

# Peer Development of Apps for Teaching: Benefits to Undergraduate Research and to Active Learning

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# The Undergraduate Research Program

- Stat majors with 3.0+ GPA and familiarity with R
- Participate in USCOTS Shiny App Workshop
- 9-week 40 hr/week summer program
  - 2.5 hour student-run group meetings 3 times per week
  - 2 person teams assigned to each of 5 “chapters”
  - Multiple faculty advisors
- Fall semester group studies education research course
  - Refine apps based on group feedback
  - Some apps tested in intro courses

# P<sup>5</sup> Features

**P**rocess (feature the modeling of processes)

**P**robability (feature variability)

**P**resentation (feature visualizations)

**P**roblem (feature context where possible)

**P**edagogy (feature exploration to complete challenges,  
& provide feedback)

# The Apps

- Data Gathering
  - Variable types matching game
  - Bias versus reliability exploration
  - Weighting survey responses
  - Activity on Random versus Haphazard assignment
  - Issues in biased wording
  - Survey designs
- Data Description
  - Location/variation challenges
  - Regression line challenges
  - Effect of outliers on summary statistics
  - Correlation guessing (with and without outliers)
  - Six level descriptive statistics game

# The Apps

- Probability
  - Modeling with Venn Diagrams
  - Law of Large Numbers
  - Central Limit Theorem
- Estimation and Testing
  - Confidence intervals for means (single and difference)
  - Confidence intervals for proportions (single and difference)
  - Tests for proportions
  - Significance Testing Caveats
  - Power and the distribution of p-values
  - BINGO style Testing Game
  - Relationship Between Tests and Intervals

# The Apps

- Other Topics
  - ANOVA
  - The value of log transformations
  - Overfitting
  - Simpson's Paradox
  - Chi-Squared Goodness-of-fit

# Some Results

Agreement with “Effective way to learn”

SA/A	Neutral	D/SD	
66%	22%	12%	
57%	26%	17%	n = 82
59%	28%	12%	

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67%	22%	11%	
78%	11%	11%	n = 9
100%	0%	0%	

# Next Steps

- Stricter adherence to development pipeline
- More content targeted at upper division courses
- Building website to facilitate consistency
- Instructor resources & better links to learning objectives
- More feedback to users
- Watch our progress at  
<http://shinyapps.science.psu.edu>
- Email to [dkp13@psu.edu](mailto:dkp13@psu.edu)