

Flipping Radiologic Anatomy – An Assessment of Effectiveness in a Condensed Medical Gross Anatomy and Embryology Course

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Journey to the Flipped Side

Reform

- Curriculum
- Course
- Content



Create

- Sessions
- Study Design



Assess

- Performance
- Perception

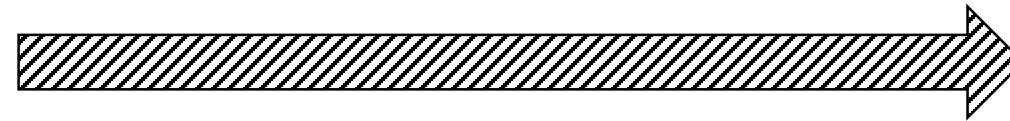
Curriculum and Course Reform

2015

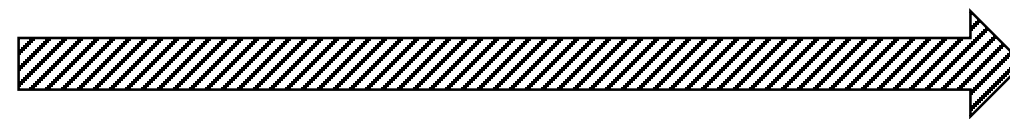
24-month
Pre-clinical
curriculum

19-week course
~137 contact hours

93 hours Lab
42 hours Lecture
2 hours Flipped classroom



2016 - 2017



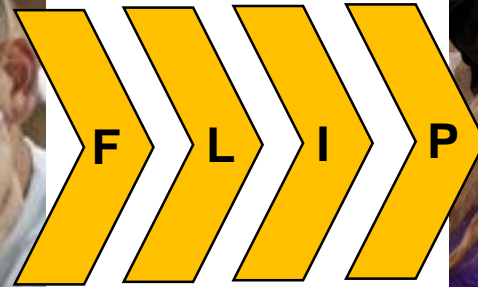
2018

17-month
Pre-clinical
curriculum

16-week course
~116 contact hours

79.5 hours Lab
25 hours Lecture
12 hours Flipped classroom

Radiology Reform



Passive Learning
Large Group Delivery
Teacher-Centered
(2016)

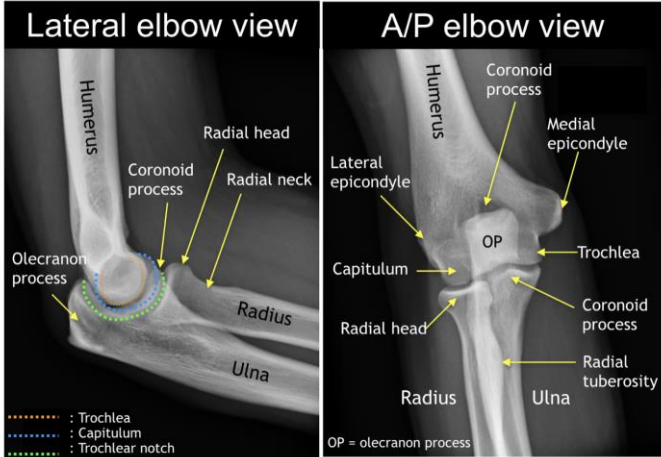
Active Learning
Small Group Delivery
Learner-Centered
(2017-present)

Preparatory materials

- ❖ Available on Blackboard
- ❖ Average 60 min prep time
- ❖ Materials include:
 - Handout with labeled radiographs
 - Online modules
 - Videos

The Elbow
 The radiographic evaluation of the elbow usually consists of AP and lateral views. On these films one should be able to identify the **medial and lateral epicondyles, trochlea, capitulum, radial head and neck, coronoid process, coronoid fossa, and radial tuberosity**.

Traumatic injuries to the elbow occur commonly during falls on the outstretched hand. In children, the most common injury is a supracondylar fracture, which can be quite subtle radiographically. In adults the most common fracture of the elbow is a fracture of the radial head. This is often nondisplaced and can also be very difficult to identify on radiographs.



The Forearm
 The forearm is usually evaluated with AP and lateral views. Fractures of the radius and ulna are usually clinically and radiographically obvious. They are usually the result of falls upon an outstretched hand. The distal part of the radius flares to become wider and has a concave articular surface at the **radiocarpal joint**. The bone projection seen at the lateral aspect of the distal radius is called the **radial styloid**. There are two bone projections at the distal ulna. The more rounded and proximal protuberance that forms part of the articular surface is the **head of the ulna**. The more distal and lateral projection is the **ulnar styloid**.

The Wrist and Hand
 The standard radiographic views of the wrist and hand are the AP and lateral views. The carpus consists of eight bones aligned in two parallel rows. The **proximal row** (from the radial

GEISEL SCHOOL OF MEDICINE AT DARTMOUTH
 DEPARTMENT OF MEDICAL EDUCATION

HOME BACK UPPER EXTREMITY THORAX ABDOMEN PELVIS LOWER EXTREMITY HEAD & NECK

UPPER EXTREMITY

Regional Resources

- [Shoulder](#)
- [Axilla & Brachial Plexus](#)
- [Arm & Elbow](#)
- [Forearm](#)
- [Hand & Wrist](#)

Unit Resources

- [Angiograms](#)
- [Videos](#)
- [Radiology Quiz \(30\)](#)
- [Axial Cadaver Images Quiz \(25\)](#)

ANATOMY TEXT MEDICAL DICTIONARY

YouTube Search

Basics of the Chest X-Ray

Dr. Kate Henderson
 ST7 in Anaesthesia
 Education Fellow
 Central Manchester University Hospitals

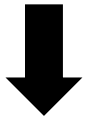
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Session details

Primary: Clinician Educator

+

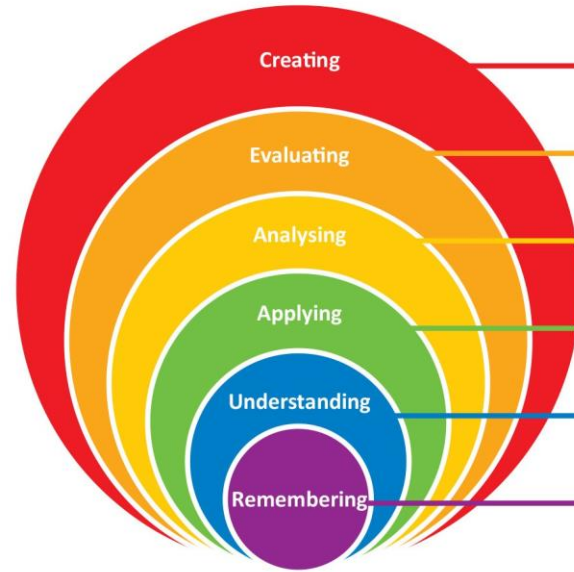
Supportive: Basic Science Teaching Faculty



Small groups of 8-10 students

60-90 minute sessions

- Part 1 - Introduction (5 min)
- Part 2 – Individual **Radiologic Anatomy** Activity (12 min)
- Part 3 - **Whole group discussion** (10 min)
- Part 4 - Small-group Clinical **Application** Activity (12 min)
- Part 5 - **Whole group discussion** (10 min)



Bloom's taxonomy (revised)

Level	Can the learner...	Key verbs
Level 6	create a new product or point of view?	assemble, construct, create, design, develop, formulate, write
Level 5	justify a stand or decision?	appraise, argue, defend, judge, select, support, value, evaluate
Level 4	distinguish between different parts?	appraise, compare, contrast, criticise, differentiate, discriminate, distinguish, examine, experiment, question, test
Level 3	use information in a new way?	choose, demonstrate, dramatise, employ, illustrate, interpret, operate, schedule, sketch, solve, use, write
Level 2	explain ideas or concepts?	classify, describe, discuss, explain, identify, locate, recognise, report, select, translate, paraphrase
Level 1	recall or remember the information?	define, duplicate, list, memorise, recall, repeat, state

Whole group discussions provide formative feedback

Study Design

Question:

Is flipping radiology effective in improving learning and creating a more engaging, active learning experience when compared to lecture?

