EXAM PAPERS PRACTICE

RESEARCH METHODS

Revision Notes

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RESEARCH METHODS

Specification

Research Methods

- Experimental method. Types of experiment, laboratory and field experiments; natural and quasi experiments.
- Observational techniques. Types of observation: naturalistic and controlled observation; covert and overt observation; participant and non-participant observation.
- Self-report techniques. Questionnaires; interviews, structured and unstructured.
- Correlations. Analysis of the relationship between co-variables. The difference between correlations and experiments.
- Content analysis.
- Case studies.

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Specification

Scientific Processes

- Aims: stating aims, the difference between aims and hypotheses.
- Hypotheses: directional and non-directional.
- Sampling: the difference between population and sample; sampling techniques including: random, systematic, stratified, opportunity and volunteer; implications of sampling techniques, including bias and generalisation.
- Pilot studies and the aims of piloting.
- Experimental designs: repeated measures, independent groups, matched pairs.
- Observational design: behavioural categories; event sampling; time sampling.
- Questionnaire construction, including use of open and closed questions; design of interviews.
- Variables: manipulation and control of variables, including independent, dependent, extraneous, confounding; operationalisation of variables.
- Control: random allocation and counterbalancing, randomisation and standardisation.
- Demand characteristics and investigator effects.
- Ethics, including the role of the British Psychological Society's code of ethics; ethical issues in the design and conduct of psychological studies; dealing with ethical issues in research.
- The role of peer review in the scientific process.
- The implications of psychological research for the economy.
- Reliability across all methods of investigation. Ways of assessing reliability: test-retest and interobserver; improving reliability.
- Types of validity across all methods of investigation: face validity, concurrent validity, ecological validity and temporal validity. Assessment of validity. Improving validity.
- Features of science: objectivity and the empirical method; replicability and falsifiability; theory construction and hypothesis testing; paradigms and paradigm shifts.
- Reporting psychological investigations. Sections of a scientific report: abstract, introduction, method, results, discussion and referencing.

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Specification

Data Handling and Inferential Testing

- Quantitative and qualitative data: the distinction between qualitative and quantitative data collection techniques.
- Primary and secondary data, including meta-analysis.
- Descriptive statistics: measures of central tendency – mean, median, mode; calculation of mean, median and mode; measures of dispersion: range and standard deviation; calculation of range; calculation of percentages; positive, negative and zero correlations.
- Presentation and display of quantitative data: graphs, tables, scattergrams, bar charts, histograms.
- Distributions: normal and skewed distributions; characteristics of normal and skewed distributions.
- Analysis and interpretation of correlation, including correlation coefficients.
- Levels of measurement: nominal, ordinal and interval.
- Content analysis and coding. Thematic analysis.
- Introduction to statistical testing; the sign test.
- Probability and significance: use of statistical tables and critical values in interpretation of significance; Type I and Type II errors.
- Factors affecting the choice of statistical test, including level of measurement and experimental design. When to use the following tests: Spearman's rho, Pearson's r, Wilcoxon, Mann-Whitney, related t-test, unrelated t-test and Chi-Squared test.

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Types of Experiment

Laboratory Experiments

Takes place in a highly controlled environment, it does not have to be in a lab.

Strengths:

- High level of control of the independent variable (IV) and extraneous variables so we can determine cause and effect.
- High internal validity
- High replicability

Weaknesses:

- Artificial so lacks generalisability (ecological validity/mundane realism)
- Low external validity
- Risk of demand characteristics

Field Experiments

Takes place in a more everyday setting but the IV is still manipulated.

Strengths:

- High mundane realism/ecological validity
- High external validity

Weaknesses:

- Difficult to replicate
- Less control of extraneous variables
- Low internal validity
- Ethical issues could include consent and privacy

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Types of Experiment

Natural Experiments

The IV(s) occur naturally rather than being manipulated by the researcher. Can be conducted in a lab or field setting.

Strengths:

- Can be very useful in situations where you cannot manipulate the independent variable.
- High mundane realism/ecological validity

Weaknesses:

- Opportunities may only come along rarely
- Participants may not be randomly allocated to experimental conditions

Quasi Experiments

Has an IV based on an existing difference between people (age, gender etc) with no manipulation from the experimenter.

Strengths:

- Usually under controlled conditions – high internal validity and replicability

Weaknesses:

- Cannot randomly allocate participants so there may be confounding variables
- Difficult to establish cause and effect without manipulation of the IV

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Observations

	Description	Strengths	Weaknesses
Naturalistic	Behaviour is studied in a natural environment where nothing is changed	High external validity	Hard to replicate. Lack of control over variables
Controlled	Some variables are controlled by the researcher through manipulation or by controlling extraneous or confounding variables	Some variables are controlled by the researcher	Low external validity
Covert	Participants do not know they are being observed	Reduces demand characteristics. Increased internal validity	Could be unethical due to issues with consent, right to withdraw and privacy
Overt	Participants know they are being observed and have given consent	More ethical as participants are aware that they are being studied	Increased demand characteristics
Participant	Researcher becomes part of the group they are studying	Increased insight. Increased external validity	Could lose objectivity (going native)
Non-Participant	The researcher remains separate from those that they are studying	More objective than participant	Might lose valuable insights as they are too far removed

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Self Report Techniques

Questionnaires

Strengths

Richer in-depth answers and so gain a better understanding of individual responses

Open Questions

No fixed answers and respondents can answer freely. Tends to produce more qualitative data.

Weaknesses

More difficult and time consuming to analyse. Takes longer to administer.

General Evaluation

+ Can be distributed to large numbers of participants
+ Researcher doesn't have to be present
- Participants may not be truthful
- Social desirability bias
- Response bias

Strengths

Easier to analyse than qualitative data and quick to administer.

