

How Do We Make Our Students Remember What We Teach?

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Background

- The current/modern educational curriculum worldwide consists of,
- **Student-centred**, multimodal, content-driven & **evidence-based** active learning.
- A blended/hybrid learning approach that is aimed to,
 - Foster student engagement
 - Improve the subject knowledge
 - More professor-student interaction
 - Social & communication skills & critical thinking
 - Retain a long-term knowledge of the course



Passive Vs. Active Learning

Didactic, Passive Learning	Active Learning
Poor student performance	Better student performance
Higher student failure rate	Lower student failure rate
Achiever lower exam score	Higher exam scores
Gain superficial knowledge	Gain deep knowledge
Decreased long-term knowledge retention	Increased long-term knowledge retention
Gain less social & communication skills	More social & communication skills
Produce lower achievement & less positive relationship among students	Produce higher achievement & more positive relationship among students
Little lecture info. retention	Increased lecture info. retention
Students are less engaged in class	Students are more engaged in class

Bioscience Problem?

- The medical & allied-health students **worldwide** reported a growing concern over the loss of bioscience knowledge of first-year of their degree program.
- Students lose approx. **50-80%** of the first-year anatomical knowledge within two or more years of medical school.
- Ninety-two (**92%**) of second year medical students reported that anatomical knowledge was very helpful.
- Only **14.0%** of the final year medical students felt confident in their first-year anatomy knowledge.
- Knowledge retention studies have not yet been assessed in nursing students.

Narnaware & Neumeier, *Educator*, 2021

Objectives

- Assess the anatomical knowledge acquisition in the first-year nursing students and its transfer/loss, retention, and application in the subsequent years of nursing.
- Identify factors impacting knowledge retention.
- Discuss active learning strategies to help students remember the course contents long-term.



Pre-assessment



Course/Project Design

- How do you evaluate knowledge acquisition in the first-year & its retention & application in the subsequent years of nursing program?



Kahoot Time!

Which of the animals below is a mammal?



Full Screen

12



Skip

0
Answers



Robin



Gorilla



Shark

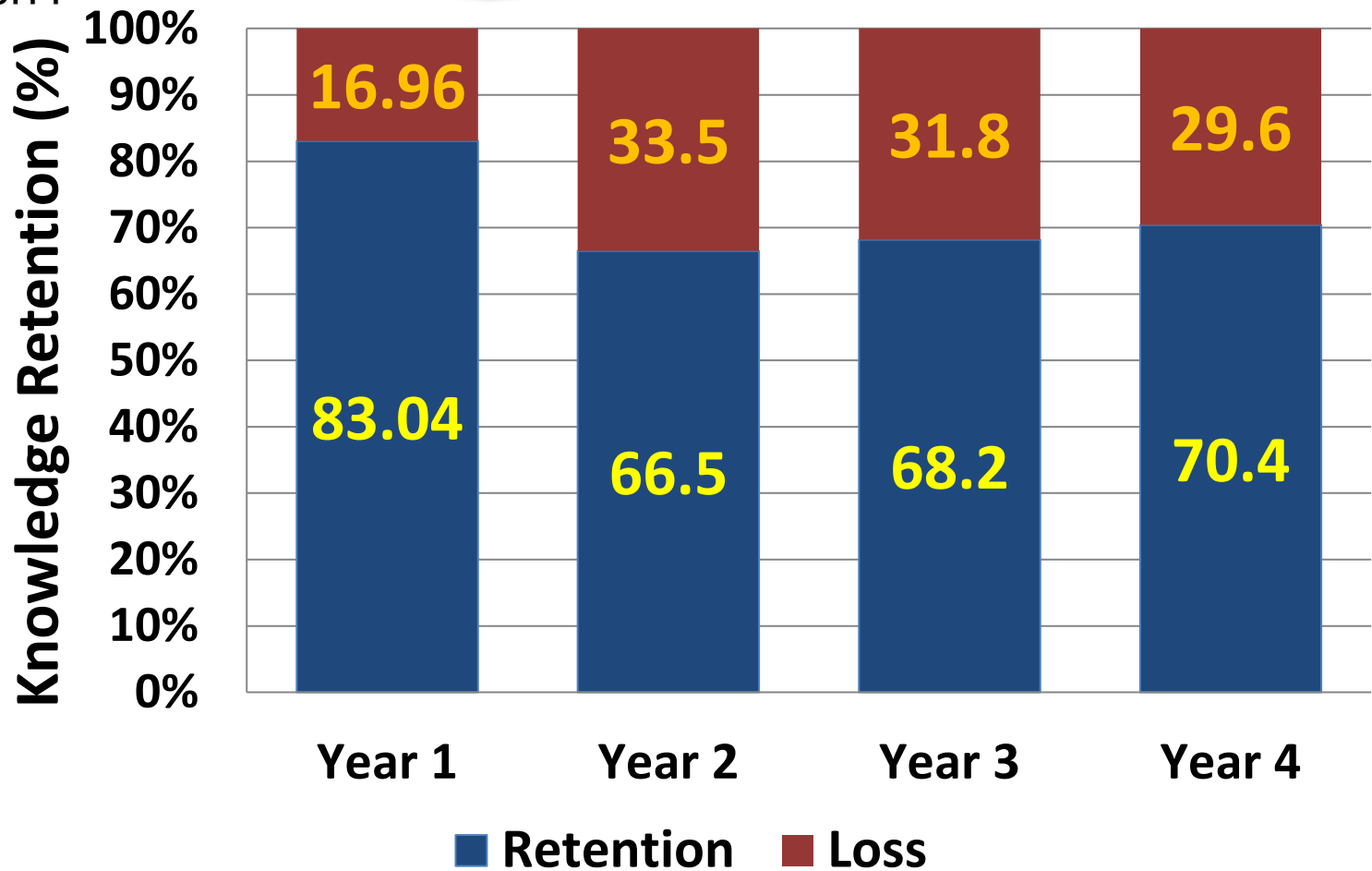


Snake

Results



Knowledge Retention in Nursing Students



Narnaware & Neumeier, *Anat. Sci. Educ.*, 2023 (submitted)

