PSY 260- RESEARCH METHODS-II

Single-Factor Experimental Designs

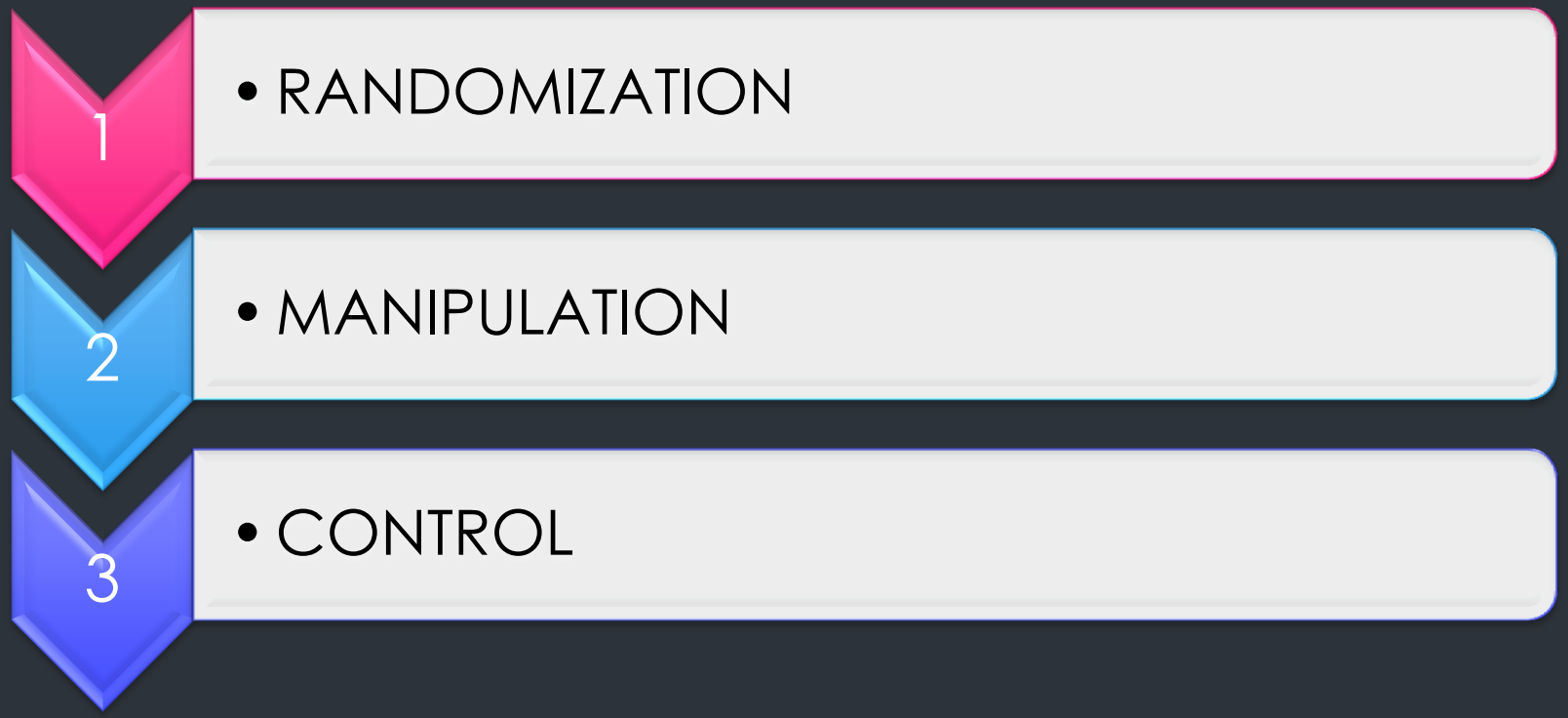
Experimental Research

- Scientific approach to research, where **one or more independent variables** are **manipulated** and applied to one or more dependent variables to measure their effect.
- Experimental research involves a **direct assessment of how one variable influences other.**
- It is defined as “**observation under controlled condition**”.

Experimental Control

- Manipulation of one or more IVs
- Measured DV(s)

Principles of Experimental Research



Randomization

Definition: Randomization is the process of **randomly assigning** participants to experimental and control groups.
- Each participant has an equal chance of being assigned to either the experimental group or the control group.

Purpose:
•Random assignment helps **minimize pre-existing differences** between groups, ensuring that any differences observed in the dependent variable are due to the independent variable and not other factors.
•It reduces the impact of **confounding variables**, making the groups comparable at the start of the experiment.

