PSY 121- STATISTICS IN SOCIAL SCIENCES

WHAT IS STATISTICS?
BASIC CONCEPTS OF STATISTICS IN PSYCHOLOGY-II

Last week…

- What statistics is ☺
- Why should we know statistics at a certain level?
- Population, sample, variable, measurement…
- Mean, mode, median!

Descriptive Statistics – *let's remember* ☺

- It includes the methods and techniques used for collecting, describing, and presenting numerical data related to a specific group (Büyüköztürk, Çokluk, & Köklü, 2013).

- The aim is to determine the characteristics of the studied group (e.g., frequency, percentage, measures of central tendency, measures of variability, correlation coefficient, etc.).

- For example, describing the academic achievement or height of students in a classroom.

Inferential Statistics

- Methods used to make predictions or generalizations about the population based on sample data…

- *Refers* to the set of methods used to make **conclusions, predictions, or generalizations** about a larger population based on data collected from a **sample** of that population.

- In other words, instead of just describing the data you have (as in *descriptive statistics*), inferential statistics helps you **infer** something beyond it.

- It uses probability theory to estimate population parameters, test hypotheses, and determine the likelihood that observed results are due to chance.

Examples:
- Hypothesis testing (e.g., t-test, ANOVA)
- Correlation and regression analysis

let's solve the case together ☺

Exmp.: If you collect data on 100 students' stress levels and test whether stress differs between males and females, inferential statistics help you decide whether any difference you find is likely true in the entire student population.

"In this example, which parts represent descriptive statistics and which parts represent inferential statistics?"

let's solve the case together ☺

Descriptive statistics are the statistics that **summarize and describe the data you have**.

In this example:

- The **mean** stress score of 100 students,
- The **average stress scores for males and females**,
- **Frequencies and percentages** (e.g., 60% female, 40% male)

- **THE QUESTION «WHAT HAPPENED?»**

What about inferential statistics?

let's solve the case together ☺

Inferential statistics allow you to **make generalizations or conclusions about the population** based on your sample.

In this example:

- Performing a **t-test** to see whether stress levels differ significantly between males and females,
- Testing whether the observed difference is statistically significant (e.g., $p < .05$),
- Making conclusions about the **population!!**
- All of these are **inferential statistics**.

  → They answer the question: **"Why and how meaningful is this difference?"**

CONSTANT (SABİT)

Constant is a variable whose value remains the same for every observation. In other words, it does not change across individuals or measurements in the dataset.

Examples:

- 1. The «school name» of all students in a class: If all students attend the same school, this is a constant. (e.g. ÇAĞ UNIVERSITY)
- 2. The «room temperature» in an experiment: If all participants are measured in the same environment, this is also a constant. (e.g. 37,5 Celcius)
- Constants do not create variance in data, so they usually have **no effect** in analyses like correlation or regression.
- In experimental studies, it is often necessary to **keep certain variables constant**.
  For example, if the effect of **gender** is not intended to influence the research results, and the study is conducted with only ONE GENDER (ONLY MEN OR WOMEN), then **gender is a constant variable** in the study.

Classification of Variables

WHAT IS VARIABLE?

- A **variable** is something that can **change or vary** in a study, experiment, or situation.
- In research and statistics, variables are elements that you **measure, manipulate, or control** to see how they affect outcomes.
- **Independent Variable (IV):** The variable that is manipulated or changed to see if it has an effect on another variable.
  Example: Amount of sleep (4 hours, 6 hours, 8 hours) on test performance.
- **Dependent Variable (DV):** The variable that changes as a result of the independent variable; **it's what you measure.**
  Example: Test score after different amounts of sleep.
- **Control Variable:** Variables that are kept constant so they don't affect the outcome.
  Example: Same test, same room, same time of day.
- **Extraneous Variable:** Variables that are not intended to be studied but might influence the dependent variable if not controlled.

WHAT IS VARIABLE?

Scenario: You are studying the effect of drinking coffee on exam performance.

- **Independent Variable (IV):** Drinking coffee or not (coffee group vs. no coffee group)

- **Dependent Variable (DV):** Exam score

- **Control variable examples:**
- *The difficulty of the exam is **the same** for everyone*
- *The exam environment is **the same***
- *Everyone takes the exam at the **same time***

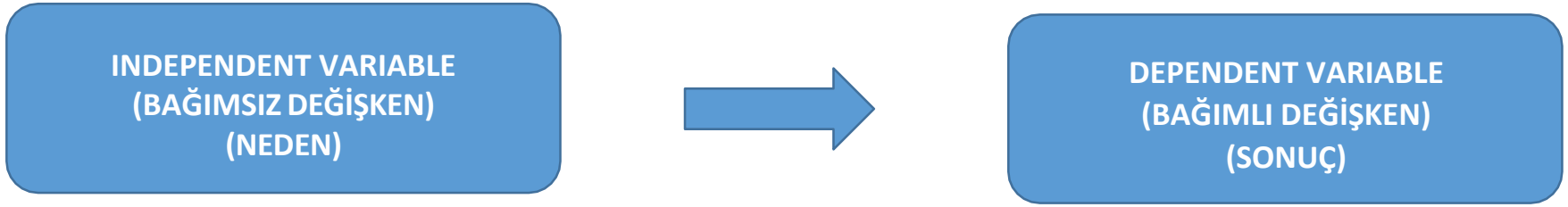
- **Extraneous variable examples:**
- *Participants' amount of sleep the night before may vary*
- *Participants may be stressed or tired*
- *Hunger or mood differences*

These **can affect the results**, and if not controlled, they may cause a **misinterpretation** of coffee's effect.

