Introductory Statistics Flexible Learning Project: Development and evaluation of statistics educational material

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Introduction

Introductory statistics is taught in many UBC departments. Typically, instructional resources and expertise are not shared across units, resulting in duplication of efforts or underuse of valuable material. This project brings together instructors from Science, Arts, & SPPH, to develop instructional resources that address conceptually challenging topics in introductory statistics. The goal of the project is to provide resources that are open, adaptable, consistent in look and feel, and grounded in existing research on learning and statistics, for use at UBC and beyond.

Flexible Learning Team

Science		
Statistics	**Zoology**	**Physics & Astronomy**
Eugenia Yu	Mike Whitlock	
Bruce Dunham		Doug Bonn
Melissa Lee		Joss Ives
Gaitri Yapa		
Andy Leung		
Rick White		

Medicine	Arts	Other
School of Population & Public Health	**Political Science**	**CTLT and SCLT**
Mike Marin	Fred Cutler	Gillian Gerhard
	Andrew Owen	
	Economics	Noureddine Elouazizi
	Diana Whistler	
	David Green	
	Philosophy	
	Leslie Burkholder	

Project Lead: **Nancy Heckman – Statistics**

Resources

Resource & Lead(s)	Description	Progress to date	Evaluation to date
Web Visualizations (WV) *Mike Whitlock*	Simulations (using HTML5 with JavaScript) to support visualization of abstract concepts, supporting learning wrappers	Four visualizations developed: 1. Sampling means from a Normal distribution 2. Confidence intervals of the mean 3. Central Limit Theorem 4. Chi-Square contingency test	• Beta-tested first two simulations via interviews with STAT200 (Nov 2015) and BIOL 300 students (Jan 2016) • Trialed WVs in BIOL 300, SPPH 400
Activities *Fred Cutler Andrew Owen*	Interactive engagement questions and activities to engage students & facilitate peer-instruction (in lectures/labs)	Four activities developed: 1. Understanding confidence intervals 2. Introduction to sampling distribution of the mean 3. Population variance and sampling variability 4. How likely is the sample statistic?	• Trialed first two activities in POLI SCI classes • Trialed "Understanding confidence intervals" activity in STAT200 labs
