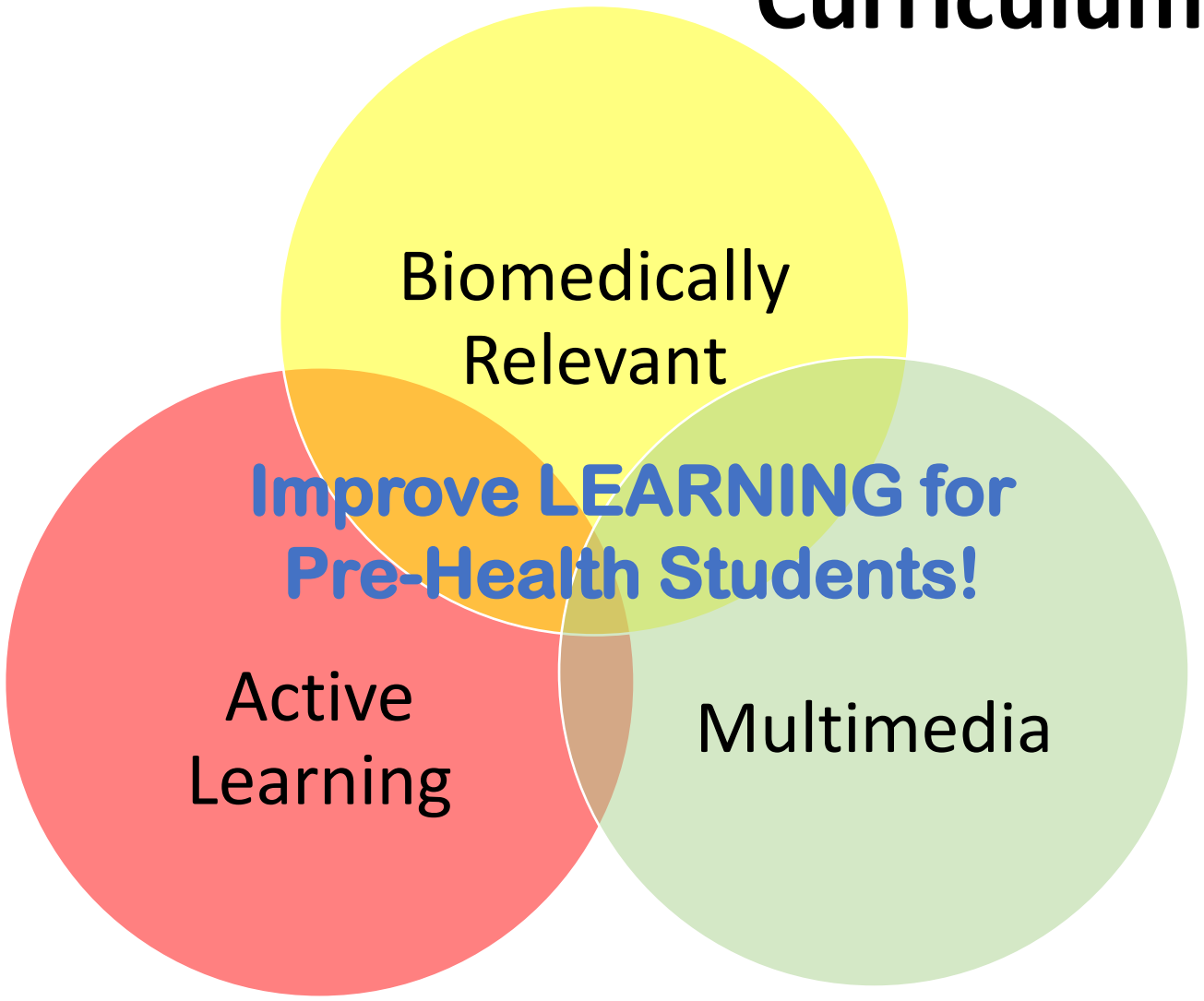
Development of an Active-Learning, Multimedia, Biomedically-Relevant Introductory Physics Curriculum



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IUSE Summit , Washington, D.C. June 1 – 3, 2022

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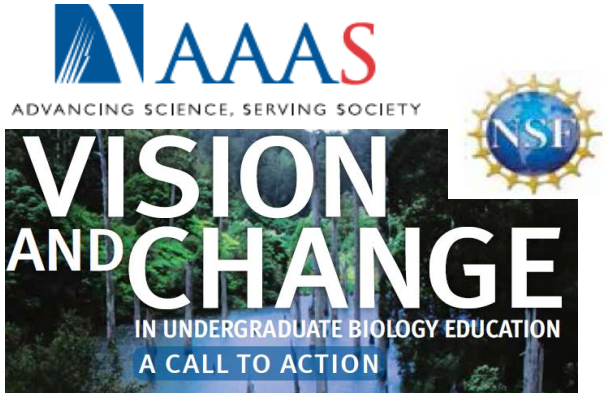
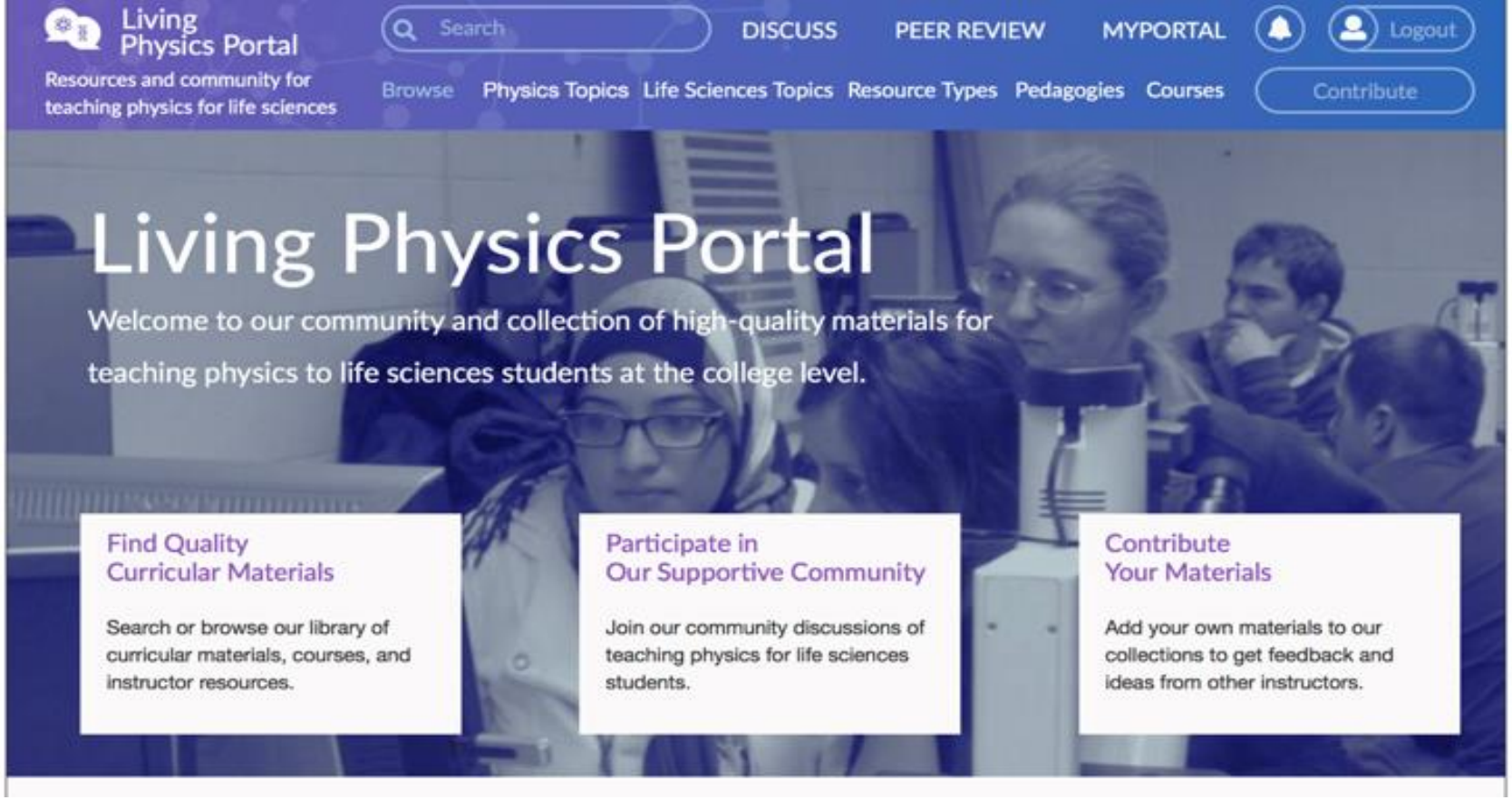
Background

- National calls for reformed physics courses for pre-health students
- Emphasis on interdisciplinary competencies



Audience Interests? We'd love to collaborate!



