Title of Resource	Teaching Students The Dangers of Researcher Degrees of Freedom in Sampling with a Coin-Flipping Activity
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Brief Description:	This activity teaches students the danger of basing sampling stop-rules on interim data analysis. It works by showing students that sampling this way can lead to false results such as that a coin is highly biased towards heads or tails.
Keywords:	Research Methods; I might suggest the new sub-category "Sampling"
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Simmons, J. P., Nelson, L. D., & Simonsohn, U. (2011). False-Positive Psychology: Undisclosed Flexibility in Data Collection and Analysis Allows Presenting Anything as Significant. *Psychological Science*, 22(11), 1359-1366.

Introduction: An incorrect procedure that some researchers follow is to choose small sample sizes for their initial run of participants, check their results, and if needed, add participants to the study one or a few at a time until they find the results they were hoping for. In other words, they base their decision to stop collecting data on interim results, not on having reached a predetermined and adequate sample size. The problem with this (in addition to small sample size) is that the probability that *at some point* in data collection, a researcher's data would resemble the results the researcher is looking for is very high even if there is no real effect.

Instructions: To demonstrate the danger of basing sampling stop rules on the results of interim data analysis, you will use either this improper sampling procedure or a proper sampling procedure to test if a coin disproportionately returns either heads or tails. Specifically, you will test if a coin has a 10% or greater deviation (either 60%+ heads or 60%+ tails). Your instructor will randomly assign you to use either procedure one, which represents the inappropriate sampling technique described above, or procedure two, which represents a proper sampling technique.

Procedure One

This procedure reflects the problematic way some researchers go about sampling.

1) Flip the coin 12 times. Calculate the percentage heads and the percentage tails. If either is 60% or greater, than stop and circle the result at the bottom that indicates you found a **"Based on this test, the coin is 10% biased or more."** If not, continue to step two.
2) Continue flipping the coin and keeping track of heads and tails. After *each flip* recalculate the percentage heads and tails. Continue this until you get to 50 flips. However, if *at any point* either heads or tails gets to 60% or higher, stop flipping and circle the result below that indicates **"Based on this test, the coin is 10% biased or more.".**
3) *Only* if you reach 50 flips without ever finding that either heads or tails gets to 60% should you circle the result below that indicates **"Based on this test, the coin is not biased 10% or more."**

Procedure Two

This represents a better way of sampling: using a pre-set stop rule with large sample size.

1. Please flip the coin 50 times and record the number of heads and tails.
2. Calculate the percentage of heads and tails in your flips.
3. Circle your result below.

Results (Circle One)

Based on this test, the coin is 10% biased or more.

Based on this test, the coin is not biased 10% or more.