Research Methods Study Guide

Module: 4-8

AP Objective II: Research Methods (8-10%)

Psychology is an empirical discipline. Psychologists develop knowledge by doing research. Research provides guidance for psychologists who develop theories to explain behavior and who apply theories to solve problems in behavior.

Part 1: The Need for Psychological Science

- Our intuition is more inaccurate than we realize.

- **Hindsight Bias**
  - Also known as the knew-it-all-along effect
  - The tendency to believe, after learning an outcome, that you could have predicted or foreseen it all along.
    - Example: When the Patriot's came back to win the Super Bowl, many people looked back after the game and said they knew it would happen all along when really there was no evidence to indicate that (after all, the Falcons were winning by a mile for the majority of the game).
  - We think things are more predictable than they really are.

- **Overconfidence**
  - We humans tend to think we know more than we do.
  - We are wrong far more often than we realize.

- **Perceiving Order in Random Events**
  - We have a tendency to look for patterns and meaning even when they aren't there.
  - Random sequences often don't look random even though they are.

Part 2: The Scientific Method

- **Theory**
  - A tested and widely accepted model that helps explain and predict behaviors or events.
  - It is based on observations, experiments, and reason (logical thinking/arguments).
  - One feature of a good theory is that it should be falsifiable.
    - If you can find one instance where the theory is proven wrong and replicate the study and results, the theory can be rejected.
  - In order for a theory to develop credibility, it must be subjected to the rigorous test of a thorough peer review performed by experts in the same field.

- **Hypothesis**
  - A specific, testable prediction that is based on a theory.

- **Example of Theories and Hypotheses**
  - According to Freud's psychoanalytic theory, our personality is shaped by early childhood experiences.
  - A hypothesis based on this theory would be: children who come from abusive homes are more likely to mistrust others later in life.
  - Theories are more general; hypotheses are more specific (and must be based on theories)

- Our theories can bias our observations. If we firmly believe that personality is shaped by early childhood experiences, we might only look for information that confirms our belief and avoid or discard information that doesn't.
  - **Operational Definitions**
    - A definition that provides an objective description of procedures and concepts and how they will be measured in a research study.
      - Example: If we are conducting a study on how sleep deprivation affects memory, we need to provide operational definitions of sleep deprivation and memory.
        - Sleep deprivation: for our test, we might say that sleep deprivation consists of 24 hours without sleep.
        - Memory: for our test, we might say that memory is the ability to recall items in a list.
    - Used to make sure biases don't interfere with research results.
    - Used so other researchers can replicate our study
    - They must be precise
  - **Replication**
    - Repeating the essence of a research study, usually with different participants in different situations, to see whether the basic results are similar with other participants and circumstances.
    - No research finding is credible unless the study can be replicated with similar results.

Part 3: Descriptive Research

Descriptive research is about describing some phenomenon—determining its basic dimensions and defining what the thing is, how often if occurs, and so on.

- Can help identify (describe) problems, but cannot prove what causes them.

Types of Descriptive Research

- **Naturalistic Observation**
  - Records behavior in natural environments
  - Provides interesting snapshots of everyday life, but it does so without controlling for all the factors that may influence behavior.
  - **Limitations:** May not be generalizable to the wider population.
  - **Naturalistic observation does not explain behavior, it describes it.**

- **Case Studies**
  - Examines one individual in depth.
  - Used when, for either practical or ethical reasons, the unique aspect of the individual's life cannot be duplicated and tested with other individuals.
  - Provides information about one's personal goals, hopes, fantasies, fears, traumatic experiences, family relationships, health, and anything else that helps the psychologist or psychiatrist understand the person's mind and behavior.
  - Can also involve in-depth explorations of particular families or groups.
  - **Limitations:** The case study might not be generalizable to the wider population. This means that a case study may tell us a great deal about the individual person being studied, but not very much about people in general. What is true for one person isn't necessarily true for all.
  - **Case studies to not explain behavior, they describe it.**

- **Surveys**
  - Asks people to report their thoughts and behaviors.
  - The answers often depend on the ways questions are worded.
    - **Wording effects:** Even small changes in the order or wording of questions can have major effects.
      - Example: People are much more approving of "aid to the needy" than they are of "welfare," even though they are essentially the same thing.
  - **Limitations:** Surveys can only measure what people think about themselves, and people don't always know the truth about themselves. They sometimes provide inaccurate responses out of fear of judgment.