Percent Anatomical Knowledge Retention by System Over Time

Organ System	Year 1	Year 2	Year 3	Year 4
	Mean Score \pm SD	% Knowledge Loss		
Integumentary System	90.6 \pm 6.8	19.9%	23.9%	28.2%
Head & Neck Lymphatic	91.4 \pm 11.7	57.4%	57.6%	55.7%
Special Senses	88.4 \pm 6.9	20.6%	17.3%	37.0%
Gastrointestinal	63.6 \pm 6.9	10.3%	12.6%	12.0%
Respiratory System	72.9 \pm 5.8	11.0%	14.0%	13.9%
Vascular System	83.5 \pm 5.4	46.1%	49.0%	27.6%
Nervous System	83.9 \pm 8.1	25.1%	25.1%	25.1%
Cranial Nerves	88.2 \pm 4.4	41.2%	42.6%	44.1%
Musculo-skeletal System	88.0 \pm 7.0	30.7%	40.3%	26.6%
Lymphatic System	82.6 \pm 2.8	35.7%	37.6%	37.6%
Genitourinary System	80.4 \pm 16.4	16.4%	21.2%	21.2%

Fluctuating Knowledge Loss

Organ System	Year 2	Year 3	Year 4
Special senses	20.6%	17.3%	37%
Vascular	46.1%	49%	27.6%
Musculoskeletal	30.7%	40.3%	26.6%

Factors That Impact Learning



Student-Related Factors Impacting Teaching & Learning of Biosciences

- Inadequate time to study anatomy
- Class time & attendance
- Lab experience
- English as a second language
- Program entry (BScN vs. DPN)
- Student factors:
 - Prioritization
 - Previous experience
 - Self-efficacy

Faculty-Related Factors Impacting Teaching & Learning of Biosciences

- Course organization and methods of delivery
- Available curriculum time
- Teaching style and strategies
- Experience in didactic, passive teaching

