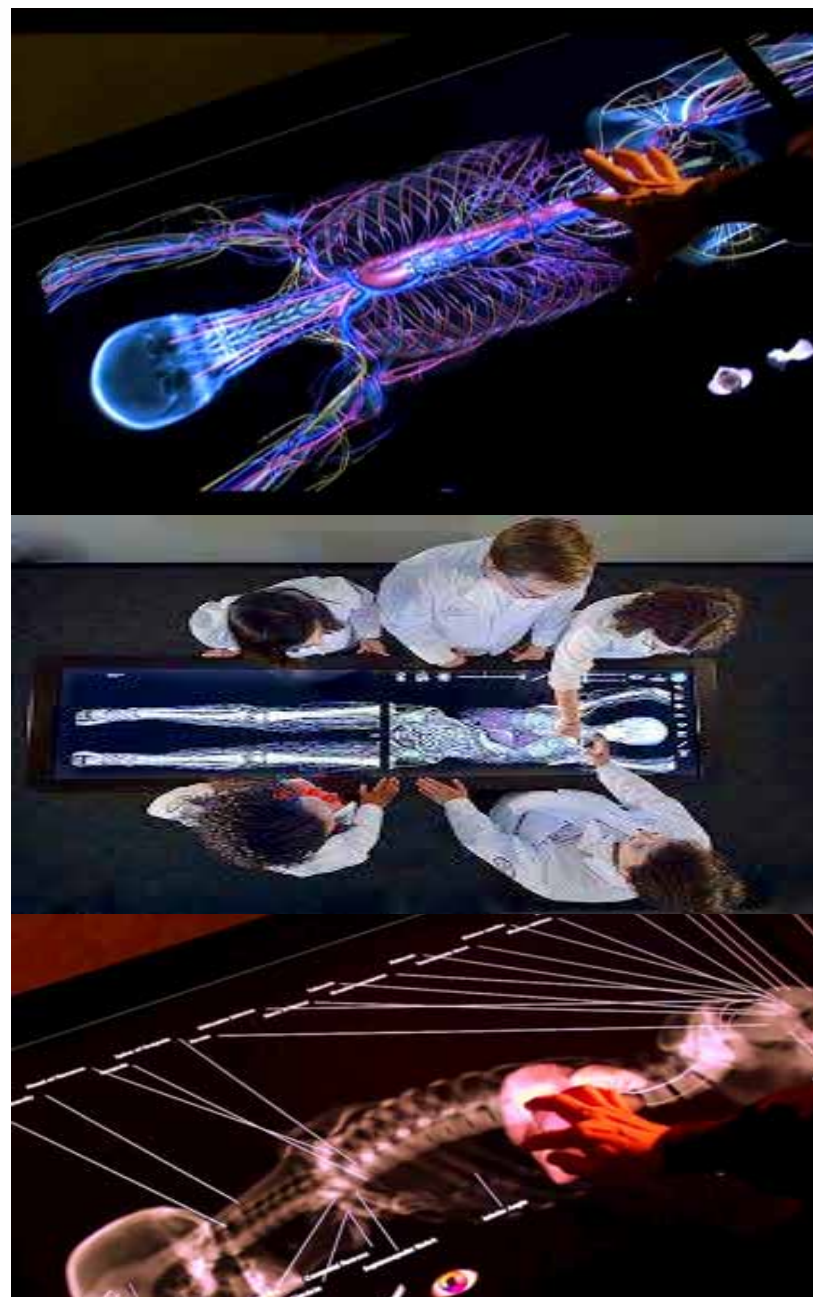
<sup>2</sup> Nnodim JO. Learning human anatomy: by dissection or from prosections? *Med Educ.* 1990 Jul;24(4):389-95.

<sup>3</sup> Yammine K, Violato C. A meta-analysis of the educational effectiveness of three-dimensional visualization technologies in teaching anatomy. *Anat Sci Educ.* 2014 Dec 31.

# Anatmage Table

- Developed by Anatomage Inc. in San Jose, California
- Touch-interactive display system
- Life-sized form
- 3D gross, whole body, male and female models
- 3D high resolution regional anatomy with skeleton, muscles, organs and soft tissue
- Import and view DICOM images
- Library with pathology images
- Cost: \$60,000

Anatmage Table. <http://www.anatmage.com/medical-products/anatmage-table>



# Objective

- Conduct a study to explore the effectiveness of learning anatomy and medical imaging, using the Anatomage Table compared with prosection.