Need:
Cohesive full-year introductory biomedically focused physics curriculum

https://www.livingphysicsportal.org/

1) Provide **STUDENTS** with an introductory biomedically related curriculum that stresses the importance of physics as a basic science relevant to medicine

2) Provide **FACULTY** unfamiliar with biomedically related interdisciplinary content with a coherent physics curriculum that can be implemented in multiple educational environments.

NSF-Funded Project Goals:

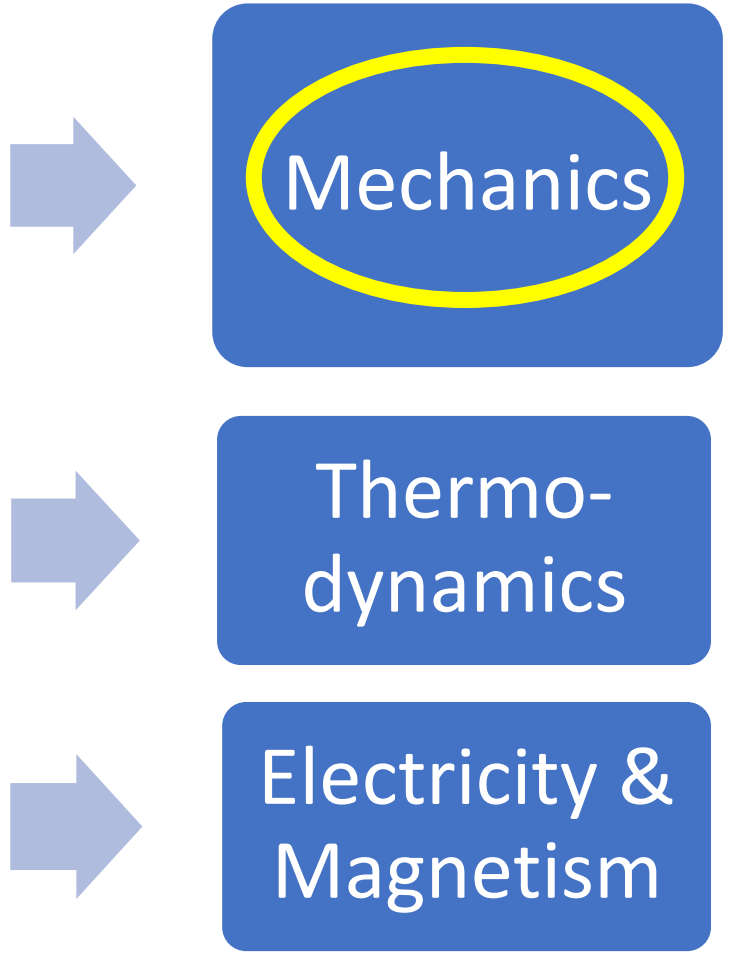
- To develop a full year of modular multimedia biomedically-relevant educational material for introductory physics geared toward pre-health students

- Develop, Implement and Assess curriculum in two different educational environments: small, liberal arts university (RU) and large state university (PSU)

Design NEW Biomedically Relevant Multimedia Modules:

Biomedical Field

New Curriculum

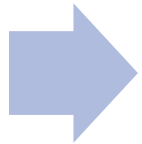


Merge/Re-design previously developed curriculum:

Biomedical Field

Curriculum

Static and Dynamic Fluids



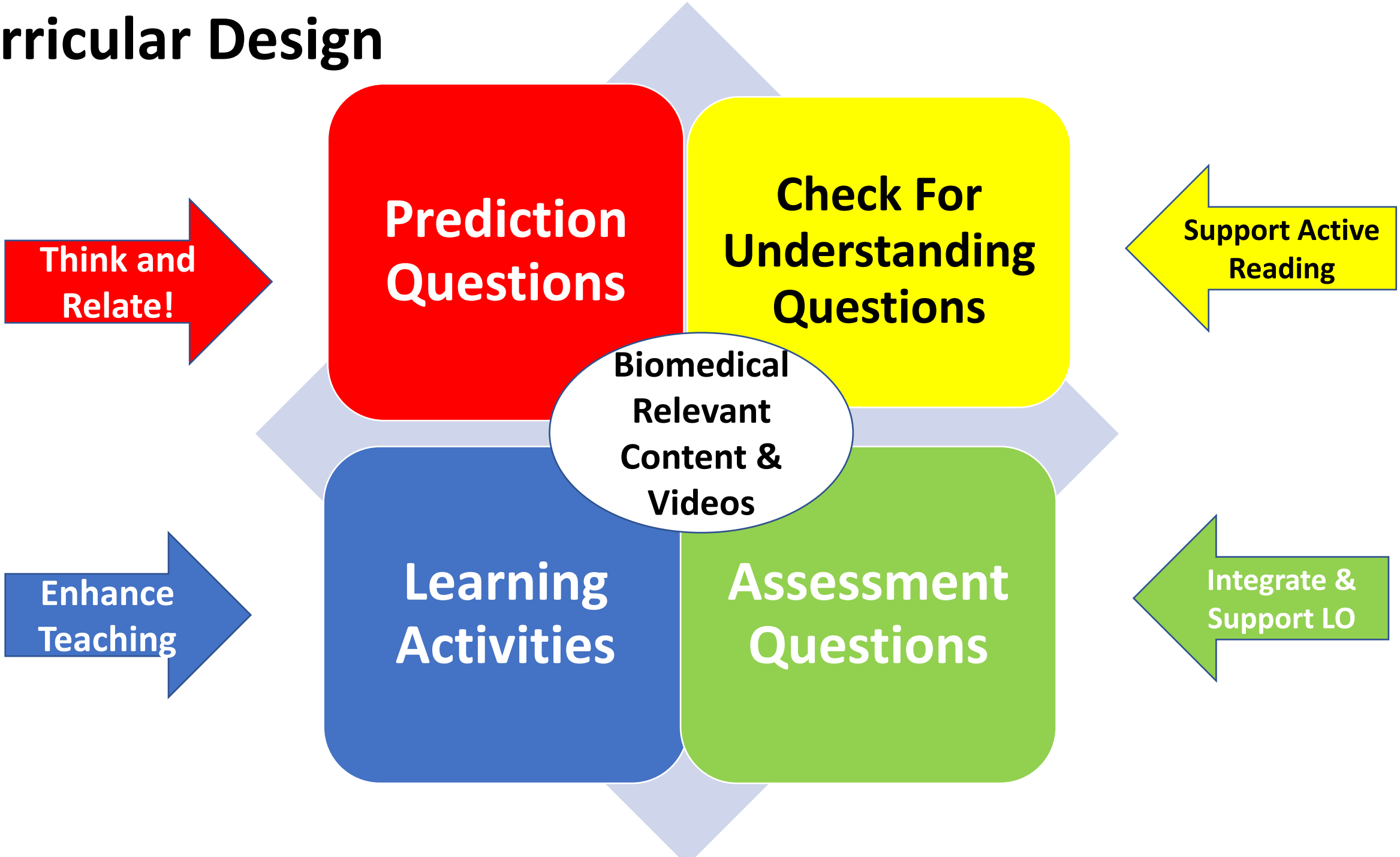
Sound and Optics

Aim 1:

Design a full year of multimedia biomedical relevant introductory physics curriculum