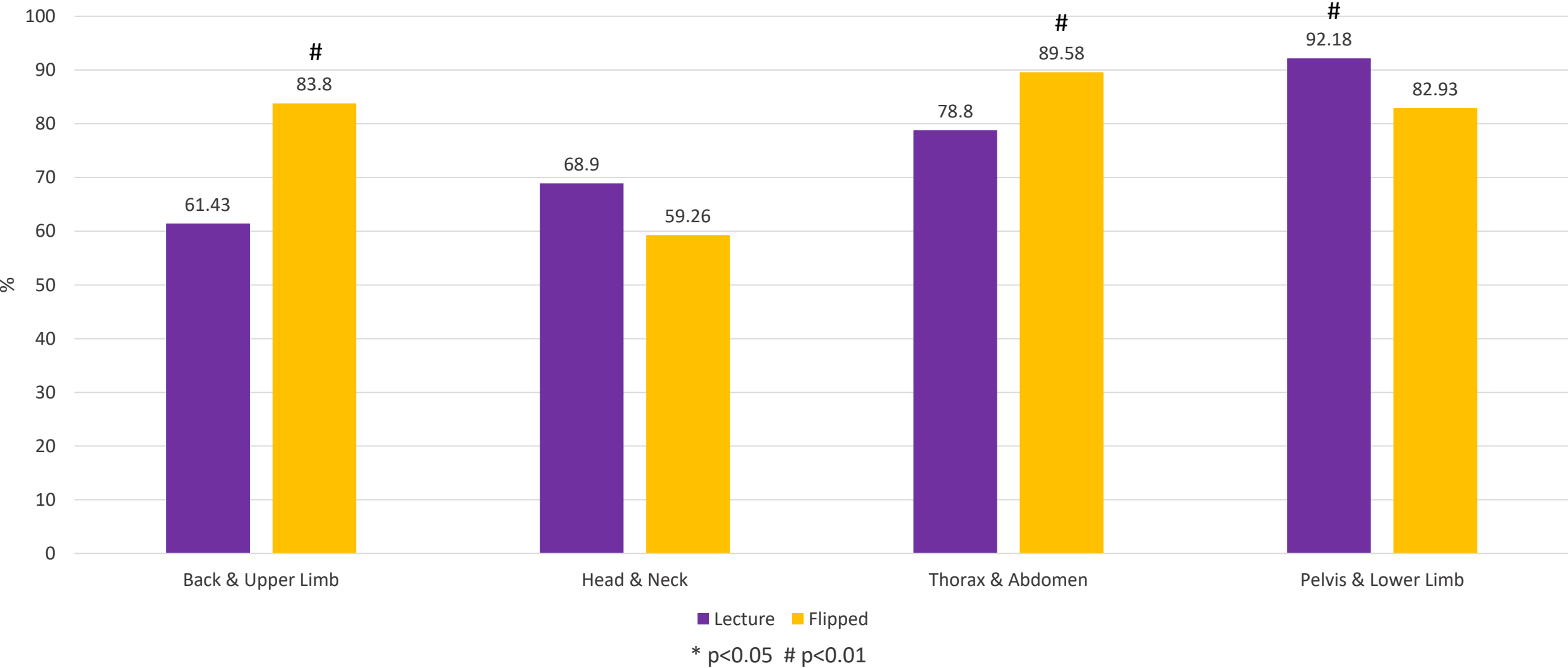
Aims:

1. Assess student performance on radiology questions in a first-year medical gross anatomy course from 2016-2018
 - Compare computer MCQ and laboratory images (identification only)
 - unpaired t-Test ($p < 0.05$)
2. Assess student perception of radiology flipped classroom sessions
 - Voluntary survey data (2017: $n=87$; 2018: $n=83$)

