

Research Brief No. 3

What Characteristics Are Found in Reformed and Non-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 reformed and non-reformed undergraduate science courses 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.

One NSEUS goal is to investigate the impact of NOVA courses on learning and teaching of k-6 science teachers. Common features found to turn off undergraduate students from science courses include:

- 1) a lack of relevance
- 2) science being presented as a set of facts
- 3) emphasis on competition
- 4) focus on algorithmic problem solving
- 5) passive student roles

Reform NOVA course characteristics align with the national science standards developed to make science meaningful for all students. Common reform features are:

- 1) involving all students in an inquiry/investigative approach to learning science,
- 2) using collaborative and cooperative learning groups during course activities,

3) applying continuous alternative assessment, rather than using only a few traditional exams.

Table 1
Instructional Methods Used in Reform Courses

Instructional Method	Average % of Time per Week
Lecture	15%
Traditional Lab	03%
Discussion/Interaction with student groups	10%
Inquiry Based Integrated lab	68%
Integrated use of technology	04%

Reform course student activities involving the science laboratory, during and outside of a class, included about 2/3rds of the class time per week (see Table 1). The other 1/3rd of class time involved interactive discussions, use of technology, and lecture (see Figure 1).

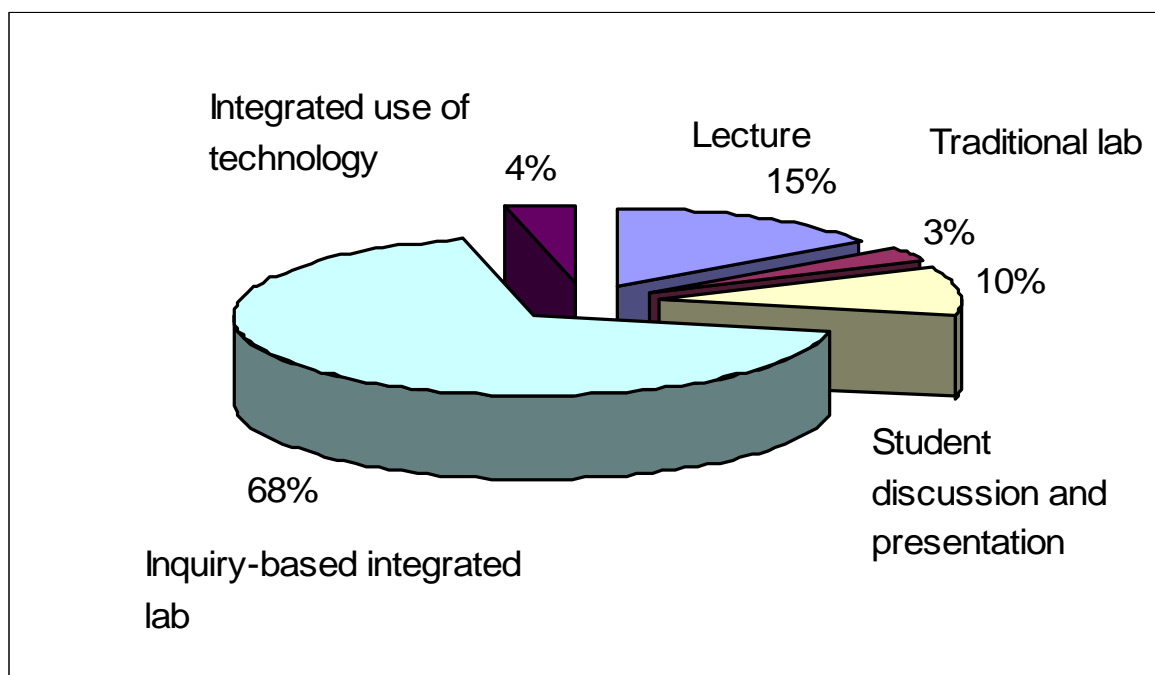


Figure 1: Pedagogy in Surveyed Population of Reform Courses

Overall characteristics of the NOVA reform courses surveyed include frequent offerings, averaging twice a year, generally in fall and spring (see Table 2). The courses have a high average enrollment of minority students (25%), are 4 credit hours, and include laboratory work as a regular part of the course not an add-on that may be taken at another time. Still-active NOVA courses enroll about 10,000 students annually. The population of courses surveyed represents a significant sample of the total number of

courses and students enrolled in undergraduate science courses in the United States during 2007.

