

MSc Applied Research
Ethics and Analysis (AREA)

Wrap-up and recap of
quantitative research

Dr Kate Williams

Key points.....

- Qualitative versus Quantitative
- Experimental V Quasi-Experimental V Non-experimental
- Information manipulation/intervention studies
- Within-subjects vs. Between-subjects designs
 - Or Mixed designs

Hypotheses

- Prediction on the outcome of the research.
- **One-tailed:** makes prediction regarding *both* presence of an effect *and* direction of effect.
- **Two-tailed:** only predicts presence of an effect, not its direction.
- **Null:** predicts a possibility that there will be *no* effect or association between variables.

Key points.....

- Study design choices must be considered carefully
- Choice of variables should be based on appropriate theory and/or empirical evidence
- Need to think carefully about the type of data you need to collect **BEFORE** you collect it
 - Continuous data stronger: more scope for analysis
 - Categorical data – less options for analysis
 - Can collect continuous data then categorise

Key points.....

- Parametric versus non-parametric tests
- Parametric always stronger but needs certain sample size and data.
- Non-parametric alternatives should be used if your data does not satisfy key assumptions

Key points.....

- Sample size
 - Power and Effect Size
 - If sample size is too small may not detect an important effect
 - Power = chance of detecting a statistically significant effect if it exists
 - Effect size = magnitude of effect considered important
 - Clinical versus statistical significance
 - Need to know prior literature – cannot carry out a study in isolation

Simple Designs

- Difference between two variables:
 - One IV and one DV
- Either within- or between- subjects
- Analysed through t-test
 - Cannot explore influence of other factors or variables

Complex designs

- Mixed design common in research
- Theoretical and design reasons for this?
- Choice of within IV often preferable
 - Consistency of participant variables
 - Clear effect of the IV manipulation
 - Clear distinction between IV condition effects
- But between-design necessary if different groups must undergo different manipulations

Complex designs

- Within IV designs exhibit control
- Manipulation of variables = experimental
- However, many designs are better described as 'quasi-experimental'
 - Direct manipulation ruled out
 - Ethical boundaries
 - Theoretical validity

Complex designs

- Consider example research question:
- Effect of smoking on memory function
- Need to analyse IV of smoking
 - Ethically unacceptable to manipulate
 - Theoretically less valid (long term smoking effect)

Complex designs

- Inclusion of naturally between participant IVs
 - Age
 - Gender
 - Ethnicity
 - Variables with categories that are naturally occurring and defined
 - Collated data rather than manipulated conditions

Complex Designs

- Even for naturally occurring variables:
- Need to be aware of grouping choices
- E.g., Age: where to place group boundaries
 - 20-35 or 18-30 as ‘younger group’ for instance
 - Theoretical implications for choice

Complex Design Summary

- Mixed design studies often represent:
 - Experimental control of manipulated IVs (within)
 - More natural (ecological) IVs (between)
 - Represents closest compromise between ecological validity and scientific control
 - Therefore, a powerful research design
 - Analysed through ANOVA

ANCOVA

- Allows you to look at the effect of one or more factors on the DV, whilst *partialling out* or removing the effect of another variable - *Covariate*.

MANOVA

- When the experimental design of the study includes *more than one DV*.

Correlational design

- How to distinguish between interpretations?
 - Theoretical basis needed to distinguish
 - Plus any further evidence
- Interpretation for TV/reading association?
 - TV watching causes lower reading scores?
 - How might this mechanism work?
 - Intermediary factor e.g. fatigue/sleep/cognitive effects?
 - Additional factor influences both TV and reading?
 - Parenting style, Socio-economic factors?
 - Child's individual differences, cognitive style, etc.

Correlational design

- Causality is difficult concept in correlation
- When do we chose to use correlational study and why is it still useful?
- Theoretically:
 - Can still aid understanding of relations between variables
 - Can provide **evidence** for a theory/hypothesis
 - Or contradict a theory/hypothesis
 - Can suggest **new** theoretical questions/models

Correlational design

- Additional reason for using correlational design:
- Cannot always manipulate variables
- Ethical issues in research
- Consider:
 - Relation between parents eating habits and childhood obesity
 - The effect of amount of smoking on health measure
 - Can we explore these ‘experimentally’ and manipulate these variables?
 - Why not? Ethical considerations would rule it out

Correlational design

- Correlations also used as a 'control' analysis in some designs:
 - E.g., correlate ages of participants with test scores to eliminate it as a possible explanation for results (if non-significant correlation)
 - Often **ruling out** potential confounds from designs

Regression design

- Family of techniques to explore relationship between one DV and many IVs (or predictor variables).
 - Standard
 - Hierarchical
 - Stepwise (to be avoided!)
- Ideal for investigation of complex real-life research questions
 - Less used in lab-based experimental designs
 - Ideal for longitudinal prospective designs
- Often used to test how “good” a theory is
 - To what extent do the variable identified by a theory explain a given behaviour
 - Can add additional variables/new element to theory and test this

Key points.....

- Some studies often include more than one type of analysis that include both simple and complex analysis
- May have multiple hypotheses
- May need to do different things with the data at different stages
- E.g. Randomised controlled trial could have:
 - Main outcome analysis of ANCOVA design
 - Multiple regression to test validity of theoretical model used
 - T-test to check differential drop-out/demographic differences
 - Correlations to check assumptions for other analyses

Checking assumptions

- Every statistical test has assumptions that need to be met
 - Validity of conclusions drawn depend on appropriate analysis and that assumptions have been satisfied
 - Analyses are only robust if not affected by violation of assumptions
 - Sample size and power are important aspects of “robustness”
- Need to check the required assumptions for each and every test you do!

Common assumptions

- Are data normally distributed?
 - Histogram or stem-and-leaf plot
- Are two or more variances equal?
 - Is the variability of observations in each group the same?
 - E.g., Levene's test in SPSS – want a NON-SIG value!
- Are variables linearly related?
 - Scatterplot
- If not, *use non-parametric test or transform data*
 - *If proceed as planned – be very aware of limitations of your analysis*

N.B. Scale Data

- Reliability analysis – Cronbach's Alpha
- Factor analysis
 - Technique which tells you which items group together within a scale
 - Useful for creation of sub-scales
 - Some scales require FA as part of their standard analysis e.g., IPQ-r causal sub-scale

N.B. Scale Data

- What if you forget about the importance of continuous data when designing your study?
- What statistical tests could you do if both your IV and DV were categorical?
- What options are there?

Important....

- Don't forget about what the data is actually telling you!
- Importance of “eye-balling”
 - Looking at patterns, distributions, outliers, etc.
- Importance of descriptives for interpreting the results of your inferential tests in a meaningful way

IMPORTANT!!!

- Convention for significance testing:
 - p value **less** than 0.05 means **significant**
 - p value **more** than 0.05 means **not significant**
 - **Remember this (don't neglect a decimal place)!**

Finally....

- Read the stats books!!
- Read the Research Methods books!!
- Read journal articles/studies in the area of research you are interested in!!
 - Pay attention to the type of analyses they conduct and the manner in which they report the results.