An Assessment Based Approach for Evaluating Learning in Natural Science General Education Courses

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Student learning that is consistent with goals of the General Education Program can be evaluated using a multi-tiered, assessment-based approach that integrates content, concepts and higher-order thinking skills assessments into the class. The Department of Geology at The University of Akron evaluates content and conceptual learning in the general education class, Earth Science, using the Geoscience Concepts Inventory (GCI) and, more recently, using concept map development. Students complete the GCI in the first and last week of this large classroom setting (160 students), active learning course. A comparison of pre- and post-test results from the GCI indicated that students improved in their ability to answer conceptual questions related to the Earth by 13% over the course of a semester (paired results; $n = 58$; $p < 0.00001$). Similar gains are consistently found for pre- and post-course analyses of logical thinking scores. Gains to contextual and conceptual understanding of the earth system are also being tracked using pre- (and eventually post-) course concept maps that are scored using a quantitative approach. Student pre-course scores on this exercise average 11 +/- 8 (n= 132) compared to 44 +/- 15 (n= 7) for faculty-generated concept maps using the same terms. Post-course scores are not yet available. Synthesis-level exercises embedded in the course allow for formative and summative assessment of higher order thinking skills. In one such task, students are required to integrate contextual knowledge and understanding of rock-forming processes with conceptual understanding of geologic time principles by constructing a geologic cross section for a set of randomly arranged events. These diagrams are then scored using a standardized rubric. Similar exercises requiring students to evaluate risk for a variety of natural hazards (e.g. earthquakes, hurricanes, floods) compel students to integrate scientific information with social decision making. Such results demonstrate that natural science courses can help develop a scientifically literate society by achieving goals of developing critical thinking skills and independent thought. The data also show that students begin to develop the analytical skills needed to make sound qualitative and quantitative judgments and that they are acquiring knowledge of science and its impact on society. This study is showing that evaluation of progress toward meeting general education goals can be effectively accomplished by including multiple, embedded classroom assessments directly into the class.