Enhancing the biology capstone research experience via required courses within the major

Alicia S. Schultheis, Associate Professor & Provost Faculty Fellow for Faculty Development,
Biology Department Stetson University, 421 North Woodland Blvd Unit 8264, DeLand, FL 32724
aschulth@stetson.edu

Background

Stetson University is a comprehensive university that requires capstone senior research projects of all undergraduates. The Biology Department has developed a robust capstone project model for majors, which includes individual mentoring of student research and four required courses.

Curricular Elements

Required courses occur in the sophomore, junior, and senior years.

Sophomore level-course : Biostatistics; focuses on statistics and experimental design.

Junior-level course: Research proposal; students learn research interests of departmental faculty, select a faculty mentor, and write a research proposal. Research proposal writing coincides with the application deadline for the Stetson SURE (Summer Undergraduate Research Experience) grant program.

Senior-level courses: Senior Project;
research is conducted and a formal scientific paper and poster are prepared.
Senior Seminar; students give an oral presentation of their results to the entire department and give a talk or present a poster at Stetson Showcase, the on-campus undergraduate research and creative arts symposium.

Figure 1: Stetson student presenters at the 2011 annual meeting of the Association for Southeastern Biologists meeting in Huntsville, Alabama. Left to right: Tim Roberts (MS program, Auburn University), Cailin Kellmann (Research Scientist, National Park Service), Caity Peterson (Visiting Researcher at Centro Internacional de Agricultura Tropical, Cali, Colombia), Courtney Gardner, PhD Program, Duke University). Parentheses indicate post-graduate employment/graduate work.

Assessment

Most students achieved the desired learning goals with an 'Acceptable' rating or higher.

The efficacy of these courses was assessed with respect to the desired learning outcomes shown below. Each outcome was reviewed by three independent raters who used previously designed rubrics with the categories 'Exemplary', 'Acceptable', 'Developing' and 'Unacceptable'.

- Design of scientific studies (*80%)
- Execute scientific studies and collect data using knowledge of discipline-specific equipment and methodologies (78%)
- Deliver effective oral presentations (100%)
- Writing of scientific reports (70%)

*Numbers indicate the percent of students with 'Acceptable or higher rating for a desired learning outcome.

Other measures of success: Scholarly Productivity and Student Outcomes

Our approach to undergraduate research results in tangible scholarly outcomes for students and faculty.

Over the last five years:

- Departmental faculty have published 16 articles in peer-reviewed journals with undergraduate student co-authors.
- 25 presentations have been given with student co-authors
- 11 students have presented posters or presentations at scientific meetings
- 6 students have won awards for presentations (on- and off-campus)
- 7 students have received Stetson SURE grants for summer undergraduate research experiences
- Students have had a high rate of success in graduate programs and as research scientists (Fig. 1)

Conclusions

Integrating undergraduate research into the curriculum at Stetson benefits faculty and students. Our model is robust and leads to achievement of desired learning outcomes and scholarly activity.

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