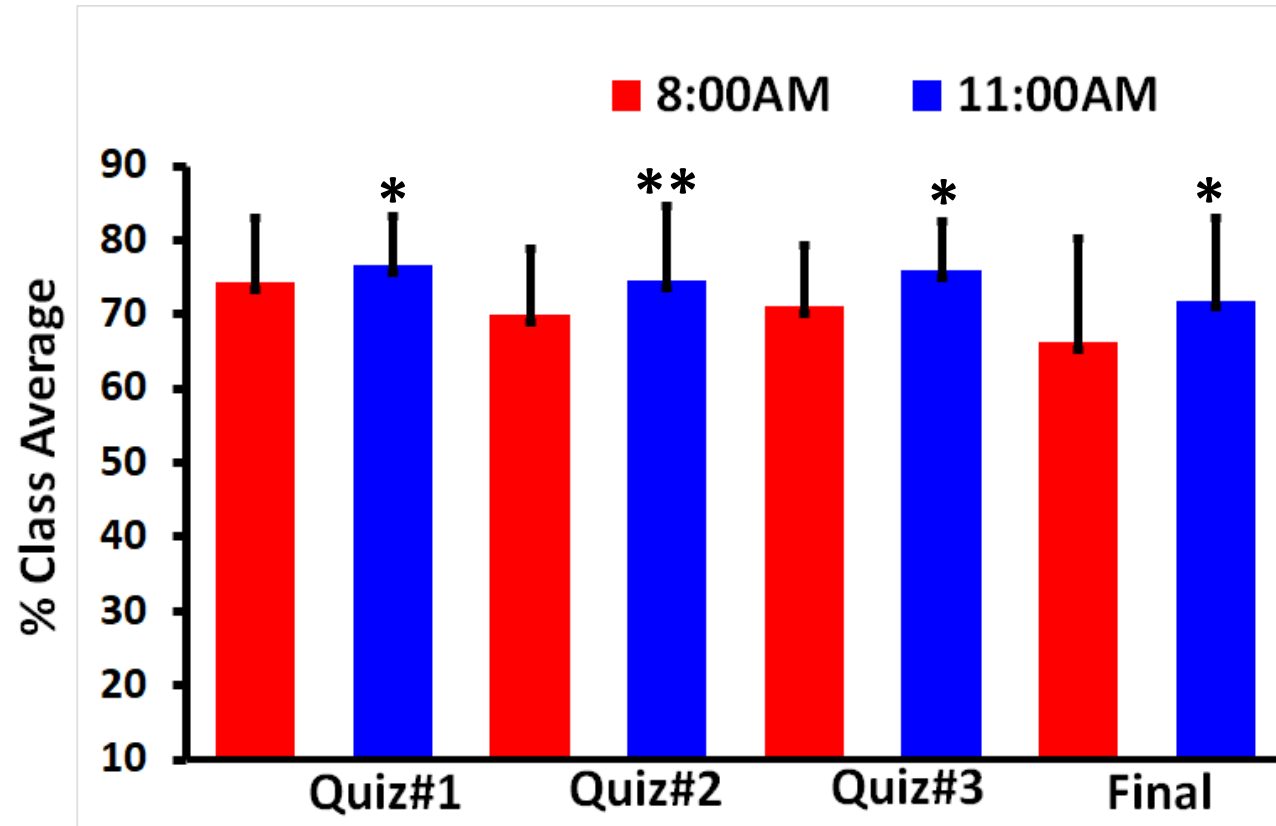
Factors Impacting the Present Study

1. Teaching Hours

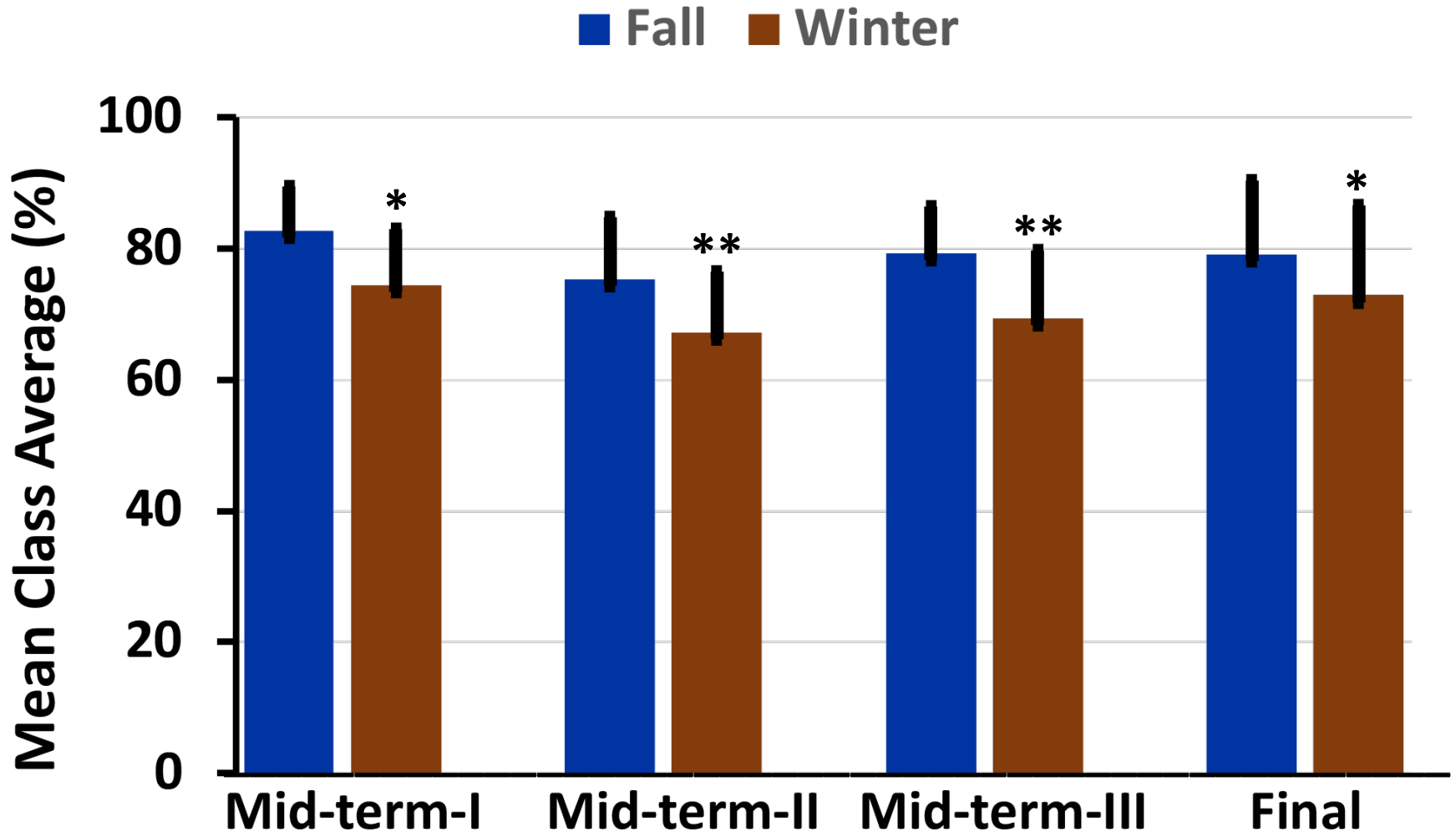
Body organ system	Teaching hours
Integumentary system	1.2
Head and neck lymphatic	1.2
Special Senses	1.2
Gastrointestinal	1.2
Respiratory system	1.2
Vascular system	2.4
Nervous system and cranial nerves	1.2
Musculo-skeletal system	9.6
Lymphatic system	1.2
Genitourinary	2.4
Review	1.2
	Total: 26.4

