UNIT II: RESEARCH METHODS

Module 4: The Need for Psychological Science
Module 5: Scientific Method and Description
Module 6: Correlation and Experimentation
Module 7: Statistical Reasoning in Everyday Life
TRUE OR FALSE

• The scientific finding that depressed people tend to have low self-esteem proves that depression causes people to be down on themselves.

• Most abused children do not become abusive adults.

• Patients whose brains are surgically split down the middle survive and function much as they did before the surgery.
I. The Need for Psychology Science

A. Did we know it all along?

1. Hindsight Bias: the tendency to believe, after learning an outcome, that one would have foreseen it.

“I knew it all along”

“Out of sight, out of mind”

“Absence makes the heart grow fonder”
Module 4

• B. Overconfidence

• 1. Together with hindsight bias, can lead to overestimating our intuition.

• “They couldn’t hit an elephant at this distance.”

  “We don’t like their sound. Groups with guitars are on their way out.”
Module 4

C. The Scientific Attitude (*Empirical Approach*)

1. Three main components

- CURIOUS eagerness
- SKEPTICALLY scrutinize competing ideas
- Open-minded HUMILITY before nature

S.A. = skeptical but not cynical, open but not gullible
“To believe with certainty, we must begin by doubting.” - Polish Proverb
Module 4

• D. Critical Thinking: examines assumptions, assesses the source, discerns hidden values, confirms evidence, and assesses conclusions.

• 1. “Smart thinking”

*Four elements*
Examine assumptions
Discern hidden values
Evaluate evidence
Assess conclusions
• Types of Psychological Research:

• *Descriptive methods*: describe behaviors. (case studies, surveys, nat. observation)

• *Correlational methods* associate diff factors, or *variables*.

• *Experimental methods* manipulate variables to discover their effects.
ETHICS

A. Animal Rights

1. Some Psychologists study animals out of an interest in animal behavior. Some study animals because their physiological and psychological characteristics are similar to humans.

2. Animals used in psychological experiments rarely experience pain.

IACUC (Institutional Animal Care and Use Committee) approves animal research,
B. Human Research

1. Informed consent- participants must know that they are being involved in research and give their consent. *Notify them of possible challenges in study.*

2. Coercion-? Participation *must* be voluntary. Give them opportunities to drop out of the study.

3. Confidentiality- treat information about individual participants confidentially. Participants identities and actions must not be revealed by the researcher.
4. Risk- Participants cannot be placed at significant mental or physical risk.

5. Debriefing- participants must be told the purpose of the study and provided with ways to contact the researchers about study results. (post experiment)

_Deception: Based on APA’s ethical principles, under most circumstances the participant must be notified. However some cases of deception are acceptable if it poses no risk on participant._

IRB (Institutional Review Board)- reviews and approves all research
II. Scientific Method and Description

• How do scientists ask and answer questions?

• A good theory is useful if it:
  - Effectively organizes a range of self-reports and observations
  - Implies clear predictions that anyone can use to check the theory
  - We MUST put all theories to the test.

EX: Sleep improves memory
A. The Scientific Method

1. **Theory**- explanation using set of principles that organizes observations and predicts behaviors or events.

2. **Hypothesis**- testable *prediction*, often implied by a theory. (Results will either confirm theory or lead us to revise or reject.)

3. **Research and Observations**- different controlled tests.
   - Gathering data
   - Analyzing the results

4. **Replication**- repeating the essence of a research study
(1) Theories

Example: Low self-esteem feeds depression.
(1) Theories
*Example:* Low self-esteem feeds depression.

(2) Hypotheses
*Example:* People with low self-esteem will score higher on a depression scale.
(1) Theories
Example: Low self-esteem feeds depression.

(2) Hypotheses
Example: People with low self-esteem will score higher on a depression scale.

(3) Research and observations
Example: Administer tests of self-esteem and depression. See if a low score on one predicts a high score on the other.

confirm, reject, or revise

lead to
B. Description (Descriptive research methods)

1. Case Study: (analysis of special individuals)

- **Features**: Intensive examination of behavior and mental processes associated with a specific person/situation.

