



Hybrid Horizons: *Rethinking Introductory Statistics for Life Scientists*



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eCOTS 2024: What's Next? Moving Forward
June 10-13, 2024

WHY HYBRID?

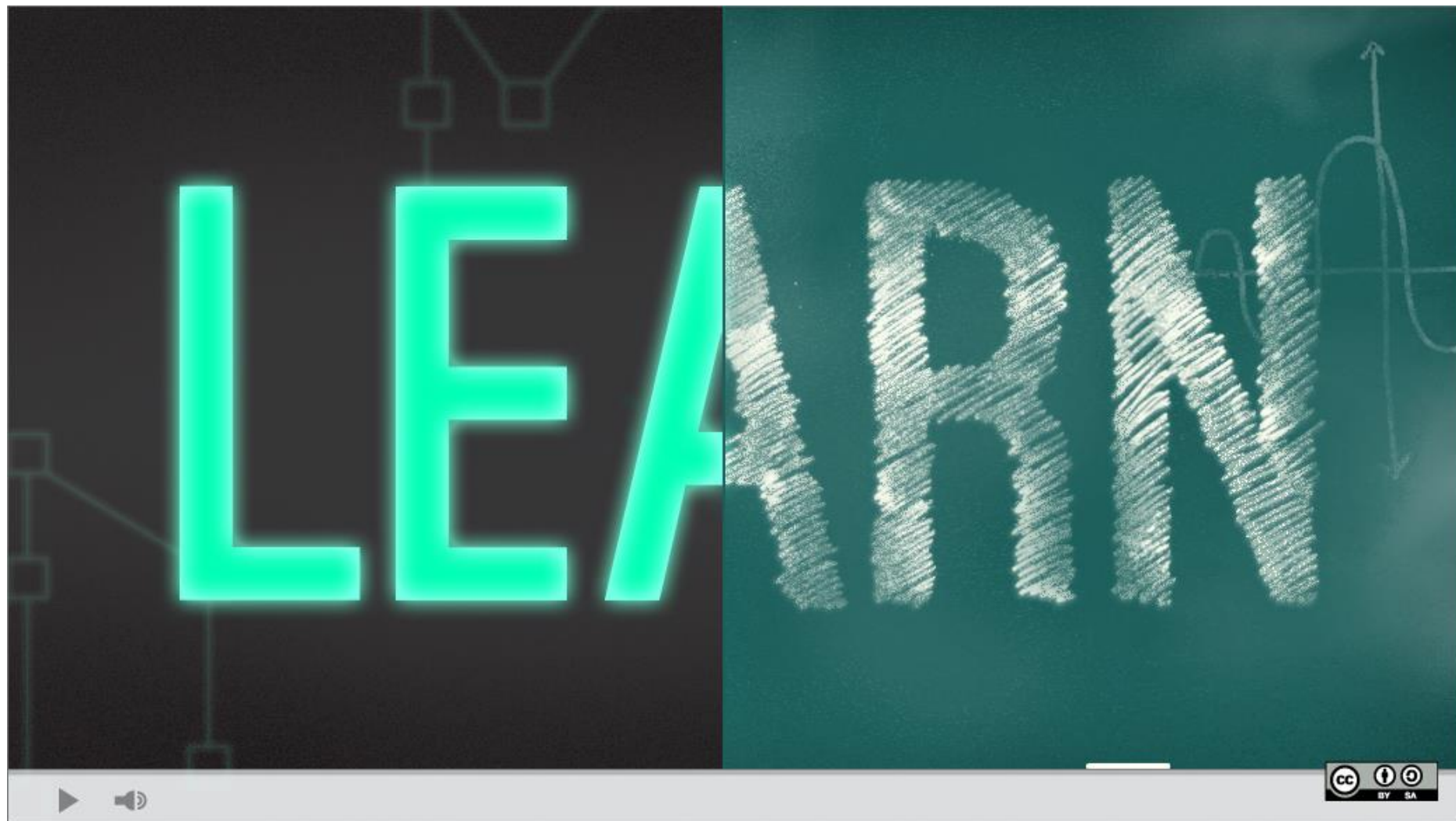


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HYBRID DEVELOPMENT PROCESS

University of Toronto Office of the Vice-Provost,
Innovations in Undergraduate Education (VPIUE)

Flexible Learning Initiative

(<https://ocw.utoronto.ca/flexible-learning-initiative-2022-23/>)

Priorities for this course:

- Create **flexible** learning experience
- Take **scholarly approach** to all pedagogical decisions
- Encourage **interaction** between students and between students and the teaching team & build **community**.
- Be mindful of **student workload!!**

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Dr. Jasty Singh, Department of Immunology

Giancarlo Di Giuseppe, PhD Candidate (Epidemiology), Dalla Lana School of Public Health

Quin Xie, PhD Candidate, Department of Medical Biophysics

Backwards Design - Wiggins & McTighe (1998 & 2005)

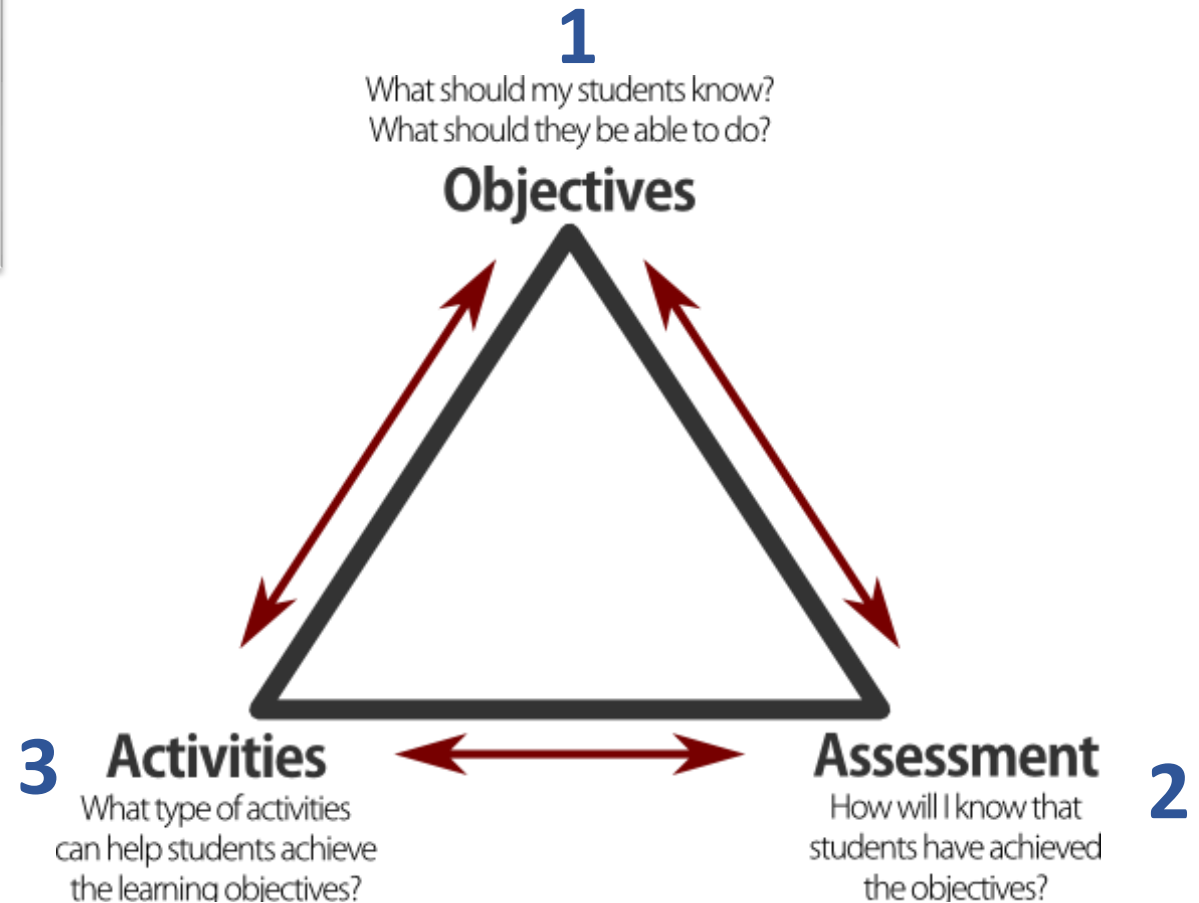
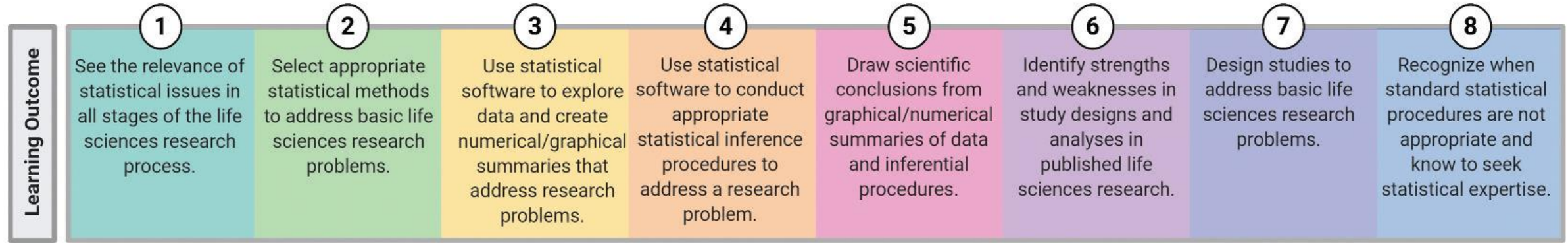


