Quantitative Research: the experiment

Confounding variables: distort the relation betⁿ IV & DV.

The experiment includes defining the independent variable (IV) and the dependent variable (DV). The independent variable is manipulated and the change in dependent variable is observed.

→ It is important to isolate the IV so that when it is manipulated, nothing changes.

Confounding variables contribute to bias and need to be controlled. They can be controlled either by eliminating them completely or keeping them constant in all the groups so that they do not affect the comparison.

SAMPLING IN THE EXPERIMENT.

Target population: It is the group of people to which the findings of the research are expected to be generalized.

Sample: It is the group of people that participate in the study itself.

Representativeness: A sample is said to be representative of its target population if it reflects all the characteristics that are essential for the study.

SAMPLING METHODS

- Random Sampling
- convenience Sampling OR Opportunity sampling
- Stratified sampling
- self-selected sampling

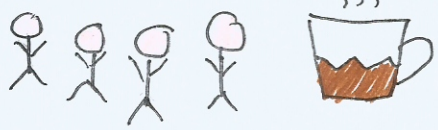
EXPERIMENTAL DESIGNS:

The organization of groups and conditions in a research is known as an experimental design.

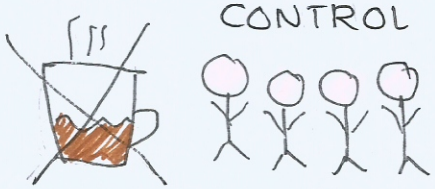
Independent measures design:

- random allocation of participants into groups and these two groups are compared.
- there is an experimental and a control group.
- the experimental conditions are manipulated
- all potential confounding variables cancel each other out.

EXPERIMENTAL



CONTROL



Matched pairs design:

- Instead of random allocation, researchers use matching to form groups.
- The variable that is controlled is called the matching variable.

These designs are preferred when:

- The researcher finds it particularly important that the groups are equivalent in a specific variable.
- The sample size is small and random allocation into groups will not be sufficient to ensure group equivalence.

1
2] Randomly
[3 allocated
4
5 into
6] groups

Repeated measures design:

- Main goal is to compare conditions rather than groups of participants.
- The same group is exposed to 2 or more conditions and the conditions are compared.

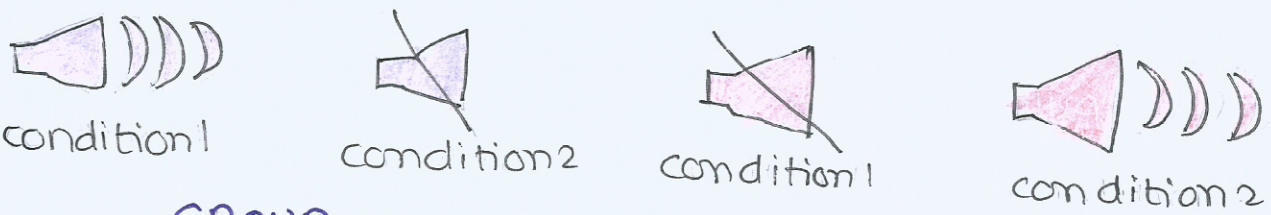
Limitation:

They are vulnerable to order effects. It may appear due to:-

- Practise: the participants can improve their concentration and become comfortable with the experimental task. They might do better in the second trial.
- Fatigue: Participants might get tired during the first trial and their concentration decreases which results to a decrease in the second performance.

How to fix order effects? COUNTERBALANCING

→ other groups of participants are used where the order of the conditions is reversed.