*Anatomage*  
**TABLE**  
Virtual Dissection



# Methods

- Randomized study comparing two methods of learning knee anatomy:
  - a) Anatomage Table
  - b) Prosection
- 16 undergraduate students who had never previously completed or enrolled in a university anatomy course.
- Each participant was randomized into either the Anatomage Table or prosection group.
- Designed separate lesson plans, specific to Anatomage or prosection, for teaching knee anatomy including, the major bones, ligaments, menisci, muscles and tendons.

# Methods

## Lesson Learning Objectives

- Understand and apply basic anatomic terminology (anatomical position, terms of location, and planes).
- Name and describe the major bones, menisci, ligaments, muscles and tendons of the knee.
- Describe the function of the major bones, menisci, ligaments, muscles and tendons of the knee.
- Orient and identify knee anatomy in different planes (Anterior-Posterior, lateral, sagittal, coronal).
- Identify knee anatomy on illustrations and models.
- Identify knee anatomy on a prosected (pre-dissected) specimen.
- Explain the advantages and disadvantages of the three main imaging modalities for identifying knee pathology.
- Distinguish normal from abnormal anatomy on medical imaging.

# Methods

- Lesson plan for both groups mirrored each other.
- Total of four learning sessions were held with an instructor and groups of four students per session.
- Anatomage learning sessions averaged 60 minutes.
- Prosection learning sessions averaged 70 minutes.
- Student assessment tool was created using FluidSurveys (Ottawa, ON) and administered to the students before (pre) and after (post) the teaching session.
- Assessment tool included short answer and multiple choice questions covering
  - a) anatomical terminology, structure, function, labelling on illustrations, prosected images
  - b) diagnostic medical images, medical imaging basics for X-ray, CT and MRI, identifying modality used, plane of imaging and distinguishing between normal and abnormal images.



# Methods

## ■ Assessment example:

Which muscle group is responsible for flexion of the knee?

Which ligament prevents anterior displacement of femur and helps to control knee flexion?

Which of these bones does NOT articulate at the knee joint?

- Femur
- Tibia
- Fibula
- Patella

# Methods

- Assessment example:



1: Modality

2: View

3: Pathology?

# Methods

- Practical component of the assessment: participants identifying anatomy on Anatomage Table, prosections, and diagnostic images indicated by examiner.
- Self-assessment was completed by the participants at the end of learning session evaluating self-perceived achievement of learning objectives following, and retrospectively prior to the teaching session.
- Data analysis performed using SPSS version 22 for Windows (Armonk, NY). Independent and paired t-tests and for the scores grouped by total, question category (anatomy or imaging) and specific question type (e.g. labelling prosection, identifying imaging plane).
- Chi-squares were also computed for each group.

# Results

- Total possible score on the post-test assessment was 41.
- Mean assessment scores:
  - a) Anatomage: 26.2 +/- 5.9 (Figure 1 on next slide)
  - b) Prosection: 29.6 +/- 4.2 (Figure 2 on next slide)
- Differences between the total anatomy scores for the Anatomage and prosection groups was not statistically significant ( $p=0.159$ ).
- Effect size was  $d=.74$  (high) in favour of prosection-based instruction.
- Differences between total diagnostic medical imaging scores between the two groups not statistically significant ( $p=0.511$ ).

