



# Study Designs with ChatGPT in an introductory statistics classroom

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# Introduction

## Statistical Toolbox

Shift in using tools; Advantages of using statistical tools

### Old-school

- Textbook
- Notes
- Calculator

### Up-to-date

- White Board/ Smart Board
- Electronic/open-source textbook
- Statistical software
- Interactive applets
- Educational videos

**ChatGPT?**



# Motivation

## Enhance statistical education with ChatGPT



### Why add ChatGPT?

#### Student Guidance & Community awareness

**Modernization & Dynamic Learning** Embrace new technology; interactive, real-time assistance

**Participation** Enhance student engagement & active participation; confidence

**Safe Exploration** Prepares students for AI-driven future.

**Assessment** Formative assessment tool

**Study Design** ChatGPT helps students understand different study designs.

#### Our Approach: Guided Prompts

# Moving forward with ChatGPT



## Target Audience

- Introductory statistics students at research institutions, community colleges, and AP courses.
- Class size: small to medium (up to 35 students).
- Graduate stats classes

## Let's Move Forward!

- Feel free to customize prompts to fit your class and emphasize the key points you'd like to convey.
- Good luck with your upcoming academic year!

# ChatGPT Guided Prompts for study designs



## Objective

Understand the difference in observational and experimental design

## Series of guided prompts

- ✓ “What is a study design?”
- ✓ “What is a randomized experimental design?”
- ✓ “What is confounding?”
- ✓ “Difference between control and experimental groups”
- ✓ “Advantages of RED”
- ✓ “Real-world applications of RED”
- ✓ “Problem solving”

# ChatGPT Guided Prompts for study designs



ChatGPT:  
<https://chat.openai.com/>

## Introduction to designs

### What is a study design?

A study design is a framework or blueprint for conducting a research study, outlining the procedures for collecting, measuring, and analyzing data. The choice of study design depends on the research...

- Experimental Designs:...
- Observational Designs:...
- Descriptive Studies:...
- Qualitative Designs:...
- Mixed-Methods Designs:...

## Introduction to RED

### What is a randomized experimental design (RED)?

A randomized experimental design, also known as a randomized controlled trial (RCT), is a type of study where participants are randomly assigned to either the treatment group or the control group. This random assignment is crucial because...

## QA session

### What is random assignment (RA)?

### What is confounding?

### What is the difference between control and experimental groups?

### Follow-up

How can I perform random assignment of units in an experimental study (with Minitab/R/Excel)?

What happens if a don't use RA in experimental study?

Provide example of confounding in a medical study

# ChatGPT Guided Prompts for study designs

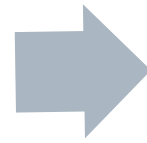


Explore

## List the advantages of RED.

Randomized experimental designs, or randomized controlled trials (RCTs), offer several key advantages, making them the gold standard in many fields of research. Here are some of the primary benefits:

- **Elimination of Selection Bias:** random assignment....
- **Enhanced Internal Validity:** control of confounding variables...
- **Causal Inference:**...
- **Statistical Power:**...
- **Reduction of Bias:**...



Explore

Provide a **real-world application** of a RED study in the business industry. Summarize in **one paragraph**. Explain what the experimental groups and potential confounding variables are.

A retail company might want to assess the impact of a new discount pricing model on customer purchases. The company randomly assigns different stores to two groups: one group implements the new discount pricing (experimental group), while the other group maintains the existing pricing strategy (control group).

# ChatGPT Guided Prompts for study designs



## Practice

### Class notes

#### Observational or experimental study?

A German study (Stang et al 2001) compared 118 patients with rare form of eye cancer called uveal melanoma to 475 healthy patients who did not have the eye cancer. The patients' cell phone use was measured using a questionnaire. The eye cancer patients used cell phones more often, on average.

The study described is an **observational study**. Here are the key reasons why:

- 1. Comparison of Existing Groups:** The researchers compared a group of patients with uveal melanoma to a group of healthy patients. They did not assign cell phone use to the participants but rather observed and compared the existing behavior of the two groups.
- 2. Use of Questionnaires:** The study measured cell phone use through questionnaires, which is a common method in observational studies to collect data without manipulating any variables.
- 3. No Intervention:** There was no intervention or treatment applied by the researchers to influence the cell phone use among the participants. They simply observed the existing cell phone usage patterns.

In contrast, an experimental study would involve the researchers actively assigning or manipulating cell phone use among participants to observe any resultant effects on the incidence of uveal melanoma.



# ChatGPT Guided Prompts for study designs



## Practice

### Observational or experimental study?

In an Australian study (Repacholi et al 1997) 200 transgenic mice, specially bred to be susceptible to cancers were used. 100 mice were exposed for 2.5 hour periods a day to the same kind of microwaves with roughly the same power as the kind transmitted from a cell phone. The other 100 mice were not exposed. After 18 months, the brain tumor rate for the first group was twice as high as the brain tumor rate for the unexposed mice.

The study described is an **experimental study**. Here are the key reasons why:

- 1. Manipulation of Variables:** The researchers actively exposed one group of mice to microwaves similar to those transmitted by cell phones, while the other group was not exposed. This manipulation of the exposure variable is a hallmark of an experimental study.
- 2. Control Group:** The presence of a control group (the 100 mice that were not exposed to microwaves) allows for a comparison to determine the effect of the microwaves on the development of brain tumors.
- 3. Random Assignment:** Although the description does not explicitly mention random assignment, the use of two distinct groups (exposed and unexposed) suggests a controlled experimental design typical of laboratory experiments.
- 4. Cause and Effect:** The design allows researchers to infer a potential causal relationship between microwave exposure and brain tumor development in the mice, a key aim of experimental studies.

# Lesson Plan



- ❖ **Lecture** Introduce study designs (25 min)
- ❖ **Pre-test** Assess students' baseline knowledge (5 min quiz)
- ❖ **ChatGPT session** Engage students with guided prompts (15 min)
- ❖ **Post-test** Evaluate learning outcomes (5 min quiz)

# Study designs with ChatGPT

## Advantages, disadvantages & limitations



Enhance understanding of study designs.	Promotes active participation	Hands-on activity
Supplementary statistics tool	Critical thinking	Customized study
Formative assessment	Tutoring	Statistics approachable & fun



- ChatGPT has Limited context understanding
- No data interpretations, just concepts
- Misleading information
- Trained with data up to Jan 2022
- Ethical considerations
- Human job displacement

**Do not replace traditional instructional methods but supplement them with ChatGPT!**

Thank you!