2. Class Time

*Factors
Impacting the
Present Study*

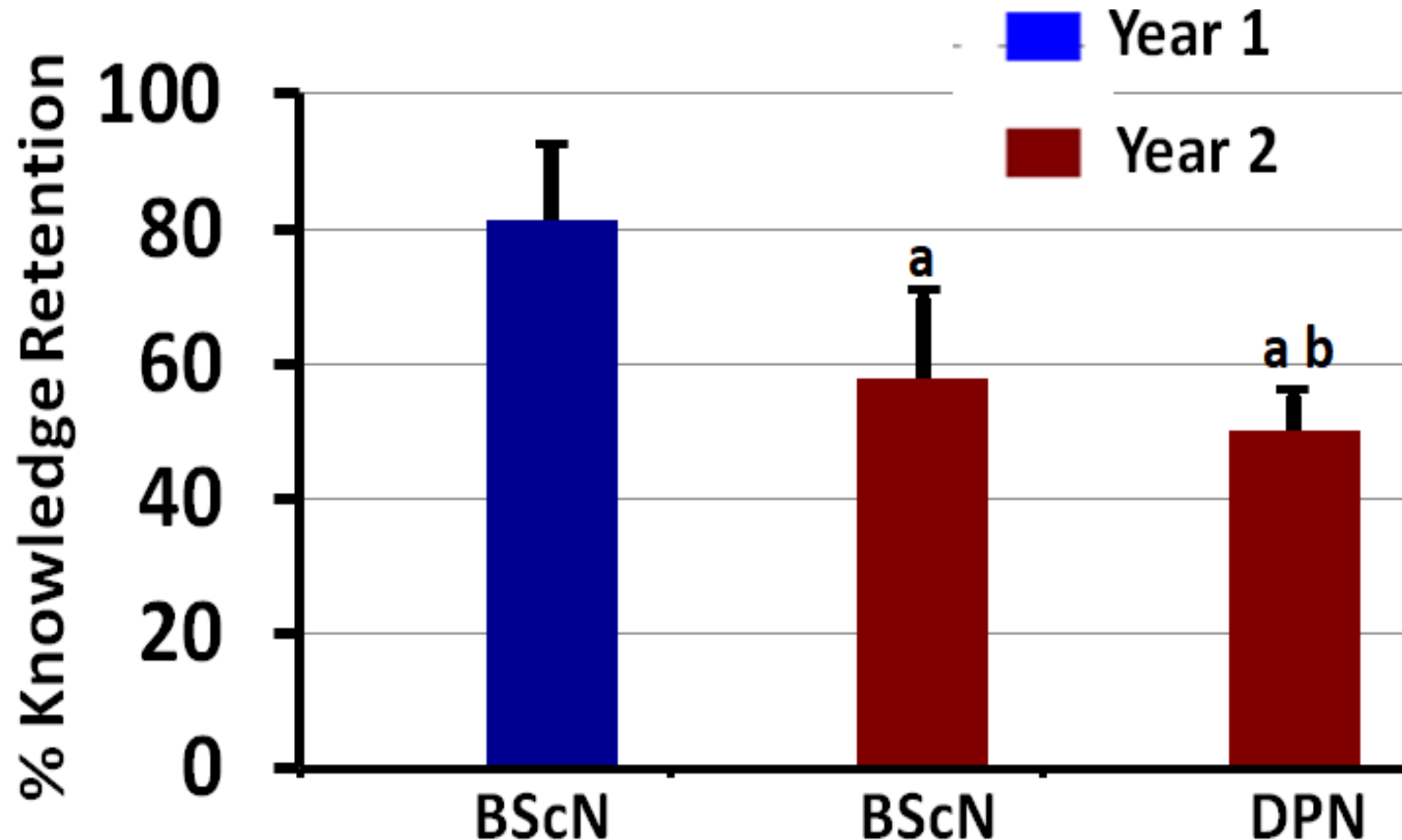


3. Fall Vs. Winter Semesters



4. Choice of Program of Study

BScN vs. DPN



Interventional Strategies



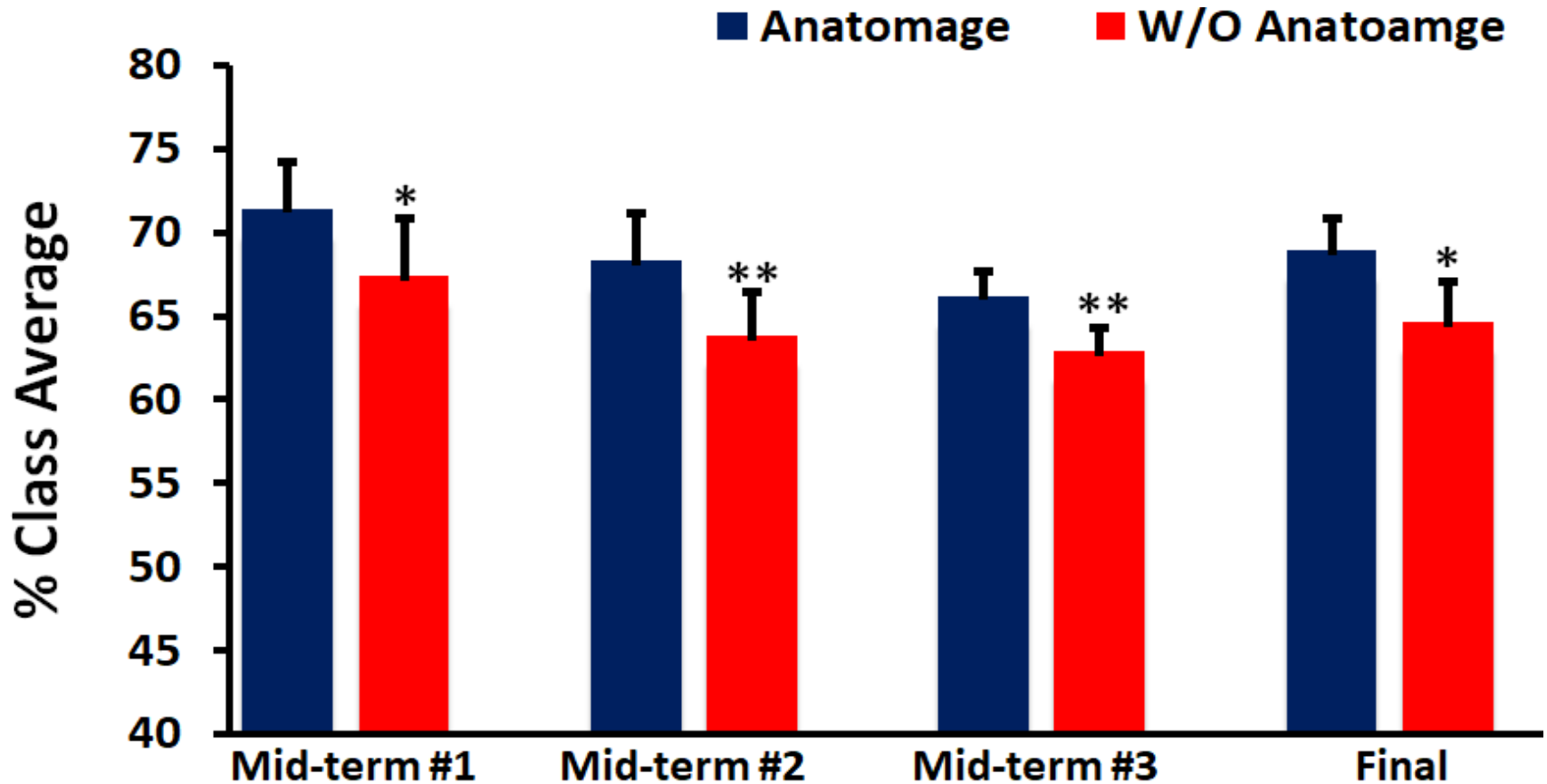
***Interventional
Strategies in
Present Study***