Table 2
Selected Reform Course Characteristics

Characteristic	Average
Years course has been offered at institution	6
Number of times offered in a year	2
Course enrollment	35
Minority enrollment	25%
Credit hours	4 (range = 3 - 5)
Number of sections per semester	1.5 (range = 1 - 6)
Number of student enrolling in reform courses per year	~10,000

The survey data included information on 12 comparison courses at the same institutions that had not been involved in the NOVA reform process. The information from these courses indicated that lecture was utilized 68%, laboratory work 10%, discussion and interaction of student groups 10%, integrated lab 6%, and integrated use of technology 6% (see Figure 2). Based on this preliminary data, there appears to be a significant difference in the instructional process occurring in reform courses in comparison to other courses in the same department at these institutions.

Which of the courses represents undergraduate science for all students in the 21st century? If we are to make a change in the way science is viewed by students, we have to change the way science is experienced by students. In traditional courses, where the majority of the time is spent in lecture, the stereotype that science is irrelevant will continue to be perpetuated.

Further discussion of NSEUS findings is available in:

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>

Sunal, C., Sunal, D., Sundberg, C., Mason, C., & Lardy, C. (2008). What criteria can be used to identify the level of implementation of reform in an undergraduate science course? *Research Brief No. 2*. Tuscaloosa, AL: The Office of Research on Teaching in the Disciplines. <http://nseus.org> and <http://www.teachingdisciplines.ua.edu>

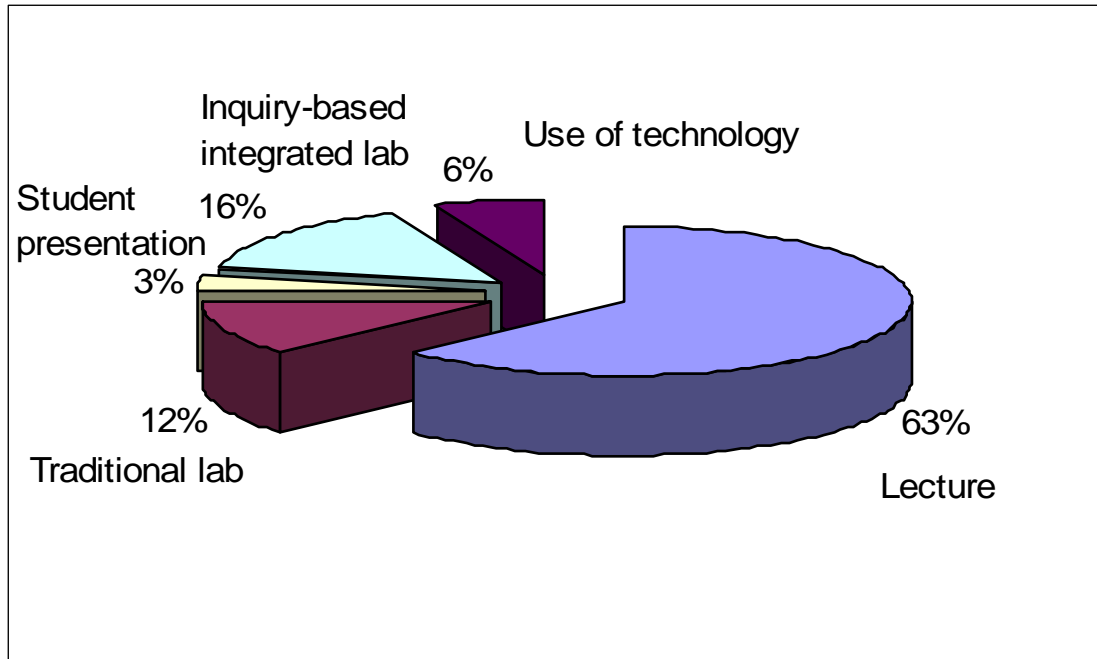


Figure 4: Pedagogy in Comparison (Non-Reform) Undergraduate Courses



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