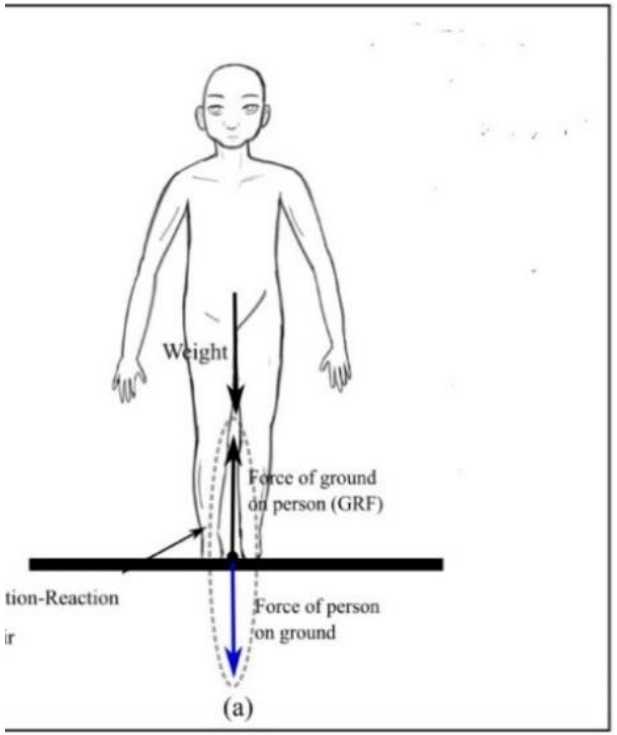
- Guided by Learning Objectives
- Active Reading Text designed to incorporate biomedical relevance and scaffold learning for pre-health students
- Biomedical Expert Videos interwoven into curriculum
- Formative and Summative Assessment Questions embedded in Curriculum

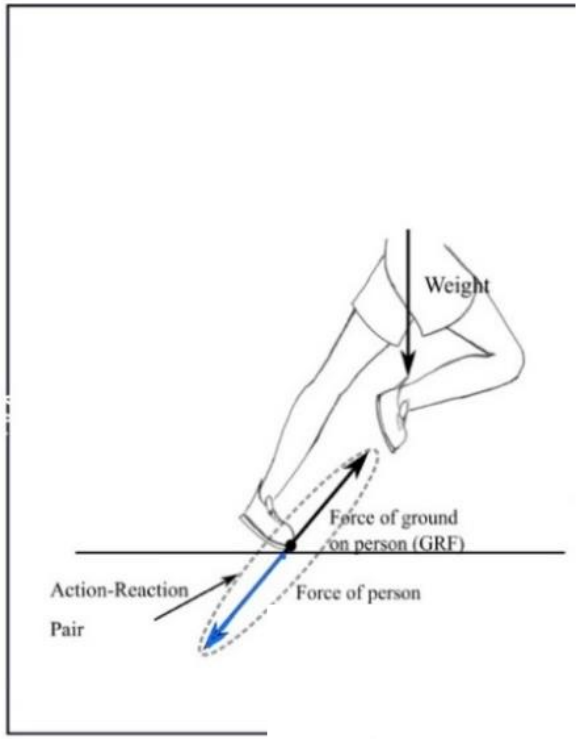
Curricular Design



Experience the Curriculum:

