The impact of IPLS in a senior capstone biology course

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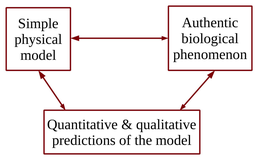
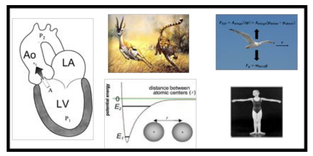
Research Question

Compared to peers with no college physics or traditional introductory physics,
do IPLS students demonstrate a greater ability to leverage physics competencies in later biology coursework?

Introductory Physics for Life Sciences (IPLS) at Swarthmore

- Introductory Mechanics (IPLS 1) and E&M (IPLS 2) courses designed to **prepare and motivate life science students** to **exercise physics competencies**





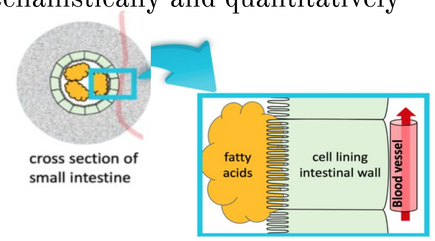
- Very little longitudinal research has assessed long-term efficacy of IPLS

Crouch & Heller Am. J. Phys. 82, 378 (2014)

Evaluating IPLS: Diffusion Task in Biology Capstone course

- Co-designed by a biologist (SHB) and physicist (BDG).
- Framed as drawing on quantitative skills
- Preceded by brief description of diffusion as molecular collisions
- Asks students to analyze diffusion in the context of animal digestion, both mechanistically and quantitatively

33 students participated in this task



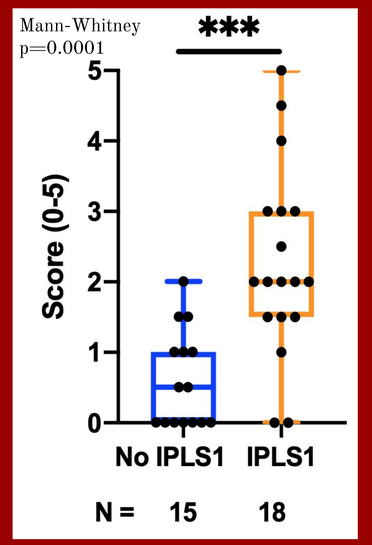
IPLS 1 students successfully employ IPLS 1 skills and content in a biological setting

Check out my talk and Q&A:
Par-F.05 Tuesday, 2:30-3:30

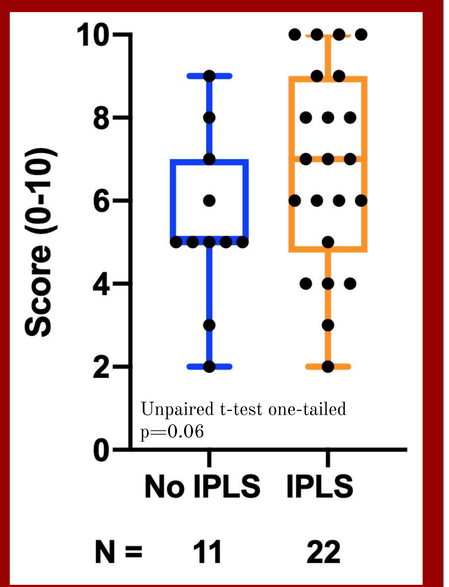
For our group's AAPT talks and posters (and more info on IPLS):
https://materials.physics.swarthmore.edu/sm2020/

IPLS students may be more proficient at quantitative reasoning than non-IPLS peers

IPLS-1 skills/content



General Quantitative skills/content



Questions and Methodology

Does IPLS 1 improve students' abilities to analyze diffusion in a biological setting?

Do IPLS courses improve students' abilities to apply quantitative competencies in a biological setting?

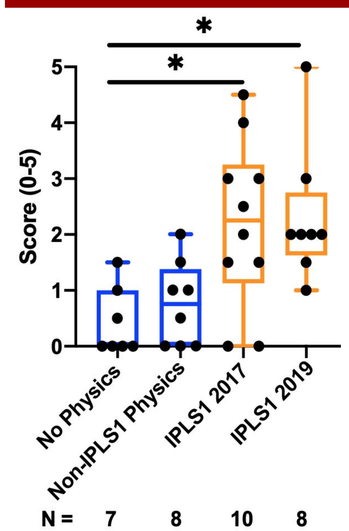
2 emergent coding schemes

Inter-rater reliability ~0.8-1.0 for all coding elements (Cohen's Kappa)

IPLS 1 emphasized
- Mechanistic description of diffusion
- Coordinate sign of flux with direction in space

General Quantitative
- Draw graphs
- Use equations
- Reason with units

IPLS 1 Gains Persist after 2 years



Gains in IPLS 1 scores persist 2 years post-IPLS 1 (task completed by students in 2019)

Kruskal-Wallis test
p=0.0033
Dunn's post-hoc
* indicates $p < 0.05$

Acknowledgements

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