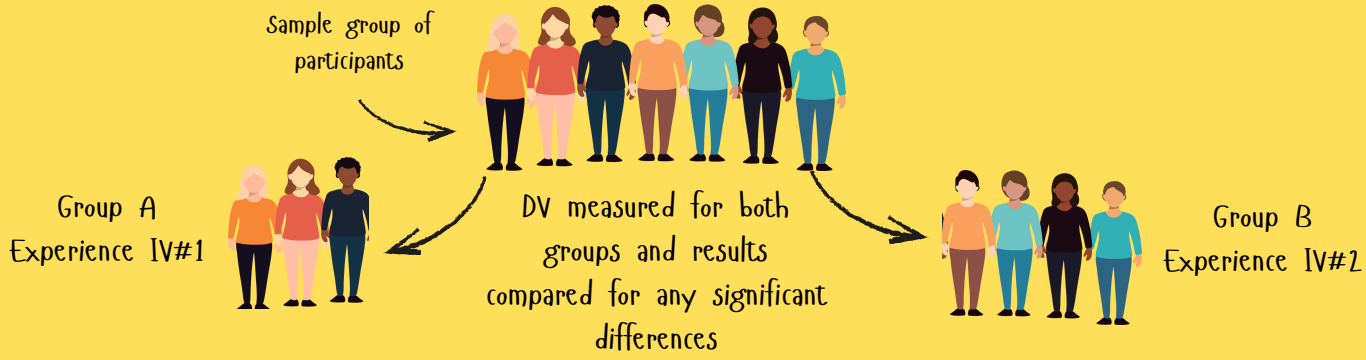
Experimental Design

If a researcher opts to use the experimental method, they have to make some important decisions about how they are going to organise the participants into the different levels of the independent variable. There are a few different options to choose from when managing this process and these different methods are referred to as the **experimental design** (or research design).

There are three choices for experimental design, each with its relative merits and drawbacks.

Independent Groups

An independent groups design involves splitting your group of participants into two (or more) separate groups. **Each group experiences a different level of the independent variable (IV)**. The **dependent variable (DV)** is measured for each group and then compared.



DEFINITION

INDEPENDENT GROUPS

An experimental design where different participants take part in each condition of the independent variable.

EXAMPLE

A psychologist compares memory recall between one group of participants who study in silence and a different group who study while listening to music. Each participant takes part in only one condition.

- Avoids order effects present in repeated measures (fatigue, boredom, and practice effects).
- Participants are less likely to work out the aim of the research and change their behaviour (demand characteristics).

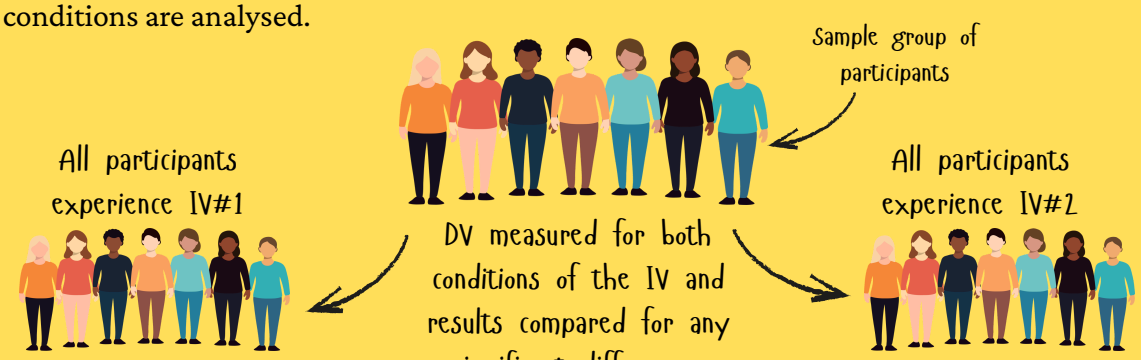
- No control over participant variables (these are the differences that make us all unique).
- Requires more participants than repeated measures, which is time-consuming and more costly.

Overcoming limitations

Researchers should randomly allocate participants into the different groups to ensure individual differences are equally dispersed between conditions. They could also opt for a repeated measures or matched pairs design instead.

Repeated Measures

In a repeated measures experimental design, **all participants take part in both conditions of the independent variable (IV)**. The DV is measured in both cases and significant differences between the two conditions are analysed.