- Introduction of cutting-edge teaching technology.
- Inclusion of the anatomy Images in exams.
- Various Online & In-class teaching activities.
- Content Reinforcement (Repeated knowledge testing).

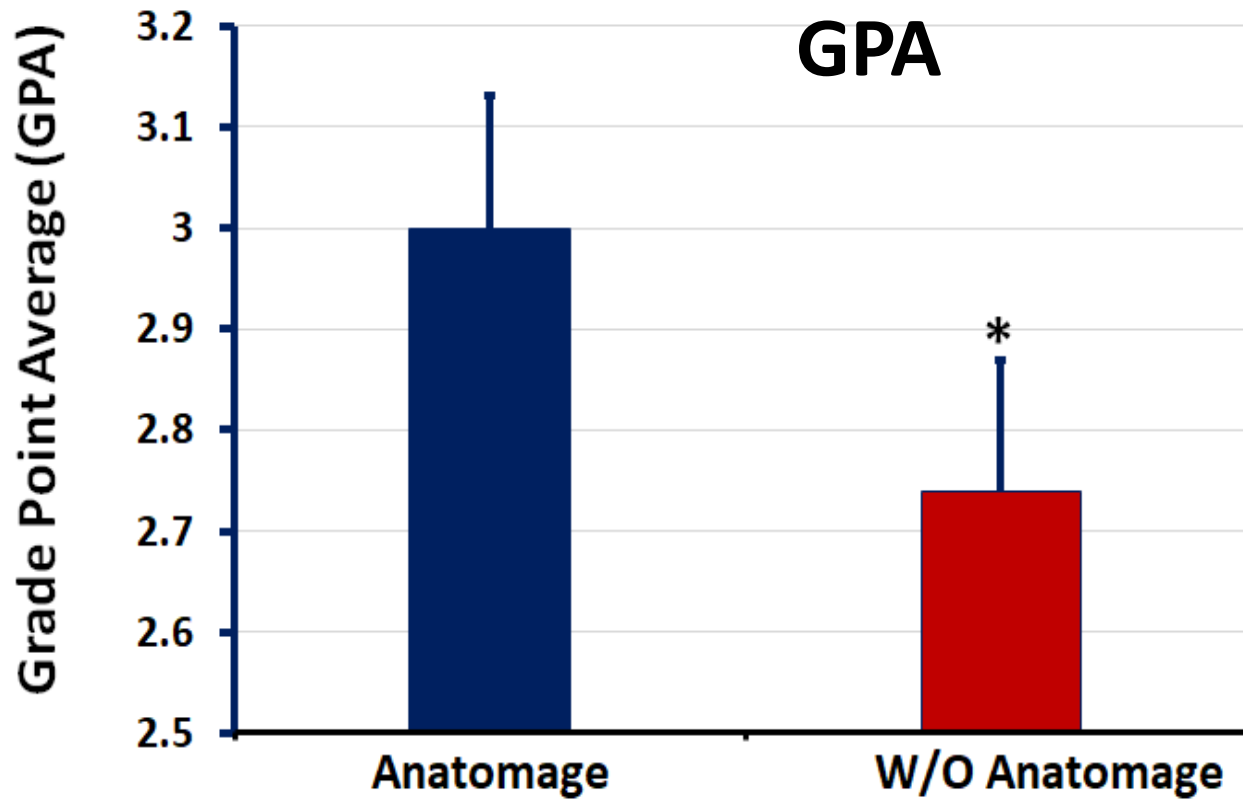
Strategy I: 3D Virtual Human Cadaver- *Anatomage*



