## The Scientific Approach

### Goals

- Measurement and description
- Understanding and prediction
- Application and control

### Steps in an investigation

1. Formulate a testable hypothesis.
2. Select the method and design the study.
3. Collect the data.
4. Analyze the data and draw conclusions.
5. Report the findings.

### Advantages

*Clarity and precision* yields better communication.

*Intolerance of error* yields more reliable data.

## Experimental Research

### Elements

**Independent variable (IV):** Condition or event manipulated by experimenter

**Dependent variable (DV):** Aspect of behavior thought to be affected by independent variable

**Experimental group:** Participants who receive special treatment

**Control group:** Similar subjects who do not receive treatment given to experimental group

**Extraneous variables:** Factors besides IV that might affect DV, hence they need to be controlled

### Variations

- Can have one group of subjects serve as their own control group
- Can manipulate more than one independent variable in a study
- Can use multiple dependent variables in a study

### Advantages and disadvantages

+ Permits conclusions about cause and effect relationships
– Manipulations and control often make experiments artificial
– Practical realities and ethical concerns make it impossible to conduct experiments on many issues

## Descriptive/Correlational Research

### Examples of specific methods

**Naturalistic observation:** Careful, systematic observation, but no intervention with subjects

**Case study:** In-depth investigation of single participant, typically involving data from many sources

**Survey:** Questionnaires and interviews are used to gather information about specific aspects of particpants' behavior

### Advantages and disadvantages

+ Broadens the scope of phenomena that psychologists can study (can explore issues that could not be examined with experimental methods)
– Cannot demonstrate that two variables are causally related

### Key Themes

- Psychology is empirical.
- Our experience of the world is highly subjective.

## Statistics

### Basic descriptive statistics

- Three measures of central tendency are the *median* (center score), the *mean* (arithmetic average), and the *mode* (most frequent score).
- The mean tends to be the most useful index of central tendency, but the median may be better if the mean is inflated by a few extreme scores.
- *Variability* refers to how much scores vary from each other and the mean.
- The *standard deviation* is an index of the amount of variability in a data set.

### Correlation

**Correlation** exists when two variables are related to each other.

**Types:** Positive (variables covary in the same direction) or negative (variables covary in the opposite direction).

**Correlation coefficient:** Numerical index of degree of relationship between two variables.

**Strength:** The closer the correlation to either −1.00 or +1.00, the stronger the relationship.

**Prediction:** The stronger the correlation, the better one can predict.

**Causation:** Correlation is *not* equivalent to causation.

### Inferential statistics

- *Inferential statistics* are used to interpret data and draw conclusions.
- *Hypothesis testing* involves making calculations to determine whether research results are statistically significant.
- *Statistical significance* exists when the probability that observed findings are due to chance is very low.

## Common Flaws in Research

### Sampling bias

Exists when a sample is not representative of the population

### Placebo effects

Occur when particpants' expectations lead them to experience some change even though they receive empty or fake treatment

### Distortions in self-report data

Result from problems, such as social desirability bias and response sets, that happen when participants give verbal accounts of their behavior

### Experimenter bias

Occurs when a researcher's expectations or preferences about the outcome of a study influence the results obtained

## Internet-Mediated Research

- Internet-mediated research has grown in recent years because it offers access to larger and more diverse samples and to specialized samples while reducing costs and saving time.
- However, Internet-mediated research raises its own concerns about sampling bias and uncontrolled conditions during data collection.

## Ethical Issues

### The question of deception

Should researchers be permitted to mislead participants?

**YES**

- Otherwise, important issues could not be investigated.
- Empirical evidence suggests that deception is not harmful to subjects.

**NO**

- Deception is inherently immoral and may undermine participants' trust in others.
- Deceptive studies often create stress for subjects.

### The question of animal research

Should researchers be permitted to subject animals to harmful or painful procedures?

**YES**

- Otherwise, important issues could not be investigated.
- Relatively little animal research involves pain or harm.

**NO**

- Animals are entitled to the same rights as humans.
- Animal studies are often trivial or may not apply to humans.