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**Lesson One**

**Research Methods: Scientific Method & Techniques**

**Scientific Processes**

**Aims:** The aim of a study is what the purpose is of a piece of research. For example- to investigate if age affects memory.

**Hypothesis:** The prediction of what the results will be. This can be directional, in which the expected effect of a variable is stated, or non-directional, where a difference is predicted, but not the nature of the difference. For example:

* Directional: young people will do better in a memory test than older people
* Non-directional: there will be a difference between young and older people in performance on a memory test

The above hypotheses are known as the experimental/alternative hypothesis. There is also the **null hypothesis**, which predicts that there will be no difference between the conditions, for example ‘there will be no difference between young and older people in performance on a memory test’.

Directional hypotheses are used when previous research indicates what the results will be, for example if other studies have found that young people have better memories than older people, we can predict that the result will go the same way. If there is no previous research, or previous research is contradictory, and a non-directional hypothesis would be used.

**Independent and dependent variables:** In an experiment, the variable manipulated or changed by the researcher is the independent variable (IV). The result, which should be affected by the change in IV, is the dependent variable (DV). All other variables should be controlled as far as possible, so that it is the IV that affects the DV and nothing else. For the purposes of experiments, IVs and DVs must be **operationalised**- put into a form which is measurable. For example, ‘Age’ (the IV) could be operationalised as ‘participants between 20 and 25 years of age and participants between 60 and 65 years of age’. ‘Memory ability’ (the DV) could be operationalised as ‘the score on a test of memory’ or ‘the number of words successfully recalled’. This can be used in a hypothesis as follows:

Participants between 20 and 25 years of age will score more highly on a memory test than participants between 60 and 65 years of age’.

This is an operationalised hypothesis, and it is directional, in this case.

## Key terms Experimental method – Involves the manipulation of an independent variable to measure the effect on the dependent variable. Experiments may be laboratory, ­ eld, natural or quasi. Aim – A general statement of what the researcher intends to investigate; the purpose of the study. Hypothesis – A clear, precise, testable statement that states the relationship between the variables to be investigated. Stated at the outset of any study. Directional hypothesis – States the direction of the difference or relationship. Non-directional hypothesis – Does not state the direction. Variables – Any ‘thing’ that can vary or change within an investigation. Variables are generally used in experiments to determine if changes in one thing result in changes to another. Independent variable (IV) – Some aspect of the experimental situation that is manipulated by the researcher – or changes naturally – so the effect on the DV can be measured. Dependent variable (DV) – The variable that is measured by the researcher. Any effect on the DV should be caused by the change in the IV. Operationalisation – Clearly de­ ning variables in terms of how they can be measured.

## Questions :

## 1-Explain the difference between an aim and a hypothesis. …………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………………..

## 2-Explain what is meant by operationalization of variables.

## …………………………………………………………………………………………………………………………………………………………………………

## 3-Identify the independent and dependent variables in the following investigations:

## **•** a study to investigate whether cats or dogs sleep longer

## The IV is :……………………………………………….

## The DV is :……………………………………………

## **•** a study to see if age affects the amount of sleep we need

## The IV is :……………………………………………….

## The DV is :……………………………………………

## **•** an investigation into how the type of praise you receive influences grades achieved in exams. The IV is :……………………………………………….

## The DV is :……………………………………………

## Lesson Two :Variables & Control

As well as the IV and DV, other variables exist which potentially affect the results of experiments.

**Extraneous variables:** Variables other than the IV which may have an effect on the DV if not controlled for. For example, in the memory experiment, the intelligence and motivation levels of the participants may have an impact on their score on the memory test. The researcher should take steps to minimise the impact of these, for example by giving participants an IQ test beforehand and eliminating any particularly high or low scores from the sample.

**Confounding variables:** Variables other than the IV that have (or almost certainly have) had an effect on the DV. We know they have had an effect because they vary systematically with the IV. For example, in the memory experiment, if all of the young participants are given the memory test at 9am, and all of the older participants are given the test at 7pm, the time of day has acted as a confounding variable, as it has varied systematically with the IV. Therefore, any difference in the results of the two groups may be due to the difference in time of day, rather than the difference in age. The effect of this can be reduced or eliminated by testing both age groups at the same time of day.

**Demand characteristics:** These are clues which participants respond to when in an experimental situation, in which they try to guess the aim or intended outcome of a study and therefore change their behaviour accordingly. They are a form of participant reactivity (people not behaving naturally as they know they are being studied). The effect of these can be reduced by not revealing the aim of the study to the participants, or by using an independent measures design, so that participants only take part in one of the experimental conditions. For example, if participants are told the aim of the memory study, the young participants may try really hard on the memory test, as they may guess that this is the predicted outcome of the study. They act in ways that they think will please the experimenter. Alternatively, the older participants may try really hard on the test in order to prove the prediction wrong. Either way, the participants do not act naturally, so reducing the validity (correctness) of the results.

