Passion-Driven Statistics: A data-driven, multidisciplinary curriculum providing access to the data analytics economy through project-based learning

Wesleyan University

Kristin R. Flaming, Lisa Dierker and Jennifer Rose

Introduction

- A central challenge of introductory statistics courses is the development of a curriculum that not only serves diverse students, but also sparks communication, reasoning, and collaboration that crosses disciplines and cultures.
- Inquiry-based projects may be the best way to achieve this by allowing students to, “decompose their topic, identify key components; abstract and formulate different strategies for addressing their research question; connect the original question to the statistical framework; choose and apply methods; reconcile the limitations of the solution; and communicate findings” (Nolan & Temple Lang, 2009).

Course Design

- In our flipped, project-based classroom, the majority of each session is devoted to students actively working on their analyses and thinking about their data.
- In the first week, students develop their own research question after an introduction to a number of large data sets representing different disciplines. The students’ research questions evolve as they continue through the course and apply newly learned statistical techniques.
- All statistical analyses are done within the context of the students’ research question culminating with a poster presentation.

Results

- In previously published work, we have demonstrated that the project-based course enrolls higher rates of under-represented minority (URM) students compared to a traditional introductory statistics course (Dierker et al., 2015).
- Further, because of our focus on programming in the context of data analysis (i.e. R, SAS, Stata, Python, etc.), we have compared enrollment in the project-based course to traditional introductory programming experiences, revealing higher rates of female and URM enrollment compared to both a general introductory programming course and an introductory course representing a gateway to the computer science major (Dierker et al., 2017).

- When compared to a traditional math-statistics course, students completing the project-based course were more likely to report an increase in confidence between the pre- and post-survey with regard to choosing the correct statistical test, managing data and writing code to run statistical analyses. Project-based students were also more likely to show an increase in interest in pursuing advanced course work in statistics (Dierker et al., 2018).
- We also compared experiences of under-represented(URM) and non-underrepresented students in 4 years of the course. While URM students considered the material more difficult than non-URM students, URM students demonstrated similar levels of increased confidence in applied skills and interest in follow-up courses as non-URM students (Dierker et al., 2016).
- URM students were found to be twice as likely as non-URM students to report that their interest in conducting research increased.

Resources

ANOVA

SPSS	**UNIANOVA** QuantResponseVar **BY** CategExplanatoryVar**.**
STATA	**oneway** QuantResponseVar CategExplanatoryVar**, tabulate**
SAS	**proc anova;** **class** CategExplanatoryVar**;** **model** QuantResponseVar **=** CategExplanatoryVar**;** **means** CategExplanatoryVar**;**
R	myAnovaResults **<- aov(**QuantResponseVar **~** CategExplanatoryVar**, data =** myData**)** **summary(**myAnovaResults**)**

- Public website linked in the above QR code.
- Translation code, as shown above, linked at **http://bit.ly/PDSTranslationCode**
- Videos integrating content, demonstrations and interpretation at **http://bit.ly/PDSe-book** (R, SAS, SPSS, Python and Stata).

Discussion

- Traditional classroom settings place the burden of effort on the instructor – thus, class sizes must remain small in order for students to receive adequate support and direction. Many schools and universities lack the staffing to provide such instruction to a large student body and must rely on the large general lecture.
- This program, however, leverages faculty, technology, and peer-to-peer learning to enable larger class sizes without losing individual support and attention.
- The model has been implemented successfully by numerous high schools, colleges, and universities.
- The model has also been adapted to reach a worldwide audience as a Massive Open Online series of courses available through Coursera (for more information see https://www.coursera.org/specializations/data-analysis).
- We are always eager to identify new implementation partners.

Funding

U.S. National Science Foundation (#1820766)

Improving Undergraduate STEM Education (IUSE)

REFERENCES: