

## 17.3: Why did you take this class?

### Why did you take this class?

Do you remember, way back, months and months ago, when you first read Chapter 1? There was a whole section about why this course might be required for your major or helpful for you. In this section, we'll review those ideas to see if you agree that you learned the information and it might be important.

*First reason that you are taking a statistics class: Understanding statistics will help make you better in your future career.*

*Second reason that you are taking a statistics class: You will need to report evidence to show that what you are doing helps your clients/patients/customers.*

Do you think that you might be better at your career because you can understand any statistics that you come across related to your field? In particular, you now can calculate, interpret, and report descriptive statistics and graphs, and statistically compare means or find relationships. Let's break that apart a little.

Descriptive statistics include measures of central tendency, measures of variability, and graphs.

#### ✓ Example 17.3.1

What are the three typical measures of central tendency? What is the typical measure of variability?

##### **Solution**

The three typical measures of central tendency are the mean, median, and mode. The typical measure of variability is the standard deviation, although the range can also be useful.

Do you remember how to calculate them? We won't be testing on this because that's what the first unit was all about, but you can go back to some of the practice pages or exercises in the first unit to make sure that you understand the formulas. That would also be a great way to show yourself how much you've learned! It will also support Dr. MO's belief that you now understand statistics and can report them.

Hopefully you can see that reporting the descriptive statistics of your clients/patients/customers can be useful in any career to take a "temperature check" on how things are going now. The next step is to make some changes and use these statistical analyses to compare group means, or find relationships between variables to decide what changes might meaningfully affect your outcome variable (DV).

### Understanding Statistics

Now, here's the clincher. If you were provided (or calculated) descriptive statistics for a topic in your (future) career field, do you think that you could use them to understand the topic? Again, we won't be testing on this, but hopefully you can see how useful it is to understand what descriptive statistics are tell you.

The next part of understanding statistics is about statistically comparing means (t-tests or ANOVAs) or finding relationships (correlations, regression, Chi-Square). Although we definitely won't be seeing if you remember how to calculate all of those, let's see if you remember how to interpret them! We'll start with t-tests.

#### ✓ Example 17.3.2

For future managers: Manager often want to use surveys to understand the thoughts and behaviors of their clients. Although it is cheaper to use online surveys because it saves on printer costs, does it provide as much data as in-person surveys? As a future manager, you might want to know which type of survey provides the most responses. Using the surveys that your agency has implemented in the last three years (three online surveys and three in-person surveys, all aiming for 100 respondents, you find that  $t(4)=6.78$ ,  $p<.05$ , with the average number of responses for online surveys is 22 and the average number of responses for the in-person surveys is 88. In the future, would you use online or in-person surveys? Why or why not?

**Solution**

In-person surveys should be the primary method of surveying clients because the average number of responses is statistically significantly higher. .

That was an independent samples t-test.

**? Exercise 17.3.1**

What is the t-test with two samples, other than an independent samples t-test?

**Answer**

There are three kinds of t-tests:

- One-sample (compares a sample to a population)
- Independent samples (compares two independent samples)
- Dependent samples (compares two dependent samples)

So the other kind of t-test with two samples is dependent samples t-test.

Let's try interpreting the results of a dependent samples t-test.

**✓ Example 17.3.3**

For future therapists: Sleep deprivation is a serious issue that affects physical health, memory, and safety. Some non-pharmaceutical solutions include meditation or exercises. Imagine that a therapist had 50 clients suffering from insomnia, so the therapist had half of the clients try meditating for 10 minutes every day for two weeks, and then those same clients stopped meditating and exercised for 30 minutes every day for two weeks. The other half of the clients started with the exercise condition for two weeks, then stopped exercising and meditated for two more weeks. The time it took them to fall asleep was measured at the end of each two week period for all clients so that we can see which method worked best. If  $t(49)=1.23$ ,  $p>.05$ , with it taking an average of 65 minutes for all clients to fall asleep after the meditation condition and about 58 minutes, on average, for all clients to fall asleep after the exercise condition, which method to treat insomnia would you recommend, and why?

**Solution**

This is sort of a trick question because there is no statistical difference between the two groups, so there is not enough information to recommend either method.

The next set of examples will use the results for hypothetical ANOVAs.

**✓ Example 17.3.1**

For future health care workers: Medical professionals, like doctors and nurses, often admonish their patients to lose weight. If you were a medical professional and read a study that compared weight loss for three groups (exercise, low-fat diet, both exercise and low-fat diet) that found  $F(2,87) = 6.78$ ,  $p<.05$ , with the average weight loss being:

- Exercise: 3.6 pounds
- Low-Fat Diet: 2.4 pounds
- Exercise & Low-Fat Diet: 11.1 pounds,

What would you recommend to your patients as a good way to lose weight?

**Solution**

Ack, another trick question! We don't have the pairwise comparisons to know which means are different from one another! