Show me the data: An exploration of photographic data representation in undergraduate life sciences

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Visual thinking – the ability to interpret and communicate via visualizations such as graphs, diagrams, and figures – is a necessary skill for practicing life scientists. Realistic images are considered to have a greater impact on students than graphs or equations as they lie closest to the real-world experience and are often thought of as truthful evidence of a concept (Pozzer and Roth 2003). Not only are these abstractions prevalent within undergraduate science textbooks, a look at primary literature showed that approximately a third of those figures contain realistic images (~30% photographs and ~10% conventional cartoons). In order to develop skills to understand the nature of expert figures, students should be increasingly exposed to more expert-like representations.

**Methods**

An analysis of the primary literature confirmed that the general function of expert visualizations is to serve in the creation of a scientific argument; they function to either show data or propose a model.

**Coding Rubric**

- **Decorative (DEC):** Either lacks a caption or relevance to the material is not made explicit
- **Illustrative (ILL):** Relates to something observable, but does not represent the actual concept in part or in whole. Ex: Analogies, related examples
- **Explanation (EXP):** The actual concept is being represented
- **Expert-like (EXL):** Image is presented in a manner similar to what is found in primary literature

**Explanatory Model (EMOD):** A molecular mechanism or structure is explained "as truth"

- **Authentic Example (AEX):** Depicts actual structure or laboratory result NOT in context with research

- **Procedural (PROC):** Image presented in context with GENERALIZED procedure

- **Reproducible Protocol (RPRO):** Image presented in context with SPECIFIC procedure

The function coding rubric was then applied to introductory biology and biochemistry textbook figures.

**Discussion and Future Directions**

- The results of this study suggest that scaffolding is absent when considering undergraduate textbooks in the molecular life sciences.
- Similar work needs to be done regarding the authenticity of graphs in textbooks.
- If the role of textbooks is simply explanatory, instructors need to supplement authentic figures to explicitly target expert visualization skills.

**Select References**


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