An Undergraduate Course in Statistical Consulting and Communication

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Winona State University (WSU) is primarily an undergraduate university with approximately 8,000 students.

WSU Statistical Consulting Center was created in 2007 in order to:
- Coordinate statistical consulting efforts on campus
- Address substantial increase in demand for assistance with undergraduate research projects

Purpose of the Consulting Center:
- Enhance research
- Promote collaboration
- Educate both faculty and students
Each academic year, the Center is managed by a faculty member who also teaches the course during the fall.

In the fall, projects are completed by students in the course.

Students are hired to staff the center in the spring.
Motivation for our Statistical Consulting Course

• Helps us meet consulting needs on campus
  — Provides training in statistical consulting
  — Prepares students to staff the consulting center

• Well-aligned with the ASA-endorsed curriculum guidelines for undergraduate statistics programs which call us to
  — Emphasize real data and authentic applications
  — Encourage synthesis of theory, methods, and applications
  — Offer frequent opportunities to develop communication skills

• Addresses Higgins’ call (1999) to “give greater prominence to the important, nonmathematical things we do as statisticians”
  — Develops skills in oral communication, written communication, collaboration, and teamwork
Overview of our Statistical Consulting Course

Who are the students?

- Class size is usually about 10 students
- Most students are statistics majors

What are the prerequisites?

- Any introductory statistics course
- Completion of either a regression or design course

What are the learning outcomes?

- The course enhances a student’s ability to communicate with both clients and other statisticians
- Students learn the skills required of a successful consultant and also become aware of issues statisticians encounter when consulting
- Students gain experience in analyzing data and writing summary reports
The First Six Weeks – Course Content

Discuss the process of consulting

- Students become aware of client expectations and the role of a consultant
- Students learn qualities of an effective consultant
- Students learn how to ask good questions and refine their listening skills

Participate in mock consulting sessions

- Students practice with mock clients and receive feedback from this client, the instructor, and their peers
- Mock clients are typically past clients, other instructors, or myself
The First Six Weeks – Course Assignments

Write reflections on relevant reading assignments

- Selected readings from *Statistical Consulting*... by Janice Derr
- “Ethical Guidelines for Statistical Practice” from the ASA
- “The Impertinent Questioner...” by Willliam Lurie
- “Some General Remarks on Consulting ...” by Cuthbert Daniel
- “The Practice of Statistics...” by William G. Hunter

Interact with experienced statistical consultants

- Students interview experienced statistical consultants
- If possible, students observe consulting sessions

Analyze data, write summaries, and present to mock clients

- Mock projects give a brief review of common statistical techniques
- Feedback is essential!
The First Six Weeks – Examples of Mock Projects

Analysis of Survey Data

- Client provides the raw data sheets and a list of research questions the students must address
- Students review a variety of statistical methods in the analysis

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The First Six Weeks – Examples of Mock Projects

Analysis of Pre-Post Data on Glucose Levels

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• Students are forced to deal with an unethical request
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Course Content for the Remainder of the Semester

Interact with actual clients (with client permission)

- Internal clients have been from the Department of Biology, Nursing, Business Administration, and Social Work
- External clients have included the Minnesota Academy of the Sciences and the Minnesota Deputy Registrar’s Association
- Clients meet with students during class time, if possible

Analyze data, write summaries, and present to clients

- Projects are assigned to a team of 2-3 students
- Class time is devoted to meeting with clients, discussing projects, and working on projects
- Students choose appropriate methods for analyzing the data and provide both a written report and an oral presentation of the results to the instructor, their peers, and the client
Examples of Projects Encountered by our Students

Client: Department of Nursing
Objective: Measure the effect of an intervention

Outcomes:
• The client did a preliminary analysis by converting the 5-point Likert scale outcomes to numeric values so that differences could be computed
• A student consultant investigated alternatives to this naïve approach
• A table was used to contrast pre/post outcomes using the original scales
• Bowker’s test, a test of symmetry, was used to confirm the effect of the intervention
Examples of Projects Encountered by our Students

Client: Department of Biology
Objective: Examine the effect of eating pistachios on HDL

Outcomes:

• There was no evidence for a difference across treatment groups in the change in HDL
• Student conducted post hoc power analysis and discussed this with the client
Student Evaluations of the Course

Responses to “which word best describes your overall evaluation of the course?”

• Results collected over three semesters from two different instructors

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Students have commented that they enjoyed

• “doing stuff that mattered”
• ”the application of statistics to help others”
• “seeing how other people need and use statistics”
• “figuring out what to do with actual raw data”
• “implementing skills attained in other classes”
• “learning what tests to use where”
• “getting experience that is similar to the kind of work I’ll be doing after school”
Some Challenges We Face

Project Management

- Demand for statistical consulting fluctuates
- A solution for having too few projects is to solicit a list of suitable projects from clients in advance

Background Knowledge

- Some projects require advanced techniques (e.g., multivariate analyses or logistic regression) that must be taught to students
- A potential solution is to assign these projects to students with a background in these courses (or to exceptional learners)
Advantages of our Consulting Course

Positive Impact on our Curriculum

• Course is well-aligned with ASA-endorsed guidelines for undergraduate programs in statistics

Positive Impact on Students

• Students leave with improved skills in data analysis and communication
• Exceptional students leave ready to work in our consulting center and gain unparalleled experience as undergraduates
References

My contact information

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