FOSTERING DEEP STATISTICAL LEARNING USING DIVERSITY CONTENT: THE "STATISTICS OF SEXUAL ORIENTATION" COURSE

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This course is the first of its kind, and to this day it remains unique. It was developed in 2004 after the realization that all the questions people ask in the public debates surrounding LGBT rights are (Is homosexuality genetic or learned? Are LGBT couples good parents? How many people are LGBT? Can you change your sexual orientation? And so on) are in fact statistical questions—they involve gathering data from a sample, measuring relevant variables, drawing a conclusion from the sample, and generalizing to a larger population to the extent possible. Based on this realization, my hope was that the diversity content and the statistical tools would act synergistically and stimulate deeper leaning in both areas. Statistical knowledge would enable students to take informed positions on important societal debates, and real life applications would demonstrate the power of statistics.

The course is shaped by the following learning outcomes:

1. List and discuss statistical and foundational issues that impact research on LGBT topics.
2. Discuss features and limitations of various sampling procedures and research methodologies.
3. Perform simple calculations and statistical analysis.
4. Represent simple data in the appropriate graphical form.
5. Interpret statistical output in terms of the original research question.
6. Do library research using print and online resources as appropriate.
7. Evaluate the content of research and popular press articles, and websites by combining all the previous skills.
8. Draw informed conclusions that reflect an understanding of multiple (and sometimes conflicting) sources of information.
9. Communicate orally and in writing your knowledge, thoughts and positions about scientific LGBT issues.

In order to achieve the objectives, the course asks some fundamental questions connected to statistical concepts. The question "Who is gay?" introduces the issue of operational definitions of statistical variables and how these definitions affect numbers and results. The question "How do we find a representative sample of LGBT folks?" brings up sampling, the realization that a simple random sample of LGBT people is next to impossible, and pros and cons of other sampling schemes. The question of prevalence, "How many people are LGBT?" introduces the issue of estimation, error, and systematic bias and properties of estimators. The questions "Is homosexuality normal? Is it a choice? Is it changeable?" introduce hypothesis testing as gathering evidence in favor of competing explanations (e.g., nature vs. nurture).

In addition, the course relies on classroom activities to stimulate student engagement. In addition to providing rich data to mine throughout the course, a minimal group exercise based on an adaptation of the popular 'blue eye/brown eye' activity demonstrates a quantifiable level of prejudice in the students and sets the tone for what's at stake in the course. A "gaydar" activity asks students to guess the sexual orientation of many men based on their headshots, creates an enjoyable moment in class, and serves as the foundation for a discussion on classification and a demonstration of the χ^2 test. The LGBT version of the Implicit Association Test from Harvard University sets the stage for questions of Reliability and Validity. Exploration of the site CommercialCloset.org reinforces the concept of operational definitions. An annotated reference list for these activities and more will be provided in the session.

Because of the dual content, assessments in the course have to be varied. Mastery of the statistical tools is promoted through traditional problem sets. Reflection and integration of the dual

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emphases in the course is achieved through class discussions and weekly journaling. The application of statistical concepts in real life applications is focused by several paper analyses, where students read papers with controversial claims (e.g., that gay people recruit, that bisexuals lie, that gay men die at 40, that children of LGBT couples suffer, that homosexuality is caused by incest, or by the mother's stress during pregnancy) and use the tools they learned in class to understand their flaws. An end of semester literature review and oral presentation (an extended paper analysis over multiple papers covering an issue) requires students to look at an LGBT issue of their choice not addressed in class, review different perspectives, and take a side based on the most compelling statistical evidence. Concept maps at the beginning and the end of the course reveal how the students' mental models expand through the course. Evidence from these assessments, including student quotes, will be supplied in the session, in order to document the learning that occurs.

The learning I have been able to document in the course can be grouped in 3 categories. First, there is the statistical learning. Students do make progress in their understanding and ability to apply key statistical tools, such as typical statistical tests.

In addition, students progress in their intellectual and epistemological development. As first year students, most enter the course with a black and white mentality, without room for uncertainty or ambiguity in their thinking. They move to positions where they start realizing people have such different perspectives that knowledge is really a matter of opinions and nobody can really be right or wrong, and looking for the truth is hopeless. Most of them arrive to an understanding of rules of evidence, logical, statistical and scientific, by which competing opinions and perspectives can be evaluated against each other.

Finally, student progress in their diversity and leadership skills. By the end, many of them show evidence of the ability to empathize with unfamiliar perspectives. They also show evidence of critical self-analysis for the stereotypes they harbor, and efforts to abandon them. Some of them show leadership in educating others about the things they learned in class and asking the to stop disrespectful and exclusionary behaviors and attitudes.

In conclusion, my hunch proved true. Controversial examples do indeed motivate students to engage in deeper learning. Conversely, robust statistical reasoning helps students embrace the complexity of important societal debates without settling for simplistic answers.