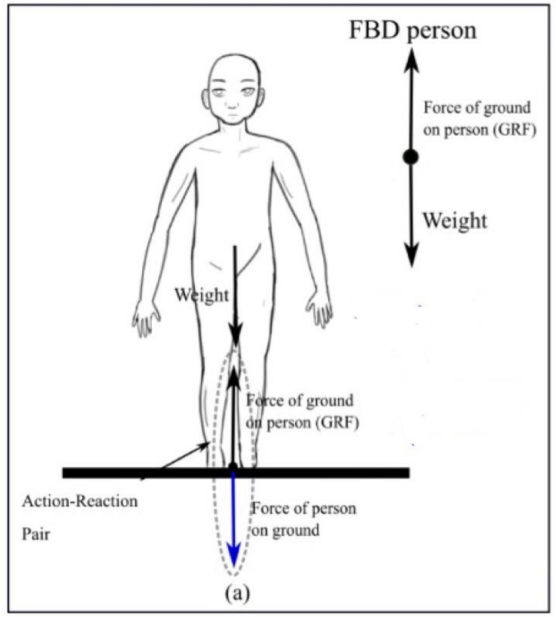
Human Gait and Ground Reaction Force

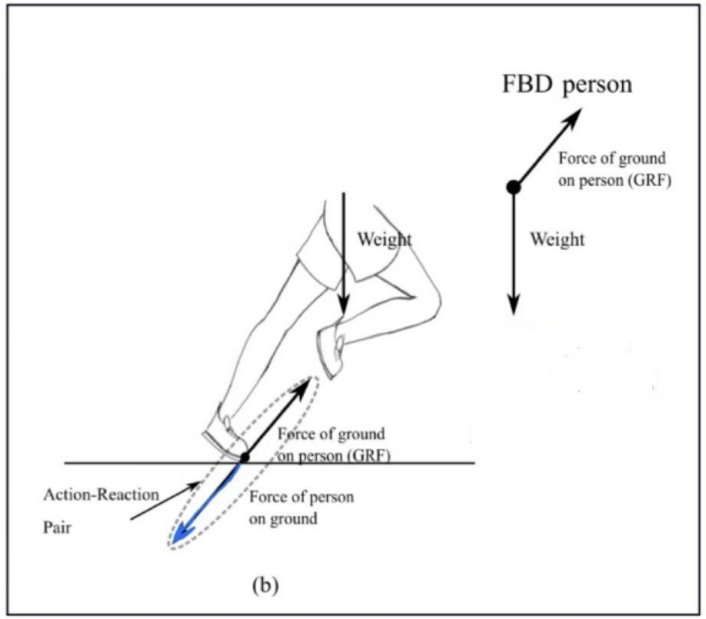


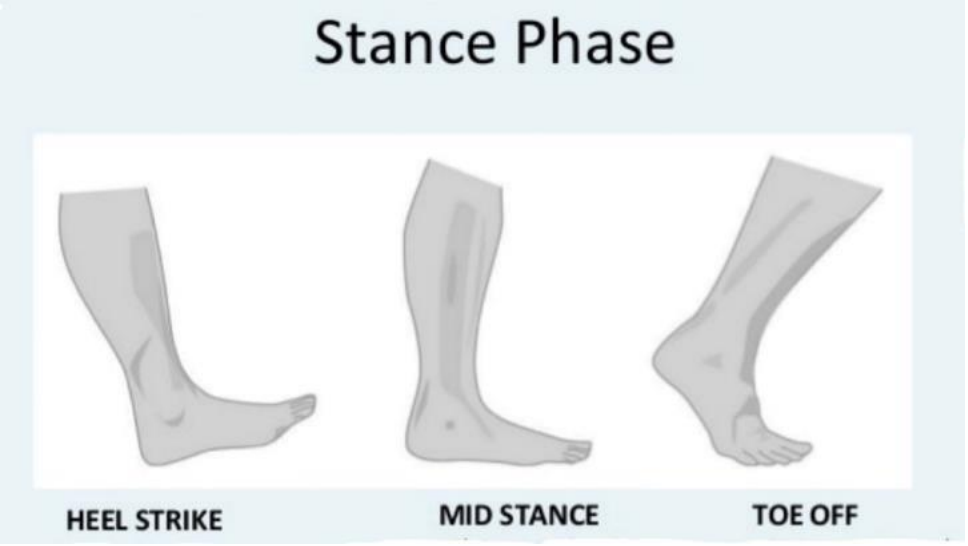


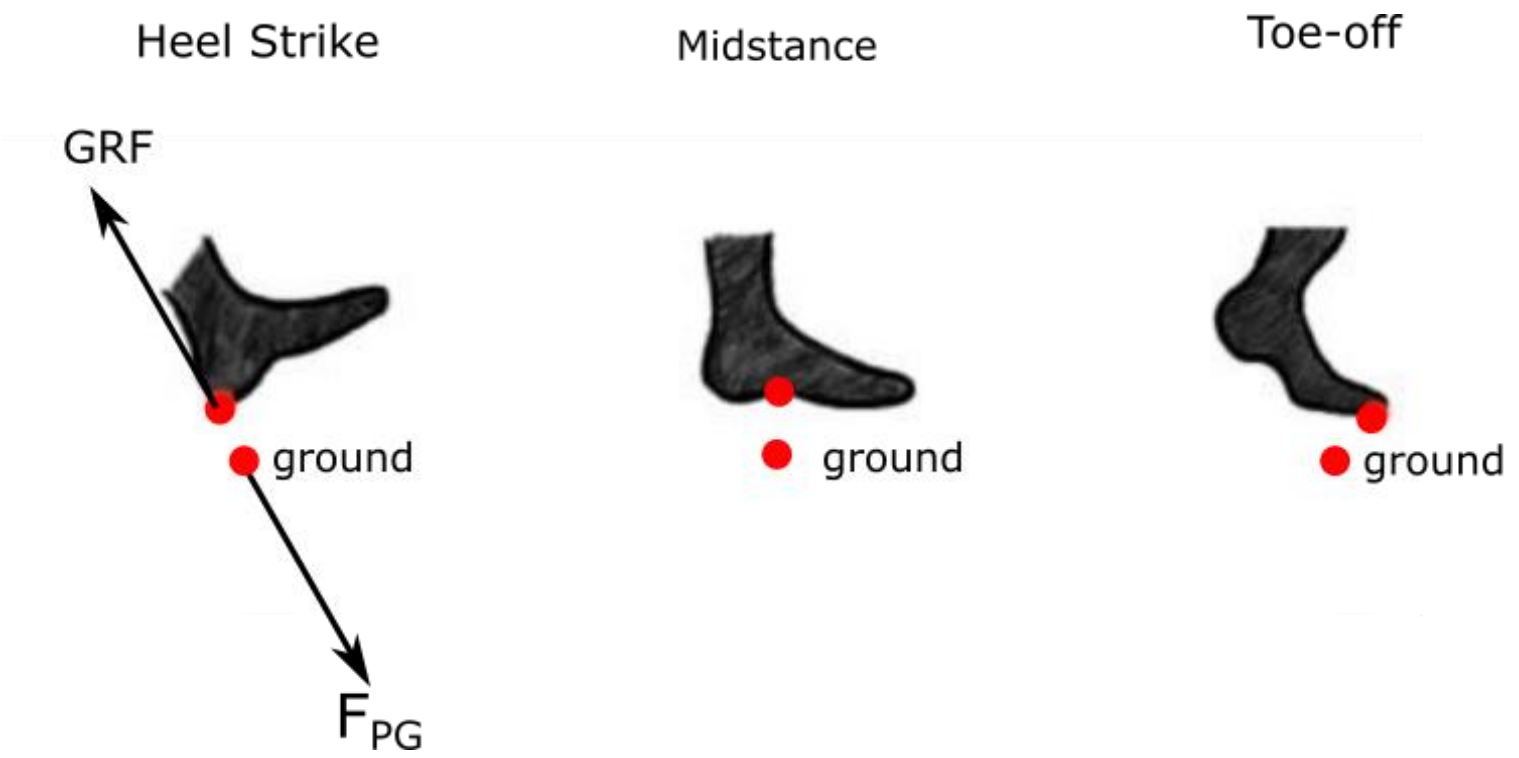
Identifying Forces:

Activity pgs. 1 - 2:





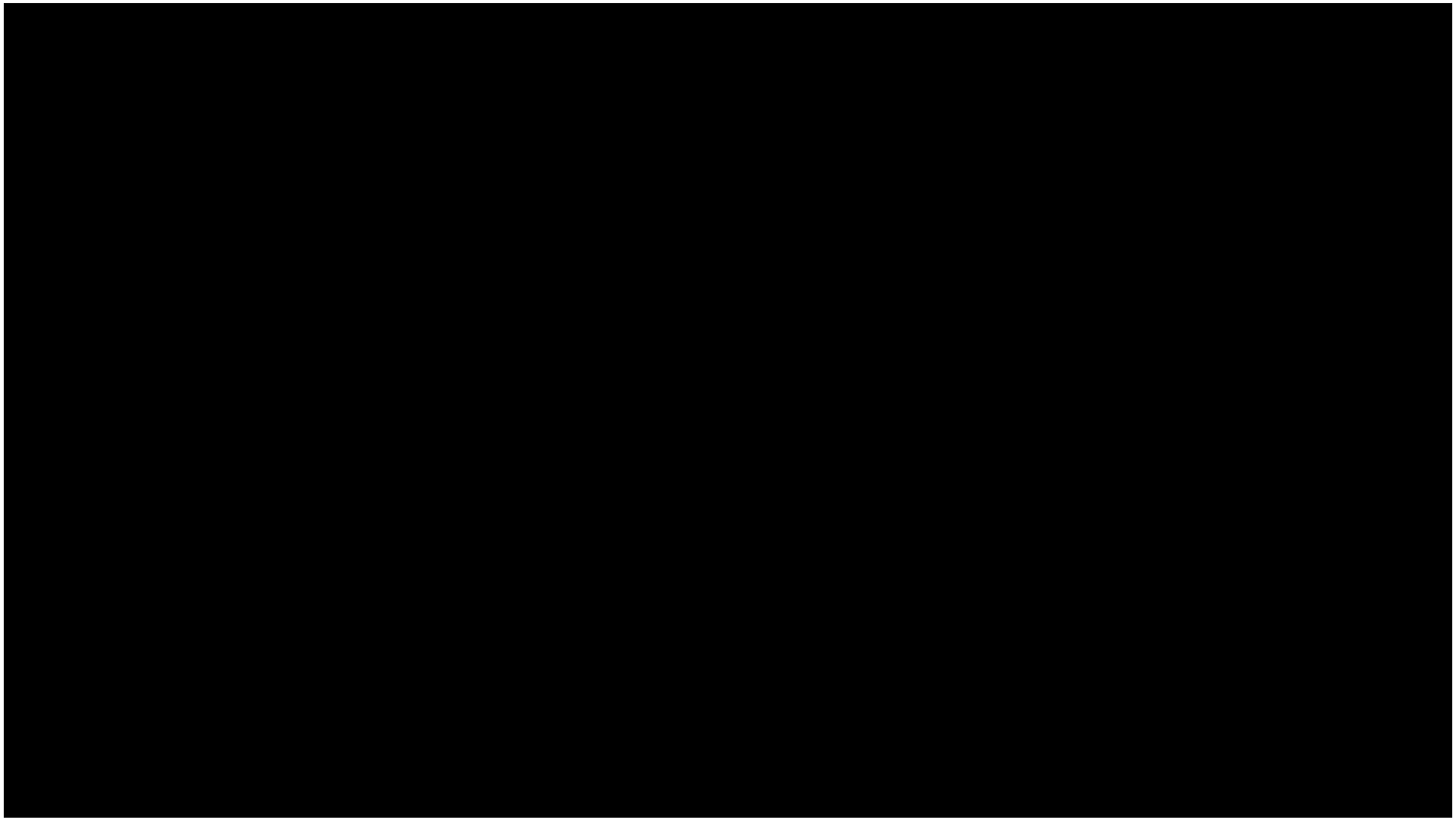




Activity pgs. 3 - 4:

Identifying Action-Reaction Pairs: https://www.geogebra.org/m/yp6sqg2v

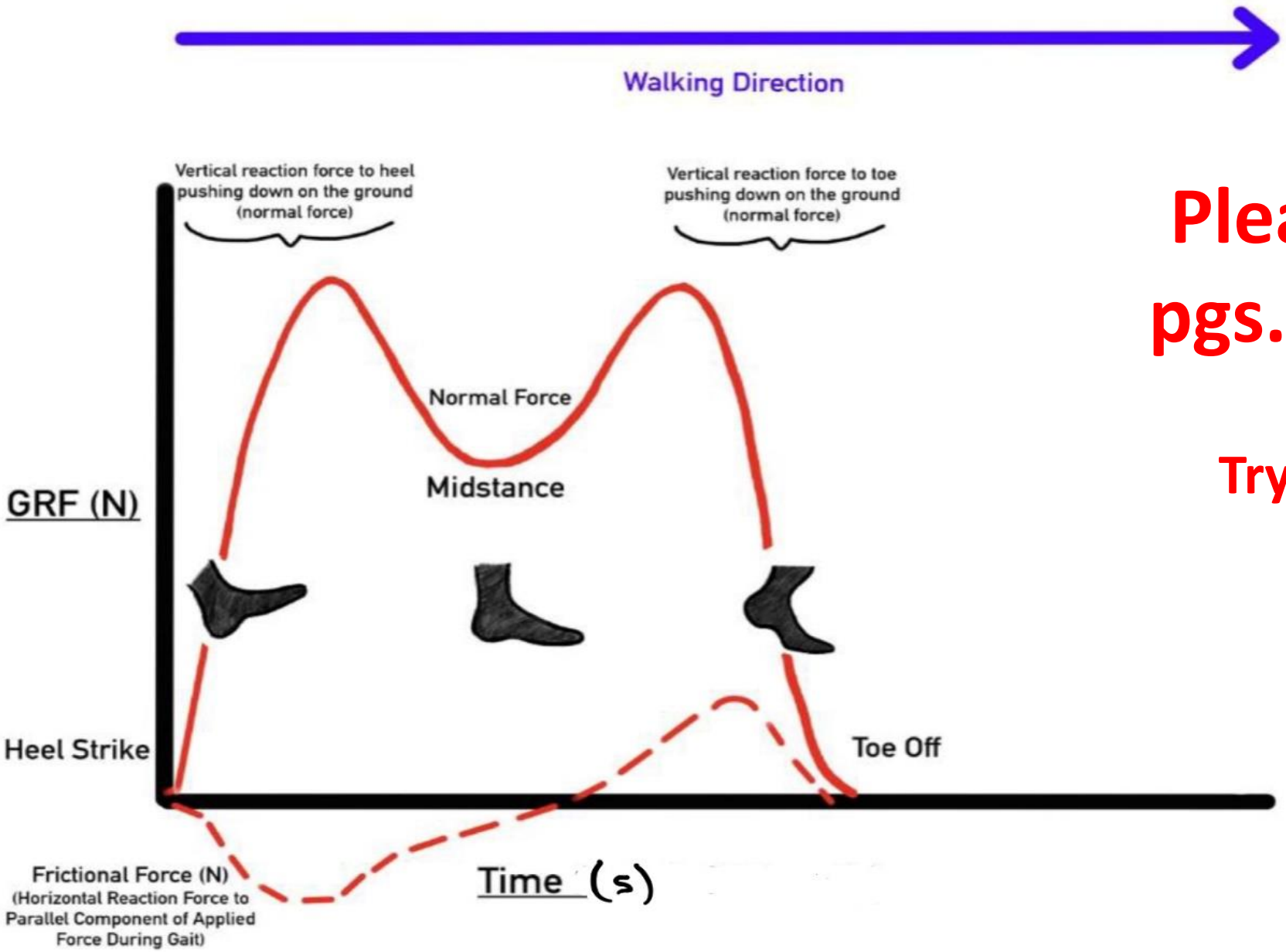
Identifying Components of Forces: https://www.geogebra.org/m/nhxqrwj7



GRF Video

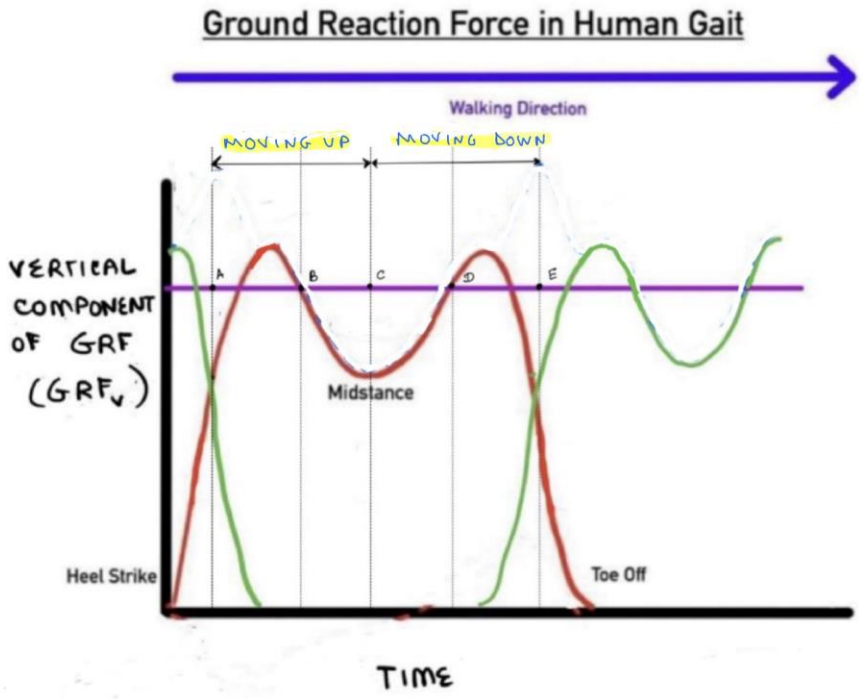
- Physics of Medicine. “Ground Reaction Forces at the Human Performance Lab – KU Medical Center.” *YouTube* video. https://www.youtube.com/watch?v=qDSpJzpzx5o&list=PL9FHWj4DTorSfd9ggZt6GJOysnFIdSk0D&index=4

Ground Reaction Force in Human Gait



Please do Activity pgs. 6-7 (one foot):

Try Kinesthetically!



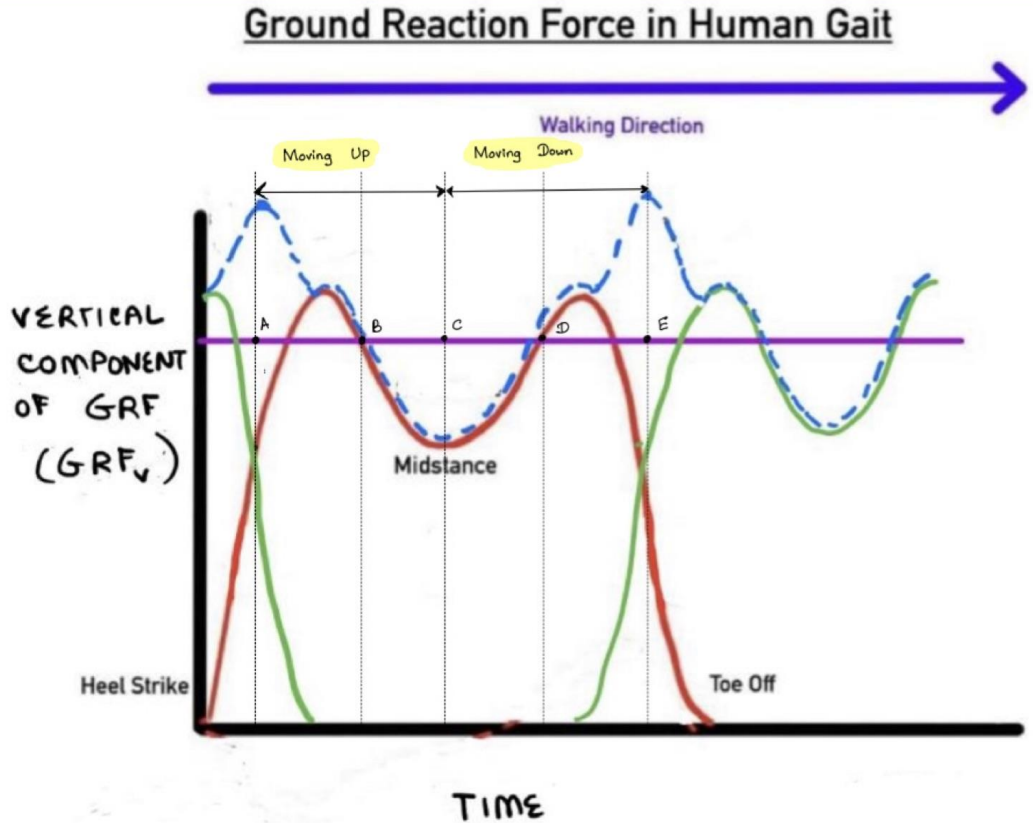
Red = GRF_v right foot

Green = GRF_v left Foot

PURPLE = COM "AT REST" NORMAL

Please do Activity pgs. 7-9 (two feet – Stance and Swing Phases):

Try Kinesthetically!