Closed Questions

Fixed responses through Yes/No answers or Likert scales. Produces quantitative data.

Weaknesses

Less depth of detail in answers. Response bias is more of an issue.

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Self Report Techniques

Interviews

Strengths

Easily repeated, easier to analyse than unstructured. Less chance of interviewer bias and higher inter-interviewer reliability.

Structured

Questions are pre-determined and in a fixed order. It is conducted face-to-face or over the phone.

Weaknesses

Interviewers cannot deviate from the questions which reduces the richness of their data.

General Evaluation

+ Can be distributed to large numbers of participants
+ Researcher doesn't have to be present
- Participants may not be truthful
- Social desirability bias
- Response bias

Strengths

More detail than a structured interview as the interviewer can explore different avenues of questioning.

Unstructured

No pre-determined questions but a general aim of the interview. The participant is encouraged to talk freely and expand on answers.

Weaknesses

Higher risk of interviewer bias and so requires well trained interviewers - expensive. Analysis is more time-consuming and complex.

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Correlations

Correlations are designed to test the strength and direction of a relationship between co-variables. Unlike experiments, there is not an independent and dependent variable as there is no manipulation by the researcher of the independent variable. Therefore, correlational studies do not tell you about causal relationships. The relationship is analysed by plotting a scattergram and calculating a correlation coefficient. The strength of a coefficient is between 0 and -1/+1.

Negative Correlations

As one co-variable increases the other decreases. This uses a – sign in the coefficient e.g. -.6

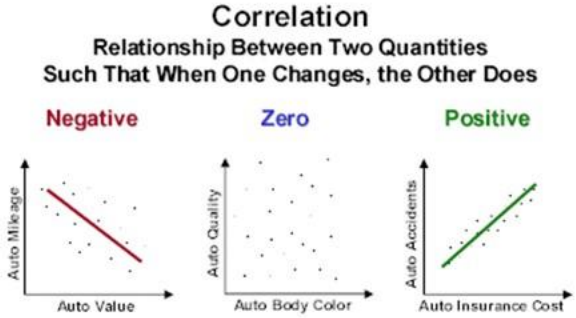
Positive Correlations

As one co-variable increases so does the other. This uses a plus sign in the coefficient e.g. +.6

Evaluation

+ They can be used when it is unethical or impractical to manipulate.
+ It can tell us is further research is justified.

- There may be extraneous variables that influence results and so we cannot establish cause and effect
- As with experiments they may lack internal/external validity.



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Content and Thematic Analysis

Content Analysis

Content analysis is used to analyse qualitative (non-numerical) data and convert it into quantitative (numerical) data. It is particularly used when analysing sources such as interview transcripts, diary entries, films and articles. This can be done through frequency analysis e.g. how many times a certain word appears or through concordance analysis e.g. how many times a phrase appears. A coding system is created before carrying out an analysis.

Thematic Analysis

Thematic analysis is an alternative to content analysis which first assesses the source/material for common themes. These themes are then coded, like content analysis.

Evaluation

+ Good for studying and analysis qualitative data in a numerical way
+ Enables researchers to analyse things like emotions and feelings

- Not very scientific as coding and analysis can be subjective
- Could have low inter-rater reliability
- Difficult to establish general laws and principles from

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Case Studies

A case study is an in-depth study that gathers a lot of detail about one person or a small group. It can use a variety of research methods e.g. interviews, observations or experiments and is usually conducted over an extended period of time.

Evaluation

+ Rich and detailed data as it tends to be more qualitative
+ High ecological validity
+ Avoids practical or ethical issues of studying more sensitive/impractical behaviours in a laboratory

– Subjectivity of the researcher can cause low internal validity e.g. Freud
– Lacks generalisability as it is only one person or a small group of people and not representative of everyone
– Difficult to replicate and is very time consuming to conduct

Examples

Little Hans (Freud)	Clive Wearing	H.M.

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Aims and Hypothesis

Aims

An aim is what you want to find out. They are developed from previous theories and are general statements that describe the purpose of the research you want to conduct.

'An investigation into.....'

Hypotheses

A hypothesis is a prediction of what you might think will happen in your research. It is a precise and measurable statement of the relationship between two operationalised (defined) variables.

The alternative or experimental hypothesis makes a prediction about the effect of the IV on the DV. In the case of a study using a correlational design, the alternative hypothesis makes a statement about the relationship between the co-variables.

Directional: predicts the direction of the difference or relationship e.g. increase, decrease, more, less etc.

Non-directional: predicts that there is a difference but not the direction of the difference or relationship.

The null hypothesis is a statement of 'no difference' or 'no relationship'.

When to Use a Directional Hypothesis?

A directional hypothesis is used when previous research suggests there will be a specific outcome. If there is no previous research or there is contradictory research then a non-directional hypothesis is used.

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Sampling

The **population** is all the possible members of the group the researcher is interested in. The **target population** is the part of the population that the sample is selected from. The **sample** are the actual participants selected.

Random

Every member of the target population has an equal chance of being picked.

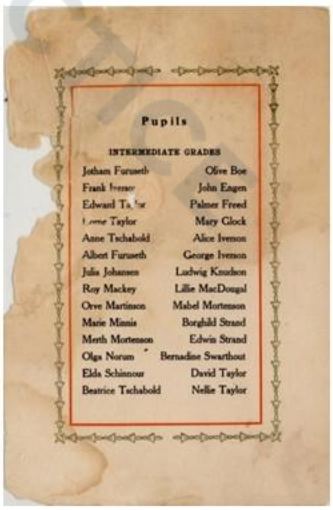
Step 1: Create a list of all members of the target population
Step 2: Each name is assigned a number
Step 3: Select numbers out of a hat or computer randomiser.

