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Assessing Multimodal Learning in Biochemistry

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RCEU 2022 Project Proposal

Project Title

Assessing Multimodal Learning in Biochemistry

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Instructions are on the last page.

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I. Project Description

This project explores students' understanding of metabolic pathways in the biochemistry classroom. The biochemistry class is typically a capstone experience for undergraduates toward the completion of a biochemistry degree. Students enter the biochemistry class with a wide array of experiences leading to an uneven playing field for instructors. Understanding metabolic pathways is a fundamental part of the biochemistry classes but due to their various backgrounds students struggle with studying the material. Our exercise requires that students collaboratively create a metabolic map that highlights regulatory points and design infographics on the effects of a metabolic disorder on energy homeostasis. This exercise encourages students to review the steps in metabolic pathways, apply concepts, analyze information, and enable them to construct new knowledge. The goal of this project is to evaluate the effectiveness of the exercise at developing students skills in synthesizing and communicating biochemical information.

II. Student Duties, Contributions, and Outcomes

a. Specific Student Duties

The student will be responsible for completing IRB training; reviewing literature; organizing data; using rubrics to evaluate data collected from participants; providing feedback on rubrics and exercise effectiveness; and compiling summaries of findings from analysis.

b. Tangible Contributions by the Student to the Project (10% of Review)

By participating in this project, the student will provide an essential perspective (i.e. the student perspective) on the implementation and effectiveness of the exercise which was built to enhance student learning. This perspective is valuable and often missing from the evaluation of these types of tools in biochemistry education research.

c. Specific Outcomes Provided by the Project to the Student (30% of Review)

As a result of working on this project, students will deepen their understanding of biochemical concepts like metabolic pathways. They will also have gained experience

(1) *evaluating* scientific communication (e.g. infographics) for accuracy;
(2) *analyzing* and *synthesizing* data;
(3) *engaging in collaborative discussions* with faculty regarding research;
(4) *evaluating* classroom exercises and *engaging in the design process* to improve exercises;
(5) *comparing* the desire and achieved learning objectives to determine the quality and effectiveness of a classroom exercise;
(6) *creating* original written and oral communications of research findings; and
(7) *presenting* education research to a regional audience of peers and practitioners.

III. Student Selection Criteria

The student must be a rising junior, or senior who has taken CH121, CH123, BYS119, and BYS121 as well as either CH 331 or CH201 and CH/BYS301. Students who have taken CH315 will receive special consideration. A student from Chemistry or Biology in the education track will be considered as long as they meet the minimum requirements.

IV. Project Mentorship *(30% of Review)*

The student will be mentored by an interdisciplinary team of researchers including myself and Dr. Sara Johnson. Dr. Johnson is a Biochemist and Chemical Education Researcher (CER) at the University of North Alabama. Her primary research areas are undergraduate research mentoring, scientific discourse and biochemistry representation. She is a Division of Chemical Education Representative for the Southeastern Regional Meeting of the American Chemical Society (SERMACS) and has organized CER symposia for regional and national meetings, including SERMACS, the Biennial Conference on Chemical Education (BCCE) and the American Chemical Society (ACS). She is a reviewer for NSF, the *Journal of Chemical Education,* and *ACS Books.* She is published in the *Journal of Chemical Education* and *Towards a Framework for Representational Competence in Science Education*, a title in the Springer Models and Modeling in Science Education series.

We will facilitate the student reaching the stated outcomes through weekly meetings and a mapped out timeline of IRB and data analysis training(2 weeks), evaluation of data(4 weeks), design-based research practice (2 weeks), development of original abstract and poster (2 weeks). Dr. Johnson will attend at least two meetings in person during the length of the experience. We will have a hybrid open door approach to mentorship where the student will have access to the team outside of the scheduled meetings through a designated Google Space (chat) or my open door.