A Categorical Approach for Analyzing Interdisciplinary Curricula

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DUE 1560142

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Introduction: Biomedically Relevant Content in Algebra-based Physics

"As part of this call for reform, the National Academies recommended further changes in how scientists are educated and trained, particularly at the undergraduate level. They advocated for more interdisciplinary courses, greater integration of biology in introductory physics" (Watkins et. al 2012)

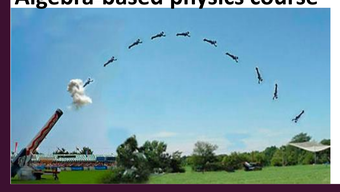
Overarching Objective: The overarching objective of this study was to bridge the gap between students' understanding of biomedical applications and physics concepts.

IPLS Course Descriptions

To facilitate this objective, we analyzed questions from an Introductory Physics Course for the Life Sciences (IPLS) at Portland State University. In this interdisciplinary course, biomedical professionals, tools, and practices were integrated with traditional physics content.

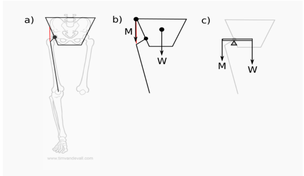
Study Objective: Understand the extent to which questions in an IPLS course have authentic biology and physics context and content, and which questions are only biologically or medically relevant on their surface.

Algebra-based physics course



vs.

IPLS course



Methods

- The questions from two new modules of the FlipIt physics tool in the IPLS course were reviewed and analyzed.
- The descriptions of the questions found in FlipIt physics were similar but superficial.
- Nine coding categories were developed to concisely identify the common features of curricula present in FlipIt Physics.
- The creation of these categories helped in understanding whether or not the curricula found in the IPLS course were truly *interdisciplinary *(biomedically relevant physics content).
- These categories can help us to understand the extent to which IPLS courses authentically produce interdisciplinary curricula.

Can we successfully categorize problems across many IPLS courses?

In this study, two modules from the IPLS Course were studied. The Physics of Physical Therapy and the Physics of Fluids in Medicine are new units that have yet to be used by students, but on the surface seem to have a great deal of biomedical and A&P content questions.

Context Categories

Questions were coded for the most salient context presented in the question. All questions were successfully categorized by one of three categories.

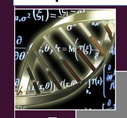
A&P based questions: Question whose contexts discuss the general structure and function of the body

Physics based questions: Questions whose contexts discuss physics concepts, principles, and models

Biomedical based questions: Questions whose contexts discuss common biomedical measurements, terminology, practices, technology, and applications relevant to the field

Content Categories

The content codes attempted to highlight any mismatch between the content of the question and the context in which the question was presented, or if a question was interdisciplinary, or just consistent.



Biophysics question: Questions that concisely incorporate biomedical applications and physical concepts ***equally*** within a question/unit/course

Superficial Question: Questions whose components are inconsistent or irrelevant with what the question is asking for as a whole

Cognitive Task Categories

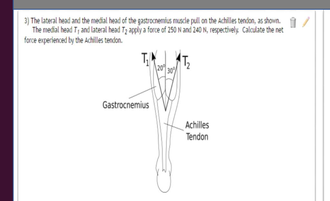
The codes developed for this section primarily analyzed the cognitive tasks of a given question.

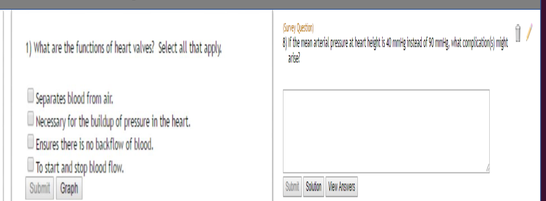
Recalling questions: Questions that require students to refer to information from previous questions or content that they would have learned previously (either inside or outside of the classroom)

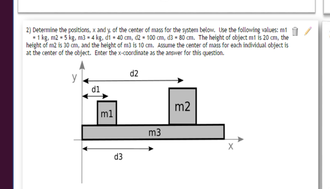
Plug & Chug" questions: Questions that require students to use information from a question and "plug it into" a given equation or function

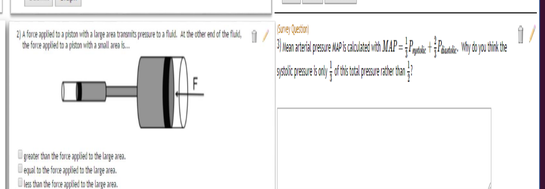
Conceptual Reasoning:
- Questions that require students to understand mathematical relationships and the features/nature of a given equation
- Questions that require students to explain their reasoning for choosing a given answer as well as requiring a transfer and application of previous knowledge to new contexts/situations

Examples



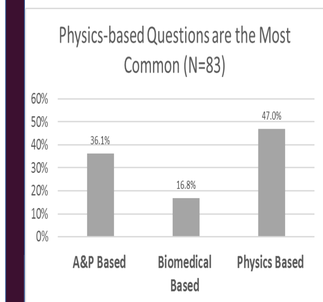


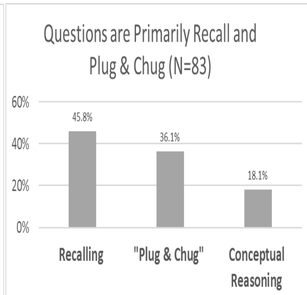


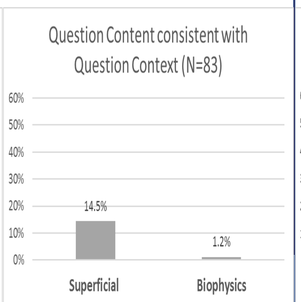


Statistical Analysis

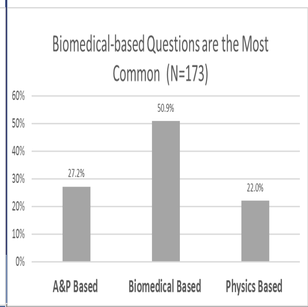
Physics of Physical Therapy Unit

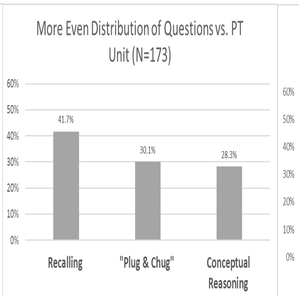


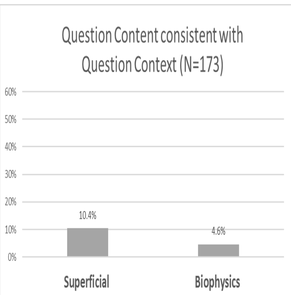




Physics of Fluids in Medicine Unit







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Acknowledgements: I would like to thank the NSF (DUE 1560142) for funding this project. I would also like to thank the researchers in NDSU (Warren Christensen, Jordan Brainard) and PSU (Elliot Mylott, Ralf Widenhorn, Bradley Mosier) for helping me conduct my research study.