Evaluation

+ Potentially unbiased
- Difficult and time consuming
- Sample can still be unrepresentative

Systematic

Participants are chosen from a sampling frame which is a list of people from the target population in a particular order e.g. alphabetically. The sample is chosen at every nth interval e.g. every 5th person.



Evaluation

+ Objective system
- Not everyone has an equal change of being selected
- Can be time-consuming

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Sampling

Stratified

The sample is a mini reproduction of the wider population. Before sampling, the population is divided into characteristics of importance for the research. For example, by gender, social class, education level, religion, etc. Then the population is randomly sampled within each category or stratum.

Evaluation

+ Representative and more generalisable
- Cannot represent all possible strata
- Difficult and time consuming

Opportunity

Use whoever happens to be willing and available. Most commonly used by researchers.

Evaluation

+ Quick, convenient and economical
- Researcher can be bias in who they select
- Not representative or generalisable

Volunteer

Participants self select themselves to take part. Usually in response to an advert.

Public Announcement

WE WILL PAY YOU $4.00 FOR ONE HOUR OF YOUR TIME

Persons Needed for a Study of Memory

*We will pay five hundred New Haven men to help us complete a scientific study of memory and learning. The study is being done at Yale University.

*Each person who participates will be paid $4.00 (plus 50¢ carfare) for approximately 1 hour's time. We need you for only one hour: there are no further obligations. You may choose the time you would like to come (evenings, weekdays, or weekend).

*No special training, education, or experience is needed. We want:

Factory workers	Businessmen	Construction workers
City employees	Clerks	Salespeople
Laborers	Professional people	White-collar workers
Ruthers	Telephone workers	Others

All persons must be between the ages of 20 and 50. High school and college students cannot be used.

*If you meet these qualifications, fill out the coupon below and mail it now to Professor Stanley Milgram, Department of Psychology, Yale University, New Haven. You will be notified later of the specific time and place of the study. We reserve the right to decline any application.

*You will be paid $4.00 (plus 50¢ carfare) as soon as you arrive at the laboratory.

Evaluation

+ Less time consuming
+ Participants are motivated and engaged
- Volunteer bias means the sample is hard to generalise from

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Pilot Studies

A smaller version of a larger study that is conducted to prepare for that study and 'iron out' any problems.

Problems could include questions or instructions being misunderstood, participants getting bored or issues with the validity of the measurement tool.

If problems are found then amendments can be made before the larger study is conducted.

Observational Design

Observational Categories

In order to be systematic, the researcher needs to break down the continuous stream of human behaviour into categories during an observation. This enables operationalisation of the behaviours being observed and a tally kept when each behaviour is seen.

Time Sampling

The researcher records the behaviour that is happening at regular time intervals e.g. every 30 seconds.

Event Sampling

The researcher records every time the behaviour is observed by keeping a tally.

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Experimental Design

Independent Groups

Different participants take part in each condition. Participants are randomly allocated to which condition they will take part in.

Strengths:
- No order effects
- Quickest and easiest way to allocate participants

Weaknesses:
- Participant variables (individual differences) could still affect the dependent variable
- Different participants are needed for each condition which takes more time and expense.

Repeated Measures

The same participants are used in each condition.

Strengths:
- The dependent variable will not be affected by participant variables
- It requires less participants than independent groups or matched pairs

Weaknesses:
- Participants may guess the aim of the study and cause demand characteristics
- Order effects may affect the participants performance unless counterbalancing is used

Matched Pairs

Participants only take part in one condition but are paired with a participant in the other condition based on important characteristics e.g. intelligence

Strengths:
- No order effects
- Reduced participant variables

Weaknesses:
- More expensive and time consuming than independent groups or repeated measures
- You cannot control all possible participant variables

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Variables

Independent Vs. Dependent

Independent variable: The variable that is manipulated by the researcher to see the effect it has on another variable.

Dependent variable: The variable that is measured as a result of the effect of the independent variable.

Operationalisation

When a variable has been **defined** and made **measurable** by the researcher. For example, the dependent variable 'aggression' may be measured by the 'number of punches in 20 minutes'.

Controls

Random Allocation	Participants are randomly allocated to the conditions to spread out individual differences. This can be done by numbering each participant, putting these into a hat and drawing each one out, allocating to condition A then B and so on.
Counterbalancing	Used for a repeated measures design. The sample is divided in half, with one half completing the two conditions in one order and the other half completing the conditions in the reverse order (ABBA). Any order effects should be balanced out by this technique.
Randomisation	Presenting the order of the conditions or tasks or experiment in a randomised order.
Standardisation	All parts of the procedure and experimental setup are kept the same for every participant. This increases the replicability and ensures changes to the dependent variable are caused by the independent variable.

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Variables

Confounding Vs. Extraneous

Extraneous variables: Any variable other than the independent variable that may have an effect on the DV if it is not controlled (i.e. lighting in the lab)

Confounding variables: Any variable other than the independent variable that may have affected the DV but varies with the IV (i.e. personality)

Participant Variables

What are They?	Examples	How to Control
Individual differences between participants	Age, gender, mood, ethnicity, intelligence, personality, memory, previous experience	• Use a large representative sample • Random allocation to conditions or use a repeated measures/matched pairs design

Situational Variables

What are They?	Examples	How to Control
Differences in the set up of the experiment	The environment such as heat or noise, time of day, order effects and demand characteristics	• Standardised procedure and instructions • Counterbalancing

Investigator Variables

What are They?	Examples	How to Control
Differences caused by the person conducting the experiment	Body language, tone of voice, leading questions (experimenter bias), demand characteristics	• Single blind or double blind procedure • Randomisation of procedure and conditions

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Ethics

British Psychological Society's Code of Ethics

The BPS Code of Ethics focusses on four primary ethical principles:

Respect: for the dignity of persons and people
Competence: have the training and skills to conduct their research
Responsibility: To not abuse the trust of others and be professionally accountable
Integrity: Be honest and truthful

Ethical Issues

	What is it?	How to deal with it
Informed Consent	Participants should be able to make an informed judgement as to whether to take part or not.	Informed consent forms should be provided and those under 16 should have a parent or carer sign on their behalf. If it is not possible to gain consent directly then presumptive consent (from a similar group of people) or prior general consent can be used.
Deception	Lying to participants about the aims or procedures of the study, usually to avoid demand characteristics.	Should only be used when there is no alternative. Debriefing should be offered afterwards to explain the full aims of the study.
Right to Withdraw	Participants have the right to withdraw at any point in the study and to withdraw their data after the study (even if they have been paid).	Participants should be told in the informed consent form and during the debriefing that they have the right to withdraw.
Protection from Harm	Participants' psychological and physiological safety must be ensured.	Do not expose them to greater risk than their normal life experiences.
Confidentiality	Participants should not be identifiable in published research.	Participants should be identified by a number or code rather than their name.
Privacy	A person's right to control information about themselves.	Researchers should only observe people where they would expect to be observed by others in public places.

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Peer Review

What is Peer Review?

Peer review is the assessment of scientific work by other specialists in the same field, which ensures that research intended for publication is of a high quality. Every aspect of a written investigation must be scrutinised by a small group of experts ('peers'), who are objective and anonymous to the researcher.

Aims of Peer Review

1) To allocate research funding

Independent peer evaluation can decide who is awarded funding for research. This may be done by government-run organisations who have vested interests in the research area such as the Medical Research Council.

2) To validate the quality and relevance of research

Every aspect of a research paper is assessed for quality (hypotheses, methodology, statistical tests & conclusions). This avoids research being published that is of poor quality or even made up!

3) To suggest amendments or improvements

Reviewers may suggest minor revisions, or may conclude that research should be withdrawn altogether.

4) To assess the research rating of a university department

The Research Excellence Framework (REF) is used to judge the quality of a university department's research and may be used for future funding allocation.

Evaluation of Peer Review

Finding an expert	It can sometimes be difficult to find an appropriate expert.
Anonymity	Some peers may use their anonymity to criticise rival researchers (who compete for funds and academic praise).
Publication Bias	Journal editors may favour 'headline grabbing' findings. There may also be the file drawer problem (tendency to publish positive results that confirm hypothesis) rather than research with negative results.
Preserving the status quo	Research that opposes mainstream theories may be suppressed to maintain the status quo, therefore slowing down the rate of change in psychology.

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Implications for the Economy

Improving the Economy

The topics in Psychology A Level can be applied to the wider economy in order to improve it or devalue it. Below are some examples of research areas you may have studied that you could use.

Mental Health

Any studies that you have examined into causes and/or treatments for mental health will have implications for the economy. A third of all absences at work are due to mental health disorders and so to find the causes and treatments for these will enable the workforce to be healthier and therefore cost less in sick pay for absent employees. Examples of this could include, using cognitive behaviour therapy (CBT) for depression or anti anxiety drugs for stress.

Role of the Father

Research into the role of the father demonstrates that fathers are potentially as important as mothers in the development of a child. Policymakers are now more aware of the equal importance parents have in their child's life and so have promoted flexible working arrangements and made changes to parental leave.
Subsequently, couples where both work can still contribute to the economy and divide childcare as they see fit. Alternatively, if the mother is the higher earner she can continue to work and the father stay at home.

Criminal Psychology

Knowledge of the cognitive interview can save police officer's time and money when interviewing eye witness testimonies, as they can gain more accurate information in the first instance. Additionally, if treatments are found by psychologists that help treat criminals this can also decrease the cost to the economy by reducing crime in the future.

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Reliability

Types of Reliability

Reliability is the consistency of a measure. A measure/test is considered reliable if we get the same result repeatedly.

Internal Reliability: Consistent within itself i.e. IQ test
External Reliability: Consistency over several occasions.

Assessing Reliability

Test-Retest

Giving the same test/questionnaire on two occasions and correlating the results. If it is a positive correlation of +.80 then it has good reliability.

Inter-Observer Reliability

Use more than one observer and correlate their recordings. Again, if it has a coefficient of +.80 or more than it has good reliability. Can also be used for content analysis (inter-rater) and interviews (inter-interviewer).

Improving Reliability

Questionnaires	Some questions to be removed, or rewritten, particularly if they are ambiguous or complex. Open questions can be replaced with closed questions.
Interviews	Use the same interviewer each time and make sure they are properly trained. Use structured interviews where possible.
Observations	Make sure behavioural categories are operationalised, without overlapping each other. Ensure observers are trained in the use of the categories.
Experiments	Use standardised instructions and procedures so that they are the same every time.

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Validity

Types of Validity

Validity is the extent to which a test measures what it claims to measure.

Internal Validity: Does the study measure the behaviour it's supposed to or is it affected by participant/experiment effects or extraneous variables?
External Validity: Can it be generalised to other people and situations? (Ecological Validity) Can it apply to other time periods? (Temporal Validity)

Assessing Validity

Face Validity

Does the test or measure appear to measure what it is supposed to at first glance (on the face of it). This can be determined by an expert.

Concurrent Validity

Compare the results of your test with another established test. An agreement of more than +.80 correlation coefficient suggests good validity.