- **Strengths**: Provide detailed descriptive analysis of new, complex, or rare phenomenon.

- **Pitfalls**: May not provide representative picture of phenomena.
2. **Survey: (asking people questions)**

- **Features:** Looks at many cases at once in less depth. Standard set of questions asked of a large # of participants.

- **Strengths:** Gather large amounts of descriptive data (opinions) relatively quickly and inexpensively.

- **Pitfalls:** Sampling errors, poorly phrased questions, social desirability, and response biases can distort results.
Module 5

2. **Survey: (asking people questions)**

- *Word effects*: subtle changes in the order or wording of questions and framing of a question- can have MAJOR effects. (Do you believe in space aliens? OR Do you believe in intelligent life somewhere else in the universe?)

- *Random sampling*: Ignore sampling bias and generalize from a representative sample.

  - Every person in the entire group has an equal chance of participating.

  - EX: Number student roster, number generator to select survey participants.

* Before accepting survey findings, think CRITICALLY: consider the sample.
3. **Naturalistic Observation:** (watching and recording the natural behavior of many individuals)

- **Features:** Observations of human or animal behavior in the environment in which it typically occurs.
- **Strengths:** Provides descriptive data about behavior presumably uncontaminated by outside influences.
- **Pitfalls:** Observer (Personal) bias and participant self-consciousness can distort results.
Module 6

CORRELATIONAL STUDIES

How traits and behaviors are related to another.
A. Correlational Research- to detect naturally occurring relationships; to assess how well one variable predicts the other.

Features: Examine the relationships between research variables.

Strengths: Can test predictions, evaluate theories, and suggest new hypothesis.

Pitfalls: Correlation indicates the POSSIBILITY of a cause-effect relationship, but it does not PROVE causality.
Module 6

**Positive**: means two set of scores, such as height and weight tend to rise and fall together. (# of hours studying and test scores)

**Negative** - means one set of scores go up, while one set of scores goes down, such as brushing teeth and tooth decay. (# of hours watching TV and class grades)

**No correlation**- indicates little or no relationship has a coefficient near zero.
1. **Correlation Coefficient** - a number between -1 and +1 expressing the degree of relationship between two variables. (STRENGTH of the correlation)

- How well does A predict B?
- Scatterplots are used to graph the correlations
Correlation + or - ?

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Correlation???????
Correlation

Perfect positive correlation (+1.00)
Correlation

Perfect negative correlation (−1.00)
2. **Correlation and Causation**

- Correlation helps predict
- Does not imply a cause and effect relationship
- Tells us that certain variables ARE related, but not WHY they are related.

*Association does not prove causation*
The New York Times reports that U.S. countries with high gun ownership rates tend to have high murder rates (Luo, 2011). Gun ownership predicts homicide.

Student A: Well of course guns kill people. A (guns) causes B (murder)

Student B: Not so fast, maybe people in dangerous places buy more guns for self-protection. B (danger) causes A (gun ownership)

*Correlation does NOT mean causation
*Correlation is not the same as causation. Two factors may be related without one causing the other to occur. Often, a third factor explains the correlation.

Example: A psychologist uses the survey method to study the relationship between balding and length of marriage. He finds that length of marriage correlates with baldness. However, he can’t infer from this that being bald causes people to stay married longer. Instead, a third factor explains the correlation: both balding and long marriages are associated with old age.
(1) Low self-esteem could cause Depression

or

(2) Depression could cause Low self-esteem

or

(3) Distressing events or biological predisposition could cause Low self-esteem or Depression
3. Illusory Correlations (Ex: stereotypes)

- Perceived non-existent correlation (EX: busy, high populated city=rude ppl)
- A random coincidence

* When we notice random coincidences, we may forget that they are random and instead see them as correlated. We deceive ourselves by seeing what is NOT there.

