

## CASE STUDY RESEARCH U STATISTICS COURSE

A large research university wants to redesign its introductory statistics course. The course has an annual enrollment of about 2,200 students and is taught in the fall and spring semesters (960 students each) and in the summer session (280 students). Students from a wide range of majors take this course.

In the current format, students attend three lectures and two recitation meetings per week. Four experienced, full-time faculty lecture to groups of about 240 students. Twelve graduate teaching assistants (GTAs) each lead two recitation sections of about 40 students each that meet twice a week. GTAs also hold office hours and grade exams. The traditional structure is labor-intensive, creating resource problems for the department. More importantly, the traditional structure is not as effective academically as it could be.

The learning goals for the statistics course require students to:

- understand and apply basic concepts of statistics (e.g., variables, inferences, probability);
- participate actively in data analysis and design;
- critically evaluate reports containing statistical analyses of surveys and experiments; and,
- actively engage with course materials and other students.

The course faces four specific academic problems::

1. The current format does not address the broad range of differences in student learning styles and quantitative skills. Students with weak skills need more individual attention and more opportunity for group collaboration, while students with strong skills would benefit from having more opportunity to explore the material more fully.
2. The lecture format does not encourage active participation. It is difficult for students to ask questions, discuss the material, or collaborate with other students. There is not enough hands-on experience with data analysis and collection.
3. Personnel costs are high. The current structure requires twelve GTAs each semester. It is difficult for the department to identify, much less allot, this many qualified assistants for this course. Most graduate students in statistics have

undergraduate degrees in mathematics or a scientific discipline, limiting the effectiveness of the statistics instruction they can provide.

4. The course does not provide tutoring assistance for students. GTAs working with a particular faculty member have only two or three office hours for students within their own recitation section, so students receive little individual attention.

There is need for change in the traditional learning environment to enable students with a variety of learning styles to engage in classroom discussion, collaborate with fellow students, and participate in one-to-one interchange with trained instructors. The learning goals for the redesigned course will require the following pedagogic improvements to the course:

- Make students comfortable with performing real-data analysis and interpretation using computer calculations so that they can focus on interpreting the results.
- Give students a feel for which statistical tests are appropriate to apply in a given situation by matching statistical procedures to the underlying problem to be solved.
- Give students the ability to communicate their interpretation of the results to others (especially to those not trained in statistics) and emphasize teamwork; instill in students the importance of making the work intelligible; and help students to understand that communicating effectively is just as important as performing the analysis.
- De-emphasize the statistical theory that is not connected fully to the data analysis, and change the topic coverage for more appropriate sequencing and inclusion of topics that are relevant to other disciplines.
- Adopt a uniform presentation of content, and cater to the varied learning styles of students by presenting content in multiple modes; decrease TAs' idiosyncratic presentation of content, and have some redundancy with both face-to-face and online presentation.

### **Summary of the Current Course Structure**

Four professors each teach one large section of about 240 students with the following responsibilities:

- Deliver three lectures per week
- Hold two office hours per week
- Create examinations
- Supervise GTAs

Twelve GTAs assist in teaching with the following responsibilities:

- Attend lectures
- Hold four one-hour recitations per week (each student attends two per week)
- Hold two to three office hours per week
- Grade exercises and examinations