Part 4: Correlational Research

Correlational research tells us about the relation between two variables.

- The purpose of correlational research is to examine whether and how two variables change together.
  - It looks at a co-relation.
  - For instance, if one of the variables increases, what happens to the other one?
  - When two variables change together, we can predict one from the other, and we say that the variables are correlated, or co-related.
    - Example: knowing how much aptitude test scores correlate with school success tells us how well the scores predict school success.

- **Correlation coefficient:** A numerical value that measures the degree of relation between two variables.
  - Represented by the letter *r*.
  - Tells us two things about the relationship between two variables:
    - the strength of the relationship
    - the direction of the relationship
  - The value of a correlation always falls between -1.00 and +1.00.

- The number or magnitude of the correlation tells us about the <u>strength</u> of the relationship.
- The sign (+ or -) tells us about the <u>direction</u> of the relation between the variables.
    - **<u>Positive Correlation (+):</u>** as one variable increases, the other also increases.
        - <u>Example</u>: As hours of sleep increase, quality of memory increases.
    - **<u>Negative Correlation (-):</u>** as one variable increases, the other decreases.
        - <u>Example</u>: As hours of sleep decrease, levels of stress increase.
    - **<u>Zero Correlation:</u>** there is no systematic relation between the variables.

- **<u>Scatterplot:</u>** A type of graph that is used to represent correlations.

- **<u>CORRELATION DOES NOT EQUAL CAUSATION:</u>** Just because two variables are related does not mean that one causes the other.
    - Being able to predict one event based on the occurrence of another event does not necessarily tell us anything about the cause of either event.
    - **<u>Confounding Variable:</u>** Some other variable that has not been measured which may account for the relationship between two others.
        - <u>Example</u>: If the increase of ice cream sales correlates with an increase in violent crime, it would be silly to suggest that one causes the other. One or more confounding variables are likely involved.
    - Even if one variable was the cause of the other, a correlation coefficient could not tell us which was the cause and which was the effect.

- **<u>Cross-Sectional Design:</u>** compares different population groups at the same time.
    - Allows you to measure the correlation between variables among different groups.
        - <u>Example</u>: a study that splits men and women into separate groups and then measures the relationship between sleep deprivation and stress levels among each group.

        - This allows you to see whether the same variables relate differently among different groups.

- **Longitudinal Design:** measures the relationship between two variables within the same population over time.
    - This shows how the relationship between the two variables changes as people grow older.
        - Example: by measuring the relationship between sleep deprivation and stress levels in the same population over time, we can see if age plays a role in the relationship between the two variables.
            - This only works if you use the same participants from beginning to end.

Part 5: Experimental Research

Experimental research is the only way to determine a cause and effect relation between variables.

- **Experiment:** a carefully regulated procedure in which the researcher manipulates one or more variables that are believed to influence some other variable.
    - Example: to measure whether taking antidepressants decreases depression, the researcher would create two groups: one that takes the medication and one that does not. By comparing the results between the groups, the experimenter can determine whether taking antidepressants does indeed reduce depression.
        - **Experimental Group:** the people who receive the treatment.
        - **Control Group:** the people who do not receive the treatment.
            - **Random Assignment:** assigning participants to experimental and control groups randomly, thus minimizing preexisting differences between those assigned to the different groups.
                - This allows us to determine whether the treatment itself caused the result and not some other confounding variable.
        - **Population:** the entire group about which the investigator wants to draw conclusions.
        - **Sample:** the subset of the population chosen by the investigator to study.
        - **Random Sample:** a sample that gives every member of the population an equal chance of being selected.
        - **Representative Sample:** a sample that accurately represents the population being studied. You can only obtain a representative sample by randomly selecting participants from the population.
            - We tend to generalize from samples we observe, so if we want our studies to be accurate, we must make sure we select participants that accurately represent the population we are studying.
            - We achieve this by selecting participants randomly rather than targeting a specific group.
            - Example: your study of whether lack of sleep impacts performance on college exams would be broken down as follows:
                - Population: college students

- **o** Representative Random Sample: the group of college students randomly selected to participate in the study.