<table>
<thead>
<tr>
<th></th>
<th>Conceive</th>
<th>Do not conceive</th>
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<tbody>
<tr>
<td>Adopt confirming evidence</td>
<td>disconfirming evidence</td>
<td></td>
</tr>
<tr>
<td>Do not adopt disconfirming evidence</td>
<td>confirming evidence</td>
<td></td>
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</tbody>
</table>
Isolating different effects by manipulating an IV and keeping others constant.
Module 6

B. **Experimentation: to prove cause and effect**

1. **Experimental Research** - to prove cause and effect

**Features**: Manipulation of an independent variable and measurement of its effects on a dependent variable.

**Strengths**: Can establish a cause-effect relationship between independent and dependent variables.

**Pitfalls**: Confounding or extraneous variables may prevent valid conclusions.
Module 6

Basic steps to experimentation

Do a literature review
Hypothesis
Operational Definition (ex: specifications of procedures, a specific process, set of tests)
Independent Variable, Dependent Variable, Control Variable
Random Sample
Random Assignment
Representative Sample
Establish controls to eliminate extraneous or confounding variables.
  - Double blind procedure
  - Placebo
Replication
Experiment: step by step procedures used to validate hypothesis

- Isolates cause and effect
- Control of the factors by:
  - 1. Manipulating of the variables of interest
  - 2. Holding constant “controlling” other variables

How do we do this?
Create GROUPS!

**Experimental Group** (the “messed” with group)
- Receives the treatment (independent variable)

**Control Group**
- Does not receive the treatment

How do we place subjects in their groups without being biased???
Researchers *randomly assign* people to the two conditions.

**Random Assignment:**

- Eliminates alternative explanations (If a behavior (such as test performance) changes when we vary an experimental variable (infant nutrition), then we infer the variable is having an effect)

- Different from random sample
Module 6

We must establish controls to eliminate other variables

Blind (uninformed)

- **Single-Blind Procedure:**
- **Double-Blind Procedure:** procedure in which both the research participants and the research staff are ignorant (blind) about whether the research participants have received the treatment or placebo. Used to eliminate experimenter bias.

- **Placebo Effect:** response to a placebo (fake drug) caused by subjects belief that they are taking the real drugs. Used to eliminate personal bias.
Independent and Dependent Variables

- **Independent Variable**: the variable the experimenter manipulates.

- **Confounding variable**: an extraneous variable in an experimental design that correlates with both the dependent and independent variables. SEE EX: MURDER AND ICE CREAM

- **Dependent Variable**: the measured outcome of the study.

  - What is being measured?
It is known that throughout the year, murder rates and ice cream sales are highly positively correlated. That is, as murder rates rise, so does the sale of ice cream. There are three possible explanations for this correlation:

**Possibility #1:** Murders cause people to purchase ice cream. One could imagine a world where this is true. Perhaps when one is murdered, they are resurrected as zombies who primarily feed on ice cream.

**Possibility #2:** Purchasing ice cream causes people to murder or get murdered. Again, one could imagine a world where this is true. Perhaps when one eats ice cream, those without ice cream become jealous and murder those with ice cream.

**Possibility #3:** There is a third variable—a confounding variable—which causes the increase in BOTH ice cream sales AND murder rates. For instance, the weather. When it’s cold and Wintery, people stay at home rather than go outside and murder people. They also probably don’t eat a lot of ice cream. When it’s hot and Summery, people spend more time outside interacting with each other, and hence are more likely to get into the kinds of situations that lead to murder. They are also probably buying ice cream, because nothing beats the sound of an ice cream truck on a blazing Summer day.

In this example, the weather is a variable that confounds the relationship between ice cream sales and murder rates. You may also recognize this as the so-called third variable problem, which refers to the fact that any time we observe a relationship among two variables, there’s always the possibility that some third variable which we don’t know about is responsible for ("confounding") the relationship.
Experimental Design

Random assignment
(controlling for other variables such as parental intelligence and environment)
Experimental Design

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(controlling for other variables such as parental intelligence and environment)
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**Experimental Design**

**Random assignment**
(controlling for other variables such as parental intelligence and environment)

<table>
<thead>
<tr>
<th>Group</th>
<th>Independent variable</th>
<th>Dependent variable</th>
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<tbody>
<tr>
<td>Experimental</td>
<td>Breast milk</td>
<td>Intelligence score, age 8</td>
</tr>
<tr>
<td>Control</td>
<td>Formula</td>
<td>Intelligence score, age 8</td>
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</table>
Comparing Research Methods