## Comparison of individual scores for prosection and Anatomage Table groups

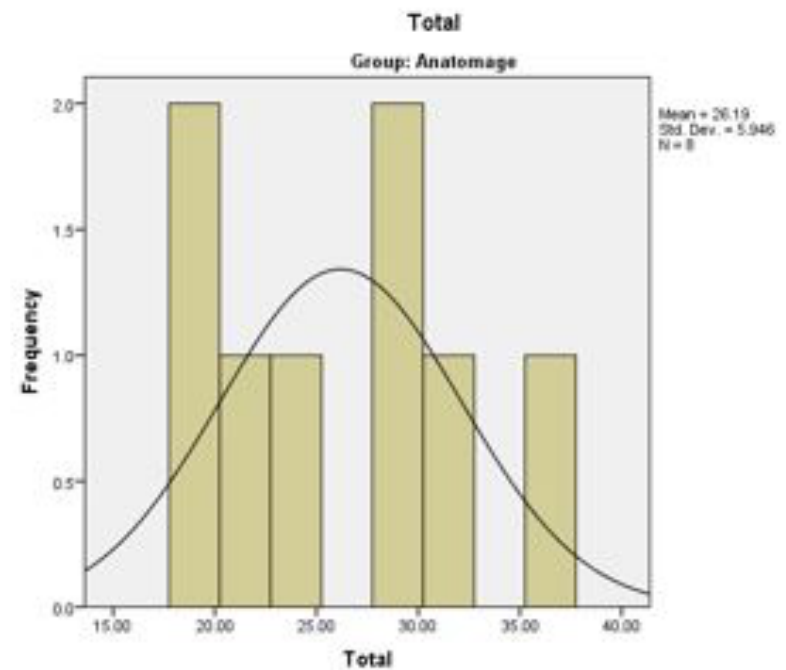
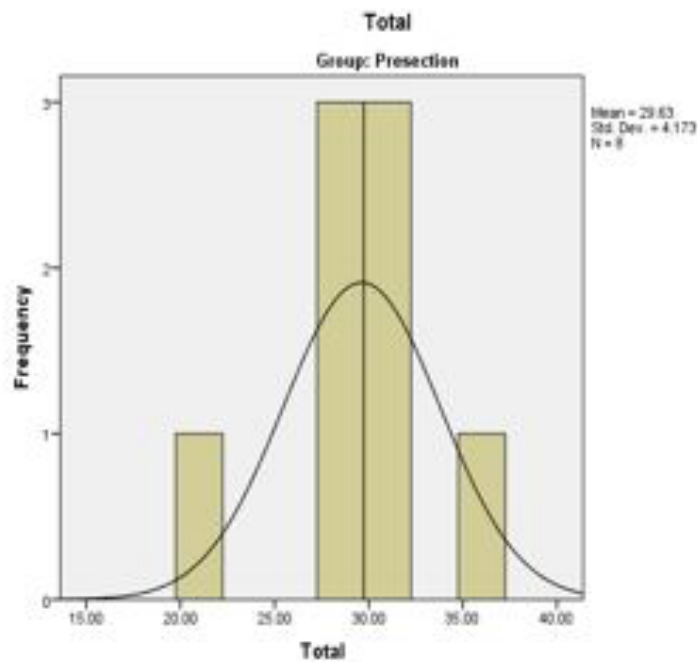


Figure 1: Histogram for prosection group scores  Figure 2: Histogram for Anatomage group scores

Prosection: 29.6 +/- 4.2

Anatomage: 26.2 +/- 5.9

# Results

- Differences between practical scores for identifying anatomical structures yielded effect size of 0.97 ( $p=0.074$ ) and identifying abnormal imaging yielded effect size of 0.59 ( $p=0.259$ ) favouring prosections.
- Anatomage-based instruction scored higher on identifying relative location of anatomy and identifying imaging plane but differences were not statistically significant.
- For both groups, marked and statistically significant increase in the self-assessed achievement of the learning objectives before and after teaching.

# Results

- Differences in self-assessment favouring prosection-based instruction:
  - a) Understand and apply basic anatomic terminology ( $p < .031$ ).
  - b) Identify knee anatomy on a prosected specimen ( $p < .001$ ).
- Qualitative feedback indicated that students greatly enjoyed teaching in both groups.
  - a) Prosection group: helpful to physically manipulate the knee joint to understand the ligaments.
  - b) Anatomage group: would benefit from more time to process the learning content.

# Discussion

- Similar performance demonstrates that learning knee anatomy with the Anatomage is effective for naïve learners compared with prosection-based instruction.
- Students believed they learned effectively using both prosections and Anatomage.
- Anatomage students had better spatial understanding of anatomy.
- Students taught using prosection felt that they learned anatomical terminology better and could better identify anatomy on prosected specimens.
- Student feedback indicated learning could be enhanced by independent time with the Anatomage Table.
- Future research may confirm these findings and attempt to explore the synergistic learning effects of Anatomage, prosection, and other learning methods and materials.



# Conclusion

- For “naïve” anatomy learners, there were no statistically significant differences in overall performance for anatomy and medical imaging between Anatomage and prosection groups.
- Effect sizes (which mostly favoured prosection-based instruction) were very large for some questions.
- Statistical significance may be demonstrated with a larger student sample size.

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