

PSY3062 | Research Methods

Unit Learning Objectives

Explain the theory underlying linear regression (including special case of analysis of variance), multiple predictors, and moderation and model comparison

Practically implement appropriate analysis plans using these models in software

Apply knowledge of the research process from:

- a) Organising an argument based on background literature
- b) formulating and justifying a research question and testable hypotheses
- c) Performing appropriate analyses using statistical software
- d) interpreting and discussing results from model testing

Prepare and communicate psychological findings by presenting a psychology research project in standard journal article format, including order of presentation, conventional methods of reporting statistics, appropriate use of tables and figures, and APA formatting

Make analysis and presentation choices that align with ethical practices for replication and reproducibility in psychology

Week 1: Introduction and Review of Basics

Variables

- Factor that can vary but observations may not always be the same for everyone

Sampling and Distributions

- Population
 - Entire group that researchers want to make inferences about
 - May be too large or inaccessible to study directly
- Sample
 - Subset of the population to ensure generalisability of findings
- Random Sampling
 - Method that ensures each member of the population has an equal chance of being selected for the sample
 - Helps minimise bias and increase likelihood of a representative sample

Central Tendency

- Value that describes what most of the data looks like (mean, median, mode)

Variance

- The dispersion/spread of data points around the mean and how they deviate
- Provides information about the variability and diversity of a set of observations
- Terms
 - Variance: mean squared difference between data point and mean

- Low: scores closer together=smaller range of variation
 - High: scores widely spread=greater variation
- Standard deviation: square root of variance

Hypothesis Testing

- Systematic approach that evaluates a claim
- Must be testable and evidence must support or contradict the hypothesis using appropriate study design and analysis
- Hypothesis
 - Null: no differences between scores
 - Alternate: difference between scores

Statistical Significance vs Effect Size

- Significance is based on likelihood and determines if the observed result is unlikely to occur by chance alone
- Effect sizes provide a measure of magnitude or the strength of the relationship between variables

Operational Definitions

- Provides a concrete description of how a variable will be observed, manipulated or measured in a study
- Template
 - Patients with [*target group*] who take [*independent variable*] will significantly [*expected outcome/dependent variable*] compared to a control group who will not receive [*independent variable*] as measured by [*how will it be determined?* *What do higher values mean?*] after [*time period?*] receiving treatment.

Statistical Assumptions

- Data is normally distributed
- All groups have the same/similar variance
- If assumptions are violated, our models may not be accurate

Week 2: Research Design

Differentiate between data measured on a continuous vs. categorical scale

Categorical

- Ordinal: logical order (grade, birth order)
- Nominal: no order (gender, sex, eye colour)

Continuous/Numerical

- Continuous: any real number value (height, scores, temperatures)
- Discrete: specific values/integers (counts, years, number of dogs)

Understand how to select the most appropriate statistical analyses

Hypothesis Testing

- Types
 - Null Hypothesis: no relationship or group difference
 - Alternative Hypothesis: there is a relationship or group difference
- How it works
 - Compute test statistic
 - Describes degree of relationship between variable/group differences

- Compute p-value
 - Estimates likelihood of seeing a difference if null is true (.05=significant)

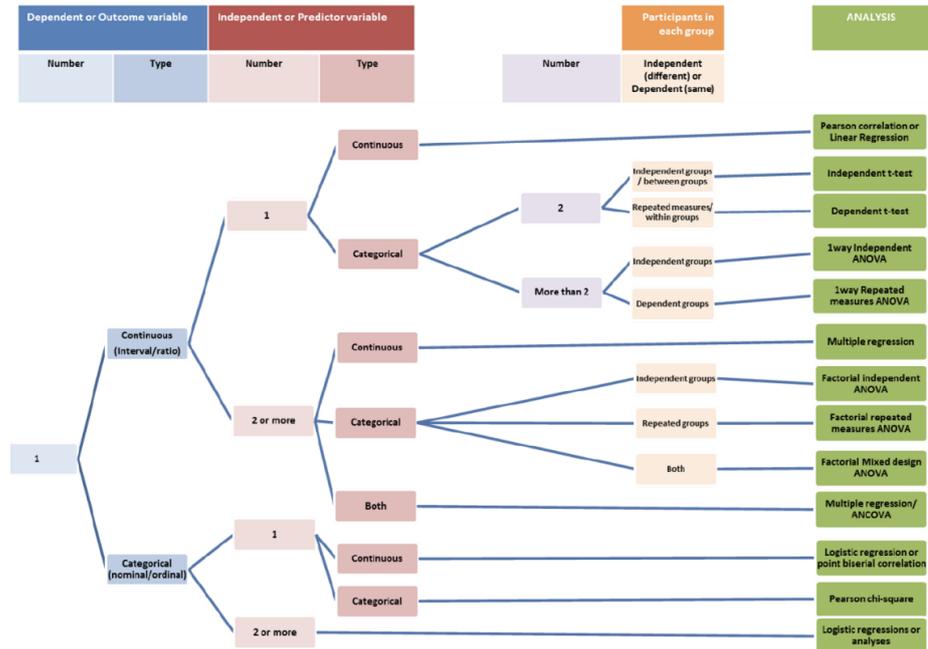


Diagram adapted from Field, A. (2013). *Discovering statistics using IBM SPSS statistics (4th Ed)*. London: Sage Publication

- How to decide
 - Does the data meet assumptions for parametric tests?
 - What type of variables do you have? (categorical or continuous)
 - Is your research design a repeated measure or independent observations?
 - How many predictors and outcome variables are there? How many levels in each variable (if any)?
 - After selecting test, check if data meets assumptions for the test
- Steps on how to decide on the test
 - What is the IV predictor?
 - Is it categorical or continuous?
 - What is the DV/outcome variable?
 - How many variables are in the analysis?
 - How many levels or groups are in the categorical variables?

Understanding bivariate relationships, and analyses involving multiple (both categorical and continuous) predictors

Notation

- $y=x$
 - x = explanatory/predictor/independent variable
 - y = outcome/dependent variable
- Questions
 - Does x predict y ?
 - Does x explain y ?
 - Is x associated with y ?
 - Do changes in x =changes in y ?
 - Are there group differences in y ?

Group Differences vs Relationship/Association

- Group differences
 - Is there a difference in Y among X?
 - Are there X differences in Y?
 - Are there differences in group means?
- Relationship/Association
 - Is there an association between X and Y?
 - Does X predict Y?
 - Is there a relationship/correlation/association/link between X and Y?

Causality

- Causality is only determined by research method and design
- Statistical tests ONLY measures the relationship between your variables
 - Interpret results with caution
 - Suggest limitations of potential confounding variables
 - Suggest how your results can inform the next research

Week 3: Assumptions

Know the parametric test assumptions

Parametric vs Nonparametric Tests

Parametric	Nonparametric
<ul style="list-style-type: none"> ● Assess group means ● Require data to follow the normal distribution <ul style="list-style-type: none"> ○ Can still produce reliable results even if continuous data isn't normally distributed, as long as it meets sample size –Central Limit Theorem ● Can deal with unequal variances across groups ● Generally more powerful 	<ul style="list-style-type: none"> ● Assess group medians ● Don't require data to be normally distributed ● Can't handle small sample sizes

Questions to ask yourself

- What is your sample size?
- What is the best central tendency measure for your data? Mean or Median?

Parametric Test Assumptions

- Additivity and Linearity
- Normality
- Homogeneity of Variance
- Independence of Observations

Additivity and Linearity