- **Variables involved in experiments:**
  - **o** **Independent Variable:** the variable that the experimenter manipulates in order to determine its effects.
    - It is a potential cause of some outcome (dependent variable).
  - ○ **Dependent Variable:** the variable that may change as a result of manipulations in the independent variable.
    - Represents the outcome (effect) in an experiment.
    - Is dependent on the independent variable.
  - o Independent and dependent variables are two of the most important concepts in psychological research. Remember:
    - **The independent variable is the cause.**
    - **The dependent variable is the effect.**

Some Cautions About Experimental Research

- If the results of a research study are **replicated** (repeated multiple times by different experimenters), the results are considered to be **reliable.**
  - ○ **Reliability:** the degree to which a research study produces stable and consistent results.
    - Just because a study is reliable doesn't mean the study is valid.
  - ○ **Validity:** the credibility or believability of the research.
    - **External validity:** the degree to which an experimental design actually reflects the real-world issues it is supposed to address.
      - Often, operationalizing variables in the lab involves creating models of real-world experiences. External validity is concerned with how will those models represent the real-world contexts they are meant to represent.
    - **Internal validity:** the degree to which changes in the dependent variable are due to the manipulation of the independent variable.
      - This allows us to determine whether the experimental methods are free from biases and logical errors that may confound the results.

- **Experimenter Bias:** occurs when the experimenter's expectations influence the outcome of the research.

- **Research Participant Bias:** occurs when the behavior of research participants during the experiment is influenced by how they think they are supposed to behave or by their expectations about what is happening to them.
  - ○ **Placebo Effect:** occurs when the participants' expectations, rather than the experimental treatment, produce a particular outcome.
  - ○ **Placebo:** a harmless substance that looks like a real pill, but has no physiological effect. Given to the participants in a control group to make them think they are receiving the treatment.

        - Example: if a member of the control group thinks they are being treated with an antidepressant when really it is just a placebo, they might believe the pill is working and report feeling less depressed.
        - Giving individuals in the control group a placebo pill allows researchers to determine whether changes in the experimental group are due to the actual medication and not simply the participants' expectations.

- **Double-Blind Experiment:** An experimental design in which neither the experimenter nor the participants are aware of which participants are in the experimental group and which are in the control group until the results are calculated.
    - This helps make sure that neither the experimenter's nor the participants' expectations affect the outcome of the study.

Part 6: Descriptive Statistics

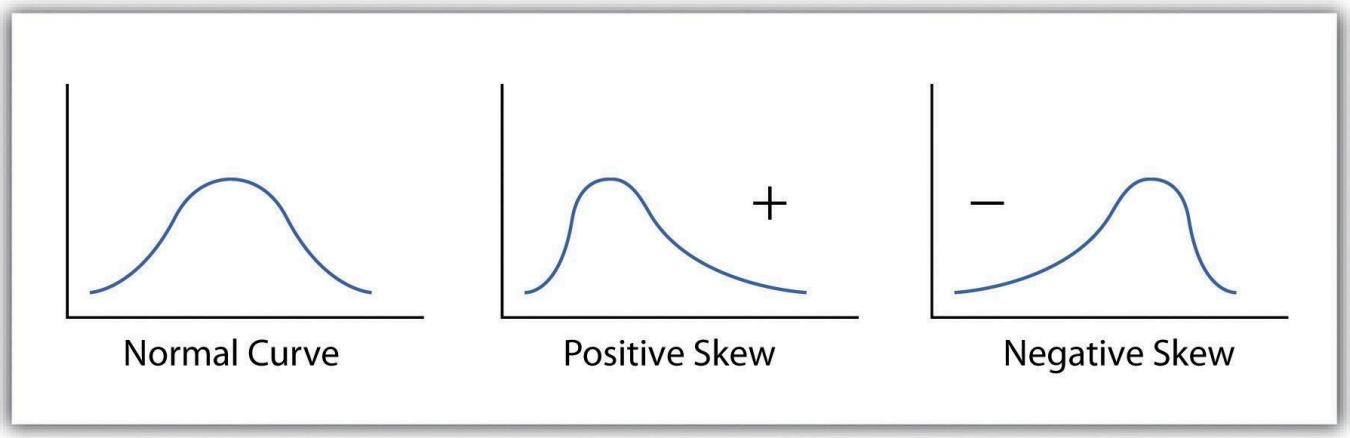
Descriptive statistics are mathematical procedures that are used to describe and summarize sets of data in a meaningful way. They reveal the "big picture"—the overall characteristics of the data and the variation among them.