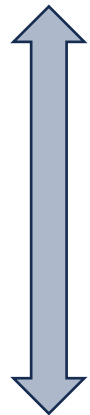
Image from the IUPUI Centre for Teaching and Learning site

<https://citl.indiana.edu/teaching-resources/course-design/backward-course-design/index.html>

LEARNING OUTCOMES & ASSESSMENTS



Formative



- Weekly quizzes (12)
- In-person class activities (7)
- Lab assignments (1+4)
- Midterm (1)
- Research project (group)
- Final exam

Summative

Assessment	Percentage of Course Grade
Completion of weekly check-in questions on Quercus	5% - 0.5% each up to a maximum of 5%
In-person class meeting participation/contributions	5% - 1% each for best 5 of 7 class meetings (excluding Lab 1-4 and midterm weeks)
Completion of Lab 0 Assignment	1%
Lab assignments	24% - 6% each for 4 lab assignments
Course project	
• Research Proposal	7%
• Research Report	18%
Midterm	15%
Final Exam	25%

LEARNING ACTIVITIES & WEEKLY FLOW

STA288H1: Statistics and Scientific Inquiry in the Life Sciences

Hours: 36L/18P

Introduction to statistics and its connection to all stages of the scientific inquiry process. Issues around data collection, analysis and interpretation are emphasized to inform study design and critical assessment of published research. Statistical software is used to conduct descriptive and inferential statistics to address basic life sciences research questions.

Statistics and Scientific Inquiry in the Life Sciences



Format	Monday-Tuesday	Wednesday-Thursday	Friday
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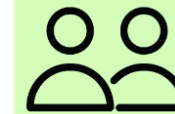
Watch **pre-recorded lecture videos** (~1.5 hours total) & complete **check-in quiz**

If applicable, submit **assignment** (noon)



Attend/participate in **class meeting** (2 hours)

Work through relevant **Learn R module(s)**, **textbook readings & practice problems**, seek support on the **discussion board** and/or **online office hours**, and do lab assignment, project, and/or midterm/exam preparation.



Meet the Instructors



Course Help & Support



Learning Activities & Resources by Week



learnr



Bulmer, M & Haladyn, JK (2011)