Improving Validity

Questionnaires & Interviews	Use a lie scale (questions which assess truthfulness) in the questionnaire. Keep questionnaires anonymous to encourage truthfulness.
Observations	Covert observations have higher ecological validity. Behavioural categories should be clear and operationalised.
Experiments	Use a control group to assess the effect of the independent variable on the dependent variable. Standardised instructions and procedures to avoid participant/experimenter effects. Use a single- or double-blind procedure.
Qualitative Research	Use direct quotes from sources to ensure 'interpretative validity'. Use triangulation of different methods eg. Diary entries and observations to strengthen validity of case studies and interviews.

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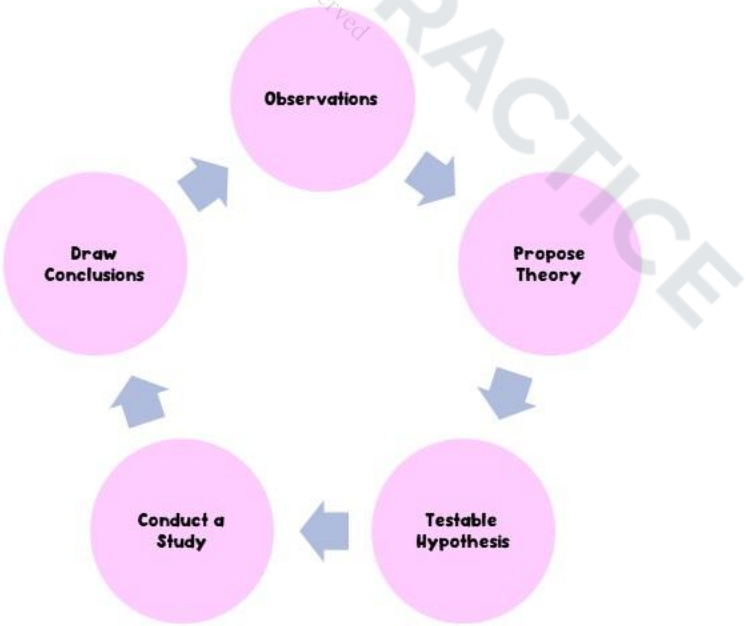
Features of a Science

Empirical Method

- It should be **replicable** - If repeated the results should be the same/similar
- All variables should be **operationalised**
- The judgements should be as fair and **unbiased** as possible
- It should be **objective** (fact based) rather than subjective (opinion based)
- It should use **nomothetic** approaches producing **quantitative** data
- It aims to research in a **reductionist** and **deterministic** manner

Theory Construction & Hypothesis Testing

- **Theory construction** uses direct observation to gather evidence, which researchers may then conduct a study into.
- **Hypothesis testing** occurs when objective methods are used to find evidence to support or contradict a theory.
- When new hypotheses are derived from previous theories this is known as **deduction**.



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Features of a Science

Falsifiability

- Popper (1959) argues that Science is unique as, in their quest to find 'truths', scientists do not try and prove themselves right, they actually try to falsify their work first.
- A good science should constantly be challenged and have the potential to be falsified
- Psychologists try to avoid using 'this proves' and always include a null hypothesis for this reason

Replicability

- In order to test in science, as suggested by Popper, then the research needs to be replicable.
- If it is repeated with the same results we can trust the theory.
- If it can be repeated across different contexts then it improves the validity as researchers can then generalise the findings.

Paradigms

- Natural sciences are based on a set of shared assumptions called paradigms. The paradigm provides scientists with a basic framework from which to work from i.e. what methods to use, what facts to follow etc.
- Progress happens in science when researchers question the accepted paradigm and a paradigm shift occurs when there is too much contradictory evidence
- Kuhn argues that Psychology is different as it has many different perspectives which it does not agree on and so is a pre-science.

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Psychological Reports

Psychological reports are when psychologists write up their research to be published in journal articles. There are key sections that all psychological reports should include.

Sections of a Report

	What is it?
Abstract	A summary of the whole report of around 150-200 words. It includes the aims, hypothesis, method, results and conclusions. It's function is to tell the reader whether it is worth reading the full article.
Introduction	A literature review of the general area of research made up of previous theories and studies. It starts broad and then narrows to the researcher's own aims and hypotheses to introduce the background of their research.
Method	A description of how the study was conducted in enough detail for someone else to replicate it. It will include the research design, sample, apparatus/materials, procedure and ethical controls.
Results	A summary of the findings of the research which could include descriptive statistics, such as graphs and measures of central tendency. It can also include the choice of statistical test, if used, calculated and critical values, level of significance and which hypothesis was accepted.
Discussion	A summary of the results with explanations of the findings. It will discuss any limitations of the study and how this could be improved in future research. It may consider real world application and implications for the field.
Referencing	Complete details of any research documents, journals, books, internet sites etc. that have been used in order to inform the reader and avoid plagiarism.

Reference Format:

Author(s), date, article title, *journal name (in italics),* volume (issue), page numbers.

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Data Handling

Quantitative Vs. Qualitative

Quantitative Data: Numerical data which is easily analysed. Collected from experiments, closed questions on questionnaires, structured interviews and observations and correlations.

Qualitative Data: Non-numerical data, usually in word format. Collected through open questions on questionnaires, unstructured interviews and observations, case studies and content analysis.

Primary Data	Secondary Data	Meta-Analysis
Data that is collected directly by the research, specifically for the purpose of their study.	Data that has been collected by someone else, not specifically for the researcher's study.	Researchers combine data from several studies and combine them to give an overall conclusions.

Levels of Measurement

Nominal	Data is in categories i.e. 'Tall' and 'Short'. Each category has a frequency count of how many items/people are in it. Simplest level of measurement. Its measure of central tendency is the **mode**.
Ordinal	Data that is usually scores in rank order but does not have equal distances between ranks. E.g. 1st, 2nd and 3rd in a race. Its measure of central tendency is the **median** and its measure of dispersion is the **range**.
Interval	Data that is a continuous scale with equal intervals. Quite often a public scale of measurement e.g. weight and has a true zero point. Most precise level of measurement. Its measure of central tendency is the mean and its range of dispersion is standard deviation.

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Descriptive Statistics

Measures of Central Tendency

	How to Calculate	Strengths	Weaknesses
Mean	Add all the numbers and divide by the number of numbers. Mean is used for interval data	More sensitive than the median, because it makes use of all the values of the data.	It can be misrepresentative if there is an extreme value.
Median	The median is the middle value when the data is in numerical order. Median is used for ordinal data	It is not affected by extreme scores, so can give a representative value.	It is less sensitive *than the mean*, as it does not take into account all of the values.
Mode	The mode is the value that is the most common. Mode is used for nominal data.	It is useful when the data are in categories.	It is not a useful way of describing data when there are several modes.

Measures of Dispersion

	How to Calculate	Strengths	Weaknesses
Range	Calculate the difference between the highest and lowest number.	Provides you with direct information that is easy to calculate.	Affected by extreme values. Doesn't take into account the all of the numbers in the data set.
Standard Deviation	The measure of the spread of data round the mean. $S = \sqrt{\frac{\Sigma(X-\bar{X})^2}{N}}$	More precise measure which takes all values into account.	May hide extreme values of data sets.

EXAM PAPERS PRACTICE

RESEARCH METHODS

Mathematical Skills

Computation

Fractions

A quantity that is part of a whole number. Numerator on top and denominator on the bottom e.g ¾ . Should always be simplified.

To calculate it you must divide the score by the total.

Decimals

Another way to write a fraction, where we only write the numerator.

To convert a decimal to a fraction, you work out the number of decimal places i.e. 0.81 has two. If there are two divide by 100, if there are three divide by 1000 and so on.

Percentages

Is the proportion of a total calculated out of 100 and also another type of fraction.

To calculate you must divide the number you wish to express as a percentage by the total score and multiply by 100. To convert a percentage to a decimal you should remove the % sign and move the decimal point two places to the left.

Ratios

Is a measure of how much of one thing you have in comparison to another.
These should also be simplified to their lowest form.

These can be expressed as part-to-part e.g. 4:1
Or part-to-ratio e.g. 4:5

RESEARCH METHODS

Mathematical Skills

Handling Data

Standard Form

A way of expressing a number by focusing on its overall magnitude.

A number between 1 and 10 X 10 (to the power of a whole number)

The power of the whole number is how many times we move the decimal point to the left or to the right.

45 billion = 45, 000, 000, 000.0
To get 4.5, the decimal point will move ten places to the left.

This would be 4.5×10^{10}

If it moves to the left, then the power will be negative.

e.g. 0.003 would be 3×10^{-3}

Significant Figures

This is rounding a score to the first digit after 0.

To do this:

- Look at the first non-zero digit if rounding to one significant figure
- Look at the digit after the first non-zero digit if rounding to two significant figures
- Look at the next digit
- If it's 5 or more, increase the previous digit by one
- If it's 4 or less, keep the previous digit the same
- Fill any spaces to the right of the line with zeros, stopping at the decimal point if there is one

E.G 47,653 to 3 significant figures would be 47, 700

EXAM PAPERS PRACTICE

RESEARCH METHODS

Tables & Graphs

Tables

Raw Data Tables

Show scores prior to analysis.
Hard to identify patterns in the data.

Morning Score	Afternoon Score
10	23
15	24
12	40

Frequency Tables

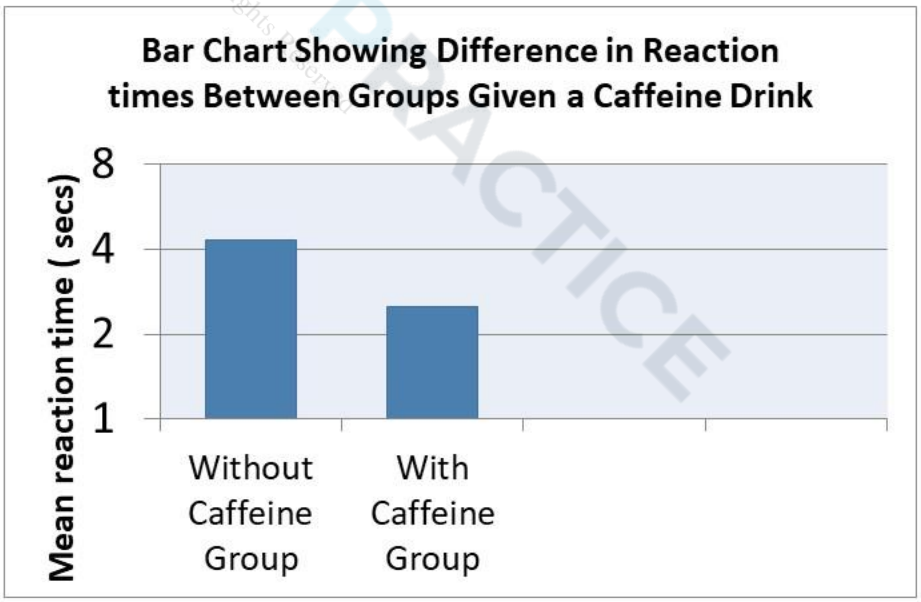
Uses raw data to count frequency of certain items.

Hours spent on phone	Number of teenagers	Total
4	III	3
5	𝍸	5
6	I	1

Graphs

Bar Chart

Used to represent 'discrete data' where the data is in categories, which are placed on the x-axis. The mean or frequency is on the y-axis. Columns do not touch and have equal width and spacing.



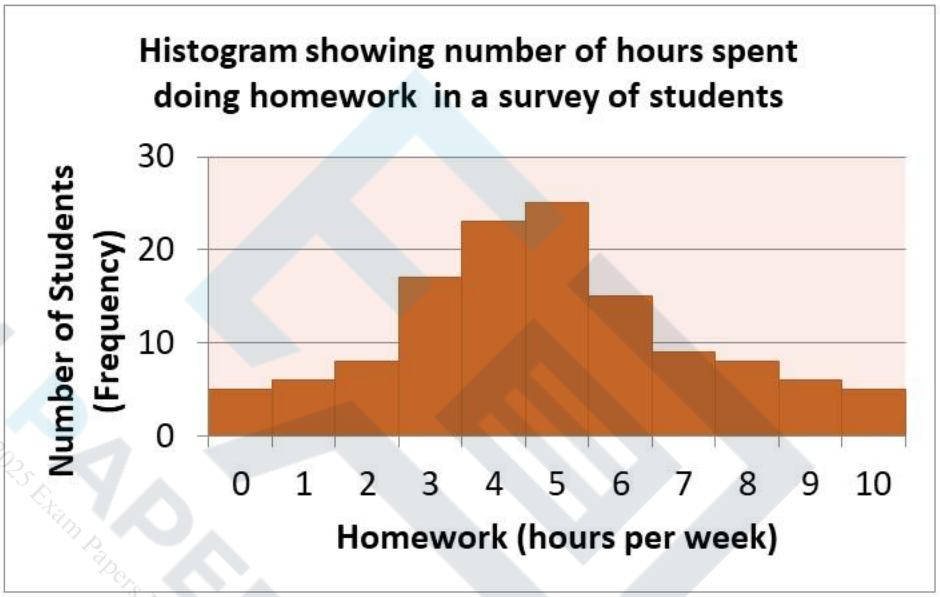
RESEARCH METHODS

Tables & Graphs

Graphs

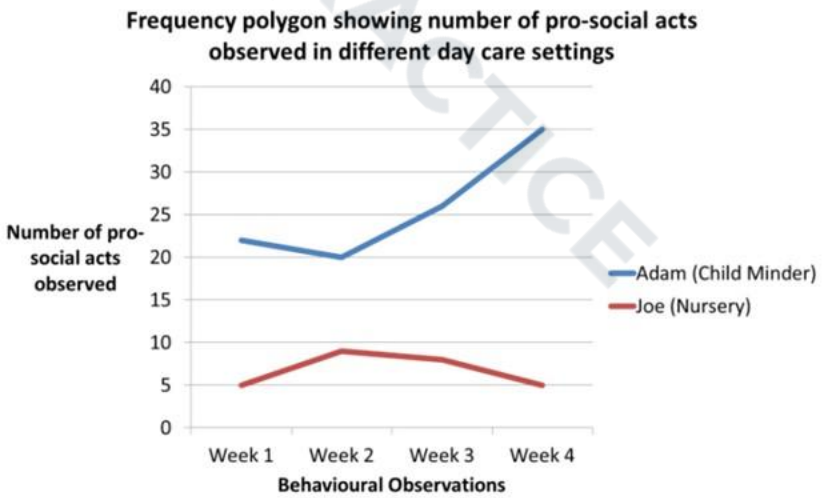
Histogram

Used to represent data on a 'continuous' scale. Columns touch because each one forms a single score (interval) on a related scale. Scores (intervals) are placed on the x-axis . The height of the column shows the frequency of values.



Line Graph/Frequency Polygon

Can be used as an alternative to the histogram
Lines show where mid-points of each column on a histogram would reach.
Particularly useful for comparing two or more conditions simultaneously.



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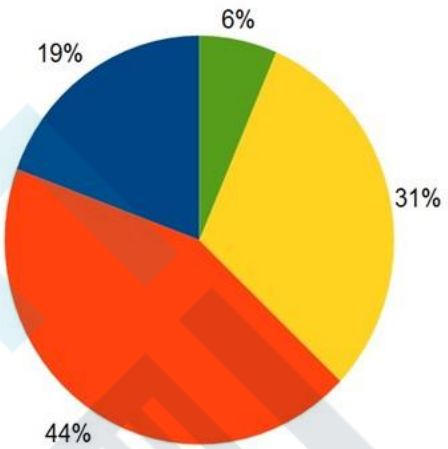
RESEARCH METHODS

Tables & Graphs

Graphs

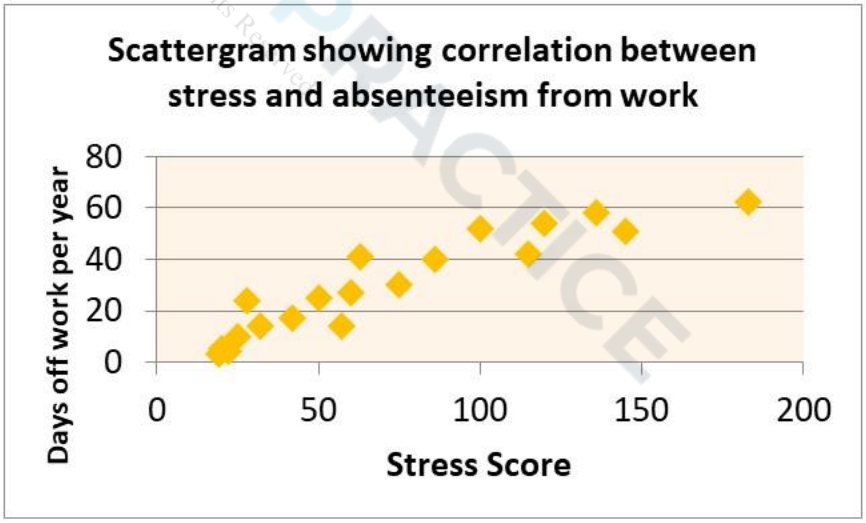
Pie Chart

Used to represent frequency data or proportions. Each slice is a proportion/fraction of the total.



