QUANTITATIVE METHODS **CASE STUDIES**

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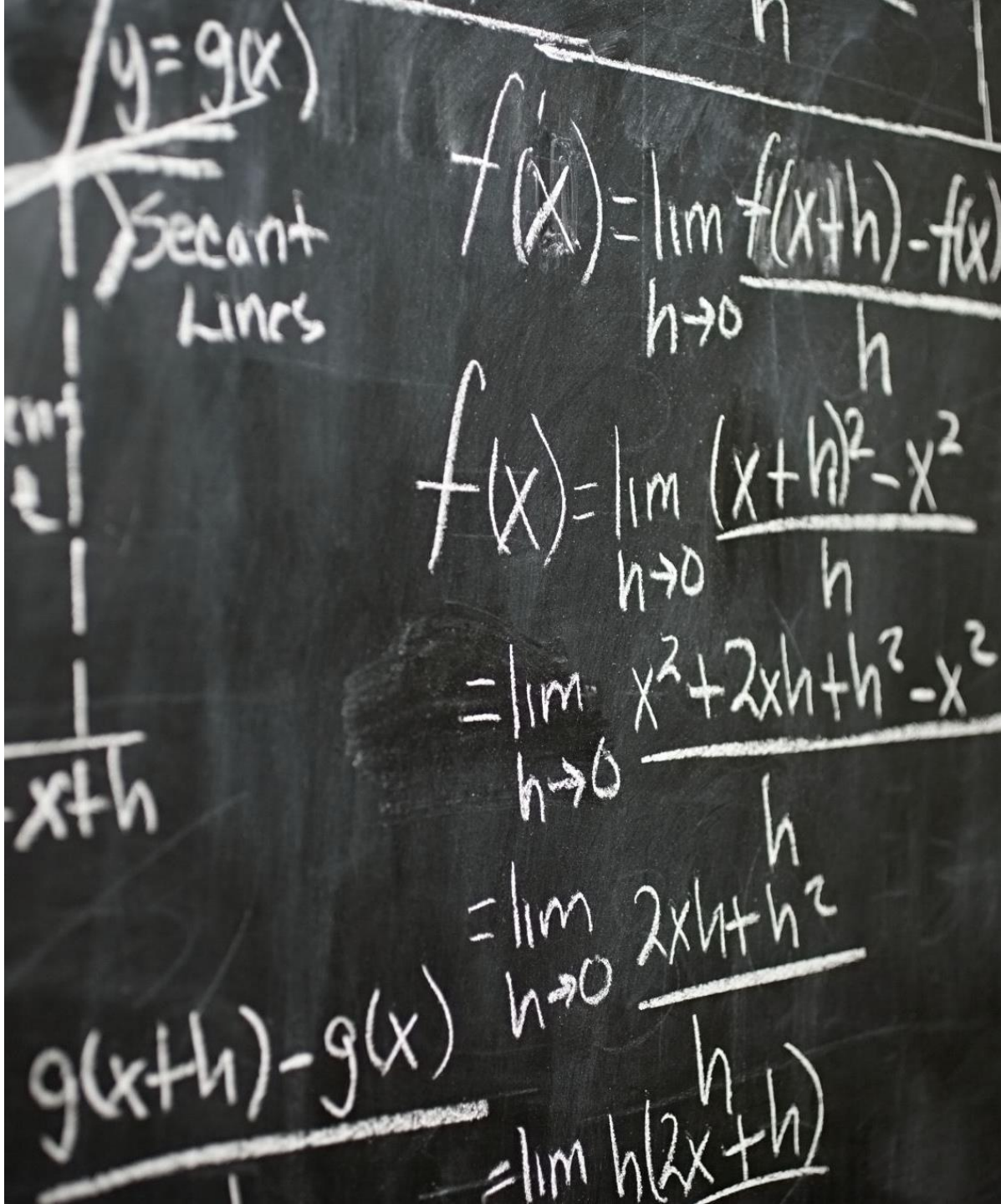

CONTENT

- Comparing groups
  - Study #1: Independent samples – two groups
  - Study #2: Independent samples – three groups
  - Study #3: Paired samples
- Correlation (Study #4)
- Association (Study #5)

STUDY #1: IMPACT OF EDUCATION INITIATIVES ON SUSTAINABILITY PRACTICES

- Objective: Compare adoption of sustainable practices between students who have taken courses with sustainability elements (Group A) vs those who have not (Group B).
- Participants: 35 randomly selected students from both categories
- Method: Measure behaviors related to waste reduction and energy conservation with a survey.
- Variables:
  - DV: adoption of practices as measured using a ratio scale (0 to 10)
  - IV: completion of sustainability courses
- Null hypothesis is that there is no significant difference in adoption of sustainable practices.
- Analysis plan: use two-sample t-test to compare the means between Group A and B