Strategy I: 3D Virtual Human Cadaver- *Anatomage*



Strategy I: *3D Virtual Human Cadaver-Anatomage*



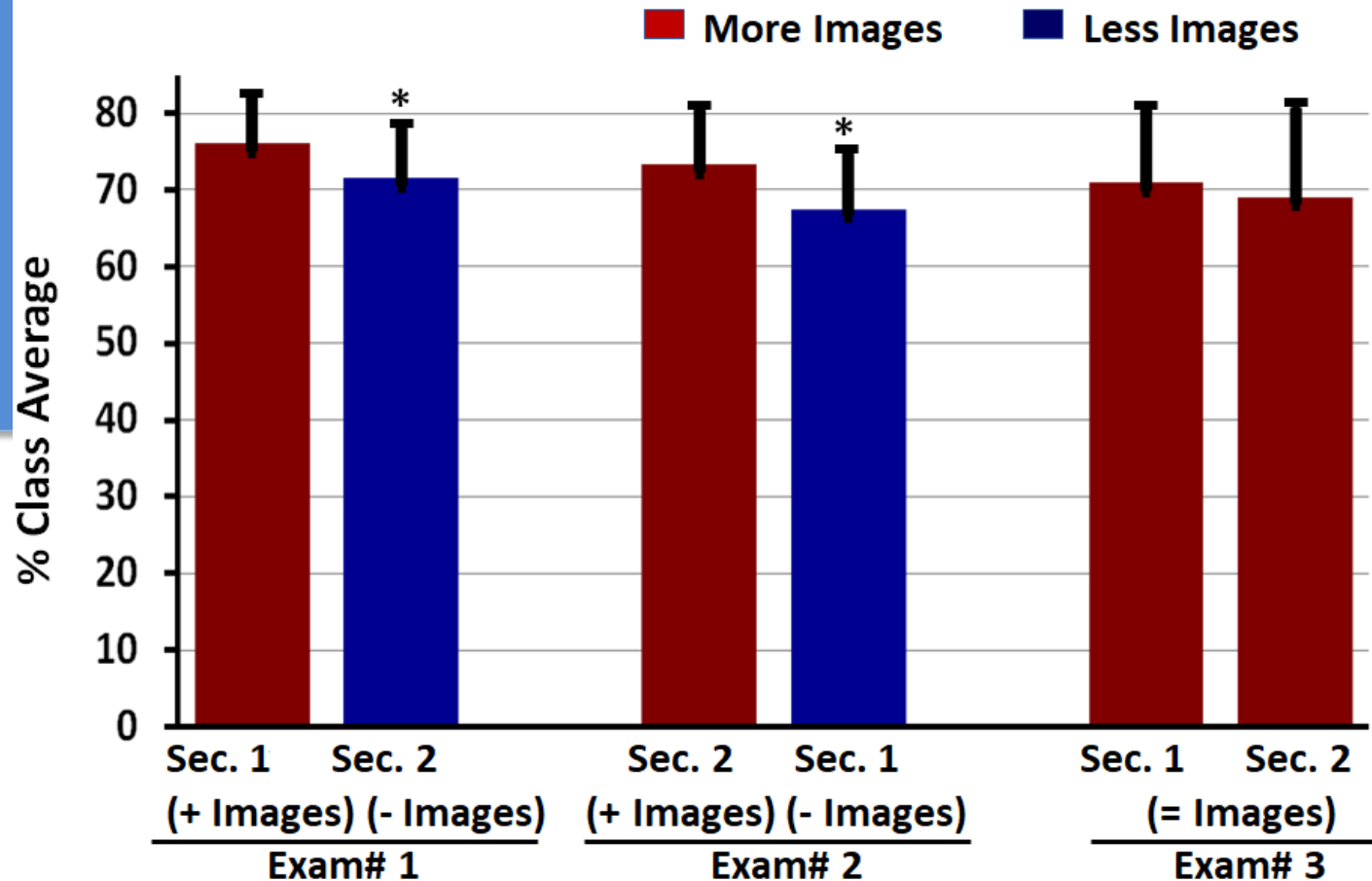
Advantages of Using Virtual Human Cadaver

Strategy I:
Virtual
Human
Cadaver-
Anatomage

- Provides a **true perception** of the human body
- Stimulate **real-life learning** environments
- Provide a **social hub** for faculty-student interaction
- Help students to develop a **social & communication** skills
- Provide **visualizing effects** that increase learning and alter cognitive load (Custers et al., 2010)
- Help **recall** anatomical knowledge

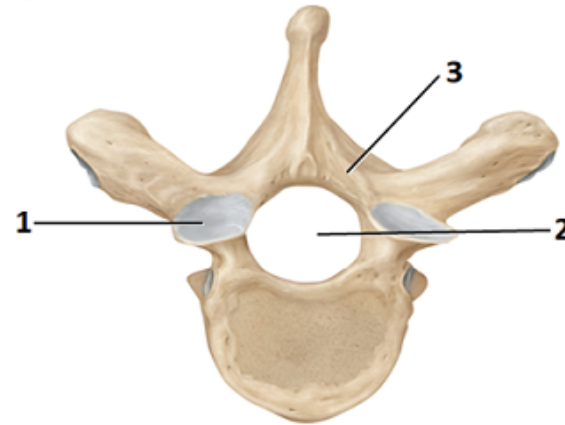
More Images Vs. Less Images

Strategy II:
Inclusion of
Anatomical
Images in
Exams



Narnaware &
Cuschieri, HAPS
Educator,
2023

Text + Images Vs. Text Only



Strategy II:
***Inclusion of
Anatomical
Images in
Exams***

Questions	% Score with Text + Image	% Score with Text only
1. Which structure serves as the attachment site for the 'facet for the head of the rib'?	56.9%	25.9%
2. Which structure serves as a passage for the spinal cord?	79.2%	68.8%
3. Which structure separates the transverse process from the spinous process?	68.0%	59.7%

Advantages of Images in Exams

***Strategy II:
Inclusion of
Anatomical
Images in
Exams***

- Increase visualization
- May reduce exam anxiety and stress in students
- Alter cognitive load (Custers et al., 2010)
- Help recall anatomical knowledge
- Provide a hint to an answer

