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MULTIMODAL PSYCHOMETRIC ASSESSMENT

TEACHING RESOURCES

Statistical Inference Essentials

Topic: Statistics
Slides: 4

Null-hypothesis testing, p-values, effect sizes, power, and the errors that come with each.

The logic of NHST

- A p-value is the probability of data at least as extreme as observed, assuming the null is true.
- It is not the probability that the null is true, nor the probability the result is due to chance.
- Statistical significance does not by itself indicate practical importance.

Type I and Type II errors

- Type I error (alpha): rejecting a true null — a false positive.
- Type II error (beta): failing to reject a false null — a false negative.
- Power = 1 − beta: the probability of detecting a true effect of a given size.

Effect sizes

- Standardized mean differences (Cohen's d) and correlations (r) summarize magnitude.
- Cohen's conventions: d ≈ .2/.5/.8 and r ≈ .1/.3/.5 for small/medium/large.
- Always report an effect size and a confidence interval alongside a test statistic.

Confidence intervals

- A 95% CI is a range of plausible parameter values consistent with the data.
- Over repeated samples, 95% of such intervals would contain the true parameter.
- Wide intervals signal imprecision — often from small samples.

Answer Key — Practice Items

Item-bank questions for the topic “Statistics”.

1. A p-value of .03 means:

A. There is a 3% chance the null hypothesis is true
B. Assuming the null is true, data this extreme (or more) occur 3% of the time
C. The effect is large
D. The result will replicate 97% of the time

Answer: Assuming the null is true, data this extreme (or more) occur 3% of the time

Rationale: A p-value is computed assuming the null is true; it is the probability of data at least as extreme as observed.

2. Failing to reject a false null hypothesis is a:

A. Type I error
B. Type II error
C. Sampling error
D. Measurement error

Answer: Type II error

Rationale: A Type II error (beta) is a false negative — missing a true effect.

3. Statistical power is defined as:

A. 1 − alpha
B. 1 − beta
C. The p-value
D. The effect size

Answer: 1 − beta

Rationale: Power = 1 − beta, the probability of detecting a true effect of a given size.

4. Which Cohen's d is conventionally considered a 'medium' effect?

A. 0.20
B. 0.50
C. 0.80
D. 1.00

Answer: 0.50

Rationale: Cohen's conventions: d ≈ .2 small, .5 medium, .8 large.

5. A 95% confidence interval is best interpreted as:

A. A 95% probability the true value lies in this specific interval
B. A range of plausible parameter values; 95% of such intervals capture the parameter over repeated sampling
C. The range containing 95% of the data
D. The standard error times 95

Answer: A range of plausible parameter values; 95% of such intervals capture the parameter over repeated sampling

Rationale: The 95% refers to the long-run capture rate of the procedure across repeated samples.