<table>
<thead>
<tr>
<th>Research Method</th>
<th>Basic Purpose</th>
<th>How Conducted</th>
<th>What Is Manipulated</th>
<th>Strengths</th>
<th>Weaknesses</th>
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<tr>
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<tr>
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<td>Descriptive</td>
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<td>Nothing</td>
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<td>Does not specify cause and effect</td>
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Note: The table continues with additional experimental methods and their characteristics.
### Comparing Research Methods

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</tr>
<tr>
<td>Experimental</td>
<td>To explore cause and effect</td>
<td>Manipulate one or more factors; use random assignment</td>
<td>The independent variable(s)</td>
<td>Specifies cause and effect, and variables are controlled</td>
<td>Sometimes not feasible; results may not generalize to other contexts; not ethical to manipulate certain variables</td>
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</table>
IV. STATISTICAL REASONING IN EVERYDAY LIFE

TOOLS THAT HELP US INTERPRET WHAT THE UNAIDED EYE MIGHT MISS
EXAMPLE:
Researchers invited 5,522 Americans to estimate the percentage of wealth possessed by the richest 20% in their country (Norton & Ariely, 2011)

- Average persons guess: 58% which was dramatically underestimated.

- The wealthiest 20% of Americans possess 84% of the wealth.
Module 7

- A. Descriptive Statistics: numerical data used to measure and describe characteristics of groups. (Describes a set of data)

- 1. Distributions: shape of our data
  
  a. Histograms (bar graph)
  
  b. Frequency Polygons
Module 7

- Bell-Shaped Curve - symmetrical, normal curve describing the distribution of data
Module 7

• Skewed Distributions- representation of scores that lack symmetry. (Lop sided)

• a. Positively Skewed Distribution- caused by relatively few high scores. Mode is the highest followed by the median, and the mean.
Module 7

- b. Negatively Skewed Distribution- caused by relatively few low scores.
2. Measures of Central Tendency - refers to how the data measure the center of a set of data.

a. **Mean** - average. The problem with using the mean is its susceptible to extreme scores.

b. **Median** - middle case score

c. **Mode** - most frequent occurring score
5. Measures of Variation- how similar or diverse the scores are.

a. Range- difference between the highest and lowest scores

b. Standard Deviation- a standard measure of how much the scores deviate from the mean
### A Set of Pretreatment Anxiety Ratings

<table>
<thead>
<tr>
<th>Participant Number</th>
<th>Anxiety Rating</th>
<th>Participant Number</th>
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<td>45 (Median)</td>
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<td>45 (Median = 46*)</td>
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<tr>
<td>11</td>
<td>50</td>
<td>12</td>
<td>100</td>
</tr>
</tbody>
</table>

#### Measures of central tendency

**Data from II Participants**
- **Mode** = 50
- **Median** = 45
- **Mean** = \(\frac{436}{11} = 39.6\)

**Data from I2 Participants**
- **Mode** = 50
- **Median** = 46
- **Mean** = \(\frac{536}{12} = 44.7\)

#### Measures of variability

**Data from II Participants**
- **Range** = 30
- **Standard deviation** = 11.064

**Data from I2 Participants**
- **Range** = 80
- **Standard deviation** = 19.763

---

*When there is an even number of scores, the exact middle of the list lies between two numbers. The median is the value halfway between those numbers.*
Module 7

• B. *Inferential* Statistics: numerical data that allow one to generalize— to infer from sample data the probability of something being true.

• Validity= Is it measuring what it is supposed to measure.

• Reliability= Consistency
Module 7

• Three principles for making generalizations:

  1. Representative samples > biased samples.

  2. Less-variable observations are more reliable than those that are more variable. Ex: an average of shots made from all games rather than game to game points.

  3. More cases are better than fewer. Ex: student visits two colleges and attends two classes at each. *Averages based on many cases are more reliable.
Module 7

• When is a Difference Significant?

• **Statistical Significance** - how likely it is that an obtained result occurred by chance.

• Refers to how 2 groups means are different.

• If the difference is large, it is statistically significant

• For psychologists that means the probability that the result occurred by chance is less than 5%. \( P < .05 \)