The Impact of On-line and In-class Activities

Strategy III: ***On-line & In-class Activities***

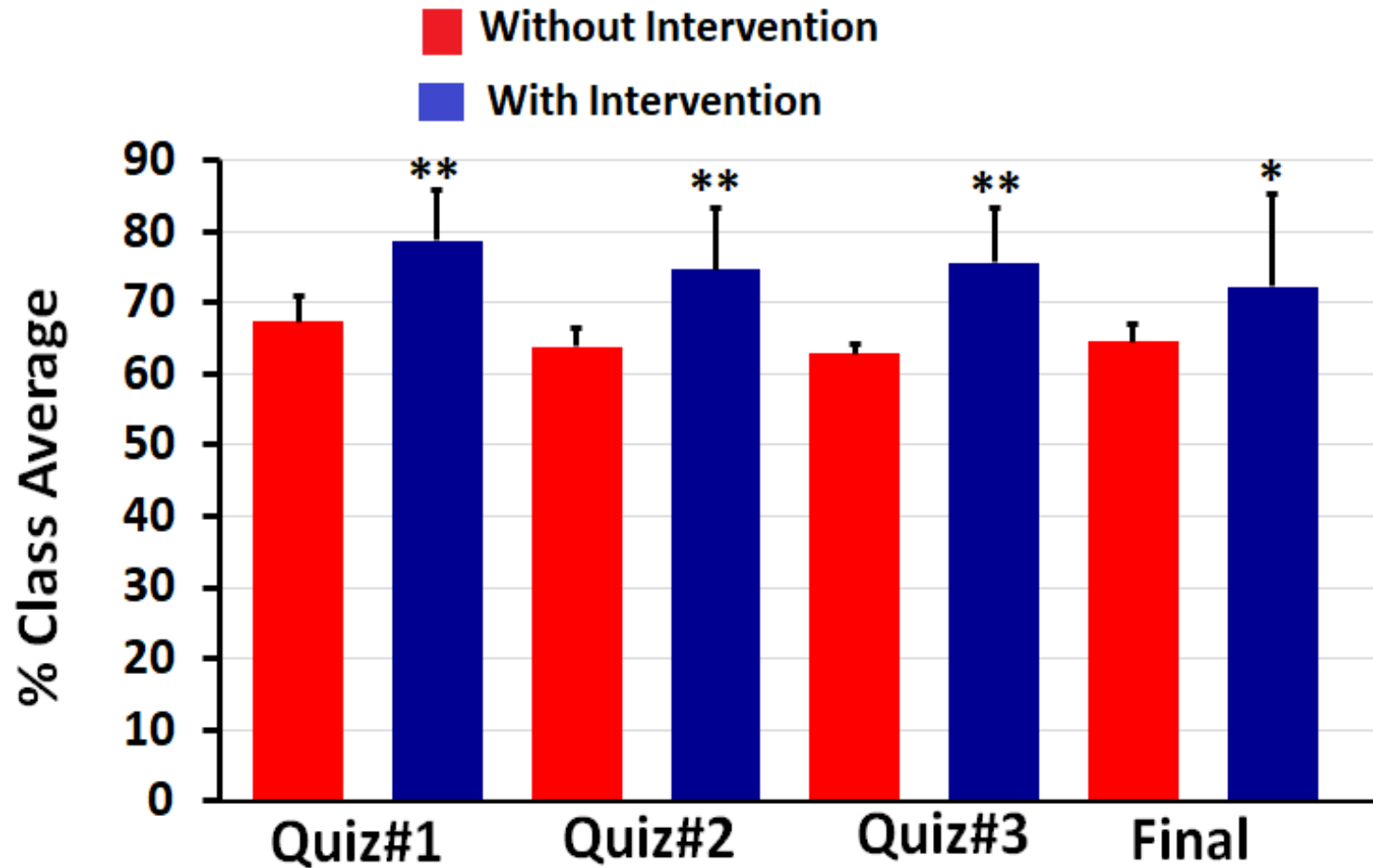
On-line Activities (Outside the class):

- WileyPlus & Orion
- Muscle assignments, dissection videos
- Practice questions on anatomy contents

In-class Activities:

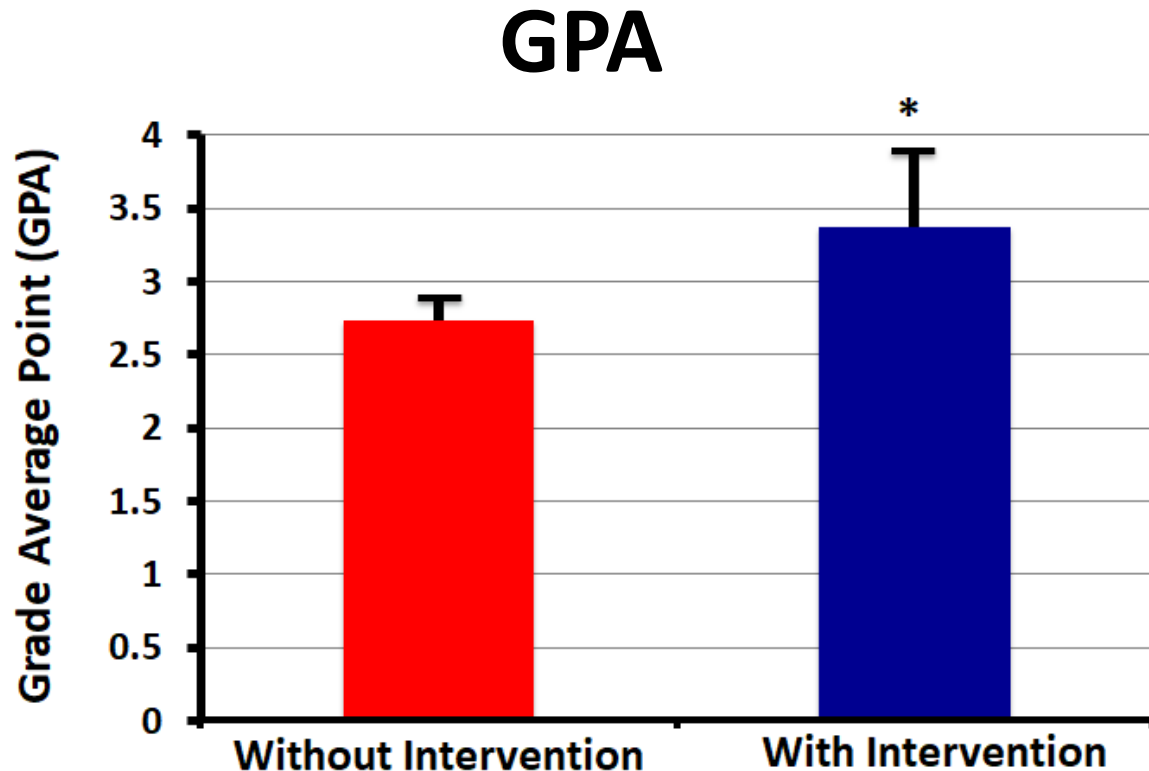
- Kahoot quizzes
- In-class quizzes, discussion & engagement
- Anatomical matching questions