Example: In a drug trial, participants are randomly assigned to either the **treatment group** (receiving the drug) or the **control group** (receiving a placebo).
- This ensures that both groups are **similar at the start of the experiment.**

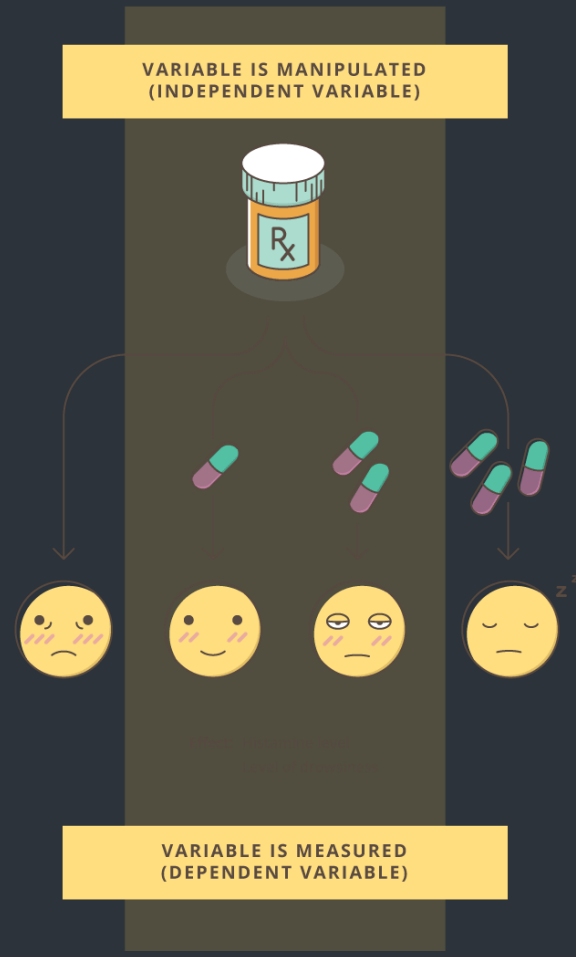
Manipulation

Definition: Manipulation refers to the **deliberate alteration of the independent variable** (IV) by the researcher to observe its effects on the dependent variable (DV).

Purpose: **To examine the effect of the independent variable on the dependent variable**, measuring how a change in the independent variable influences the outcome.

- -Manipulation is necessary to establish a cause-and-effect relationship between variables.

Example: In a study examining the effectiveness of a teaching method, the researcher applies the new teaching method (independent variable) to one group of students while using traditional methods (control group) for another group. The researcher then measures the impact on student performance.



Control

Definition: Control refers to the process of standardizing the environment and conditions to minimize the influence of confounding factors.

Purpose: To control for external variables, ensuring that only the independent variable affects the dependent variable. **To minimize the influence of confounding variable**s by maintaining consistent conditions across all groups.

> **Example:** In a study, the control group receives a placebo, while the experimental group receives the actual medicine. Both groups are tested in the same environment (temperature, lighting, etc.), and they follow the same daily schedule, ensuring that any effects are due to the medicine and not other environmental factors.

Experimental Control

- Experimental control refers to the methods and techniques researchers use to minimize the influence of extraneous variables in an experiment, ensuring that only the independent variable is responsible for changes in the dependent variable.
    - It helps establish cause-and-effect relationships by reducing confounding factors and increasing the experiment's internal validity.

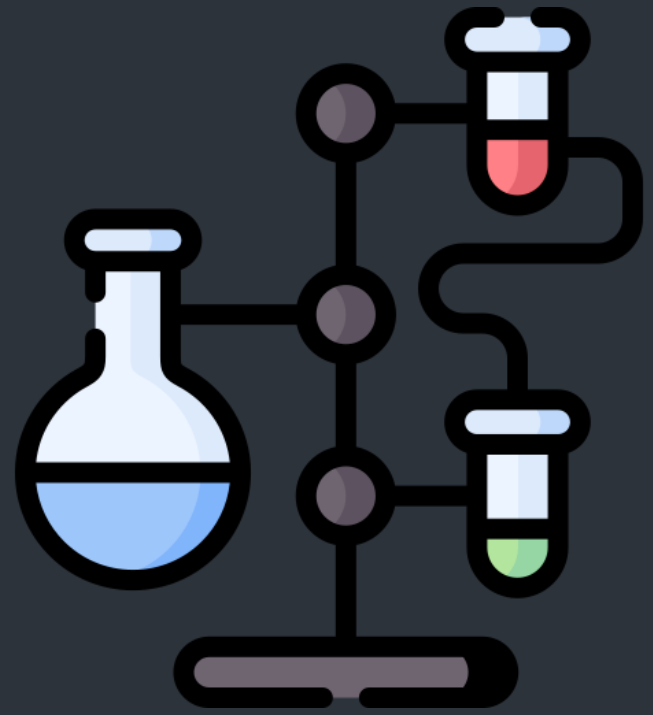
Key Aspects of Experimental Control:

