ASPECTS OF DATA ANALYSIS IN AN INTRODUCTORY PHYSICS FOR THE LIFE SCIENCES LABORATORY COURSE

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The Next Generation Science Standards (NGSS) for K-12 education propose an active, three-dimensional science education that goes beyond recitation of facts. Students utilize Scientific Practices, such as *Planning and Carrying Out Investigations* and *Analyzing and Interpreting Data*, to scientifically investigate the world, enabling them to learn and apply Crosscutting Concepts, such as *Cause and Effect*, *Energy and Matter*, and *Stability and Change*, to achieve understanding of Disciplinary Core Ideas in the physical, life, engineering, and computer sciences (N. R. Council, 2012). A segment of the physics education research community has focused on designing Introductory Physics for the Life Sciences (IPLS) lecture and lab courses, with the goal of connecting physics to biology (NEXUS; Redish et al., 2014; Moore, Giannini, & Losert, 2014). The University of Utah started offering the labs in 2017 and has since modified them. These labs are aimed at life science and pre-health majors to develop their research skills. Due to the interdisciplinary nature of the labs, many components of three-dimensional learning are present, including the practice of *Analyzing and Interpreting Data*.

Literature from K-12 instruction (Schwarz, Passmore, & Reiser, 2017), mathematics education (Doerr & English, 2003), computational thinking (Grover & Pea, 2013), and undergraduate labs (Metz, 2008) each highlight aspects of data analysis. As of yet, there is little knowledge about how students engage in this practice in IPLS labs. Needed is a more detailed understanding of this practice, which in turn can support the development of research and assessment tools.

We conducted qualitative analysis of students' lab reports, as well as audio and video recordings of class sessions and pilot task-based interviews, to support the development of a preliminary theory of how students engage in data analysis. This theory involves the following aspects: data collection, data cleaning, data manipulation, data interpretation, argumentation, mathematization, and utilizing representations. We then analyzed the first semester IPLS lab course (PHYS 2015) at the University of Utah to specify where students engaged in each aspect of data analysis in each lab. This revealed that data analysis is a non-linear, iterative process, and aspects such as argumentation and data interpretation often occur throughout the lab.

These preliminary results supported the design of a task-based assessment with biology-based questions to assess students' skills in these aspects. We conducted initial piloting of the assessment with individuals from a variety of academic backgrounds, including STEM undergraduate students, physics graduate students, and math faculty. After revisions and construction of a solution rubric, this assessment will be piloted in IPLS labs for further validation. This assessment, along with other sources of data, will provide insight into, and enable theorization of, how students engage in the process of data analysis in IPLS lab courses at the University of Utah.

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