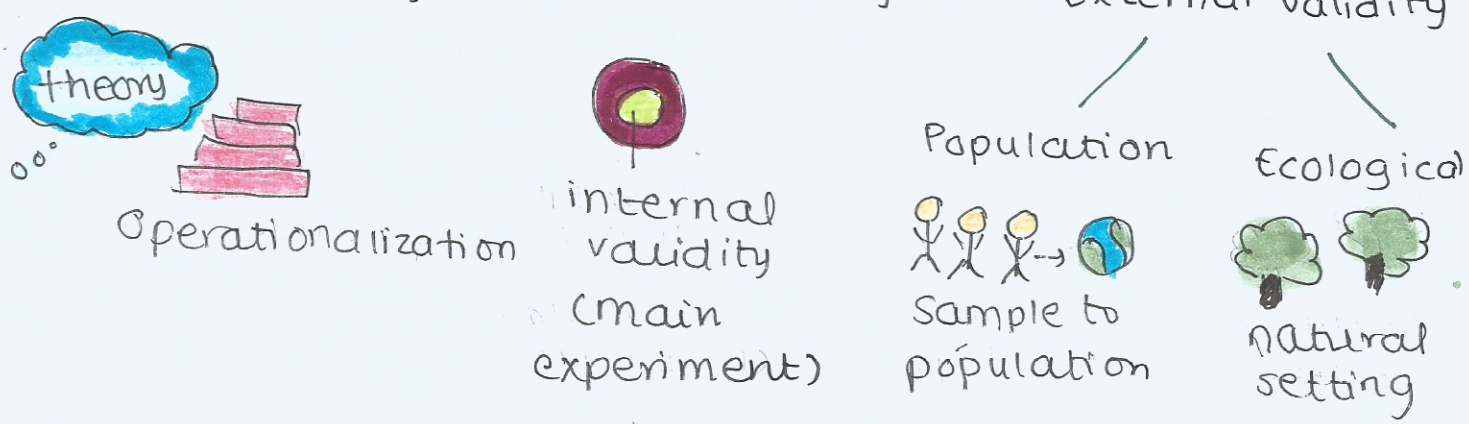


GROUP-1 GROUP-2

Participant Variability: Differences between the groups before the experiment starts. It makes the comparison more reliable.

TYPES OF VALIDITY

Construct validity | Internal validity | External validity



CONSTRUCT VALIDITY

- It characterizes the quality of operationalizations. The study is first defined theoretically and then expressed in terms of observable and measurable behaviour.
- The construct validity is high when the operationalization is able to measure the theory accurately.

INTERNAL VALIDITY

- It characterizes the methodological quality of the experiment.
- Internal validity is high when the changes in the DV is caused by the IV and not the confounding variables.
- ~ Less bias = High internal validity.

EXTERNAL VALIDITY

- Characterizes generalizability of findings in the experiment.

Population validity: It refers to the extent to which the results of the study can be generalized from a sample to the target population.

Ecological validity: It refers to the extent to which findings can be generalized from the experiment to other settings. If the experiment is conducted in an artificial setting, the ecological validity is low. It should be done in the natural setting of the participants.

There is an inverse relationship between ecological validity and internal validity. To guard the internal validity, artificial settings are used for the experiment to minimize confounding variables ~~which results~~. This results in less ecological validity.

THREATS TO INTERNAL VALIDITY

1. Selection 2. History 3. Maturation 4. Testing effect

5. Instrumentation 6. Regression to the mean 7. Mortality

8. Demand characteristics 9. Experimenter bias

1. SELECTION (of sample)

- This occours if the groups are not equivalent at the start.
- These groups might differ in some other variable.
- It occurs in independent measures and matched pair designs.
- The allocation might not be random.

2. HISTORY

- Refers to the outside events that happen to the participants during the study.
- Might become a problem when they can influence the DV or
- not evenly distributed in the comparison groups.
- important in lengthy studies.

3. MATURATION

- In course of the experiment participants go through natural development (growth or fatigue).
- Their behaviour might change which may affect the results of the study.
- Counteracting strategy is using a control group.

4. TESTING EFFECT

- The first measurement of the D.V. may affect the second.
- Testing an individual's memory makes the memory stronger and easier to retrieve.
- In repeated measures, this is a special case of order effect.

5. INSTRUMENTATION

- This occurs when the instrument measuring the DV changes slightly between measurements.
- In psychology the instrument is a human observer.
- To avoid this bais, researchers should try to standardize measurement conditions across all groups.

