

## Research Brief No. 2

### ***What Criteria Can Be Used to Identify the Level of Implementation of Reform in an Undergraduate Science Course?***

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The *National Study of Education in Undergraduate Science* (NSEUS), funded by the National Science Foundation, developed a detailed review of the research literature on undergraduate science reform. The review was an initial means of examining criteria with which to identify the level of implementation of reform in an undergraduate science course. A national survey of the 103 higher education institutions that were part of produced findings corroborating conclusions identified in the literature review (see Sunal & Sunal, *Research Brief No. 1*, 2008\*).

These 103 institutions, and one or more of their courses, were involved in the NASA/NOVA Program. The NASA/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.

Reform course criteria identified in the review of the research literature included the following factors;

- emphasis on facilitating all students' learning of science
- use of pedagogy engaging students' prior knowledge
- use of structured inquiry pedagogy with active and extended student participation as a regular part of the instruction
- refocusing of the role of the instructor who works to become a reflective practitioner using action research
- use of integrated multiple learning formats including more than separated lecture and laboratory approaches
- refocusing science content on a few key ideas covered in depth

- use of interdisciplinary approaches in course content
- interaction of faculty between colleges (e.g. Arts and Sciences and Education) regarding teaching and learning
- use of student group reflection and learning activities focused on interactive and collaborative learning through shared responsibility
- emphasis on evidence-based learning, using relevant and real data reflecting the way science is done
- use of diverse technology in most course activities to facilitate learning
- focusing on performance assessment forming the greater part of course assessment
- faculty participation in a collaborative team representing differing expertise and collaborative interactions, building on effective interpersonal skills and trust,
- a positive college and department climate relating to the reform effort's goals,
- administrator presence and support in the change process,
- beginning with the reform goals to be accomplished rather than with personnel or contextual barriers,
- planning for incremental rather than initial massive change,
- ongoing and consistent monitoring of the reform activities using action research, and
- sustaining through collaboration in a network of faculty within and outside of the institution

Necessary criteria for an undergraduate science course to claim that it is a reform course based on the national science standards are being explored as a result of the review of literature and a national survey of the NSEUS institutions. The criteria should be: (1) universal across all science disciplines; (2) unique in that change/enhancement in student outcomes would not result if it were not present; and (3) relevant and valid in that the presence of this variable is measurable in short- and long-term student science performance.

Factors causing change are being considered as a component of the criteria. These factors are of two kinds: individual and situational.

*Individual factors* are those that impact moving from traditional practice to reformed practice. These factors are specific to the individual instructor and include prerequisite knowledge, skills, and beliefs. The NSEUS project is seeking to identify other possible individual factors that may exist.

*Situational factors* include: student resistance to change, the time structure, expectations for content coverage, a lack of instructor time, departmental norms, a lack of resources, promotion and tenure and merit pay concerns, a lack of a core of supporters such as a team of colleagues, and the grading system. The NSEUS project also is seeking to identify other possible situational factors that may exist.

\*Sunal, D. & Sunal, C. (2008). What levels of institutions in a national population are reforming undergraduate science courses? *Research Brief No. 1*. Tuscaloosa, AL: The Office of Research on Teaching in the Disciplines. <http://nseus.org> and <http://www.teachingdisciplines.ua.edu>



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