#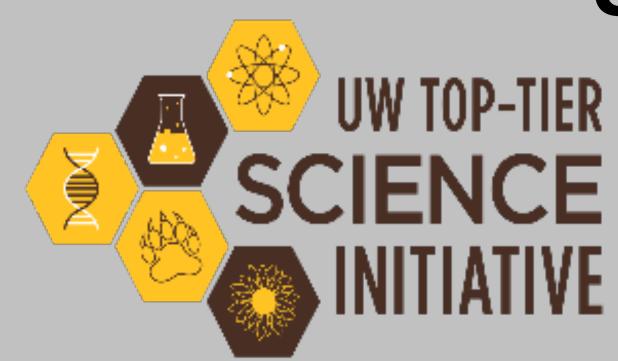 Using Blending Active Learning Strategies to Illuminate Muscle Structure & Function for Beginning, Intermediate, and Advanced Learners

Jacob Layer
jlayer@uwyo.edu
Division of Kinesiology & Health, College of Health Sciences
University of Wyoming

UW TOP-TIER SCIENCE INITIATIVE

UW | Learning Actively Mentoring Program

Purpose:
Overview process and lessons learned from implementing active learning modalities into the pedagogical and assessment approaches utilized in 3 courses addressing the neuromuscular system, at differing levels of depth, with students at different levels.

Overarching Course Goals

- HA - Assist students in developing a mental representation of the body, and the ability to communicate effectively about that representation.

- Ex Phys - Enable students to develop and apply a general understanding of how the neuromuscular, energy, respiratory, and cardiovascular systems support and respond to physical activity.

- AMP - Assist students in developing their foundational understanding of muscle physiology across the lifespan, while improving their ability to apply that knowledge and communicate about it.

Course Characteristics
- KIN 2040/41 – Human Anatomy (HA)
  - Required for Health Sciences
  - Large class size: 160+
  - Demands: Learn high volume of new information at a relatively superficial level
  - Novice learners w/ little to no contextual experience
  - Instructor experience: Taught course numerous times

- KIN 3021/22 – Exercise Physiology (Ex Phys)
  - Required for Kinesiology Majors
  - Medium class size: 60-80
  - Demands: Reinforce principles already learned and apply them to the demands of physical activity.
  - Intermediate learners w/ some contextual experience
  - Instructor experience: First time teaching a preexisting course

- KIN 4900 – Applied Muscle Physiology & Related Signaling (AMP)
  - Optional Elective in 1st Semester
  - Small class size: <30 (~10 first run)
  - Demands: Expand on and integrate previous knowledge, confront ambiguities in literature, and apply what is known to practical problems, lacking clear answers.
  - Advanced learners w/ substantial experience (mostly graduating seniors)
  - Instructor experience: First time teaching & standing up a new course

Challenges
- Mismatch of learning related value systems and desired outcomes
  - Program vs Teacher vs Student vs Other Students
  - True for both teachers and students
  - True across all levels
    - All classes instructed
    - LAMP training events
  - Ex. Personality, ethics, motivations, etc.

- Emphasizing student motivation
  - Specific area for improvement

- Implementation inversely related to preparedness & content related confidence.
  - Hesitation to implement AL modalities
    - Material specific confidence was low.
    - Material was not provided a head of time, in multiple formats.
  - Interestingly, effectiveness not impeded
    - Lack of overconfidence - facilitative?

- Scaling based on class size, room/location, and available support required some trial and error.

- Selection of AL modalities
  - Often what "should" work doesn't or requires modifications.
  - The good idea fairy is not always your friend.

- Finding the right balance & mixture of AL modalities and content presentation
  - Presenter & modality combination
  - Student – interests, motivations, cognitive level & state, etc.
  - Environment
  - Content – Volume, structure, level of difficulty, etc.

Going Forward & Next Steps
- Use typical student cognitive and affective levels to guide course design and updates

- Introduce myself w/ course specific background at the beginning of each course

- Explicitly explain the "WHY" of assignments/activities

- Utilize a variety of AL modalities, intermixed w/ content presentation

- Tailor projects instructions to the typical learner levels in the course.

- Enhance use of positive reinforcement and improve feedback schedules

Successes
- Identified a really good balance and range of AL modalities for HA
  - Have a good formula for intermixing content presentation & review w/ AL modalities that are specific to topic areas
  - Optimizes engagement
  - Lots of trial & error, student feedback, and help from Learning Assistants

- Successful implementation of TBL in Ex Phys coupled w/ a backwards design of progressing, low stakes formative assessments leading to a cumulative final led to <10% of students finishing below 80%

- 90-100% of AMP student expected to finish >90%
- Very impressive achievement of AMP SLOs
- Overwhelmingly positive feedback from AMP students

Biggest Lessons Learned
- Backwards Course Design for
  - Content Mastery
  - Development within the Affective Domain
  - Course Environment

- Importance of maximizing student motivation

- Importance of considering cognitive developmental stages when designing course work, giving instructions, and selecting pedagogies

- At all levels, it is best to intermix content delivery w/ active learning modalities
  - Small blocks of each are optimal
  - True across levels, but increasingly so at lower levels

- Important to explain philosophy behind approaches and help students see the "WHY"

- Need to have a good way of assessing the number of students engaging at a meaningful level and how that effect SLO achievement

Thanks
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Class	Student Learning Outcome	Content Delivery	Active Learning Modalities	Assessment	Results	Limitations
HA	**Identify** and **describe** the structures, organization and general functions characterizing the nervous and muscular systems, at a gross and microscopic level.	Textbook, Skeletonized Note, Content PPT, Lecture Videos, Mini-Lecture	Modified TBL, Peer Teaching, Drawing & Concept Mapping, Flipped Classroom, Pauses & Polling, Discussion, ~3 Minute Paper	Preclass HW, PollEverywhere, Online Unit Exam, Inclass Exam, Inclass Final	Unit Exams ~92%, In Class Exam 65%, Final TBD	No good way to distinguish based on participation level & Some additional information assessed
Ex Phys	Given a type and intensity of physical activity, **explain**, **compare**, and **contrast** the acute and chronic responses of the neuromuscular system, why this response occurs, and the implications of the respondent's functional capacity.	Textbook, Content PPT, Lecture	Team Based Learning, Peer Teaching, Drawing, Flipped Classroom, Pauses, Polling, Discussion	iRAT/tRAT, Online Quiz, Online Exam, In Person Final	Quiz 98%, Unit Exam 82%, NM section of cumulative final 78%	Neuromuscular was covered in 1st quarter of semester
AMP	**Explain** and **evaluate** the role of the nervous, endocrine, and immune systems in muscle physiology and adaptation, as well as the role of muscle in the endocrine system.	Textbook, PPT, Lecture, Student Presentations	Pre/Post/Class Summaries, Quizzing Review Game, Pauses & Peer Teaching, Concept Mapping	Same as active learning modalities	TBD	Class summary not yet submitted
AMP	Given an applied problem, or question, **generate** a defensible, physiologically based answer/solution, by **locating**, **assessing**, and **summarizing** relevant scientific and applied literature, and **communicate** effectively about the answer/solution.	Textbook, PPT, Lecture, Student Presentations	Problem Based Learning, Discussion	Individual Presentation w/ Reflection, Group Presentation w/ Paper	100% for vast majority of class	