

Scaffolding pedagogy and reflection in science: impact on students' ability to conduct original research and present a scientific meeting-style poster

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This paper/poster presents the results of a collaborative effort between a biology and an education faculty member to engage in faculty development while simultaneously studying the effects of scaffolding pedagogy and reflection techniques on student learning. The outcomes assessed were students' ability to conduct original ecological research and present a scientific meeting style poster. A holistic rubric was developed to assess the extent of impact on achieving the learning goals.

Context for the study

Students, K-12 teachers in a graduate program at Colorado College, were unfamiliar with conducting original scientific research and presenting a science poster. The context for this research was an annual summer science-pedagogy institute for K-12 teachers that operates all day for six weeks (8 semester hours). In addition to addressing the conceptual content and pedagogical needs of teachers, the degree program was designed (1993--) as a 'lab' for science and education faculty to explore new instructional approaches of teaching for conceptual understanding, rather than content coverage.

Methodology and Results

The course of study was wetland ecology in the Rocky Mountains; we quantified the interrelationships of plants and their environments and had the following goals for our students: 1) learn basic concepts and principles of ecology and physiology, 2) build observation skills to see patterns in the field, 3) learn how to investigate ecological questions, 4) carry out their own research project and present results. Specifically, students were required to cooperatively research a topic on plant ecology/ecophysiology that was beyond the scope of material presented in the course and to prepare a scientific meeting style poster. We put several field exercises into the syllabus that were scaffolded to build the following skills: observation, experimental design, hypothesis generation, and data collection as well as analysis. Students kept a journal during the course, which was a key instrument for personal growth and understanding the material. Faculty and students concurrently reflected on field and classroom experiences to make the process of scientific research more explicit.

The presenters of this paper will share the planning and implementing process, the scoring rubric and results, samples of student posters and a photo album (PowerPoint) of scaffolded exercises. For example, the rubric contained six categories: five specifically addressed the clarity of a poster's introduction, methods, results, discussion, and literature sections, and the sixth category addressed the overall quality of the presentation itself. Based upon faculty and student evaluations of these categories, grades were assigned to the posters and four of the five posters scored in the "A" range.

Significance of the study

The results demonstrate that scaffolding and reflection are important strategies in allowing "novice scientists" to accomplish original research and reach a substantial conceptual understanding of ecophysiology as well as experience in implementing inquiry strategies in K-12 classrooms. The college faculty gained evidence that such strategies are effective for developing students' conceptual understanding as well as the ability for novice learners to engage in original research. The results help inform faculty about effective strategies for accomplishing higher learning goals such as conceptual understanding and the ability to complete original research projects.