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What Characteristics Are Identified as Key Reform Components Among a Sample of Reformed Undergraduate Science Courses?

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The National Study of Education in Undergraduate Science (NSEUS), funded by the National Science Foundation, investigated characteristics of an initial sample of six undergraduate science courses identified as reformed by their institutions in a population of 103 higher education institutions. These institutions, and one or more of their courses, were involved in the NASA/NOVA Program. The NOVA courses were developed and offered at various times beginning in 1996 in a large professional development effort to create reforms in higher education undergraduate, and mostly entry-level, science courses.

The initial sample of six institutions represented a range of Carnegie types from Research 1 through Bachelor’s degree granting, and from large in size through small, with one primarily native American serving institution among them. Reform courses were implemented in interdisciplinary (e.g. aerospace science, natural science) courses as well as single subject area courses (e.g. biology). All of the reform courses were available to non-majors, with elementary education majors forming one large student component.
The courses differed from each other not only in content but also in the pedagogy implemented. Although there was diversity among the courses, major reform characteristics consistently were identified by course instructors and included:

- starting classes with materials students can see and touch
- asking students about their prior knowledge of the current content topic and/or ascertaining that prior knowledge through students’ interactions with materials
- making students aware of their misconceptions
- active involvement in learning experiences
- role playing, as in demonstrating the citric acid cycle
- overt comments by the instructor to initiate reflection among students
- emphasis on student construction of knowledge rather than memorization

Course instructors described the rationale they used to identify the major reform characteristics that were incorporated to construct the reform course. All instructors focused on implementing pedagogy that helped their students construct an understanding of the nature of science and of the concepts basic to the scientific topics studied. Since elementary education majors formed a major student component, and sometimes the entire student body, in these reform courses, instructors also had a focus on helping students transfer their own conceptual learning to the elementary classroom. Laboratory activities and discussions considered which aspects of key concepts should be taught to students at various elementary grades. Such an approach was considered informative to all students in a course as they considered the course of development of a concept within the human mind. Course instructors noted that they encouraged elementary education majors to use many or all of the pedagogical strategies encountered in the reform course, such as ascertaining prior knowledge through involvement with materials, with their students when they became elementary school teachers.

Further discussion of NSEUS findings is available in:


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