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Do students at UMR differ in their development of horizontal translational literacy skills for the oxygen binding concept across years and/or by sex?

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Abstract

For many undergraduate students and experts, biology, chemistry, and biochemistry courses are difficult because they involve conceptual understanding of ideas that require assimilation of new knowledge with pre-existing knowledge from prior courses. Misconceptions increase cognitive load and interrupt the mental framework, making it difficult for individuals to learn and master course material. Adding to the complexity of these disciplines, individuals are presented with a variety of representations of abstraction which adds to the already high cognitive load of these courses (Schönborn et. al 2002; Offerdahl et. al, 2017). Intentional development of individuals' visual literacy skills has the potential to increase conceptual understanding while also decreasing cognitive load. Although research suggests that developing learners' mental models can help overcome misconceptions, little to no evidence exists in the chemistry and biochemistry education literature on student and experts structural knowledge related to visual literacy skills, specifically with horizontal translational visual literacy skills for oxygen binding (Chi, 2008; Gilbert & Boulter, 1998; Cranford et. al, 2014, Schönborn and Anderson, 2010). A study was conducted in 2021 in which students and experts were administered four surveys of (bio)chemical models and were asked to scale their similarities from 0-9. This research leads the way for the development of novel targeted learning assessments that address misconceptions and integrate active learning into the undergraduate biochemistry curricula to increase undergraduate student understanding of different chemical and biochemical processes.

Research Aims

This research aims to (1) assess whether students at UMR develop horizontal translational literacy skills for the oxygen binding concept across years and (2) to assess whether students at UMR develop horizontal translational literacy skills for the oxygen binding concept between sex?

Study Timeline

Study Design
- Fall 2020 - Spring 2021
- Background Research
- Write UROP Grant Proposal

Learning Assessment
- Fall 2021 - Spring 2022
- Identify and analyze results
- Synthesize and interpret data

Figure 1. Study Timeline. Timeline of this research project from Fall 2020 to Spring 2022. Current study is in the data analysis and interpretation section, where the data is being collected and compiled and further analyzed.

Data and Results

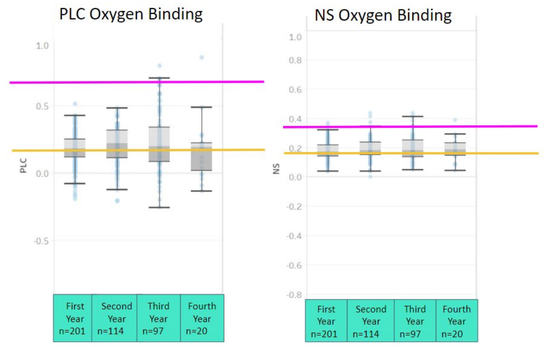

Figure 2. Data by years across UMR. PLC is measured on the left, and NS is measured on the right. Pink lines indicate average PLC and NS for experts (0.6946, 0.3548 respectively). Orange lines used for visual purposes only.

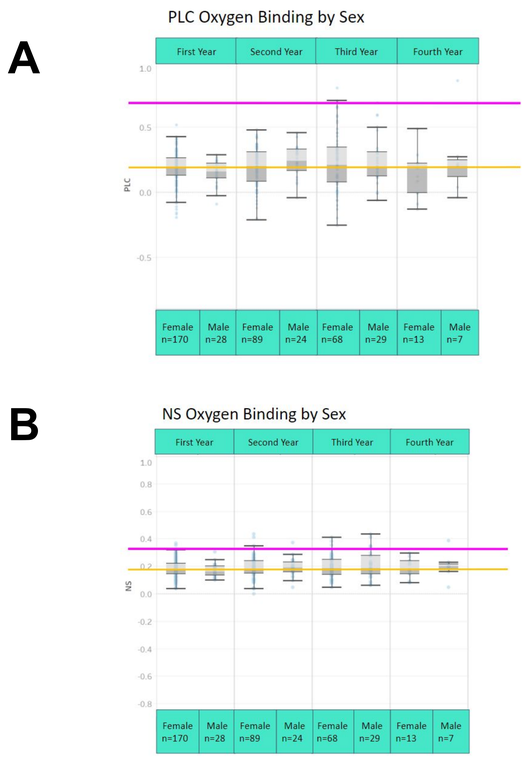

Figure 3. Data by years and by sex across UMR. Figure 3A measures PLC across years and by sex. Figure 3B measures NS across years and by sex. Pink lines indicate average PLC and NS for experts (0.6946, 0.3548 respectively). Orange lines used for visual purposes only.

Preliminary Results and Future Directions

Results

- The expert data validated the survey which then enables us to analyze the data
- Student data showed no significant differences in horizontal translational literacy skills across years and by sex at UMR
- Using the knowledge of students' neural networks could lead to improvements in teaching (bio)chemical concepts

Future

- Increase data collection from other sources
- Analyze data for further similarities and/or differences
- Determine how to use this information to change student study curricula

References and Acknowledgements

We would like to thank the chemistry and biochemistry experts at the University of Minnesota Rochester who participated in our study. This project was supported by the University of Minnesota's Undergraduate Research Opportunities Program. The project was approved by the UMN IRB under STUDY00012054.

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