DEFINITION

REPEATED MEASURES

An experimental design where the same participants take part in all conditions of the independent variable.

EXAMPLE

A researcher tests whether time of day affects memory by asking the same participants to complete a word recall test in the morning and again in the evening.

- Participant variables are controlled e.g. IQ, gender etc. as the same participants are used in both conditions.
- Smaller sample of participants required compared to independent groups which needs twice as many people

- Order effects (practice or fatigue for example) may influence performance in later conditions.
- Demand characteristics may occur as participants may guess the aim of the research, lowering validity.

Overcoming limitations

Order effects can be overcome through the use of counterbalancing (see below). Demand characteristics can be reduced by misleading participants about the true aims of the research (this can cause ethical problems though).

Counterbalancing

Order effects are a major problem with this experimental design. Depending on the nature of the research, participants may do better or worse in the second condition of the independent variable for several reasons. They could get better at the task (**practice effect**), get tired (**fatigue effect**), or become bored (**boredom effect**). This can be overcome by a process called **counterbalancing**. To do this, half the participants do condition A followed by condition B, and the other half of the participants do condition B followed by condition A. You may still get order effects, but they should balance out if you use this technique.

split group in half

Group#1 does condition A followed by condition B

AB

Group#2 does condition B followed by condition A

BA

Matched Pairs

There is a third option for experimental design that offers solutions to both the problem of order effects found in repeated measures and the issue of participant variables evident in independent groups. **Matched pairs** use an independent groups design with separate groups experiencing the conditions of the independent variable. In this case, the researcher will attempt to **match people in the two conditions based on certain characteristics.** For example, if our first participant in condition A is a 25-year-old white female with an IQ of 100, then we try to find another 25-year-old white female with an IQ of 100 to be her counterpart in condition B.

Select your participants for IV#1

Identify a participant with similar characteristics for IV#2

The two groups take part in the separate conditions of the IV and any significant differences in the DV are analysed.

DEFINITION

MATCHED PAIRS

A form of independent groups design where the experimental and control participants are deliberately similar.

EXAMPLE

A psychologist tests whether sleep deprivation affects reaction time. Participants are paired according to age and gender, with one person from each pair tested after a full night's sleep and the other after only four hours of sleep.

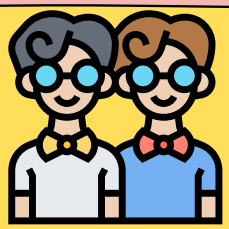
- No order effects as participants only take part in one condition.
- Less chance of demand characteristics as participants only take part in one condition.
- May be fewer participant variables as characteristics have been matched.

- The researcher needs more participants than repeated measures design in order to end up with the same number of results.
- It can be time consuming and difficult for the researcher to match participants on relevant characteristics.

Overcoming limitations

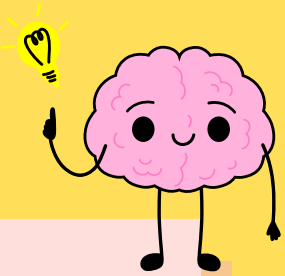
It is time consuming to find similar pairs. Researchers could use twin pairs to speed up the process.

The only way to reduce the number of participants is to revert to a repeated measures design as an alternative.



Task

For each of the research descriptions below, identify the appropriate experimental design by circling the correct option.



1. A psychologist compares stress levels of one group who meditate daily and another group who do not meditate.
   Independent Groups / Repeated Measures / Matched Pairs
2. The same participants complete a memory test once after drinking coffee and once after drinking water.
   Independent Groups / Repeated Measures / Matched Pairs
3. A researcher pairs participants by age and IQ, then assigns one of each pair to study with background music and the other to study in silence.
   Independent Groups / Repeated Measures / Matched Pairs
4. One group of participants watches a violent film, while another group watches a non-violent film, and their aggression levels are compared.
   Independent Groups / Repeated Measures / Matched Pairs
5. The same participants are tested on reaction time in both quiet and noisy conditions.
   Independent Groups / Repeated Measures / Matched Pairs
6. A psychologist pairs participants by gender and anxiety score, assigning one from each pair to a group therapy session and the other to individual therapy.
   Independent Groups / Repeated Measures / Matched Pairs
7. One group learns a word list in the morning, another group learns the same list in the evening.
   Independent Groups / Repeated Measures / Matched Pairs
8. The same participants rate attractiveness of faces before and after being shown a set of celebrity images.
   Independent Groups / Repeated Measures / Matched Pairs
9. Participants are matched on age and driving experience, with one person from each pair driving in rainy conditions and the other in clear weather.
   Independent Groups / Repeated Measures / Matched Pairs
10. Different participants complete a problem-solving task either under time pressure or with unlimited time.
    Independent Groups / Repeated Measures / Matched Pairs