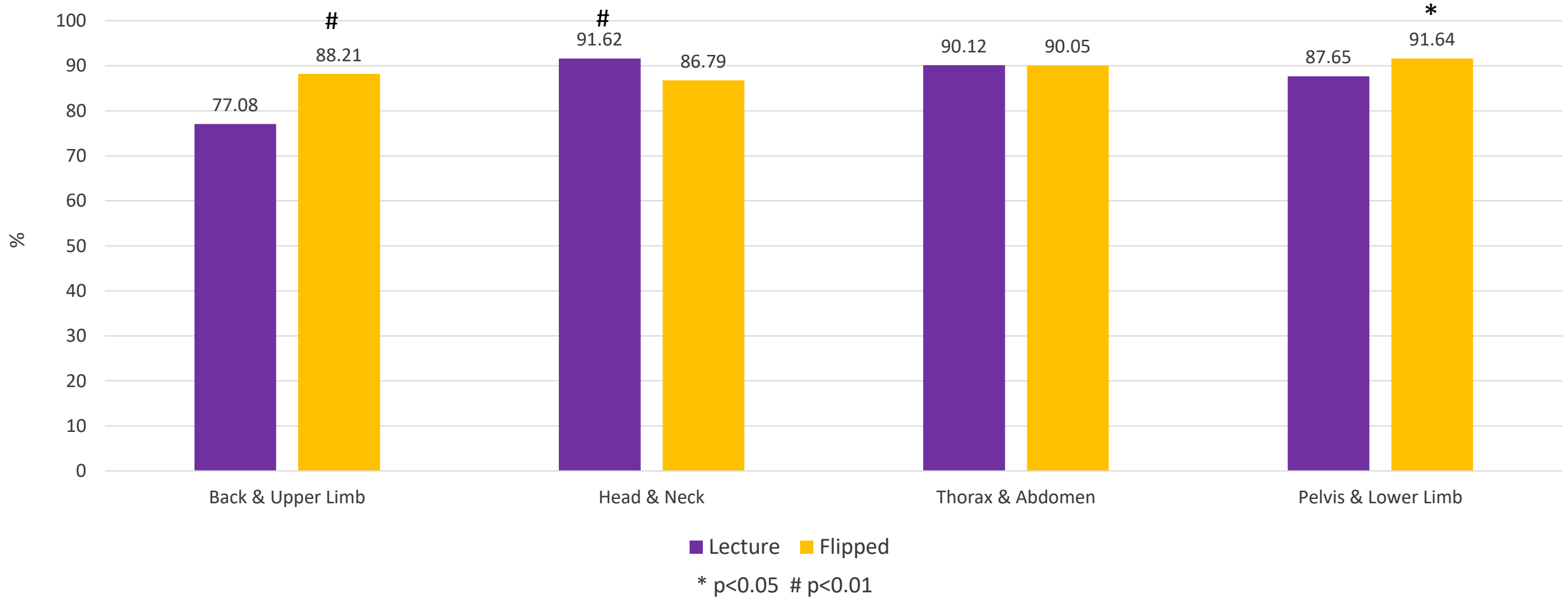
Study Groups and Interventions:

- 2016 – Received seven traditional radiology lectures ($n=87$)
- 2017 & 2018 – Received one intro radiology lecture and six flipped classroom sessions (2017: $n=91$; 2018: $n=88$)
 - Exam 1 – Intro; Spine; Upper limb
 - Exam 2 – Head & Neck
 - Exam 3 – Thorax; Abdomen
 - Exam 4 – Pelvis & Lower limb

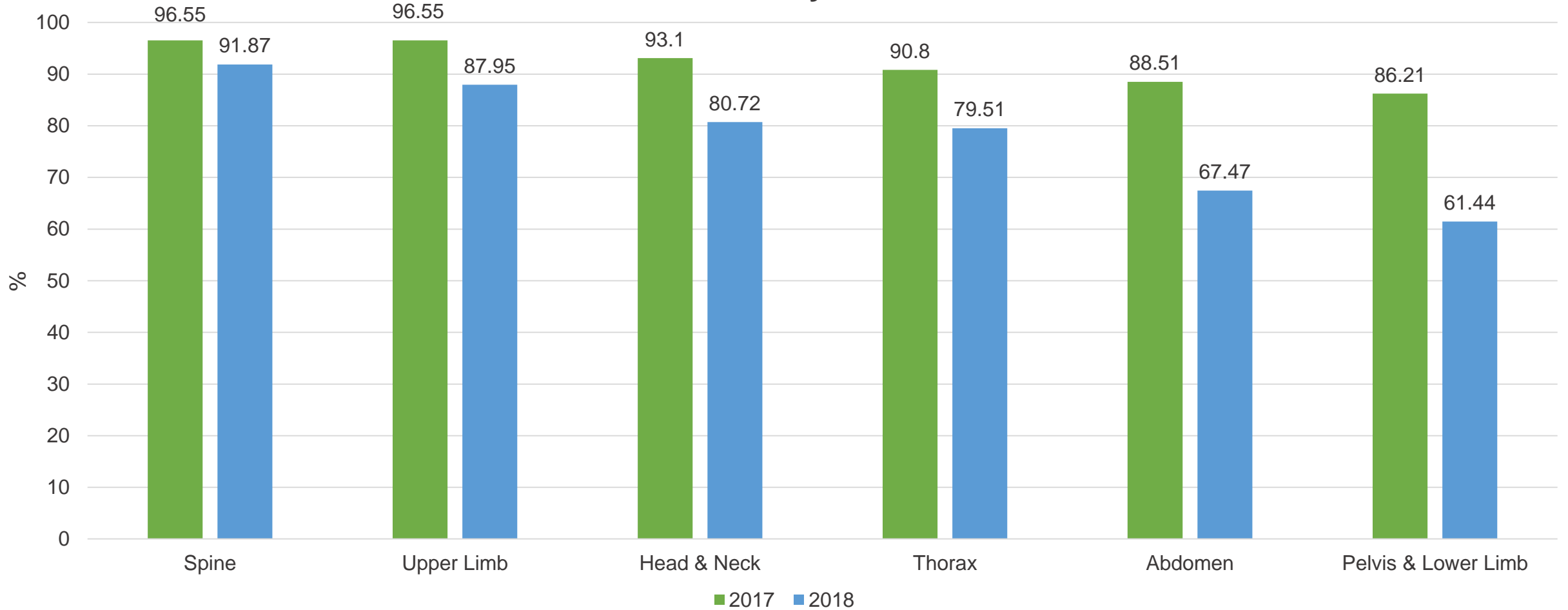
Computer Assessment Performance – Radiology Questions



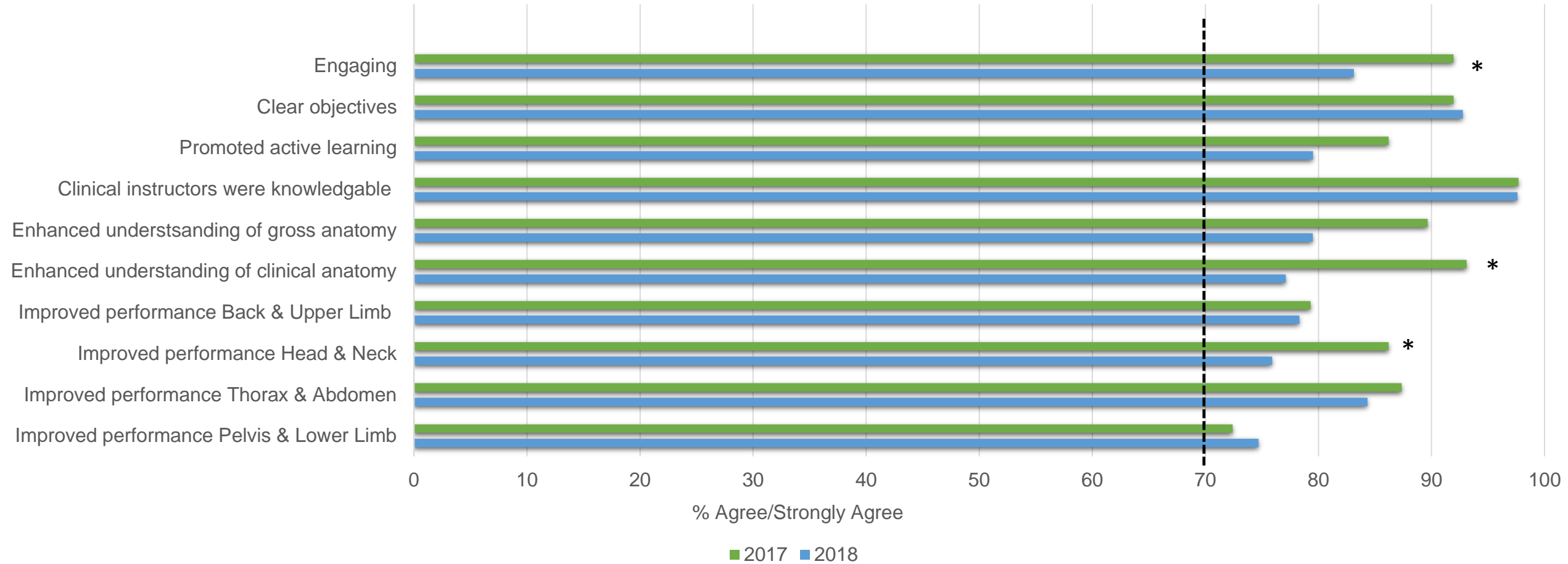
Laboratory Practical Performance – Radiology Questions



