WEEK 1 - EXPERIMENTAL AND NON-EXPERIMENTAL DESIGN

1 Understand the five approaches to research.

Experimental research: They are primarily used to assess causality. An IV is manipulated to assess the DV. KEY – there is random assignment of participants to groups. Experimental designs also control for extraneous variables (outside variables that may affect inside variables). These controls help to eliminate alternative outcomes. The two main types of experimental designs are between groups (independent-measures, one groups do one thing, the other group does another) and within groups (repeated measures, both groups do the same thing at different times).

Quasi-experimental research: Include some kind of intervention, manipulation, or treatment like an experimental design, but not to the same degree of control found in experiments. This can be because of the nature of the IV that cannot be randomised (gender). Lack of control of extraneous and confounding variables cannot produce unambiguous evidence for a cause-effect relationship which can be done in an experiment.
EG – school based intervention, the schools themselves can be picked at random, though the students participating are not random are in whichever group the school is given. One class could vastly differ from another class which may impact the results and there may be some other explanation for outcome other than intervention.

Nonexperimental research: Examining the nature of observed relationships between groups (gender and exam performance). There is no manipulation of variables and uses pre-existing and intact groups.

Correlational research: Examining the nature of observed relationships between two (continuous) variables (body dissatisfaction and self-esteem). No manipulation of variables.

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Descriptive, non-intrusive & high external validity
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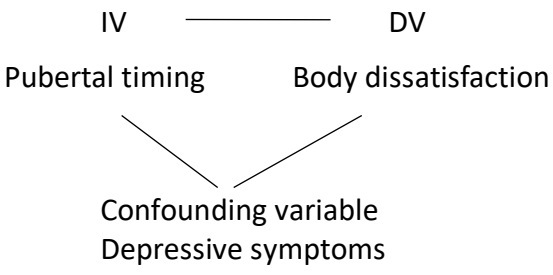
Cannot assess causality, third variable problem, directionality & low internal validity

Descriptive research: Simply describing what is seen in the individual. Generally observational research and case studies.

2 Examine internal and external validity and some of the main threats.

INTERNAL VALIDITY: the degree to which the study accurately answers the questions it was intended to answer. Threat to validity: questions or doubts about the study – any variable that a researcher is not directly interested in is an extraneous variable. These are not threats to our study, they become a problem when they turn into confounding variables, that is, any variable that influences two variables being studied and may provide an alternative explanation for the relationship.



Major threats to internal validity include:
- Environmental variables: time of testing, different researchers etc.
- Assignment bias: groups may vary in participant characteristics (use of intact groups).
- Examining groups over time: the changes in the participants may be due to some other factor (history, maturation.

EXTERNAL VALIDITY: the extent to which the findings can be **generalised** to people, settings, times and other conditions beyond the scope of a particular study. Sample to population, one study to another and from the research study to the real world.
Threats to external validity include:

WEEK 5 - MULTIPLE COMPARISONS

Type I error = the incorrect rejection of a true null hypothesis (hypothesis accepted when it should be rejected)
Type II error = the incorrect retention of a false null hypothesis (hypothesis rejected when it should be accepted)

1. Understand what is meant by error rate per comparison (PC) and familywise error rate (FW).

Error rate per comparison: the type I error rate of any on significance test conducted as part of a series of significance tests. 1 comparison = .05 (5% chance of Type I error). 2 comparisons = .10 (10% chance of Type I error). The more comparisons that are conducted, the higher the chance of Type I error.

α' = per comparison rate – usually .05.

Familywise error rate: the probability of at least one Type I error occurring in any given experiment.

$$FW = 1 - (1 - \alpha')^c$$

Number of comparisons

Per comparison rate (.05)

This formula is only true if comparisons are independent from each other.

We need to know error rates to be aware that we are likely to increase likelihood of Type I error rates when making multiple comparisons. One approach used to combat error-rate problem is to use 'a priori' or planned comparisons with a correction to the alpha level that take into account the number of comparisons planned. A second way to combat error-rates is to use a post-hoc test. This tests all pairwise comparisons of means and holds familywise error rates to a nominated alpha level.

2. Distinguish between a priori and post-hoc comparison.

A priori comparisons are chosen before the data is collected and only a few comparisons are made.

Post hoc comparisons are planned after the experimenter has examined the data, and often comparisons among all possible pairs of means are conducted.

If comparisons are planned in advance and only a subset of comparisons are conducted, this can help reduce the probability of reducing Type I error.

3. Understand how multiple t-tests can be used to make a priori comparisons.

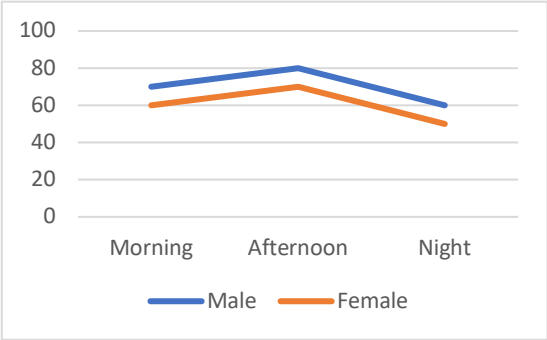
One of the simplest ways to do an a priori comparisons is to use individual t-tests to compare pairs of treatment means. But this is only useful if we are doing two groups at a time. We would use $MS_{residual}$ (mean squares) or MS_{error} from the overall ANOVA as long as the homogeneity of variance is valid because the error term is going to be more accurate because we are using the whole data set rather than relying on two sets of data at any particular time. The t-test method is inefficient as you can only use two groups at a time.

WEEK 6 - FACTORIAL ANOVA

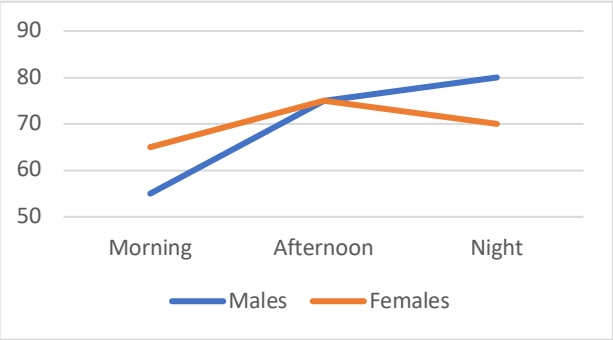
Factor = IV
Groups = Levels within each factor

1. Understand what is meant by main effects, simple effects, interactions and simple interactions.

Interaction: the combination of IV's with each other that results in an effect on the DV that is different from the effects of the individual. If you are looking at a plot and the lines are parallel, there is no interaction.



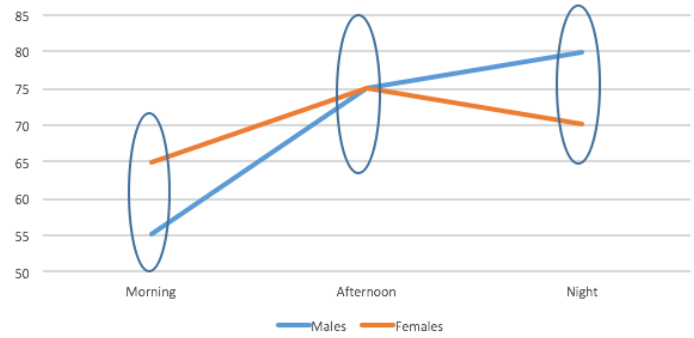
No interaction



Interaction – lines do not have to touch, they just can't be parallel

Main effect: the difference across levels of a single variable. Example: main effect for gender (M or F do better on DV) and a main effect for time of day (morn, day or night class do better on DV?).
We can only accurately interpret main effects if there is no interaction.

Simple (main) effects: are the differences among particular cell means within the design (effect of 1 variable at one level of the other variable.



In this case we would likely find that males performed better in the morning, both were equal in the afternoon and females were better at night

This is examined if we have a significant interaction effect.
Carrying out multiple simple-effects tests raises the problem of inflated type 1 error rates.
If there is no interaction, we don't look at simple effects as they tell the same story as main effects.

Simple interaction:

2. Understand the logic underlying two- and three-way ANOVA

Two-way ANOVA
There are three questions we can answer:
- Is there a main effect between groups?
- Is there a main effect within groups?
- Is there an interaction between the two factors?