Syllabus

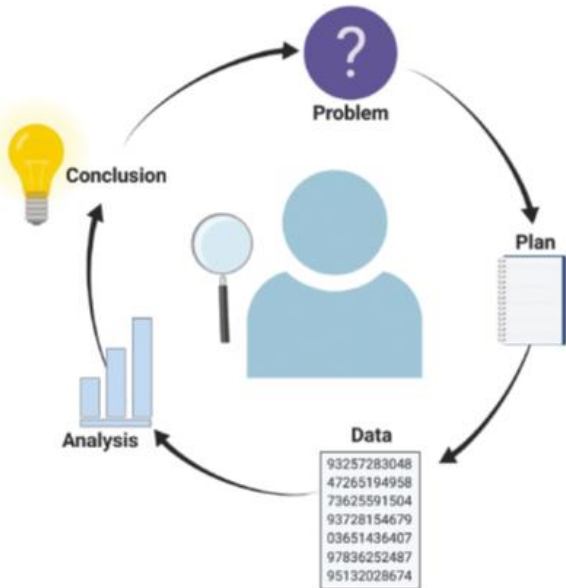


Group Project



Midterm/Exam

COURSE SCHEDULE



Week	Topic	In-person Class Meeting*	Important Dates
Jan 8-14	Course Introduction & Data Origins: Sampling and Study Design	Intro, reproducibility & study design activities, application questions about sampling and study design	Jan 8 – First day of classes
Jan 15-21	Data & Exploratory Data Analysis	Given study design, discussion about what variables to measure and how. Questions identifying potential sources of selection biases, confounding and measurement bias. Gauged previous experience with R.	Jan 21 – Last date to enrol
Jan 22-28	More Exploratory Data Analysis	Group project launch - team agreement activity & Lab 0 Q & A	Lab 0 Due
Jan 29-Feb 4	Thinking beyond the data: Estimating a population proportion (Bootstrapping)	Lab 1 Q & A	Lab 1 Due
Feb 5-11	Thinking beyond the data: Simulation-based hypothesis tests for proportions	Project proposal group peer review activity	Research Project Proposal Peer Review (in class)
Feb 12-18	Simulation-based inference on one or two means	Questions about inference - Worked through two cycles of PPDAC to estimate the proportion of research students think is reproducible (bootstrap) and to compare these across program categories (randomization test).	Research Project Proposal Due
Feb 19-25	Reading week – no class meetings or new online activities		
Feb 26-Mar 3	Inference on one proportion using mathematical models	Lab 2 Q & A	Lab 2 Due
Mar 4-10	Inference on two proportions using mathematical models	Midterm	Midterm
Mar 11-17	Inference on one and two means using mathematical models	Lab 3 Q & A	Lab 3 Due
Mar 18-24	Inference on means using one-way Analysis of Variance (ANOVA)	Discussion activity about 5% p-value threshold – should it be lowered? Questions about selecting appropriate inference procedures, strategies to increase power and precision, and identifying pseudoreplication.	
Mar 25-31	Inference on means using two-way Analysis of Variance (ANOVA)	Lab 4 Q & A	Lab 4 Due
Apr 1-7	Simple Linear Regression & Course Wrap-up	Questions about selecting appropriate inference procedures, and how they are going to engage with statistics in research beyond the course & build their quantitative skills further. Stakeholder analysis activity (ethical statistical practice).	Group Research Report due Apr 5 – last day of classes
April 10-30	Final exam period		

* Peer and class discussion, poll-everywhere questions and/or written Crowdmark assessments.



Introductory Statistics for the Life and Biomedical Sciences
Vu & Harrington (2020)



Introduction to Modern Statistics
Çetinkaya-Rundel & Hardin (2021)

<https://www.openintro.org/book/stat/>

PPDAC figure based on:
Wild & Pfannkuch (1999) &
MacKay & Oldford (2000)

STUDENT FEEDBACK*

*Open-ended questions included on Apr 1-2, 2024 check-in quiz
(n = 205 students responded = 83% response rate)*

WHAT ASPECT OF THE COURSE HELPED SUPPORT YOUR LEARNING THE MOST?

Aspect	Percent
Lab Assignments	22%
Class Meetings	17%
Support from Teaching Team	16%
Lecture Recordings	11%

Labs. They were by far the most informative. The fact that I had to understand and apply statistical procedures to a paper we read was really helpful in solidifying my understanding of the course concepts. It also forced me to understand the week's material prior to attempting the labs/during the labs.

In person lectures help me the most because we were able to review content and integrate concepts from various weeks. I liked the way that the in person classes were set up, and I found them very helping in gaining a better understanding of the material.

WHAT ASPECT OF THE COURSE COULD BE IMPROVED TO BETTER SUPPORT STUDENT LEARNING?

Aspect	Percent
R instruction	31%
Format	21%
Labs	14%
Class Meetings	11%

I felt that learning the coding was quite challenging and that it was not really touched on enough. The LearnR modules were helpful but I feel there could have been extra exercises in the in-class portions of the course to help solidify the learning.

I did not get much out of the hybrid format. In fact, virtual lecture videos were much less engaging than an in person session, even one that does not include class participation.

Returning to an in-person lecture format would help me keep up with lecture material

* Exempt from formal research ethics review since for program evaluation, quality assurance (QA), or quality improvement (QI) activity, rather than research (confirmed by University of Toronto Social Sciences, Humanities, and Education Research Ethics Board).



THANK-YOU!

Questions or Comments?



Please post a Comment in the Discussion at the bottom of <https://www.causeweb.org/cause/ecots/ecots24/program/posters/10>

- Monday, June 10th 3:35 pm – 4:25 pm ET (synchronous)
- Anytime June 10-14 (asynchronous)

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Start the discussion...

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Comment