- 1. **Random Assignment** – Participants are randomly assigned to experimental and control groups to eliminate selection bias.
- 2. **Control Group(s)**– A comparison group that does not receive the experimental treatment, helping to isolate the effect of the independent variable.
- 3. **Eliminating Confounding Variables** – Identifying and controlling for variables that could unintentionally influence results.
- 4. **Counterbalancing** – If an experiment involves multiple conditions, varying the order in which participants experience them to prevent order effects.

Causality and Confounds

What are the three criteria that must be met in order to make a causal inference?

- covariation of X and Y
- temporal order
- absence of plausible alternative explanations



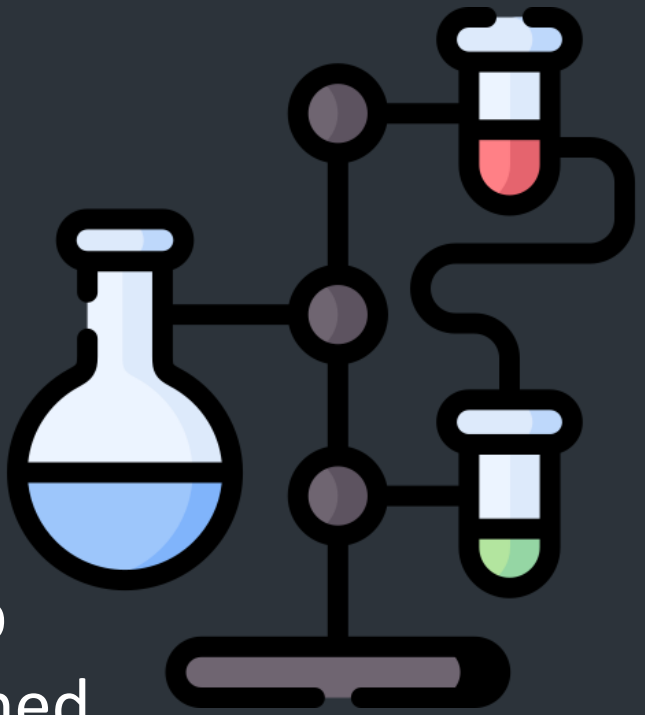
What is a confounding variable?

- a factor that covaries with the IV
- cannot tell whether the IV or the confound affects the DV

Causality and Confounds

What are the three criteria that must be met in order to make a causal inference?

- **covariation of X and Y**



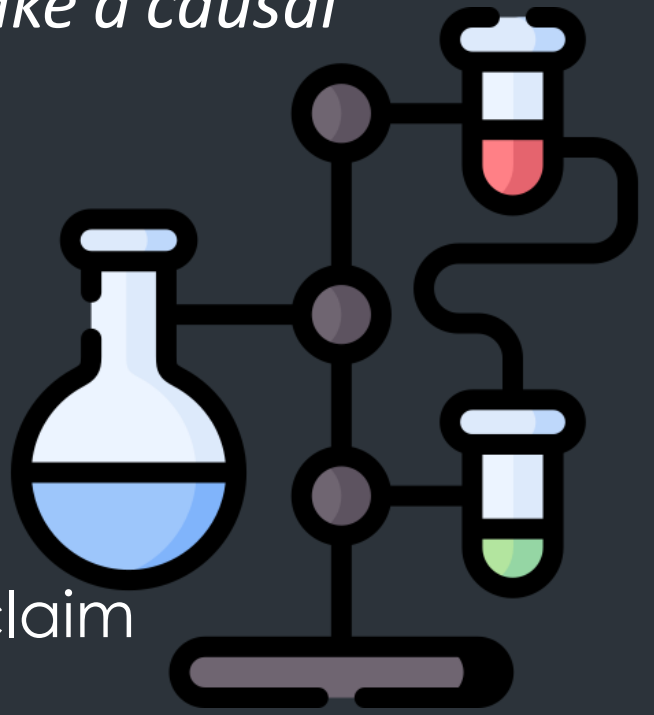
- **Meaning:** X and Y must be related.
  When X changes, Y also changes.
  - If X increases and Y increases → positive relationship
  - If X increases and Y decreases → negative relationship
  - If there is no relationship → no causation can be claimed

 Example: If study time increases and exam scores increase, there is covariation.

