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APPLICATION BASED LEARNING IN STEM:

IMPLEMENTING ENVIRONMENTAL HEALTH LEARNING TOOLS IN A PHYSIOLOGY LAB COURSE.

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Background

- The students' viewpoint on science is as important as science itself and drives quality learning.
- Education in science is comprised of 3 major elements (learning science, learning about science and doing science) and it is imperative for students to master this process.
- Therefore, teaching students *how* to learn using an environmental lens will provide them with the skills to work in the real world **(my project !)**.
- My project aims at making STEM easier to learn and highlights its applicability to the environment.
  - Physiology (my project) is in Biology (figure 1)

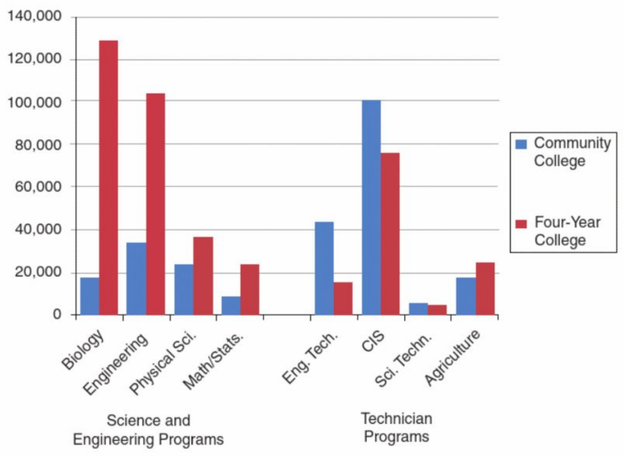


Figure 1: Demonstrates that biology is the most popular subject STEM seeking students choose. Y-axis in raw count. From (NAM 2022)

Internship & Methods

- From 2020 - 2022 I was a Peer Facilitator (PF) for *BIOL 119: Physiology Lab Course* at UW. My role increased credibility with students.
- I used my PF skills to pinpoint difficult to learn topics. My topics corresponded to 'implementation weeks'.
- I Implemented 4, application-based learning tools (Figure 2) as a lecture slide/discussion. Each tool used a different learning theory.
- Students took a post-lab, in class quiz every week.
- I analyzed these scores at the midpoint & end of the quarter. Analysis included post-lab quiz score data within and between lab sections.

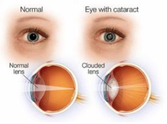
Researchable Question

Does the incorporation of an application-based, environmental studies centric curriculum aid physiology lab students in hard to learn content retention and quiz performance?

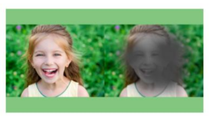
Climate Change and Vision Impacts!

- Less ozone in the atmosphere increases UV radiation → reaches our eye anatomy. (West 2016)
  - Overall, climate change is linked to an increase in ultraviolet radiation.
    - Causes... (Cullen 2012)
      - Pterygium:

      - Cataract:



      - Macular degeneration:



Question:
In figure 1, why would UV A and B be more dangerous for the acquisition of possible eye disease?

Hint:
Anatomical positioning

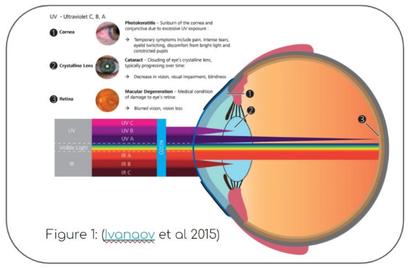


Figure 1: (Ivanov et al. 2015)

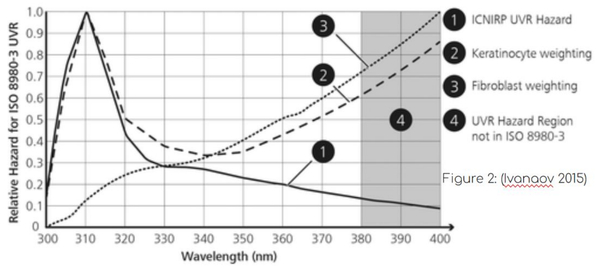


Figure 2: (Ivanov 2015)

Figure 2: Creating learning tools was the central focus of my internship. This is one of the application based learning tools that I created. This week's unit within the course was 'vision and eye anatomy'. I chose to relate vision to climate change and how ozone interacts with your vision acuity.

Takeaways

- **Content Retention:** Suggested through my data, environmental education increases critical thinking in the brain, heightens environmental knowledge and forges important discussions (figure3).
- **Quiz Performance:** My data suggested a slight increase in quiz scores throughout the quarter, or at least kept them high and constant, which was a major goal of my study (figure 4).
- **Learning Theory:** Analogical reasoning, which is learning through comparison, was the most effective education theory applied to my learning tool (figure 2).

Broader Significance

- Educators need to work on parallel subject integration in STEM classrooms.
- As I did, the use of modern research should be applied to teaching in classrooms.
- It is important to use common experiences (environmental health) to implement educational tools in introductory courses where base knowledge is not assumed.
- Proper continuation of these tools will create open minded and informed students. This will yield a determined future generational workforce and create change for our environment.

Results

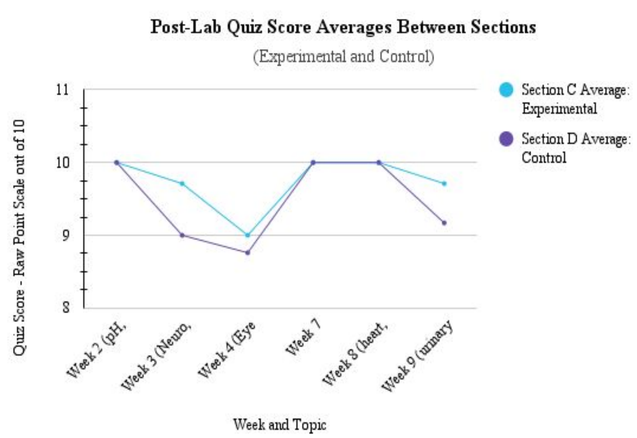


Figure 3: Post-Lab quiz score averages between sections. Section C, experimental group, had learning tools implemented on weeks 2, 4, 7 and 9. All other weeks act as basic control minus the theory behind the educational tool implementation and general mindset, not content.

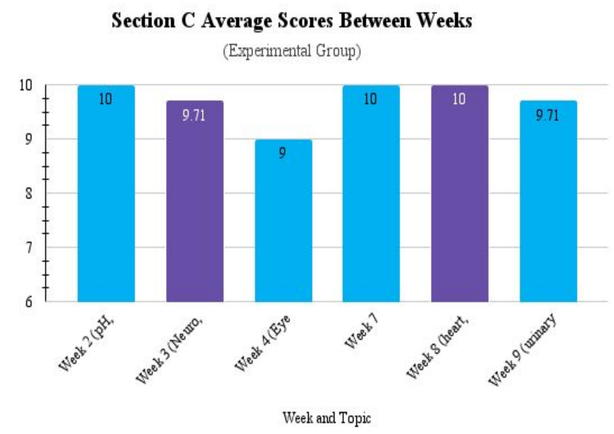


Figure 4: Section C average quiz scores between weeks. This chart compares Section C individually between weeks of learning tool implementation (blue) and non-implementation (purple).

Acknowledgements

A sincere thank you to Oscar Chacon for acting as both my Site Supervisor and Faculty Advisor.

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