Statistics HIPsters
Final LEAP report
Leda Nath, William Mickelson, Charles Zhang, David Havas, and Chris Chapp

Explain your progress and lessons learned from your Spring 2013 plan. Share any data, results, or outcomes that you achieved.

We created a common assignment for use in statistics and quantitative research methods classes (see Appendix). The goals of this assignment were fourfold:

- **Create a Common High Impact Practice Assignment:** The assignment included student inquiry, engagement, and enhancement and relates to the "Intellectual & Practical Skills" Essential Learning Outcomes (ELOs).
    a. Student Inquiry: Together, we created a student assignment with built in assessment of student understanding of elements related to these specific ELOs: inquiry and analysis, critical and creative thinking, written communication, teamwork, and quantitative and information literacy.
    b. Student Engagement: Through the student assignment, students will apply intellectual and practical skills in the evaluation of peer research at the March 2013 Undergraduate Research Day.
    c. Student Enhancement. Through student engagement in problem solving around peer research evaluation, students may enhance their intellectual and practical skills. Consistent with LEAP principles of excellence, students will apply in-class learning to complex issues outside the classroom and learn inquiry and innovation. By connecting a class assignment to the university's research day, the assignment self-consciously fosters the principle of inclusive excellence.
- **Creation of a Program Learning Goal Assessment Tool**: This assignment described above will also serve as a regular assessment tool for our own department learning outcomes which include those listed above as well.
- **Implement the Assignment/Assessment Tool**: Students were to complete the assignment via attendance to the Undergraduate Research Day on campus.
- **Data Scoring**: We will each compile and score data for our course and program learning outcomes related to this ELO. By scoring these assignments, we hoped to measure the extent to which the assignment was facilitating ELOs, as well as provide a common language to discuss quantitative learning across the disciplines.

This assignment was administered across seven sections (two statistics and five methods courses) and four academic disciplines (Mathematics, Sociology, Political Science, Psychology). In all, 153 students completed the assignment. Given that each of our courses stress different points of emphasis, data were scored using course-specific rubrics. In addition to completing the assignment, we also observed our students engaged in interdisciplinary cross-talk with their peers, suggesting that beyond the quantitative indicators of ELO achievement, the assignment was also facilitating intellectual curiosity and significant learning beyond the classroom.

The evidence indicates that this experience was successful. Students appreciated seeing their fellow peers' work, and enjoyed evaluating the projects from outside disciplines as well. For many, the assignment had the unintended consequence of "convincing" students of the importance of statistics. Students were able to see the "utility" of statistics, insofar as it enabled them to critique work in fields ranging from biology to communication to chemistry. In addition, they enjoyed observing peer work outside the discipline. By participating in Undergraduate Research Day, our students got exposure to student work in art, music, and theatre. For many, this was their first exposure to this type of student-produced work. In sum, anytime a political science student in statistics courses is asked to critique undergraduate research in biology and in the course of doing so is able to observe artistic compositions, you have a recipe for interdisciplinary engagement, enhancement, and inquiry. "Only connect," indeed.

Most importantly, though this assignment and the discussions that followed, we were able to identify common barriers to student learning, and discuss strategies to overcome these barriers. For example, we all encountered the problem to "lexical ambiguity" in student work, whereby students employ colloquial usage of a term (like "significant" or "error") rather than its technical definition. By identifying this (and other) common problem area across all our scoring rubrics, we have been able to have productive conservations about to improve stuent learning.

1) **Explain your action plan for the 2013-2014 academic year (August 2013 through May 2014):**

    a) **What are the GOALS that you want to achieve with your plan by the end of Spring 2014?**

We intend to: i) Improve our assignment by making the expectations more precise and making it more amenable to the development of an interdisciplinary scoring rubric. ii) Work to "institutionalize" the practice of interdisciplinary student learning at UW-Whitewater by implementing the assignment again. iii) Finally, we will use the assignment as a devise to have a broader conversation about teaching statistics at UW-Whitewater. We hope to engage faculty and students from other fields and build interdisciplinary relationships. Questions we will discuss and address include the following: What should statistics look like at UWW structurally? What depth of conceptual understanding is expected for UWW students (specific ELOs)? How do we best leverage interdisciplinary resources? Is it possible to build in assessment of non-cognitive skills such as interest, motivation, open-mindedness?

    b) **List and describe the ACTIONS you'll take to achieve these goals, including a TIMELINE for the actions.**

Beginning in August 2013, we will review assessment data from the previous semester, with an eye toward improving the assignment the best practices for teaching quantitative literacy. We will also share our findings with the statistics community at UW-Whitewater to broaden the

reach of the project and obtain feedback. We intend to engage students in this process, asking about how the assignment might help facilitate their own learning, and what we might do differently. These recommendations will be used to revise our approach to statistics instruction.

c) Discuss what you NEED to achieve the goals, e.g., resources, time, efforts, additional learning.

We will spend several hours of time to meet, refine the assignment/assessment tool. We may also need resources to facilitate a broader meeting amongst faculty and students in the UW-Whitewater statistics community.

d) Also discuss the BARRIERS or DIFFICULTIES you will need to overcome.

First, there are ongoing scheduling issues with implementing this assignment on Undergraduate Research Day. Many students have scheduling conflicts and so it will be important to develop "alternative" projects that still have interdisciplinary value. In addition, many semesters Undergraduate Research Day is quite early in the semester, and students will not have had sufficient instruction to adequately critique others' work. Finally, despite commonalities between our disciples and our approach to statistics, each discipline still has its own conventions and points of emphasis. While we have made great strides, we need to continue to work to apply a common framework. It is in this respect that LEAP is perhaps most valuable, providing a common language to help us understand ways in which to best leverage our points of intersection.

Appendix

Undergraduate Research Critique [updated 02/2013]

Objectives:

(1) To familiarize yourself from beginning to end with one completed undergraduate research project.
(2) To critically evaluate the project in various aspects including sampling, variables, hypothesis, levels of measurement, statistical models, and conclusions.
(3) To gain an understanding of how common statistical and methodology principles apply across disciplines.

Steps:

(1) Attend the Spring 2013 Undergraduate Research Day (March 13 from 12:00pm to 3:00pm in the Hamilton Center).

(2) Identify one quantitative research project that is complete and fill in the following:
    a. Student researcher name:
    b. Department of student:
    c. Email of the student:
    d. Title of the project:
    e. Mentor name:
    f. Department of mentor:
(3) Study that research poster and speak with the student researcher to answer the questions below:
    a. Which method of sampling was used and what is the sample size?
    b. What are the theoretical constructs, and how were they operationalized? Be sure to identify the dependent variable(s) of interest and all key independent variables.
    c. What is the unit of analysis for each, and what is the level of measurement (i.e., nominal, ordinal, interval, or ratio) for each?
    d. What is the main hypothesis?
    e. Which statistical model(s) was(were) used?
    f. What conclusion does the researcher come to?
(4) On your own, write up a critical evaluation of that research project addressing the following aspects while explaining your answer:
    a. Consider the sampling method chosen. Is there another more appropriate sampling method the researcher may have used? Is the sample size large enough?
    b. Assess the constructs. Would you conclude that variables were **reliably** measured? Are they **valid** representations of the underlying constructs?
    c. Consider the hypothesis. Are there any logical errors (e.g., tautology, ecological fallacy, reductionism, teleology, spuriousness) inherent in it? If there is more than one hypothesis, discuss all.
    d. Given your understanding of the variables' measures, did the researcher use the appropriate statistical model? If not, which statistic may have been more appropriate?
    e. Is the researcher's final conclusion solid? What else might the researcher included or discussed?