

Just-In-Time Support for Elementary Statistics

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Webinar Overview

- Our plan at CSUF
- Learning outcomes, week-by-week curriculum, plan for assessment
- Example PowerPoint slides and course notes
- Using Rguroo software for class activities

Who Takes Introductory Statistics at CSUF?

- Non-STEM students needing to fulfill GE Category B.4
- Primarily undeclared, social science and health science majors
- Many of our students are from psychology and nursing
- We do not know how the course demographics will change with EO 1110

Course Structure at CSUF

- Math 120: Introductory Statistics (3 units)
- Math 20S: Support for Introductory Statistics (1 unit)
- Treated as a single 4-unit class: Math 20S provides just-in-time instruction immediately before Math 120
- Piloting Math 120 + 20S in Summer 2018
- Offer redesigned Math 120 with and without 20S in Fall 2018

Poll Question: Software-Based Activities

Where will students primarily encounter software-based activities in your course?

- a) Not using software activities at all
- b) Integrated with the main lecture class
- c) Separate lab or discussion component
- d) Homework and/or projects

Poll Question: Simulation Activities

Do you or your faculty use simulation in teaching your introductory statistics courses?

- a) Yes
- b) No, but we plan to use it
- c) No, but we are interested in learning about it
- d) No, and we don't intend to use it

Learning Outcomes

- Developed to reflect GAISE (2016) Guidelines for Introductory Statistics
- Apply the statistical process to investigating real-world problems
- Interpret numerical/graphical summaries, and results of inference, to answer a real-world question
- Create numerical/graphical summaries, and perform statistical inference, using statistical software
- Understand the concepts of variability and randomness in context of statistics

Week 1: The Statistical Process

- Case studies
- Introduction to terminology and software
 - Corequisite activity: icebreaker to get used to group work
 - Computer component: entering and editing data in software

Weeks 2-3: Types of Statistical Studies

- Observational studies, surveys, and experiments
 - Content co-requisite topic: understanding predictor-response relationships (input-output tables, functions, etc.)
 - Computer component: drawing random samples from intuitive populations using software

Weeks 3-4: Categorical Variables

- Frequency and relative frequency tables
- Bar charts and pie charts
 - Co-requisite topics: fractions, proportions, percentages in context of relative frequency
 - Computer component: creating and interpreting bar/pie charts, tabulation

Weeks 5-6: Numerical Variables (No Formulas)

- Ordering – rank, range, median, quartiles
- Concepts of center (median) vs. spread (range/IQR)
- Boxplots, histograms, and shape of distributions
 - Co-requisite topic: understanding ranks and percentiles
 - Computer component: creating and interpreting boxplots/histograms

Week 6: Numerical Variables (With Formulas)

- Mean and standard deviation
- Comparing measures of center/spread
 - Co-requisite topics: order of operations, formulas with multiple variables
 - Computation using formulas is de-emphasized, but students should be able to understand the formulas conceptually
- Computer component: obtaining numerical summaries using software

Weeks 7-9: Two Numerical Variables

- Scatterplots, linear vs. nonlinear relationships, and correlation
- Linear regression for a single group and for multiple groups
 - Co-requisite topics: absolute vs. relative change, average rate of change, equation of a line (slope and intercept), solving system of equations (graphically)
 - Computational formulas for correlation/least-squares line are de-emphasized
 - Computer component: creating and interpreting scatterplots (including outliers in two dimensions), obtaining least-squares line with software

Week 10: Simulation and Discrete Random Variables

- Simulation of random processes (in classroom and by computer)
- Concept of probability as a limiting value of proportion of events
 - Co-requisite activity: additional support for understanding randomness
 - Computer component: using software to create a large number of simulations and estimate probabilities

Week 11: Density Curves and Continuous Random Variables

- Concept of a density curve (uniform, triangular)
- Normal density curve
 - Co-requisite activity: additional support for understanding randomness
 - Computer component: computing areas under density curves using software

Weeks 11-12: Sampling Distributions and Central Limit Theorem

- Simulation activities to understand sampling distributions and Central Limit Theorem
 - Co-requisite activity: additional support for concepts and simulation
 - Computer content: variability of sample statistics is introduced and reinforced using simulation

Weeks 13-14: Statistical Inference Using Simulation

- Problem-solving steps in context of inference (e.g., How to Solve It)
- Confidence intervals and hypothesis tests by simulation
 - Co-requisite activities: additional support for problem-solving
 - Computer content: all inference is performed using software; students must interpret output

Weeks 14-15: Statistical Inference Using Distributions

- z, t, and chi-square based inference
 - Co-requisite activities: additional support for concepts and interpretation
 - Computer content: all inference is performed using software; students must interpret output

Plan for Student Assessment: Activities

- In-class reading quizzes and reflection assignments
- Computer-based inquiry activities
 - Group projects in class
 - Individual projects as homework
- Co-requisite content embedded in activities and exams

Plan for Student Assessment: Exams

- One in-class midterm (concepts only – no computation)
- One take-home midterm (software-based – students should be able to generate appropriate output using software and interpret it)
- Final exam (software output to be generated by student or instructor depending on availability of computers)

Poll Question: Instructor Background

What level of statistics background do the majority of introductory statistics instructors at your institution have?

- a) Proficient with both traditional (pen/pencil/calculator) and modern statistical techniques (software/simulation)
- b) Proficient with traditional, but not modern, statistical techniques
- c) Basic knowledge of statistical techniques
- d) Limited exposure to statistical techniques

Poll Question: Support Material

What support material are you planning to offer students?

- a) Publisher-provided textbook only
- b) Publisher-provided textbook and instructor-provided course notes
- c) Instructor-provided course notes only
- d) We are in the process of making a decision