

CS-6460

FINAL

PRESENTATION

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WHO AM I?

Jeffery Painter, Sr. Director, Safety Innovation and Analytics, Quantitative leader for Global Safety at GSK. 15+ years in drug safety and statistical genetics. Background in software development, math and statistics. BS in computer science, applied math (NCSU), JD (NCCU School of Law).

This is my 6th course in the OMSCS program.



AGENDA

- Introduction
- Project background
- Related research
- Project demo
- Future direction

INTRODUCTION

Project:

R Shiny Web Applications for Teaching High School Statistics

Team Member: Jeffery Painter – jpainter32@gatech.edu

Project Track: Hybrid Content/Development Track

Final Deliverable:

To create both the content and application in R Shiny to teach a lesson on Power Calculation and Type I, Type II Error for a high school statistics student in the AP Statistics Curriculum: A data exploration task



PROJECT BACKGROUND

Create an R Shiny Web Application that will enable high school level students to perform a self-directed data exploration to learn the concepts of Power calculation and Type I, Type II error

THE PROBLEM

- “Nearly 70 percent of the workforce would be expected to use data heavily in their work by 2025” (Pothier and Condon, 2023)
- Teaching high school statistics faces many challenges
 - Online tools for interactive simulations are mostly focused on college level students
 - Lots of calculator type tools, but few student driven online data investigation applications with simulations (Dinov, Sanchez, and Christou, 2008) (Keengwe, Kidd, et al., 2010)
- Studies have shown that students who are able to use interactive simulations gain a better understanding of statistical concepts than those who do not (Gelman and Glickman, 2000)
- Project Goal:
 - Build an interactive, R Shiny web application framework that fully enables educators to deploy R Shiny applications to high school students. A case study exploring the concepts of Power calculation, Type I and Type II error will demonstrate the framework capabilities.

WHAT IS R SHINY?

- R, is a programming language and open-source software environment primarily used for statistical computing and data analysis.
- Shiny is an R package (software library) that allows developers to create interactive web applications using the R programming language. These web applications are designed to be user-friendly and provide a graphical user interface (GUI) that allows users to interact with data and visualizations without needing to write R code. Shiny apps can be used for a wide range of purposes, including data visualization, statistical analysis, educational tools, and more.
- R Shiny applications can be run locally on any computer with R installed, or they may be hosted on a public web site using the R Shiny server.
- Learn more about R Shiny by visiting: <https://shiny.posit.co/>

PROJECT DESCRIPTION

- This project has developed a framework to support building R Shiny application which are not available out of the box including the following:
 - User authentication
 - Allow creation of new admins, teachers and students
 - Course Management
 - Teachers can create new course sections and assign new students
 - Data storage
 - Support the collection and reporting of student assessments
 - Access control layer
 - Supports admin, teacher and student level access

LESSON PLAN



- **Lesson Title:** Maximizing Chicken Size: The Power of Quality Feed
- **Grade Level:** High School
- **Duration:** 60 minutes
- **Objective:**
 - Students will understand the concept of statistical power and its role in making informed decisions.
 - Students will apply statistical power analysis to help a farmer decide if investing in more expensive chicken feed is worthwhile for marketing larger chickens.
- **Problem Scenario (10 minutes)**
 - Present the scenario: "Billy the farmer wants to sell the biggest chickens in town to high-end farm-to-table restaurants. To achieve this, he is considering investing in more expensive chicken feed."
 - Discuss with students what factors they believe might affect chicken size (e.g., diet, genetics, environment).
- **Interactive Activity - Part 2: Statistical Power Analysis (30 minutes)**
 - Provide students with a R Shiny application to explore raw data containing the growth of chickens fed with regular versus expensive chicken feed.
 - Instruct student to investigate the data by:
 - Visualize / graph distribution of chicken weight by feed
 - Selecting an appropriate significance level (alpha) and effect size.
 - Calculate the necessary sample size to achieve a desired level of statistical power (e.g., 0.80).
 - Perform power calculations using statistical analysis software.
 - Students will use interactive power calculator to explore the effects of sample size, choice of alpha and effect size.

PROJECT DEMO

- The project can be accessed via the following link:
 - <https://shiny.mathisawesome.com/app/cs6460>
- You can login as one of the following user roles:
 - Admin access - username: admin, password: admin
 - Teacher access – username: craig, password: pass
 - Student access – username: student1, password: pass
- If any of the above passwords are no longer working, you can click the “Reset Database” button and wait 5 seconds while the database is reset to its original state.

FUTURE DIRECTIONS

- Future work could focus on improving teacher's ability to dynamically add new assessment questions
- Allow students to be registered to more than one learning module
- Create a super-admin dashboard to see performance across instructors



THANK YOU

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