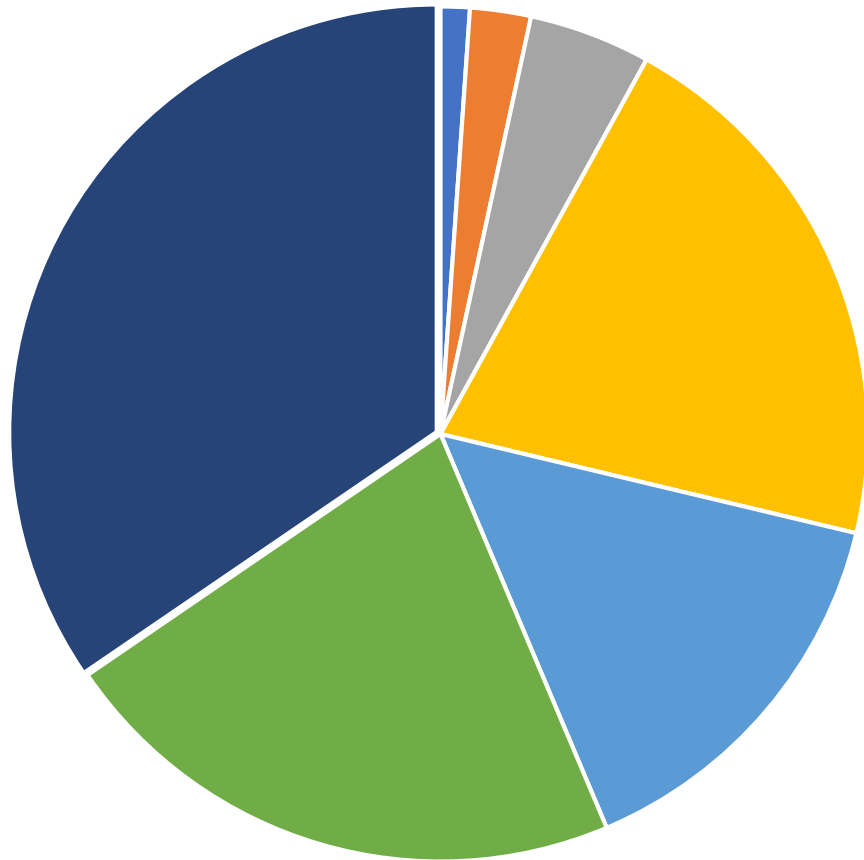
Student Preparation for Radiology Flipped Classroom Sessions Survey Data



