

Research designs and statistical interpretation

Supported GRE teaching and original transfer practice

Identify the evidence

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Classify designs by assignment and measurement structure

Use the overview measurement lesson VI for research inference.

Concepts 1 (1)

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A true experiment manipulates an independent variable with random assignment of participants to conditions; between-subjects designs give different people to each condition, within-subjects designs measure the same people in every condition and need counterbalancing. A quasi-experiment lacks full assignment, and a correlational study does not manipulate an independent variable. Correlation alone does not establish causation or temporal order. Random assignment supports internal validity (causal inference); random sampling supports external validity (generalisability). They answer different questions. Match analysis to design, measurement scale and assumptions.

Concepts 1 (2)

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Two independent quantitative groups may suit an independent-samples t-test; paired data require a paired analysis. Factorial designs often use analysis of variance; categorical counts may suit a chi-square test when expected-count assumptions hold. Correlation or regression examines specified associations; neither alone establishes causation.

Concepts 2 (1)

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A main effect averages one factor across the other factor. An interaction means one effect depends on the other factor. Nonparallel sample means suggest an interaction pattern, but variability and the design are needed for population inference. Interactions can exist when averaged main effects cancel; lack of significance is not proof of no effect. Mean age 26 with most students 25 or younger is compatible with right skew, but does not uniquely determine distribution shape.

Concepts 2 (2)

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Statistical significance is not effect size. A p-value is a probability of results at least as extreme under the specified null model and assumptions, not the probability the null is true. Type I and Type II errors depend on design and decision thresholds.

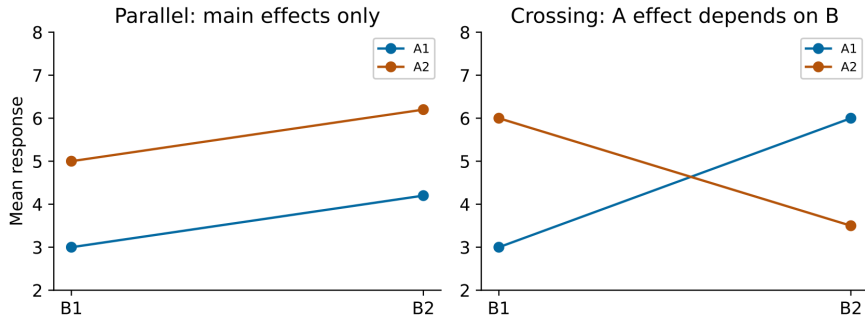
Reason through the worked case

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Fictional mean scores are: task A, novices 4 and experts 8; task B, novices 8 and experts 4. Compute marginal means and describe the pattern.

Novice marginal mean = $(4+8)/2=6$; expert marginal mean = $(8+4)/2=6$. Task A marginal mean = $(4+8)/2=6$; task B marginal mean = $(8+4)/2=6$. The task contrast reverses by expertise, an interaction pattern despite equal marginal means. Means alone do not establish a population interaction; variability, design and inference are needed.

Read the reviewed representation



Original schematic for Research designs and statistical interpretation. Illustrative relationships and numbers are not research results.

Attempt an unfamiliar case

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The same 24 people complete two tasks. Another analyst treats the 48 scores as independent. Explain the problem and a suitable analysis family.

Pause and write the explanation before continuing.

Check the transfer argument

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Scores within a person are related. Ignoring pairing uses an inappropriate independence assumption and loses information about within-person differences. For suitable quantitative difference data and assumptions, a paired t-test may fit; a justified non-parametric alternative may be appropriate otherwise. Randomized or counterbalanced order also addresses sequence effects.

Accept a different explanation when its evidence and limits are justified.

Limit the conclusion

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Drawing a causal conclusion from a correlational design, or reporting a significant interaction as if it were a main effect of one factor.

Original classroom cases are not official questions or personal clinical advice.

Check yourself

Independent retrieval

A small p-value accompanies a tiny estimated effect. Separate the statistical claim from practical importance.

Write your reasoning before comparing it with the methods and limits taught in this lesson.