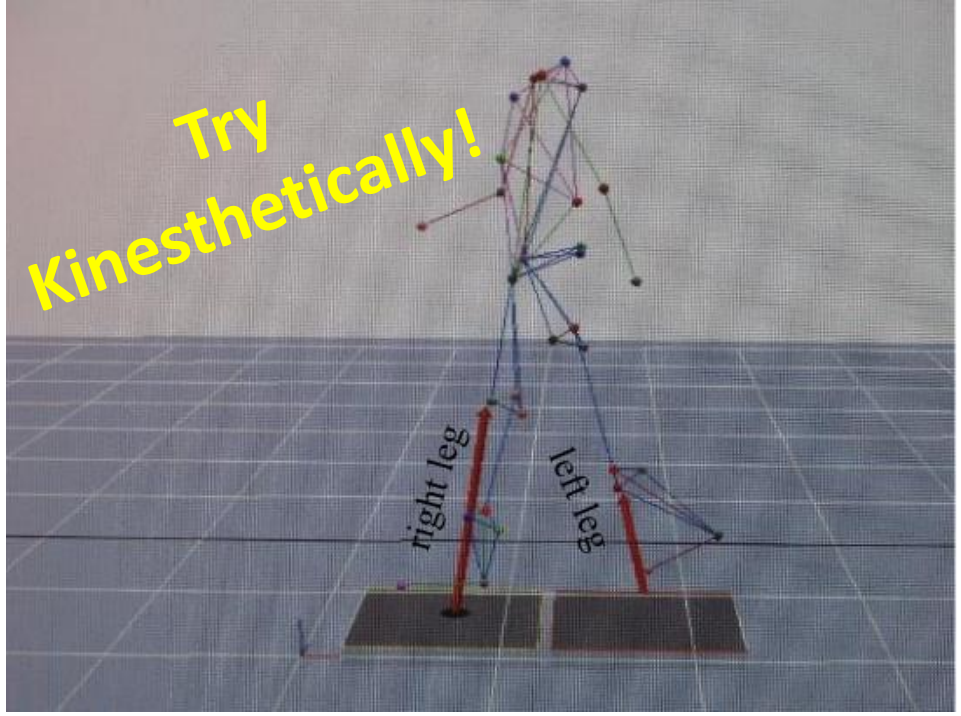


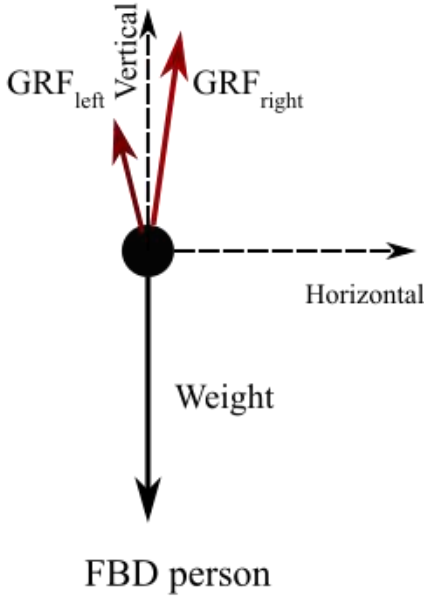
Red = GRF_v right foot

Green = GRF_v left Foot

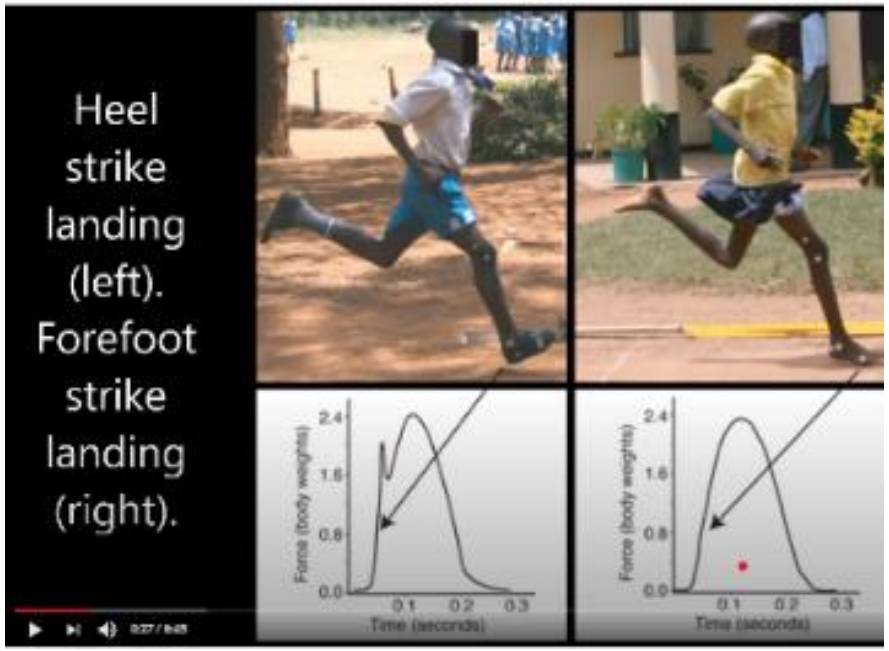
Blue = NET GRF_v BOTH FEET

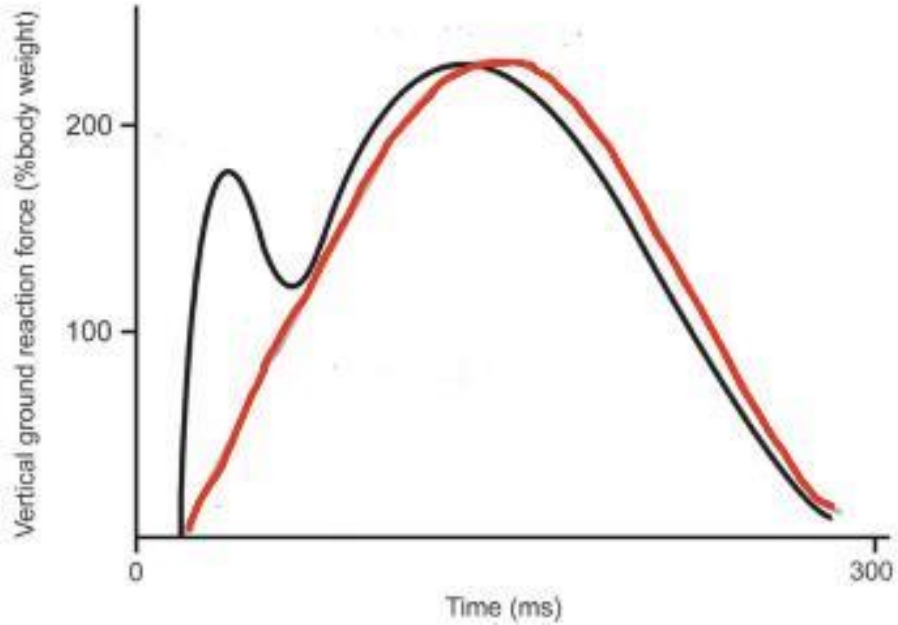
PURPLE = COM "AT REST" NORMAL

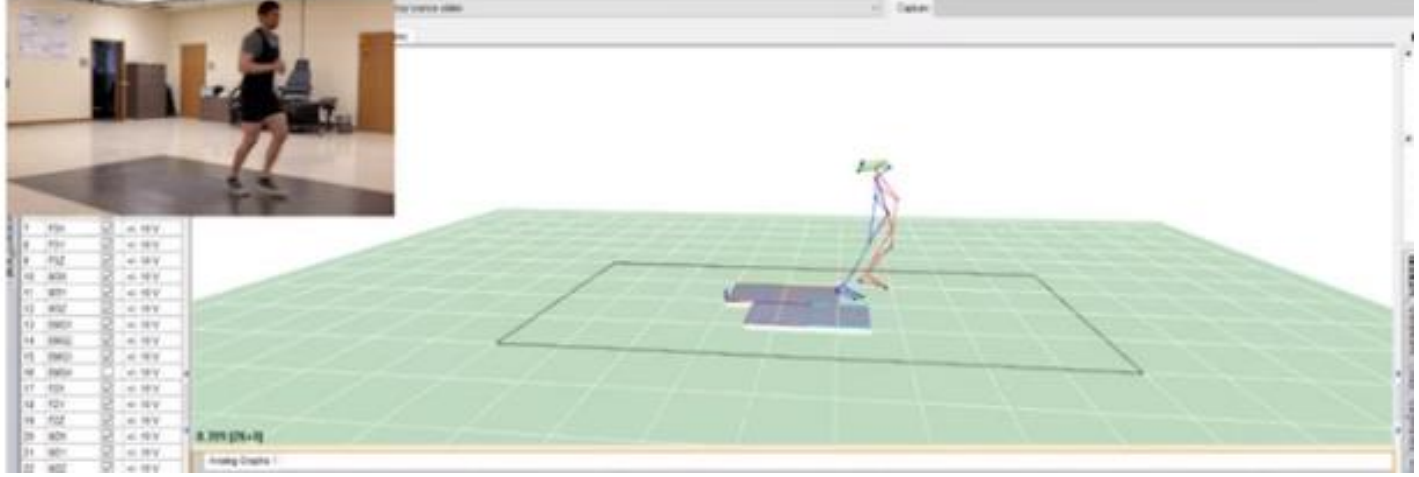


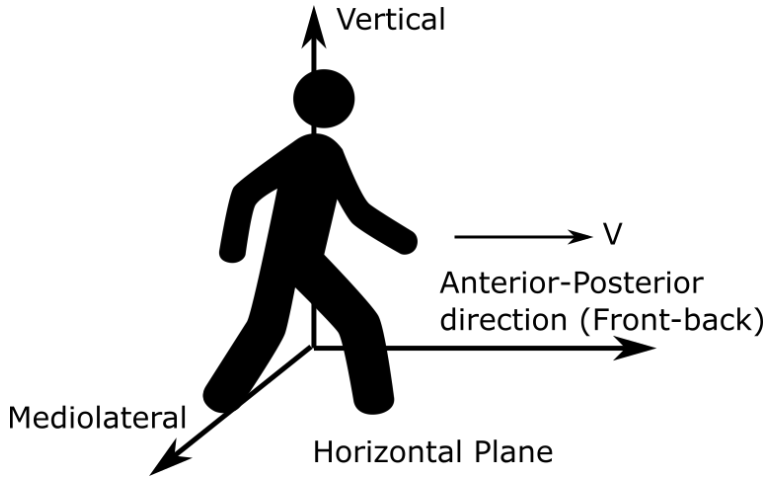


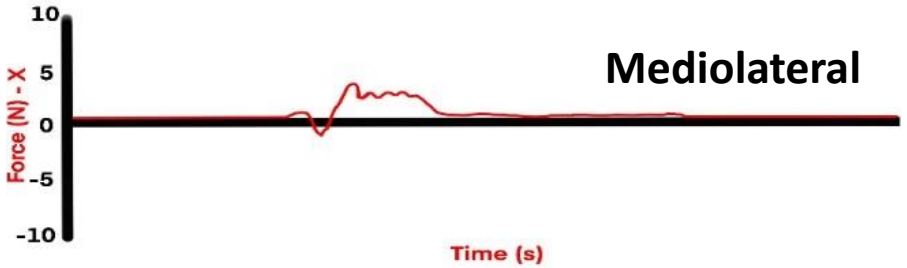
Assessment Questions #1 and 2: pgs. 11-15

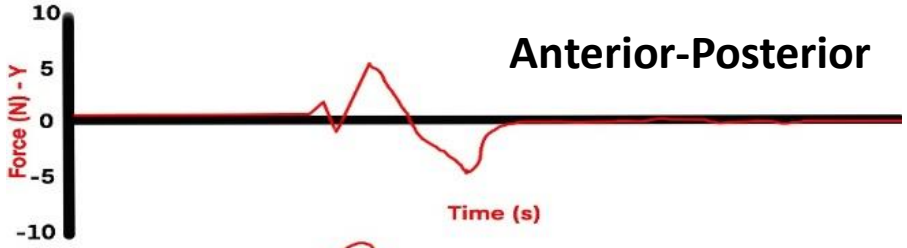


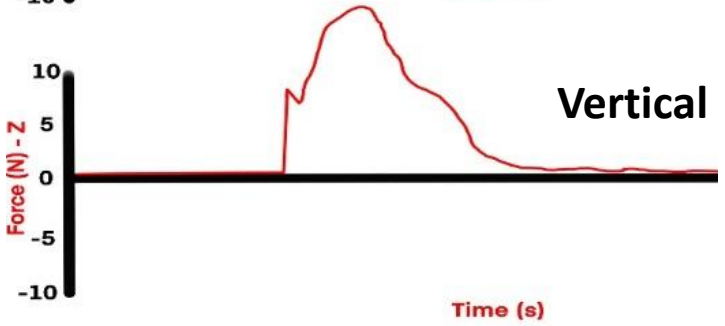




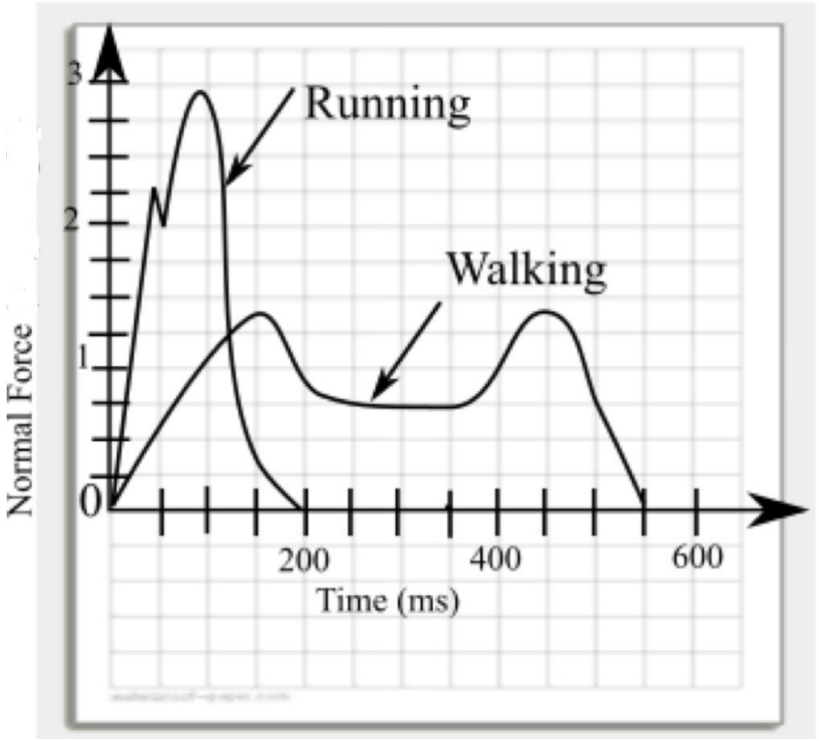








Assessment Questions
#3 and 4: pgs. 16 - 18



Aim 2:

Implement curriculum with active-learning pedagogy at two different universities with different teaching environments

Project Implementation in Two Different Teaching Environments:

- Rockhurst University: Small Teaching University - Studio Setting (~25 students/class)
  - Flipped Classroom – students read TEXT, watch videos before class
  - Classroom Small Group Learning Activities (paper) to enhance understanding
  - LMS Canvas Implementation: Pre-class work, homework (QTi files available and editable)
- Portland State University: Large State University (large classes)
  - Cogbooks Implementation
  - Small group class work

Implementation & Adaptation Ideas – Group Discussion:

How can you adapt/implement this curriculum in your IPLS course?

Ideas: Canvas (LMS), Flipped Classroom, Studio Style, Large Audience Clicker Questions, etc.