Student Perceptions of Radiology Flipped Classroom Sessions Survey Data



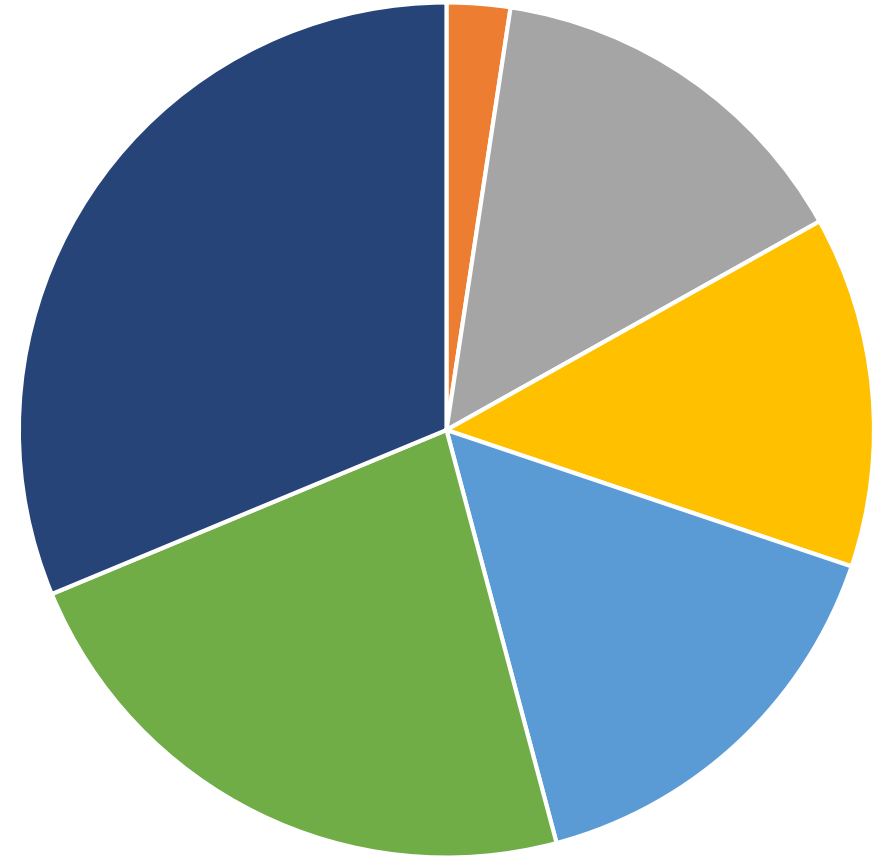
Student Preferred Instructional Strategies for Learning Radiological Anatomy Survey Data



2017

- Small group only
- Lecture only
- Independent/self-study only
- Lecture + self-study

- Small group + lecture
- Small group + self-study
- Small group + lecture + self-study



2018

From the fingertips of learners

Strengths

Promoted **problem solving and critical thinking** to analyze clinical cases

I think the flipped classroom setting was the **best way to learn radiology rather than lectures**. The group work followed by an explanation really brought everything together

The combination of **basic scientist and clinician approach** made these sessions very complete and well-rounded.

Accountability session, engaging, get to leave with a study guide

Weaknesses

Labeling images was difficult when the **images** would **print poorly**.

There was **not enough time** to think through the clinical cases or for the physician to explain them.

Having **smaller groups** would be very useful and **more engaging**, as well as promote more of an atmosphere to have your specific questions answered about the material.

[Labeling activities] could be done outside of the classroom. Our sessions would be better spent going over **more clinical examples**.

Is flipping radiology “better” than lecture?

- Data suggests:
 1. Greatest impact across both assessments occurs during the first exam block
 2. Flipping radiology creates an engaging, active learning experience that enhances both gross and radiological anatomy understanding
 3. Preferred instructional strategies may affect level of preparation and overall perceived effectiveness of flipped classroom
- Limitations:
 1. No survey data for 2016 (lecture only) cohort
 2. No control for previous radiology exposure/education

Future Directions

- Pair and evaluate student performance and survey data
 - Is there a correlation between preferred instructional strategies, self-reported preparedness and perceived effectiveness of flipped classroom on learning and performance?
- Transition to online, interactive content
- Track knowledge retention longitudinally (M3 radiology course)
- Continue to engage clinicians to be involved in pre-clinical curriculum
- Reassess how to best use allotted time to improve session effectiveness

Acknowledgements

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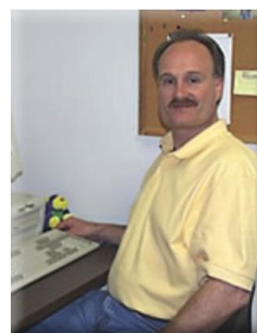
Emily Askew, PhD



Jeff Eells, PhD



Randy Renegar, PhD



John Smith, PhD



Theresa Phillips

Admin Support

Class of 2020



Class of 2021



Class of 2022



Importance of lateral view and AP view in X-ray.