6. REGRESSION TO MEAN.

- When the initial score of the DV is either very low or very high.
- The scores then become more average on more trials.
- Counter measure - control group with same starting average.

7. EXPERIMENTAL MORTALITY

- Some participants may drop out of the experiment which may cause a problem if they aren't random.
- If all the participants in the control group want to drop out, the experiment will not be continued.
- If the two groups were equivalent at the start of the experiment, they may not be equivalent now.
- The only solution is to design the experiment in such a way that the participants do not feel like dropping out.

8. DEMAND CHARACTERISTICS

- In this case, the participants may understand the aim of the study and might change their behaviour accordingly to feel socially desirable.
- Deception may be used but it might lead to ethical issues.
- In repeated measures design these are larger threat as participants take part in more than one conditions and might guess the aim of the study.

9. Experimenter bias

- Situations where the researcher unintentionally influences the results of the study.
- To counter balance this, double-blind designs should be used.

↓

where the information that could include bias is withheld from both- the participants and from the people conducting the experiment.

Quasi experiments

→ allocation of groups isn't done randomly.

→ pre-existing intergroup difference is used.

→ it resembles experimental research but it is not true experimental research.

→ It doesn't eliminate the problem of confounding variables.

Field experiments

→ conducted in real-life settings.

→ Researcher can control the IV but the confounding variables cannot be controlled.

Strength:

→ The ecological validity is high

Limitation.

→ The internal validity is low because of the confounding variables.

Natural experiments

→ conducted in a natural environment.

→ Researcher has no control over the IV.

→ the IV occurs naturally.

Strength:

→ ecological validity is high

→ can be used when it is unethical to manipulate the IV.

→ all natural experiments are quasi-experiments.

Limitations:

→ Internal validity is low.

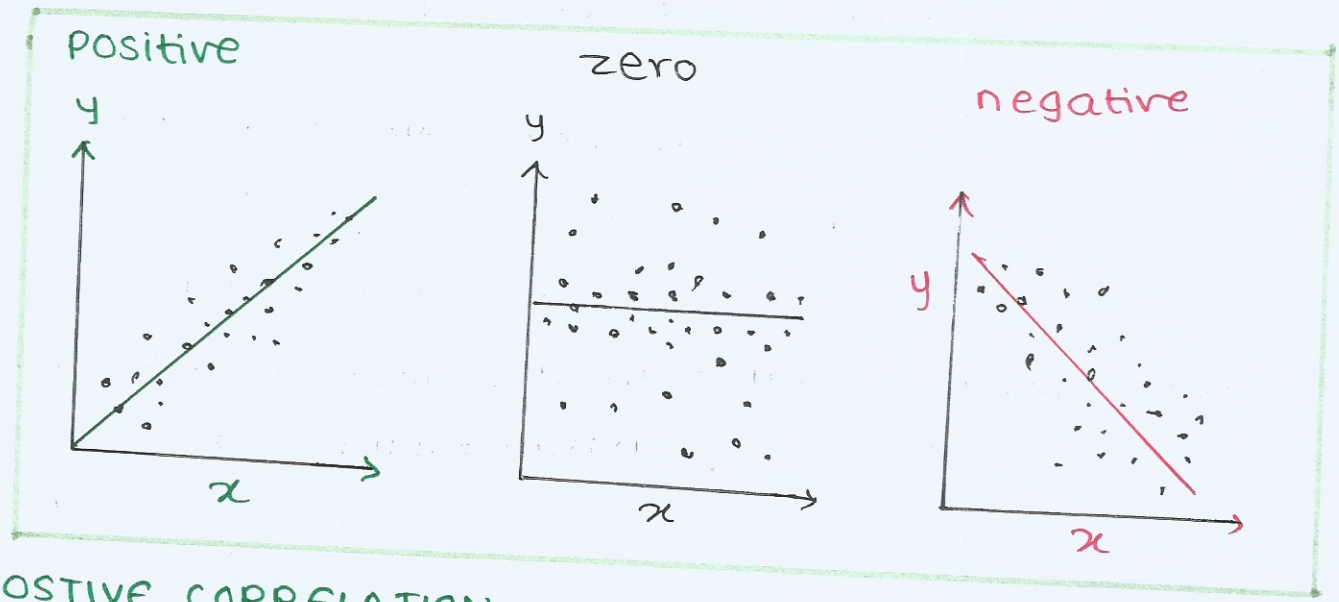
→ no control over the IV.