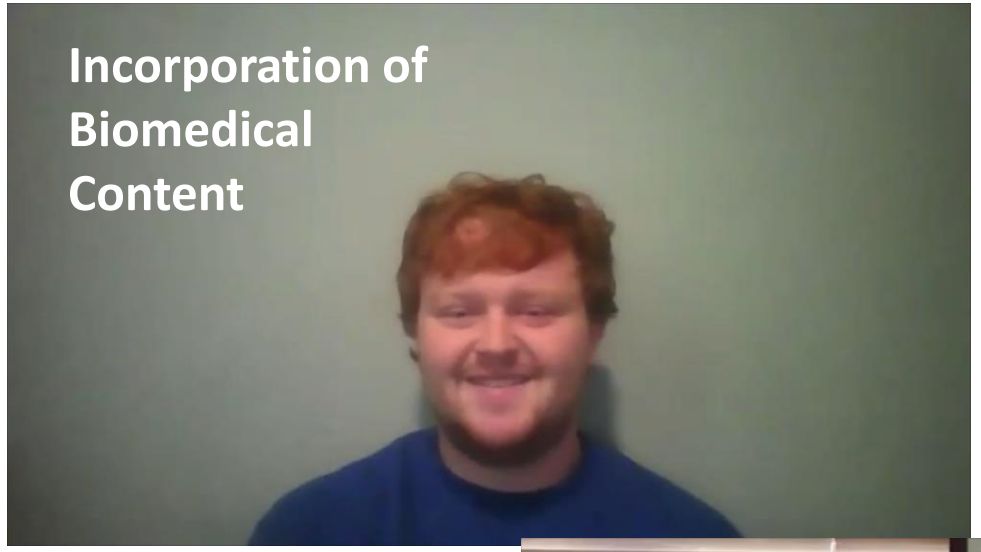
Aim 3:

Assess effect of the curriculum on student learning and attitude.

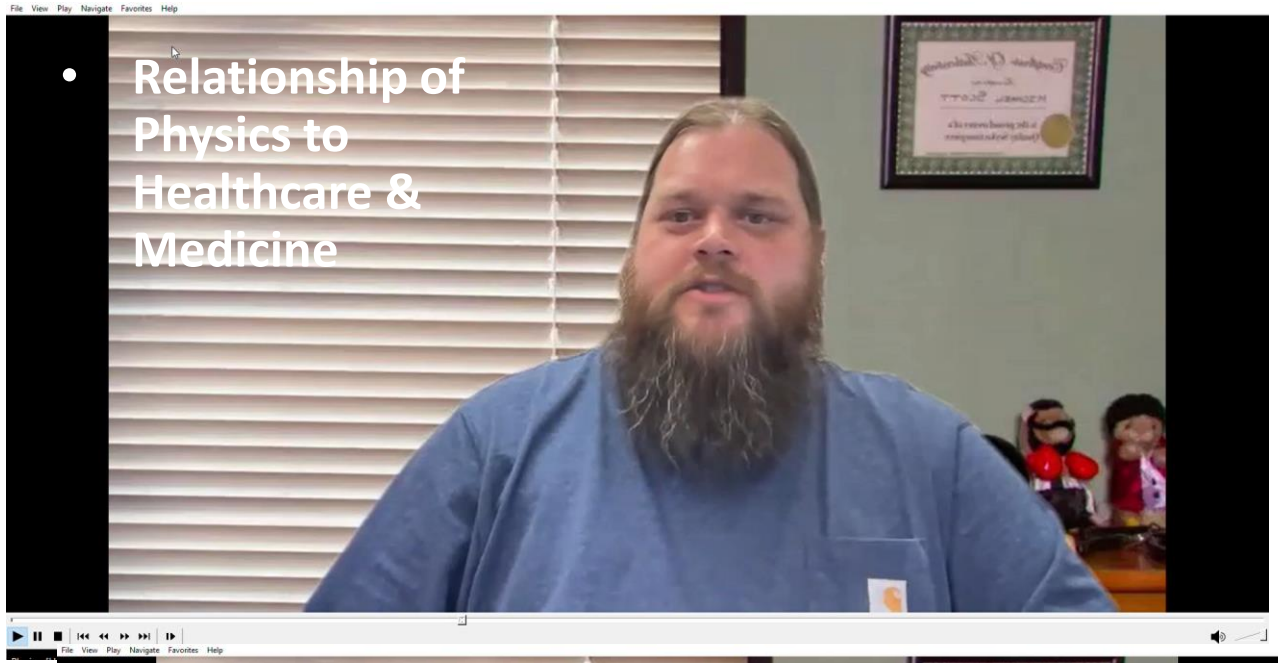
- Formative Assessment:
  - Check For Understanding
  - Learning Activities
  - Assessment Questions
  - Focus Group Interview
- Summative Assessment
  - Regular Quizzes based on Curriculum (online and in-person)
- Research Based Conceptual Survey
  - FCI, Faculty Developed Content Survey
- Attitude Survey
  - Google Survey
- IUSE Poster: Rethinking introductory physics for pre-health and life-science majors Poster 31B, 4:15pm, 6/2

Ongoing Assessment – What have we learned so far?

What seemed to work:

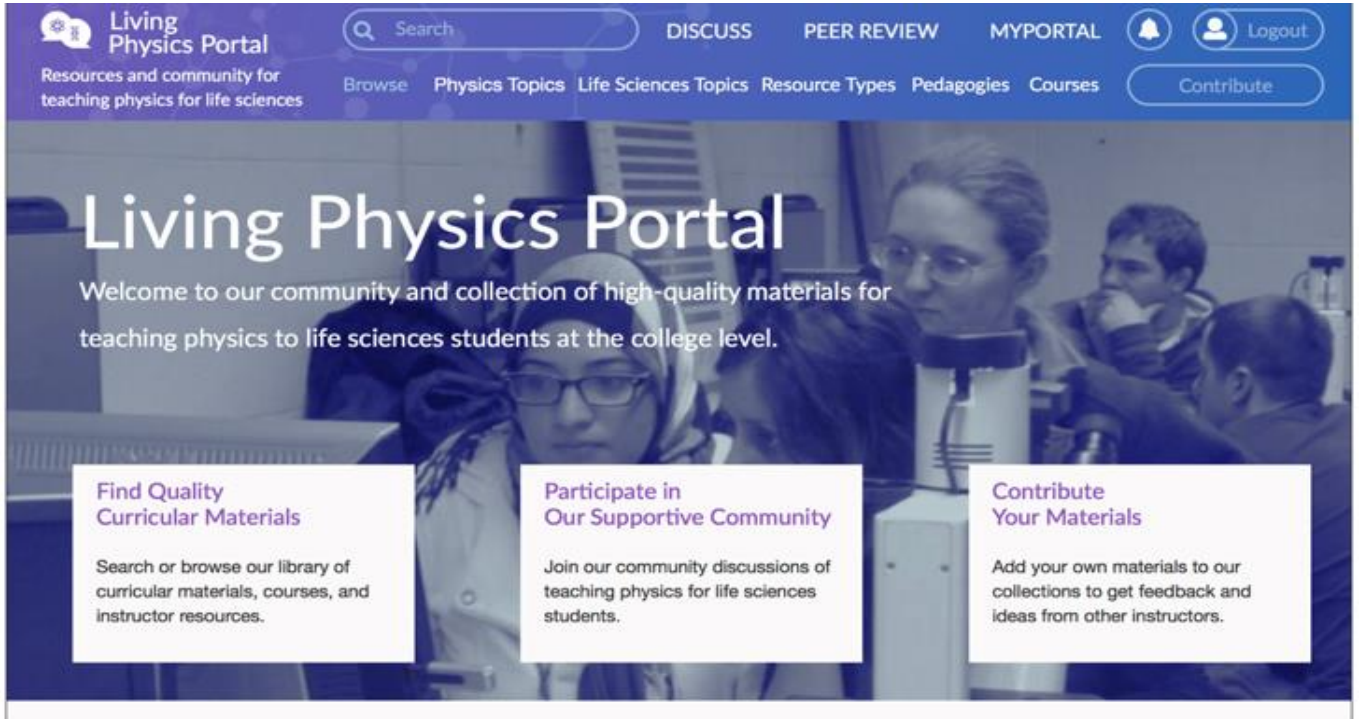


Focus Interview with RU Pre-dental student post course (May 2022):



Dissemination and Future Steps

- Work in Progress: 3-year grant – will request no-cost extension
- Seeking Implementation Collaborators! (2-to-4-year college/universities)
- All Curriculum will be posted to the Living Physics Portal
- Editable (Word), Adaptable to fit your needs!



Please contact us for information:

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Thank you!

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