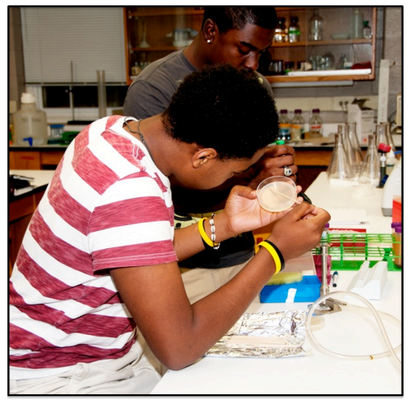
Authentic Research In Undergraduate Biology Laboratory Courses

Definitions, Implementation, And Barriers



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National Science Foundation WHERE DISCOVERIES BEGIN

REIL-Biology

Research **E**xperience in **I**ntroductory **L**aboratories **– Biology:** An RCN-UBE incubator to increase the use of authentic research experiences in introductory laboratory courses. REIL-Biology works in conjunction with the Association for Biology Laboratory Education (ABLE) and the Council on Undergraduate Research (CUR).

Survey

We conducted a national survey of faculty teaching introductory laboratory courses to:

- Define essential components of authentic research in a laboratory course context.
- Determine the extent to which authentic research experiences are occurring in introductory biology laboratory courses.
- Determine the barriers to implementation of authentic research experiences in introductory laboratory courses.
- This poster reports our preliminary findings.

Responses from 279 faculty representing:

- 48 2-year colleges
- 114 liberal-arts colleges
- 36 comprehensive universities
- 57 research universities.
- Minority-serving institutions represented 14% (39 of 279) of the responses
- 532 introductory biology laboratory courses

Defining Authentic Research

20 Most Common Words Used to Describe Authentic Research

Themes in Definitions of Authentic Research

- Novel Questions (Unknown Results)
- Student-Generated Questions
- Hypothesis Formation
- Experimental Design
- Data Collection
- Data Analysis
- Presentation or Publication

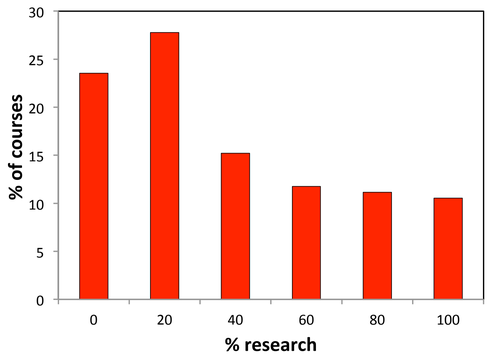
Definitions focused on words (left) used in the context of seven distinct themes (below left).

Our preliminary analysis indicates that the essential components of authentic research are the initial steps in the process of science (novel questions and unknown results, student-generated questions, hypothesis formation, and experimental design) and point to a process of discovery. However, the outcomes (data collection and analysis) and consequences (data presentation and publication) also are important to authentic research. We suggest that some but not all, of the initial process features may be sufficient for an activity to be authentic research in an introductory biology laboratory.

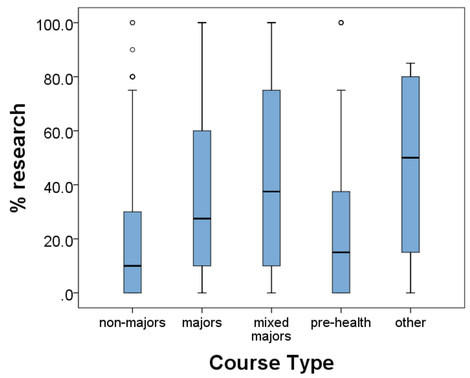
Implementation of Authentic Research

Our preliminary analysis found little to no research experience occurs in about half of all courses. Only 10% of courses were entirely research based. Courses specifically for non-majors were less likely to provide research experience than most other course types. Research experiences occurred less often in the introductory courses at 2-year college compared to introductory courses at liberal arts colleges, comprehensive or research universities.

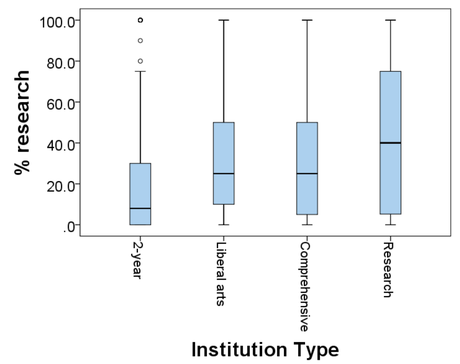
Proportion of Research Experiences



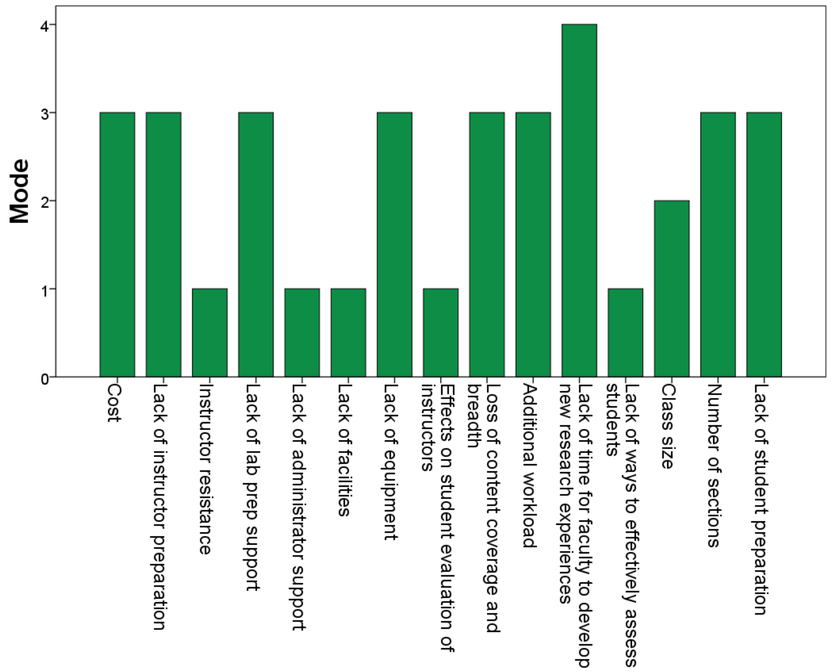
Research Experiences by Course Type



Research Experiences by Institution



Barriers to Authentic Research



Barriers at Public Institutions

- Cost
- Lack of equipment
- Lack of student preparation
- Effects on student evaluation of instructors

Barriers at Minority-Serving Institutions

- Lack of administrator support
- Lack of facilities
- Lack of time for faculty to develop new research experiences
- Effects on student evaluation of instructors

The most common responses indicate that lack of time to develop research experiences is the greatest barrier to developing authentic research experiences. Other potential barriers, such as lack of equipment, class size, and lack of student preparation varied significantly between institution types. This variation in our preliminary findings suggests that there will not be a one-size-fits-all solution to overcoming these barriers. Overcoming barriers of cost, equipment, and student preparation may be possible with creative approaches to authentic research that do not require large expenditures for equipment and supplies. Student preparation may be addressed by adopting guided-inquiry methodologies at the introductory level rather than open-inquiry.

Acknowledgements

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