Causality and Confounds

What are the three criteria that must be met in order to make a causal inference?

- ~~covariation of X and Y~~
- **temporal order**



Meaning: The cause must occur before the effect.

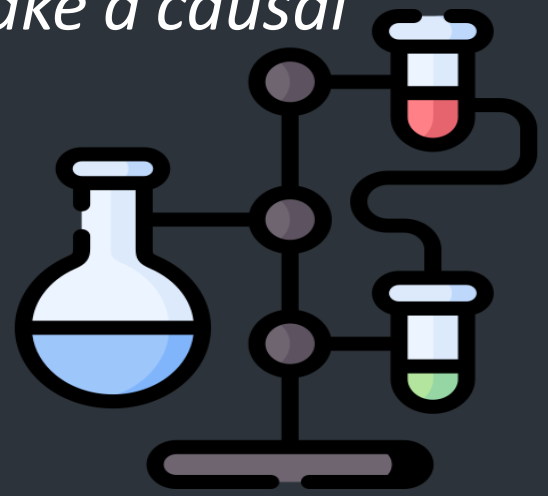
- X must happen first, and then Y must follow.
- If you cannot determine which came first, you cannot claim causality.

Example: Studying (X) must occur before getting a high exam score (Y).

Causality and Confounds

What are the three criteria that must be met in order to make a causal inference?

- ~~covariation of X and Y~~
- ~~temporal order~~
- **absence of plausible alternative explanations**



Meaning: There should be **no other reasonable variable** that could explain the relationship. In other words, **no third variable** (**confounding variable**) should account for the effect.

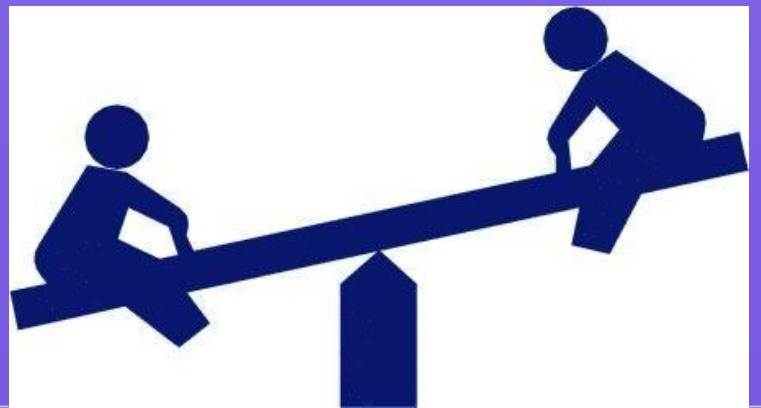
Example: If students who study more also sleep more, maybe sleep—not studying—is actually causing better exam scores.

Confounding Variables

- Confounds dealing with **participant characteristics** (e.g., personality, age) are further addressed through experimental design. – homojen örneklem olmalı!
- **Random assignment (?)**
- **Matching…**
- **Statistical Control (ANCOVA, Regression)**
- **Within-Subjects Design**

- one major distinction to attend to is whether a **between-subjects design** or a **within-subjects design** is used.

Research Design	Description	Confounds minimized through…
Between-subjects	Different participants in each condition	Random assignment
Within-subjects	Participants encounter all levels of experiment	Counterbalancing



Manipulating an IV

Quantitative vs. Qualitative Manipulation

- **Quantitative Manipulations**
  - variations in amount of independent variable
    - e.g., 0 mg, 10 mg, 20 mg, or 50 mg of a drug

- **Qualitative Manipulations**
  - variations in type of independent variable
    - e.g., exposed to rock, jazz, new-age, or classical music

ANY OTHER EXAMPLE? ☺

Between-Subject Designs

- **Participants are divided into different groups**, and each group is exposed to **only one level of the independent variable**.