CORRELATIONAL STUDIES

→ Two or more variables are measured and the relationship between them is mathematically quantified.

→ There is no causation.

→ Illustrated through scatter plots.



POSTIVE CORRELATION

→ variable on x axis increases
→ variable on y axis increases and vice versa.

NEGATIVE CORRELATION

→ variable on x axis ↑
→ variable on y axis ↓ and vice versa.

ZERO CORRELATION

→ no relation between x and y variables.

A correlation coefficient can vary from -1 to +1.

The steeper the line, the stronger the correlation.

Effect size:

The absolute value of the correlation coefficient (-1 to +1) is called the effect size.

Effect size	less than 0.10	0.10 - 0.29	0.30 - 0.49	0.50 & ↑
↓	↓	↓	↓	↓
Interpretation	negligible	small	medium	large

Statistical significance:

shows the propability that a correlation of this size has been obtained by chance.

small samples - less reliable
large samples - more reliable

Statistical significance	Interpretation
more than 5% proba-bility	Result is non-significant.
less than 5% prob.	Result is statistically significant
less than 1% prob.	Result is very significant
less than 0.1% prob.	Result is highly significant.

while interpreting correlations it is important to look at the effect size and the statistical significance.

LIMITATIONS:

- cannot be interpreted in terms of causation.
- third variable problem

↓

Possibility of a third variable existing which correlates both with X and Y and explains the correlation between them.

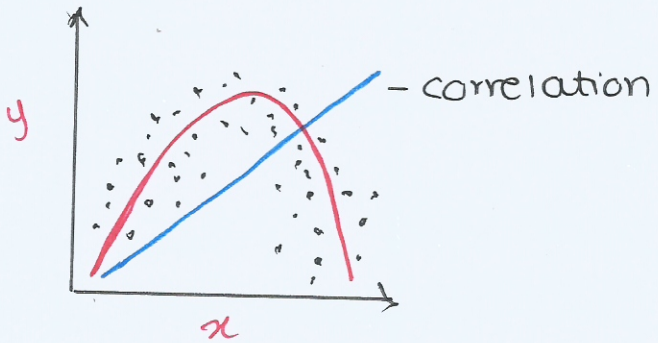
eg: no. of icecream trucks and no. of people drowning.

third variable → summer season 

- curvilinear relationships

↓

the variables are linked non-linearly. One variable might increase with the other one but upto a certain point & it might decrease after that point. correlation coefficients are linear so a straight line that fits best to a scatter plot is drawn.



▶ spurious correlations

↳ when there are multiple correlations between multiple variables, there is a possibility that the correlation might be a result of random chance.

Sampling in correlational studies

1. The target population is identified depending on the aim of the study.
2. Selection of sample is done using random, stratified, opportunity or self-selected sampling.

Generalizability in correlational studies

If the sample is representative of the target population, the study can be generalized.

Bias in correlational studies

It can occur on the level of variable measurement and on the level of interpretation of the findings.

On the level of interpretation of the findings, these are the following sources of bias.

→ Curvilinear relationships

Solution:- Researcher should study and generate scatter plots.

→ The third-variable problem

Solution:- Researcher should take all the confounding variables into account and can include them in the study to see the relationship between the X and Y and the third variable.

→ Spurious correlations

Solution: effect sizes and statistical significance need to be considered.

To increase credibility, the interpretation of multiple comparisons should be done carefully.