Exam Skills

A health psychologist predicted that taking part in regular physical exercise would reduce stress levels. To test this, participants were randomly assigned to two groups without their knowledge. One group took part in three exercise sessions per week, while the other group did no structured exercise. After six weeks, stress levels were measured using a questionnaire, and results showed lower stress in the exercise group.

EXAMPLE

(a) State and explain the experimental design used in this piece of research. [2]

This study uses an Independent groups design, as there were two different groups used for each condition: one completed exercise and one did not.

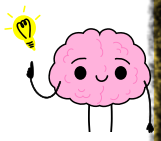
WHAT is the experimental design?

HOW is it used?

LINK to the research context

A psychologist predicted that lack of sleep would reduce concentration levels. To test this, the same group of participants completed a concentration task after a full night's sleep and again after only four hours of sleep. Their scores on the task were then compared.

(b) State and explain the experimental design used in this piece of research. [2]



Exam Skills

A psychologist compared the effect of playing relaxing music or upbeat music on heart rate. One group heard relaxing music, and another heard upbeat music.

Explain one strength and one weakness of the experimental design used in this research. [2 + 2]

EXAMPLE

A strength of using independent groups is that it reduces the risk of demand characteristics improving the validity of the research. In this case the participants will be unlikely to to guess that the study is looking at music and heart rate as they are only involved in either the relaxing or upbeat conditions.

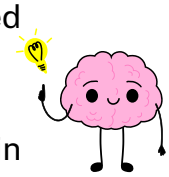
A weakness of using independent groups is that participant variables might differ between groups effecting validity . In this case, some participants might have a lower heart rate because they do more exercise or have a higher heart rate due to a medical condition.

WHAT is the strength/weakness?

WHY is it a strength/weakness?

LINK to the research context

A psychologist tested whether room colour affects creativity. One group worked in a blue room, the other in a yellow room.



(b) Explain one strength and one weakness of the experimental design used in this research. [2 + 2]

Exam Skills

A researcher wanted to see if time of day affects memory recall. The same participants completed a memory test in the morning and again in the evening.

EXAMPLE

(a) Explain one strength and one weakness of the experimental design used in this research. [2 + 2]

A strength of using repeated measures is that it eliminates the risk of participant variables reducing the validity of the research. Because the same participants complete the memory test, variables like IQ will not impact the results of the research.

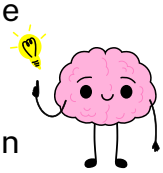
A weakness of using repeated measures is that order effects may reduce the validity of the research. For example, the second time the participants complete the memory test, they may perform better due to the practice effect.

WHAT is the strength/weakness?

WHY is it a strength/weakness?

LINK to the research context

A psychologist tested whether caffeine affects reaction time using the same participants, once after drinking coffee and once after drinking water.



(b) Explain one strength and one weakness of the experimental design used in this research. [2 + 2]

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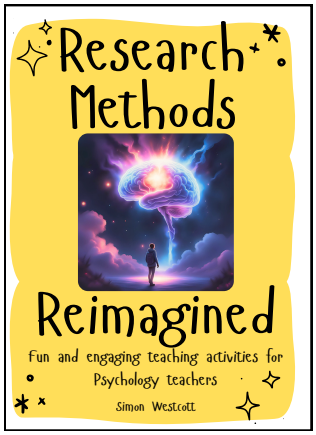

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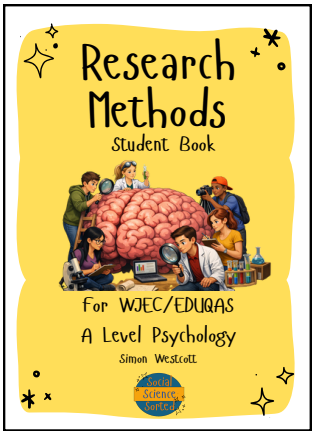

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