**Investigator effects:** These are any unwanted influences that the investigator/experimenter communicates to the participants which affects their behaviour. For example, being more encouraging towards the young participants in the memory test, as this is the expected result. These can be minimised by the use of standardised instructions, or the double-blind procedure.

**Randomisation:** This is a way of controlling for the effects of extraneous/confounding variables. Allocating participants to tasks, selecting samples of participants, and so on, should be left to chance as far as possible, to reduce the investigator’s influence on a study.

**Standardisation:** This is where the experience of an experiment is (as far as possible) kept identical for every participant, for example using standardised instructions. This reduces the effect of extraneous/confounding variables.

**Single and double-blind:** The single-blind procedure is when the participant does not know the aim of the study. This helps reduce the possibility of demand characteristics from affecting the results. Double-blind is when where the investigator who deals with the participants also does not know the aim of the study. This helps reduce the chance of investigator effects, as the investigator will not unconsciously communicate the aim to the participants.

**Control groups:** These are used for the purpose of comparison, often when testing the effects of a drug, for example. One group of participants (the ‘experimental group’) will be given the real drug, another group a placebo (fake drug). This can allow the researcher to directly compare the results of the two groups. If the experimental group improves then it is likely that this is because of the drug.

Key terms  
**Extraneous variable (EV) –** Any variable, other than the independent variable (IV), that may have an effect on the dependent variable (DV) if it is not controlled.EVs are essentially nuisance variables that do not vary systematically with the IV.  
**Confounding variables –** Any variable, other than the IV, that may have affected the DV so we cannot be sure of the true source of changes to the DV. Confounding variables vary systematically with the IV.  
**Demand characteristics –** Any cue from the researcher or from the research situation that may be interpreted by participants as revealing the purpose of the investigation.This may lead to a participant changing their behaviour  
within the research situation.  
**Investigator effects –** Any effect of the investigator’s behaviour (conscious or unconscious) on the research outcome (the DV). This may include everything from the design of the study to the selection of, and interaction with,participants during the research process.  
**Randomisation –** The use of chance in order to control for the effects of bias when designing materials and deciding the order of conditions.  
**Standardisation –** Using exactly the same formalised procedures and instructions for all participants in a research study.

## Questions :

## 1-Outline what is meant by the term demandcharacteristics.……..…………………*…………………………………………………………………………………………………….* 2. Explain the difference between an extraneous variable and a confounding variable.

## ………………………………………………………………………………………………. …………………………………………………………………..3. Suggest one example of how randomisation may be used within psychological research. *…………………………………………………………………………………………………………………………………………………………………………………… …………* 4. Outline what is meant by *investigator effects* and explain why it is important to control these within an investigation.

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## Lesson Three :Sampling

In a study, the **population** is the target group of people the researcher is studying (e.g. ‘males in their 20s’). The **sample** is the group of people selected to take part in the study, drawn from the target population. In order to select a sample, a **sampling technique** will be used:

**Random:** Each member of the target population has an equal chance of being selected. For example, using a random name or number generator, or picking names out of a hat.

* **Evaluation**: The researcher cannot influence the selection of participants, but the sample could, by chance, end up being unrepresentative.

**Systematic:** A participant is selected in a systematic way, for example, selecting every 10th person from the electoral roll. This is decided through a sampling frame, where a list of the target population is put in order.

* **Evaluation**: The researcher cannot influence the selection of participants, and it is likely to be representative.

**Stratified:** The make-up of the sample reflects the make-up of the target population. For example, if studying teachers, as there are more female than male teachers, there should be more female participants. If 60% of teachers are female, this means that in a sample of 20, there should be 12 female and 8 male teachers. Once these quotas are identified, the participants to fill them are selected at random from the target population.

* **Evaluation**: random techniques are used, so the researcher can’t influence the selection. The sample produced is representative of the target population, as it has been designed to be so. However, it is hard to represent all the ways in which people are different.

**Opportunity:** Participants are selected from whoever is most easily available. For example, standing in the street one afternoon and approaching passers-by to see if they want to take part.

* **Evaluation**: this is convenient, as it is much less time-consuming and costly than some of the other methods. However, there is a high chance of obtaining an unrepresentative sample, as large groups of the population have no chance of being involved. Also the researcher controls which participants are selected, which could lead to bias.

**Volunteer:** Participants put themselves forward to take part in a study. For example, a newspaper or internet advert is placed asking for volunteers, and people respond agreeing to take part.

* **Evaluation**: this is easy and convenient for the researcher, but it is open to volunteer bias, whereby only certain types of people (the type that put themselves forward) take part. This reduces the representativeness of the sample.