ANALYSIS PROCESS IN R

```
# Step 1: Load the data
sustainability_data <- read.csv("sustainability_data.csv")

# Step 2: Explore the data (optional)
summary(sustainability_data)
# Check distribution of Sustainable_Practices by Group
boxplot(Sustainable_Practices ~ Group, data = sustainability_data)

# Step 3: Conduct the two-sample t-test
t_test_result <- t.test(Sustainable_Practices ~ Group, data =
sustainability_data)

# Step 4: Interpret the results
print(t_test_result)
```

CHECKING ASSUMPTIONS

```
# Separate data for each group
group_A <- sustainability_data$Sustainable_Practices[sustainability_data$Group == "A"]
group_B <- sustainability_data$Sustainable_Practices[sustainability_data$Group == "B"]

# Use var.test() to test for equality of variances
var_test_result <- var.test(group_A, group_B)

# Print the result
print(var_test_result)

# Shapiro-Wilk test for normality
shapiro.test(group_A)
shapiro.test(group_B)
```

STUDY #2: IMPACT OF DIFFERENT TYPES OF INTERVENTIONS

- Basic setup is the same as in study #1 – but we add another intervention in the form of a sustainability workshop (Group C).
- Since we have three groups, we need to use one-way ANOVA to first assess overall differences and then carry out post-hoc tests to see where groupwise differences exist.

```
# Step 3: Conduct one-way ANOVA
anova_result <- aov(Sustainable_Practices ~ Group, data = sustainability_data)

# Step 4: Post-hoc tests (if ANOVA is significant)
# Example using Tukey's HSD test
tukey_result <- TukeyHSD(anova_result)

# Step 5: Print ANOVA table and post-hoc results
print(summary(anova_result))
print(tukey_result)
```

STUDY #3: REPEATED MEASURES DESIGN (BEFORE-AFTER MEASUREMENT)

- Variant of #1 where we measure students' adoption of sustainable practices before and after participating in sustainability interventions over a semester.
- Null hypothesis is that there is no significant difference in adoption of sustainble practices before and after.
- Analysis plan: Use paired samples t-test to compare before and after.

```
# Step 3: Conduct paired samples t-test (or Wilcoxon signed-rank test)
t_test_result <- t.test(Sustainable_Practices ~ Time_Point, data = repeated_data, paired = TRUE)

# Or, for non-parametric approach:
wilcox.test(Sustainable_Practices ~ Time_Point, data = repeated_data, paired = TRUE)

# Step 4: Print the t-test results
print(t_test_result)
```

STUDY #4: CORRELATION

- Objective: Explore correlation between duration of listening to relaxing audio content and change in participants' perceived level of relaxation.
- Participants: 30 randomly selected people.
- Method: Record the duration of listening to relaxing audio content in a streaming app during a day. Administer a survey to measure perceived level of relaxation at the start and end of the day.
- Variables:
  - Variable 1: Duration of listening to relaxing audio content, in minutes.
  - Variable 2: Difference in perceived level of relaxation, on a scale of 0 to 100, between start and end of day.
- Null hypothesis is that there is no significant correlation between the variables.
- Analysis plan: Use appropriate correlation coefficient to assess the strength and direction of the relationship.

ANALYSIS PROCESS IN R

```
# Step 1: Load the data
correlation_data <- read.csv("correlation_data.csv")

# Step 2: Explore the data (optional)
# Check distribution and correlation scatter plot
plot(correlation_data$Duration, correlation_data$Delta, xlab = "Duration", ylab =
"Difference in Perceived Relaxation")

# Step 3: Calculate Spearman's rank-order correlation since visual analysis
# suggests the relationship is monotonic, not linear
correlation_result <- cor.test(correlation_data$ Duration, correlation_data$ Delta,
method = "spearman")

# Step 4: Print correlation coefficient and p-value
print(correlation_result)
```

STUDY #5: ASSOCIATION

- Objective: Explore association between participation in high impact classroom practices and participation in student governance.
- Participants: 50 randomly selected students.
- Method: Survey students and measure their participation in HIPs (internships, independent studies, etc.) and participation in student governance (committees, elected service).
- Variables:
  - Variable 1: Participation in HIPs, yes/no
  - Variable 2: Participation in governances, yes/no
- Null hypothesis is that there is no significant association between the variables.
- Analysis plan: Use chi-square test of independence to assess the association between the variables.

ANALYSIS PROCESS IN R

```
# Load necessary packages (if not already installed)
library(readr)

# Step 1: Read the CSV file into a data frame
association_data <- read.csv("association_data.csv")

# Step 2: Create a contingency table
contingency_table <- table(association_data $HIP, association_data $Governance)

# Step 3: View the contingency table
print(contingency_table)

# Step 4: Run the chi-square test
chisq_test <- chisq.test(contingency_table)

# Step 5: Print the results of the chi-square test
print(chisq_test)
```