

RESTRUCTURE OF BIOCORE 324 PHYSIOLOGY LAB SYLLABUS: ENHANCEMENT OF STUDENT LEARNING PROCESS

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WHAT IS TEACHING-AS-RESEARCH?

Implement *research strategies* to investigate student learning.

Apply *novel teaching methods* combined with *assessment* of student learning to *improve teaching practices*.

BACKGROUND

The Biology Core Curriculum (Biocore) program is an honors level series of biology courses that meet the core curriculum requirements of biology majors at UW-Madison, and upper-class students in the Biocore program electively enroll in Biocore 324 (Physiology Lab). Biocore 324 is a student-centered classroom and the course content and activities are dictated by the students themselves. The current learning objectives are for students to implement lecture content in a laboratory setting, improve science communication (oral and written), improve skill sets, and learn to work effectively in groups. Most students achieve these objectives and perform to high standards, but it can be a frustrating, stressful, and 'cloudy' experience for them. As an elective laboratory experience that is based on preparing students for graduate research and/or a professional program in the medical field, one course objective should be to instill a sense of excitement and confidence in these students regarding scientific research. Inquiry-based physiology laboratories have been successful in improving confidence in undergraduate student's ability to formulate questions and hypotheses, design experiments, collect and analyze data and make conclusions¹. It is our goal to improve student achievement, since more positive attitudes toward the science learning experience have been associated with better achievement in science².

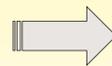
STUDY QUESTION

Do syllabus modifications to an existing student-centered laboratory course increase student confidence in and achievement of science process skills?

METHODS

INTERVENTION:

Changed syllabus from three to two research projects during the semester



Allowed for incorporation of:

- Pilot studies
- Four active learning activities in discussion sections

DATA COLLECTION:

- Rubric scores on written research papers
- Pre- and Post-Student Assessment of their Learning Gains (SALG) surveys

RESULTS

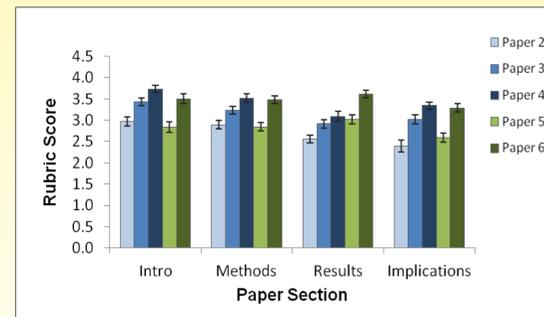


Figure 1. Paper numbers (2-6) represent chronological order. Papers 2-4 (blue) represent written papers for project 1, a 10-week long animal physiology project. Papers 5-6 (green) represent written papers for project 2, 5-week long plant physiology project. Bars represent mean rubric scores \pm s.e.m., n= 28.

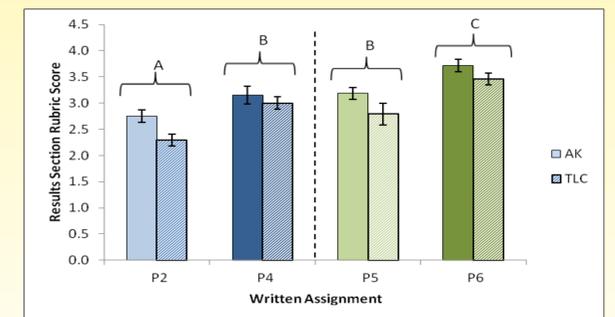


Figure 2. Results section of written paper assignments. There were no significant differences in mean Results section rubric scores between the two TA sections (AK and TLC) of the class for any of the written assignments ($p > 0.296$). Combining both sections, there was a significant increase in rubric scores from Paper 2 to Paper 4 (animal physiology project; $p = 0.0011$), and again from Paper 5 to Paper 6 (plant physiology project; $p = 0.0003$). Bars represent mean rubric scores \pm s.e.m., n= 28.



Post-SALG: Example Survey Questions & Mean Response Scores

(No gain=1, A little gain=2, Good gain=3, Exceptional gain=4)

As a result of your work in this class, what gains did you make in your understanding of the following?

- How to statistically analyze my data: 3.84
- How to develop an experimental design: 3.37
- How to appropriately use statistical results to support your conclusions: 3.16

As a result of your work in this class, what gains did you make in the following?

- Enthusiastic about research project: 3.32
- Confident that I understand research project: 3.50
- Confident that I can successfully complete my team's research project: 3.50

SUMMARY

- For all main sections of written research papers, students improved with each review and rewrite; however, student performance in the *Results* section did not peak until the final course assignment.
- During the second project (5 week duration), students advanced writing skills to the same level achieved following the first project that lasted 10 weeks. This increased achievement rate indicates a long-lasting impact of learning gained during the slower-paced introductory project.
- Post-SALG survey responses show good to exceptional gains reported by students on understanding of statistical applications to their research and on confidence regarding their research projects.

REFERENCES

1. Casotti G, Rieser-Danner, Knabb MT. 2008. *Adv Physiol Educ* 32: 286-296.
2. Lord T, Orkwiszewski T. 2006. *Am Biol Teach* 68: 342-345.

