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Reshaping active learning by using computational tools in undergraduate biochemistry education

Bonnie Hall, *Grand View University*

Active learning has been shown to improve retention of chemistry knowledge and to support inclusivity in the classroom. A way to enhance active learning in biochemistry is by incorporating the use of one or more computational tools. Many tools can be easily aligned with existing course content for brief computational activities to emphasize or explore key concepts. A range of tools and curricula are also available that are appropriate for a more in-depth integration throughout a course or as a major course project. The most intensive option is to design or re-design a course to focus heavily on using computational tools, with published curricula already available for several biochemistry-based course topics. There are even tools to allow students to perform predictive modeling using machine learning without requiring that students learn a coding language. These tools and curricula will be discussed for various levels of integration, along with examples of how they can be used for a variety of biochemistry topics and courses.

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Abstract 1930

Assembling The Pieces: Analyzing the Visual Literacy Skills of Horizontal Translation Representations of Undergraduate Students Across the Chemistry and Biochemistry Curriculum

Juquila Contreras Vital, *University of Minnesota-Rochester*

Vanessa Andrade, Chloé Morin, Xavier Prat-Resina, Cassidy Terrell

The development of visual literacy skills in undergraduate students has the potential to increase the interpretation of external representations and aid in the development of conceptual understanding. To date, there is very little visual literacy research addressing the capabilities of students in interpreting and storing information, and how students organize this information in their neural networks. This study aims to analyze both qualitative and quantitative data on expert and student visual literacy skills with respect to horizontal translation skills. More specifically, we will determine how students' structural knowledge and organization of horizontal translation representations in enzyme-substrate and oxygen-binding concepts evolve across the chemistry and biochemistry curriculum. In order to do this, students and experts took surveys that contained different visual representations and were asked to rank them according to relatedness. The Pathfinder program was used to obtain the average neural networks and quantitative values such as degree, eccentricity, Path Length Correlation (PLC), and Neighborhood Similarity (NS) values, as well as any patterns of chunking or organization of the neural networks. Rather than looking at individual data, the datum was averaged by course via the Pathfinder program, which allows for the observation of progress, or changes, depending on the course in which the students are enrolled across the curriculum. The degree values look at the nodes that are the most branched, or those which appear to be the most connected to other concepts. The eccentricity values look at the most central node, or what is deemed to be most closely connected to other concepts, and this is indicated by a lower value. The PLC is the relatedness of two nodes between the average experts and students, with a score close to 1 indicating high correlation and a score close to 0 indicating low correlation. NS measures the way nodes are grouped, with ranges of 0 (low similarity) to 1 (high similarity). Furthermore, looking at patterns of chunking or organization in the average neural networks allow for similarities of node groupings to be observed among the experts and students. The average student neural networks and quantitative values were analyzed in reference to the average expert neural network and quantitative values. These findings may provide insight into how student organization of knowledge and visual literacy skills are acquired and maintained, which can be helpful in aiding educators to adapt their curricula to further support student learning in relation to scientific topics.

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