

SIPS Hackathon: Developing resources to support teaching faculty and integrate open scholarship content into curricula

LESSON PLAN TEMPLATE:

This is a template for a lesson plan structure, so we can start turning our curated resources in the **+** **Table of activities** into full lesson plans with learning outcomes. Please either create copies of this template and upload to our [OSF project page](#) or create your own lesson plan and paste it in the [landing page](#). There's an example [here](#)

Name of the class: Interpreting effect sizes and confidence intervals		
Suitable context: (e.g., entry-level/ undergraduate/postgraduate)	Undergraduate students/possibly postgraduate	
Total time: (e.g., 1 hour, 2 hours, 1 day)	~ 1 hour	
Pre-requisites:	<ul style="list-style-type: none"> - Basic research methods knowledge - Perhaps some basic introductory statistical knowledge - If running the seminar exercise (extra), basic familiarity with R 	
Related resources (e.g. slides, assignment materials, lecture recordings, etc)	Cohen's d: https://rpsychologist.com/cohend/ Confidence intervals: https://rpsychologist.com/d3/ci/	
Learning outcomes:	<ol style="list-style-type: none"> 1. Students understand that confidence intervals are an important addition to p-value research 2. Students understand how to meaningfully interpret confidence intervals 3. Students get hands-on experience with visualization 4. Students understand the meaning of effect size and how it is calculated. 	
Time	Activity	Instructor notes
20 minutes	Introduction to effect sizes (e.g. through youtube: https://www.youtube.com/watch?v=2AKTNvVN3Dk)	Introduce the concept of effect size <ul style="list-style-type: none"> - What is effect size (measure of the magnitude of the difference)

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		<ul style="list-style-type: none"> - Introduce the difference between statistical significance and effect size (e.g., see Kirk, 1996) - Introduce common measures of effect size (such as Cohen's d)
<p>10 minutes</p>	<p>Visualize effect sizes using the shiny app for cohen's d (https://rpsychologist.com/cohend/)</p>	<p>Ask students to imagine they are doing a reading intervention study where they are comparing a treatment group (receiving the intervention to improve their reading skill) to a control group (no intervention or placebo). The two distributions show the outcome variable (e.g., standardised reading performance after intervention).</p> <p>Ask students to change the value of Cohen's d to 3 values: 0.1, 0.5, and 0.75 Ask them to think about the following questions:</p> <ul style="list-style-type: none"> - How does the difference between the two distributions change with effect size? - What does each effect size represent? - How can we interpret the effect size in terms of the research question (i.e., evaluating the effectiveness of the reading intervention?)

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<p>20 minutes</p>	<p>Introduction to confidence intervals (when to include them, how to interpret, e.g. https://www.youtube.com/watch?v=tFWsuO9f74o)</p>	<ul style="list-style-type: none"> - What are confidence intervals? (adds margin of error to the p-value) - What do confidence intervals tell you that p-values do not? (see Cummings, 2014 for an overview of the “Dance of the CIs”) - How to calculate and interpret confidence intervals (e.g. using bootstrapping)
<p>10 minutes</p>	<p>Visualize confidence intervals using the shiny app (https://rpsychologist.com/d3/ci/)</p>	<p>Ask students to run the CI simulation and think about the following issues:</p> <ul style="list-style-type: none"> - What does the 95% CI coverage mean? (hint: that 95% of all confidence intervals will contain the true population mean) - Can we say whether any single confidence interval contains the true mean (hint: NO! We can only interpret them as long-term probabilities) <p>Ask students to move the slider (CI coverage) to 50%</p> <ul style="list-style-type: none"> - What proportion of all confidence intervals will now contain the true mean? (Hint: 50%) <p>Ask students to increase the sample size from 5 to 30.</p> <ul style="list-style-type: none"> - Does the width of the confidence intervals change? Why? (Hint: standard error decreases with sample

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		size, so we get more precision around the true mean value).
Extra/ seminar (e.g. 1 hour)	Tutorial on how to compute Cohen's d and confidence intervals in R	<ul style="list-style-type: none"> - Calculate Cohen's d using the <i>effectsize</i> package. Use a dataset such as the mtcars for easy interpretation. - Calculate confidence intervals using bootstrapping (<i>Gboot</i> package) or as meta analysis (<i>metafor</i> package). This should also be possible using the mtcars dataset. <p>Let students attempt to write their own code first, but have an example code ready. Pay special attention to how to interpret the results that are calculated.</p> <p>If students are not familiar with R, there are also some shiny apps for calculating effect sizes and their confidence intervals: https://doomlab.shinyapps.io/mote/ (Erin Buchanan)</p>

References:

Kirk, R. E. (1996). Practical significance: A concept whose time has come. *Educational and psychological measurement*, 56(5), 746-759.

Cumming, G. (2014). The new statistics: Why and how. *Psychological science*, 25(3), 7-29.