**Questions :**

## A - Explain the difference between a target population and a sample.

## …………………………………………………………………………………………………………………………………………………………………………

## B-Decide which one of the ­ sampling techniques is being used in the examples below: 1. Students investigating the link between age and attitudes to the legalisation of drugs stop people in the street and ask them their views.

## ………………………………………………………………………………… 2. An occupational psychologist surveying employees about stress at work selects a sample that reflects the overall staff ratio of management to shop floor workers.

## ………………………………………………………………………………… 3. A teacher selects a sample of Year 9 students to take part in a test of selective attention by picking every third student from the register.

## ………………………………………………………………………… 4. A member of senior management is interested in teachers’opinions regarding their workload. She assigns all the staff a number, places these in a hat and draws out 20 numbers.

## ……………………………………………………………………… 5. A university lecturer requests participants for an experiment into how expectation affects perception by placing an advert on the common room notice board

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**Lesson Four :Experimental Design**

This refers to how participants are allocated to experimental conditions.

**Independent groups:** There are different participants in each condition. This would be appropriate for the memory experiment, as the participants need to be different ages in each condition.

* **Advantages**: participants are less likely to guess the aim of the study, and there are no **order effects**- effects arising from having completed two tasks, for example becoming more practised and doing better in the second condition, or getting bored/fatigued and doing worse in the second condition
* **Disadvantages**: there may be differences between the two groups of people- e.g. intelligence, age, gender, which may cause differences in the results. Twice as many participants are needed.

**Repeated measures:** One group of participants completes both/all of the conditions of the experiment. for example:  
**•** Each participant does the task with the TV on,  
e.g. does a memory test.  
**•** Then, perhaps a week later, each participant does a similar test without the TV on.We compare the performance (DV) of the participant on the two tests.

**Advantages**: there are no participant variables between the conditions, and fewer participants are needed

* **Disadvantages**: there are **order effects** which may influence the results. This can be addressed by **counterbalancing**- half the participants do one task followed by the second (A followed by B) and the other does the opposite (B followed by A). Also, participants may work out the aim of the study, like in the memory test example, and may change their behaviour.

**Matched pairs:** As independent groups, but participants are ‘matched’ on qualities relevant to the experiment. For example, in theTV study, one participant is allocated to the ‘TV on’ condition, and another who is similar in terms of age, IQ and occupation is allocated to the ‘without the TV on’ condition. This involves pre-testing participants on certain measures in order to match them up.

* **Advantages**: order effects and demand characteristics are less likely to have an impact, and participant variables are reduced
* **Disadvantages**: participants can never be matched perfectly, so there might still be some participant variables. Matched pairs is the most time-consuming and expensive design to use.

**KEY TERMS  
Counterbalancing** An experimental technique used to overcome order effects when using a repeated measures design. Counterbalancing ensures that each condition is tested first or second in equal amounts.  
**Experimental design** A set of procedures used to control the influence of factors such as participant variables in an experiment.  
**Independent groups design** Participants are allocated to two (or more) groups representing different levels of the IV. Allocation is usually done using random techniques.  
**Matched pairs design** Pairs of participants are matched in terms of key variables such as age and IQ. One member of each pair is allocated to one of the conditions under test and the second person is allocated to the other condition.  
**Order effect** In a repeated measures design, an extraneous variable arising from the order in which conditions are presented, e.g. a practice effect or fatigue effect.  
**Random allocation** Allocating participants to experimental groups or conditions using random techniques.  
**Repeated measures design** Each participant takes part in every condition under test i.e. each level of the IV.

**Questions :**

**A** 1- Outline what is meant by *random allocation*

*…………………………………………………………………………………………….*.

2. Explain **one** limitation of a repeated measures design.

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3. Outline what is meant by a *matched pairs design*.

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**B.** For each of the following experiments a–f, identify the experimental  
design that has been used.  
When trying to decide, it might help you if you ask yourself:  
**•** Would the f ndings be analysed by comparing the scores from the same person or by comparing the scores of two (or more) groups of people?  
**•** If it is two or more groups of people then ask ‘Are the people in the different groups related (i.e. matched) or not?’  
**a.** Boys and girls are compared on their IQ test scores.

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**b.** Hamsters are tested to see if one genetic strain is better at finding food in a maze than another.

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**c.** Reaction time is tested before and after a reaction time training activity to see if test scores improve after training.

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**d.** Students are put in pairs based on their Math grades and then one member of the pair is given a memory test in the morning and one in the afternoon.

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**e.** Three groups of participants are given different word lists to remember, in order to find out whether nouns, verbs or adjectives are easier to recall.

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**f.** Participants are asked to give ratings for attractive and unattractive photographs.

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