Validating biomolecular visualization assessments: A mixed methods study incorporating classical test theory and semi-structured interviews

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For over a decade, the BioMolViz group has been working to improve biomolecular visualization instruction and assessment. Through workshops that engaged educators in visual assessment writing and revision, this community has produced hundreds of assessment items, a subset of which are freely available to educators through online repository, the BioMolViz Library. Assessment items are at various stages of a validation process developed by BioMolViz. To establish evidence of validity, these items were iteratively revised by instructors, reviewed by an expert panel, and tested in classrooms. Here, we describe the results of the final phase our validation process, which involved classroom testing across 10 United States-based colleges and universities with over 700 students. Classical test theory was applied to evaluate 26 multiple-choice or multiple-select items divided across two assessment sets. The results indicate that the validation process was successful in producing assessments that performed within our defined ideal range for difficulty and discrimination indices, with only four items outside of this scale. However, some assessments showed performance differences among student demographic groups. Thus, we added an interview phase to our process, which involved 20 student participants across three institutions. In these semi-structured group interviews, students described their problem-solving strategies, adding their unique insights as the discussion progressed. As these interview transcripts were qualitatively coded, areas to further improve assessment items were identified. We will illustrate the progression of several items through the entire validation process and discuss how student problem solving strategies can be leveraged to guide effective assessment design.

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