*Strategy
III:
On-line &
In-class
Activities*



Narnaware & Chahal, *FASEB*, 2019

*Strategy III:
On-line &
In-class
Activities*

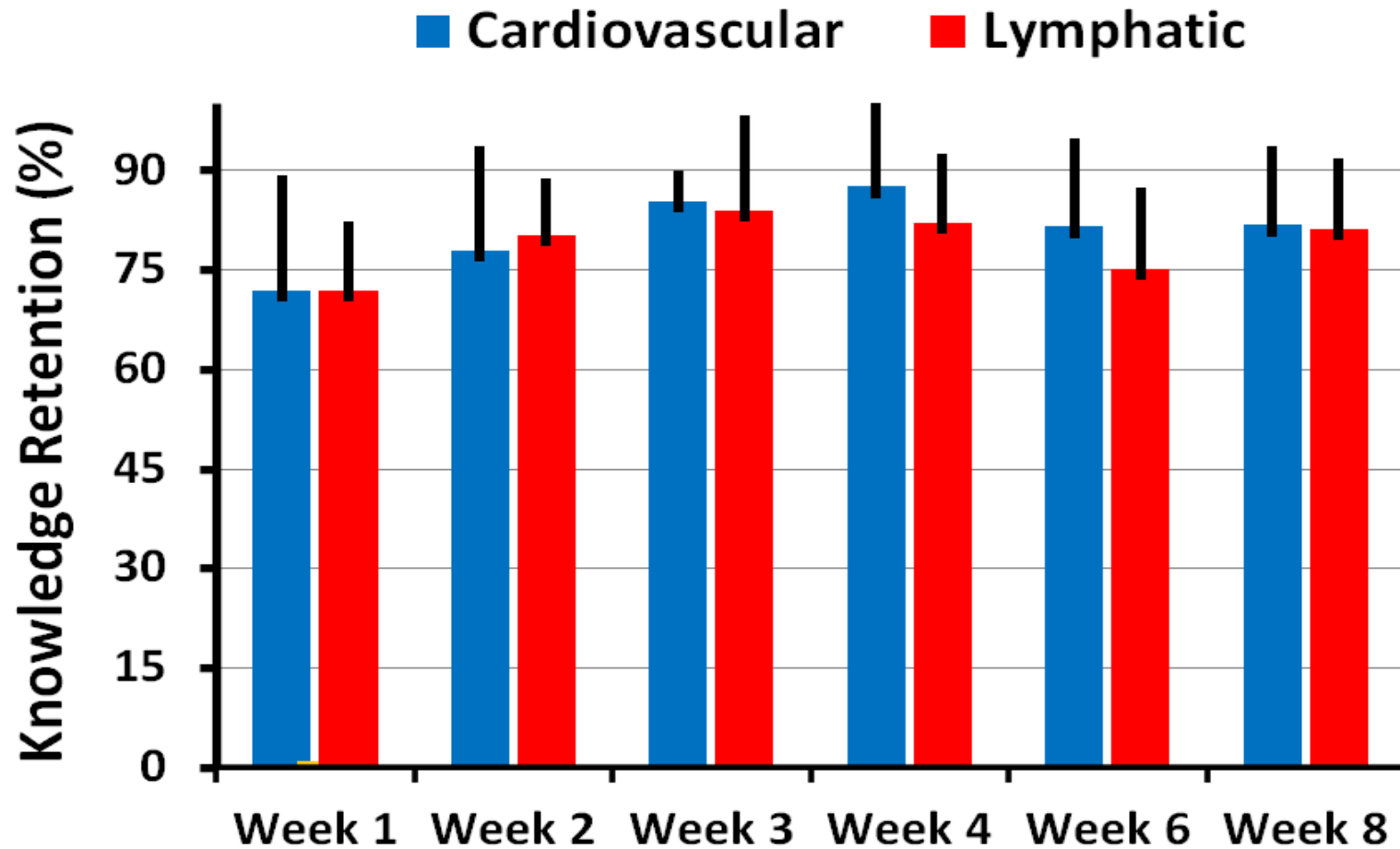


Advantages of On-line & In-class Activities

- The academic performance (Class average & GPA)
- Help gain communication and social skills
- Promote active learning
- Improve class attendance and engagement
- Develop critical thinking
- Help retain long-term anatomical knowledge

Strategy IV:

Content Reinforcement (Repeated Knowledge Testing)



Future Directions



Post-Assessment



Conclusion



- Multi-modal, blended pedagogical approaches may foster students engagement, improve academic performance, provide social & communication skills, promote critical thinking, & may help retain a long-term knowledge in nursing students.

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Thank you