Scattergram

Used for measuring the relationship between two variables. Data from one variable is presented on the x-axis, while the other is presented on the y-axis. We plot an 'x' on the graph where the two variables meet . The pattern of plotted points reveals different types of correlation, e.g., positive, negative or no relationship



EXAM PAPERS PRACTICE

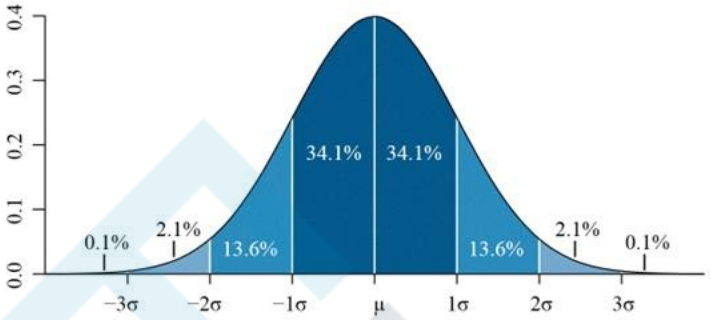
RESEARCH METHODS

Distributions

Normal Distributions

A bell shaped curve where most people fall in the mid point and a few at the extreme ends.

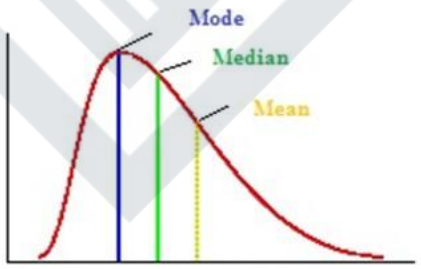
Mean, Median and Mode all occupy the midpoints. It is symmetrical in it's distribution.



Positive Skewed Distributions

Most of the distribution to the left.

Mean is pulled to the right by extreme scores.

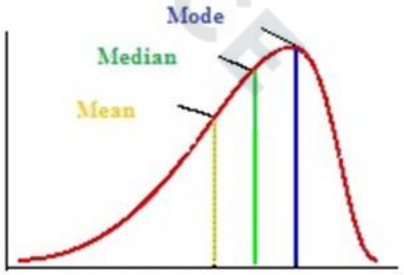


Right-Skewed (Positive Skewness)

Negative Skewed Distributions

Most of the distribution to the right.

Mean is pulled to the left by extreme scores.



Left-Skewed (Negative Skewness)

EXAM PAPERS PRACTICE

RESEARCH METHODS

Probability & Significance

What is probability?

- A numerical measure of the likelihood that certain events will happen.
- The accepted level of probability in psychology is 0.05 (or 5%).
- This means there is less than 5% probability the results happened by chance and we can be 95% confident in the results
- This is the level at which the researcher decides to accept the alternative hypothesis or not.

What is significance?

- The difference/association between two sets of data is greater than would happen by chance or fluke.

Statistical Tables

- After completing a statistical test the researcher will have a calculated value
- Each statistical test has a table of critical values.
- In this table is a set of critical values for the researcher to compare his calculated value to
- For some tests the calculated test must be equal to or more than the critical value to be deemed significant and in others it should be equal to of less than the critical value.

In order to know which critical value to use the researcher must know:

1. If the alternative hypothesis is one or two tailed
2. The number of participants in the study (N)
3. The level of significance being used (usually 5%)

Type 1 Error

The null hypothesis is rejected wrongly (false positive). Can happen if the significance level is too lenient (high) e.g. 10%

Type 2 Error

The null hypothesis is accepted wrongly (false negative). Can happen if the significance level is too stringent (low) e.g. 1%

EXAM PAPERS PRACTICE

RESEARCH METHODS

Statistical Testing

The Sign Test

1. Insert data into the table
2. Score from condition B is subtracted from condition A to produce the sign of difference (either a + or -)
3. Add up the total number of + scores and the - scores
4. Any participant who achieved the same score should be ignored/disregarded
5. The S value (the observed/calculated value) is the total of the less frequent sign (+ or -)

How to Write a Statement of Significance

The results are / are not significant as the observed value of S = ... is more/less than the critical value ....., where N=..... for a ..... -tailed hypothesis, with a p ≤ ..... level of significance, the null hypothesis can be rejected / accepted and the alternative hypothesis rejected / accepted.

If you are not using the Sign test you will need to substitute 'S' for the relevant symbol and change 'N' to degrees of freedom (df).

RESEARCH METHODS

Statistical Testing

How to Choose the Correct Statistical Test

Level of Data	Test of Difference		Test of Association
	Related (Repeated measures or matched pairs)	Unrelated (Independent measures)	Correlation
Nominal	Sign Test (S)	Chi –Squared (X^2)	Chi –Squared (X^2)
Ordinal	Wilcoxon T Test (T)	Mann-Whitney U Test (U)	Spearman's Rho (rho)
Interval	Related t-test (t)	Unrelated t-test (t)	Pearson's r (r)

Tests that use 'N'

Mann-Whitney U Test
Wilcoxon T Test
Spearman's Rho
Sign Test

Tests that use Degrees of Freedom (df)

Pearson's r: $df = N-2$
Related t-test: $df = N-1$
Unrelated t-test: $df = N_a + N_b - 2$
Chi-Squared: $df = (rows - 1) \times (columns - 1)$