- **Measures of Central Tendency:** a single number that represents the overall characteristics of a set of data. Measures of central tendency neatly summarize data.
    - **Mean:** the average score in a sample
        - Obtained by adding the scores and then dividing by the number of scores.
        - The best measure of central tendency.
    - **Median:** the middle score in a sample
        - if you arrange all the scores in order from the highest to the lowers, half will be above the median and half will be below it.
    - **Mode:** the most common score in a sample

- **Measures of Variation:** variation refers to how similar or diverse the scores are.
    - Averages derived from scores with low variability are more reliable than averages based on scores with high variability.
        - Consider a basketball player who scored between 13 and 17 points in each of her first 10 games in a season. Knowing this, we would be more confident that she would score near 15 points in her next game than if her scores had varied from 5 to 25 points.
    - **Range:** the gap between the lowest and highest scores.
        - Provides only a basic estimate of variation.
    - **Standard Deviation:** A measure of dispersion that indicates how much the scores in a sample differ from the mean in a sample.
        - If the standard deviation approaches 0, the scores are very similar to each other and very close to the mean.
        - The higher the standard deviation, the greater the difference among the scores.
        - The most useful measure of variation.

- **Graphing Variation:**

- In nature, most scores tend to form a symmetrical, **bell-shaped** distribution known as a **normal curve**. This means that most scores fall near the mean, and fewer cases fall near either extreme.
- **Positive Skew:** a curve where most values are on the lower end, but there are some exceptionally large/high values.
- **Negative Skew:** a curve where most values are on the higher end, but there are some exceptionally small/low values.



Part 7: Inferential Statistics

Inferential statistics are mathematical methods that are used to indicate whether the data sufficiently support a research hypothesis.

- **Statistical Significance:** a statistical statement of how likely it is than an obtained result of a research study occurred by chance.
  - In order for the results of a study to be statistically significant, the likelihood of the results happening by chance must be less than 5% (.05).

Part 8: Conducting Ethical Research

Ethics is a crucial consideration for all science. A number of guidelines have been developed to ensure that research is conducted ethically. At the base of all these guidelines is the notion that people participating in psychological research should be no worse off coming out of the study than they were going in.

- **Informed Consent:** All participants must know what their participation will involve and what risks might develop before they consent to participating in the study.
  - Even after informed consent is given, participants must retain the right to withdraw from the study at any time and for any reason.

- **Confidentiality:** Researchers are responsible for keeping all of the data they gather on individuals completely confidential and, when possible, completely anonymous.

- **Debriefing:** After the study has been completed, the researchers should inform the participants of its purpose and the methods they used. In most cases, the experimenters can inform participants in a general manner beforehand about the purpose of the research without leading the participants to behave in a way that might confound the results. When preliminary information about the study is likely to affect the results, the participants must be debriefed after the study's completion.

- **Deception:** In some circumstances, telling the participants beforehand what the research study is about substantially alters the participants' behavior and invalidates the researcher's data. Thus, researchers sometime deceive participants about the purpose of the study. In all cases of deception, the researcher must ensure that the deception will not harm the participants and that the participants will be told the true nature of the study (will be debriefed) as soon as possible after the study is completed.

- **Ethical Treatment of Research Animals:** The American Psychological Association guidelines state that researchers must ensure the "comfort, health, and humane treatment" of animals and minimize "infection, illness, and pain."