WHAT IS VARIABLE?

Scenario: You are studying the effect of drinking coffee on exam performance.

1. **Independent Variable (IV): ???**
2. **Dependent Variable (DV): ???**
3. **Control variable examples: ???**
4. **Extraneous variable examples: ???**



- **Independent V. (Bağımsız)**
- **Dependent V. (Bağımlı)**
- **Control V. (Kontrol)**
- **Extraneous V. (Dışsal / Müdahale Edici)**

Types of Variable

~~Dependent and Independent Variables~~

Quantitative and Qualitative Variables

Continuous and Discrete (Categorical) Variables

Qualitative & Quantitative Variables

- If a variable's characteristic can be expressed in numbers or amounts, called a **quantitative variable**.

Example: Test score, height, weight, length, etc.

- If a variable's characteristic can be classified into categories, it is called a **qualitative variable**. Qualitative variables are also known as **categorical variables**.

Example: Gender (female–male), education level (high school–university), socioeconomic status (low–middle–high).

Continuous & Discrete Variables

1. **Continuous Variables (Sürekli Değişkenler):**

• Quantitative variables that can take an infinite number of values within a given range.
• They are measurable with great precision.
Example: Height, weight, temperature, time.

2. **Discrete Variables (Süreksiz / Kesikli / Kategorik Değişkenler):**

• These are quantitative or qualitative variables that take a finite number of separate values.
• Often countable or categorical.
Example (Quantitative Discrete): Number of children, number of cars.
Example (Categorical): Blood type, type of pet, favorite color.

In your opinion, which type of variable ***cannot have a value of «ZERO»?*** ☺

Let’s GO back to the INFERENTIAL STATISTICS ☺

A researcher;

1. May want to find out whether there is a difference between the scores of two or more groups on a certain variable, or whether there is a relationship between variables.

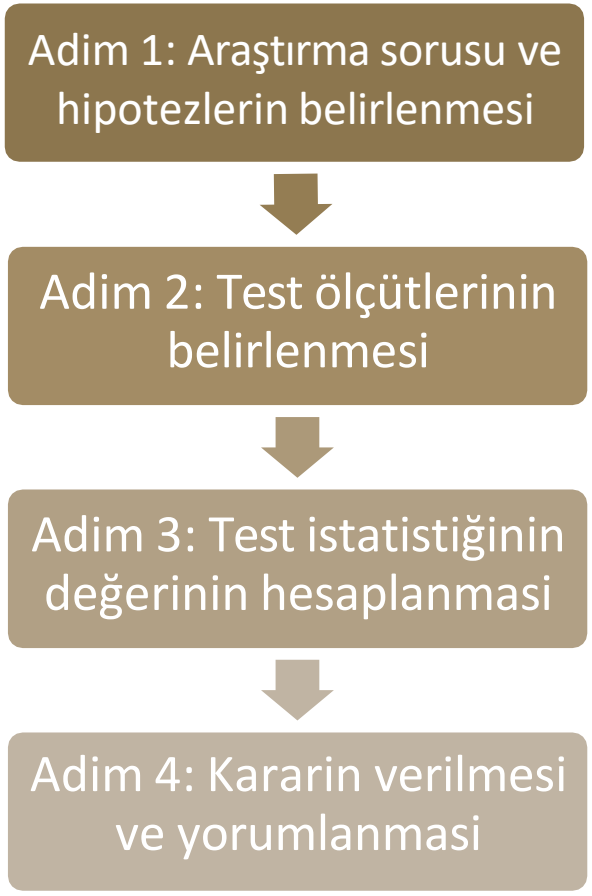
2. They may try to estimate the parameter based on a statistic calculated from the sample.

The Logic of Hypothesis Testing

- Formulate a hypothesis about a population.
- According to the hypothesis, predict the characteristics of a sample.
- Obtain a random sample.
- Compare the data obtained from the sample with the predictions made in the hypothesis.

- *If they are **consistent**, the hypothesis is accepted.*
- *If they are **inconsistent**, the hypothesis is rejected.*

Steps of Hypothesis Testing



Types of Hypothesis

In a research study, two hypotheses are actually used to make predictions and explain differences or relationships between variables:

1) Null Hypothesis (H_0):

- It states that there is ***no difference*** or ***no relationship*** between variables.
- We usually want to reject **H_0** ☺ **GUESS WHY?**

Purpose: To determine whether this hypothesis can be rejected.
Example: There is **no difference** in stress levels between males and females.

2) Alternative Hypothesis (H_1 / H_a):

- It is the opposite of the null hypothesis.
- It states that there *is* ***a difference*** or ***a relationship*** between variables.
- It is the hypothesis that the researcher aims to support.

Example: There is a difference in stress levels between males and females.