Screencasts *Mike Marin*	On-demand access to explanations of challenging concepts via 6-10 min videos	Two screencasts in development: 1. Sampling distribution of the mean 2. Confidence intervals for a single population mean	• Draft of videos vetted by FL group and MedIT
WeBWorKiR (WWR) *Bruce Dunham*	Individualized online homework questions with automatic feedback (open-source on-line HW system WeBWorK, enhanced by R functionality)	Process and training materials are being developed to support expanded use of WeBWorKiR. ECON325 questions coded in WeBWorK and used in ECON 325.	• ECON 325 questions vetted by team
Interactive Engagement (IE) Questions *Eugenia Yu*	Questions administered via Personal Response Systems (i>Clickers, etc.) to provide immediate feedback, facilitate peer-instruction	Clusters of questions developed for topics: 1. Sampling distribution of the mean 2. Confidence intervals for means 3. Hypothesis testing for means	• Sampling distribution questions piloted in ECON 325
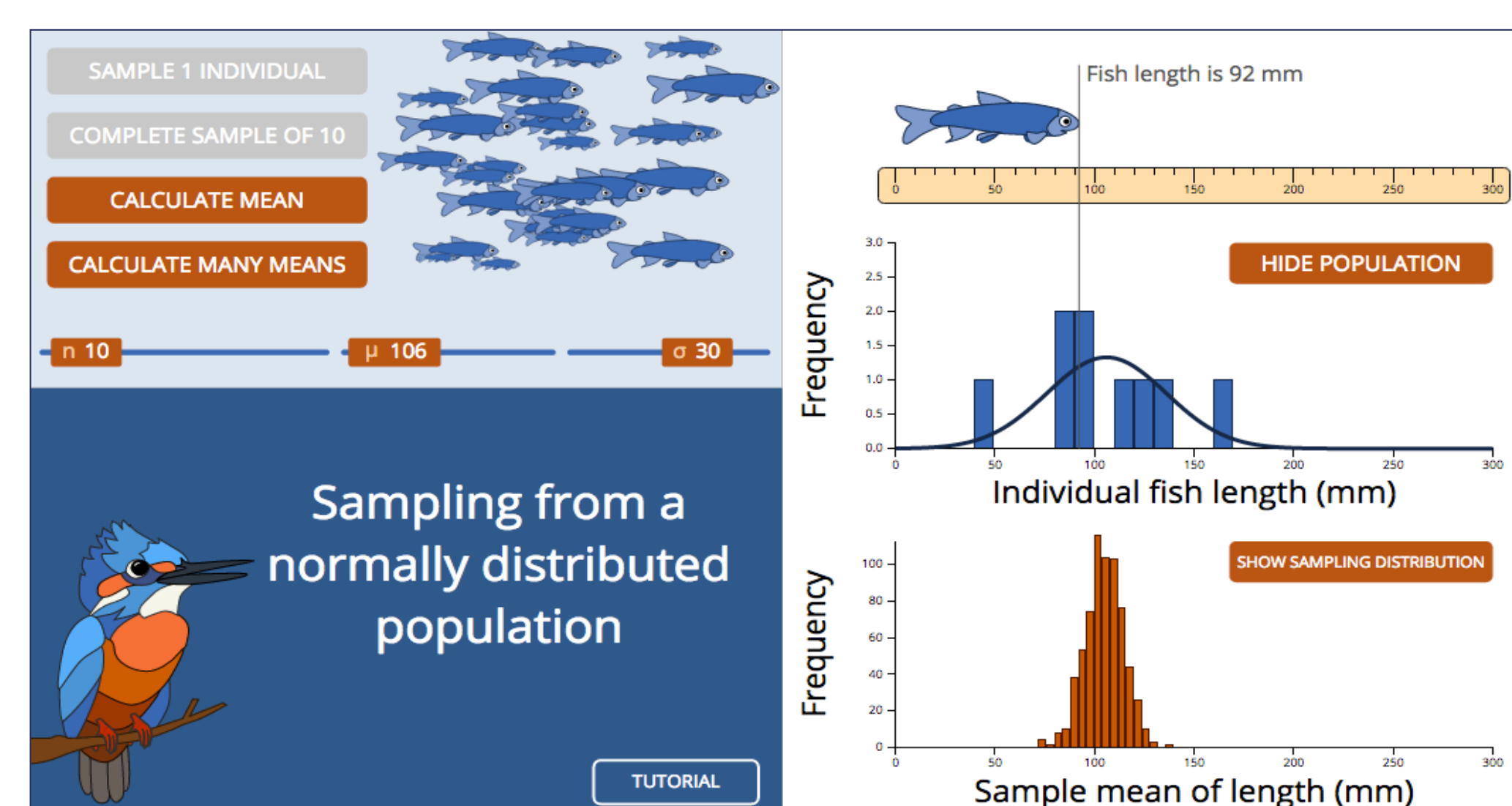
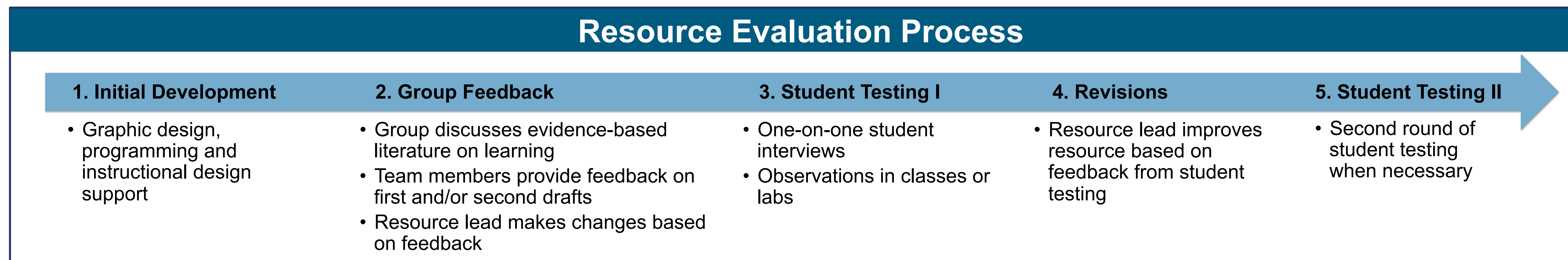Screenshot from "*Sampling means from a Normal population*" web visualization

Clicker question from "*Understanding confidence intervals*" activity

Ongoing Efforts

• Explore integrated IE questions and WWR into developed resources
• Learning wrappers to be developed for each resource, which will include lesson plans, learning outcomes and prerequisite knowledge
• Student testing of web visualizations, activities, and screencasts through focus groups, student interviews and in-class/in-lab observations in Summer and Fall 2016
• Additional topics to be decided for future resources

Special Thanks

To find out more about the resources, please contact **Nancy Heckman** (nancy@stat.ubc.ca).

Resource Evaluation Process

1. Initial Development
• Graphic design, programming and instructional design support

2. Group Feedback
• Group discusses evidence-based literature on learning
• Team members provide feedback on first and/or second drafts
• Resource lead makes changes based on feedback

3. Student Testing I
• One-on-one student interviews
• Observations in classes or labs

4. Revisions
• Resource lead improves resource based on feedback from student testing

5. Student Testing II
• Second round of student testing when necessary

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