Example:

- **The effect of music type on work efficiency.**
- **Group 1:** Listens to **classical music**
- **Group 2:** Listens to **pop music**
- **Group 3:** Works **without music** (*control group*)

Aim: They measure which group has the highest efficiency.

Between-Subject Designs

- Subjects **serve in just one of the possible experimental groups!**

Advantages

- subjects are naïve to the experimental hypothesis
- no carryover effects (katılımcıların birbirini etkilemesi)
- used where exposure to multiple levels of the IV may be impossible or ethically and practically difficult

Disadvantages

- require large number of subjects
- between-subject differences contribute to “noise” reducing efficiency
- creating equivalent groups

Within-Subjects (Repeated Measures) Designs

- Subjects serve in **all experimental conditions!**

Advantages

- require fewer subjects
- more sensitive/powerful
- don't have to worry about non-equivalent groups

What about disadvantages? ☺

- **Practice effect** → Participants may perform better in the second condition because they have **become familiar** with the task.
- **Fatigue effect** → Performance may decline in later conditions due to **tiredness**.
- **Carryover effect** → The first condition may influence performance in the second condition.

- **Counterbalancing** aims to **balance and control** these order-related effects.

Within-Subjects (Repeated Measures) Designs

Disadvantages

1.Carryover effects: Experimental manipulations in one condition may affect participants' responses in subsequent conditions, causing the effects of the previous condition to carry over.

2.Learning effects: Participants may give different responses in later conditions based on the knowledge and experience gained from earlier conditions, which can affect their responses and reduce internal validity.

3.Fatigue effects: When participants are exposed to multiple conditions, they may become fatigued, which can negatively impact their attention and responses in later stages of the experiment.

4.Progressive effects: Participants' responses may change over time as a result of cumulative experiences during the experiment, affecting their later responses.

5.Requires longer duration: Since participants need to experience multiple conditions, it may take longer to complete the experiment, which can lead to participant fatigue or boredom.

Within-Subjects (Repeated Measures) Designs

1. **Carry Over Effects- Example:**

- In a study, the same participants try two different painkillers:

Condition → Drug A
Condition → Drug B

- If Drug B is administered before the effects of Drug A have completely worn off, the effect observed in the second measurement may not be attributable solely to Drug B.
- The residual effect of **Drug A may have influenced the results.**

2. Progressive Effects- Example

- In a memory test study, participants complete three consecutive tasks of the same type. As they gain experience from the first two tasks, their performance on the third task **may naturally improve**. The performance on the third task is **influenced not only by the difficulty of that task but also by cumulative experiences** from the **previous tasks**. - **Progressive effect**.

any questions?

Single-Factor Designs: Number of Levels

Experimental and Control Conditions

- Participants in an **experimental condition** are exposed to a "treatment"
- Participants in a **control condition** do not receive the "treatment"

Varieties of Between-Subjects Designs

Matched Groups

- identify a relevant characteristic (a matching variable) and randomly assign participants to conditions based on their standing (e.g., high, average, low) on this characteristic
- possible confounds may be used as matching variables…
- High IQ vs. Low IQ…
- High level of depression, Middle level of depression, low level of depression

Varieties of Between-Subjects Designs

<u>Nonequivalent Groups/Natural-Groups/Quasi-Experiments</u>

- different groups of participants based on naturally occurring attributes called **subject variables**
  - e.g., age, classroom, gender
  - The effects of job performance – Age, gender…
  - subject variables often referred to as *quasi*-independent variables

Concept Clarification

- ***What is the difference between random sampling and random assignment?***

Random Sampling vs. Random Assignment

Table 8.3 Difference Between Random Sampling and Random Assignment

	Random Sampling	Random Assignment (in experiments)
Description	Each member of a population has an equal probability of being selected into a sample chosen to participate in a study.	People who have agreed to participate in a study are assigned to the various conditions of the study on a random basis. Each participant has an equal probability of being assigned to any particular condition.
Example	From a population of 240 million adults in a nation, a random sample of 1,000 people is selected and asked to participate in a survey.	After a college student signs up for an experiment (e.g., to receive extra course credit or meet a course requirement), random assignment is used to determine whether that student will participate in an experimental or control condition.
Goal	To select a sample of people whose characteristics (e.g., age, ethnicity, gender, annual income) are representative of the broader population from which those people have been drawn.	To take the sample of people you happen to get and place them into the conditions of the experiment in an unbiased way. Thus, prior to exposure to the independent variable, we assume that the groups of participants in the various conditions are equivalent to one another overall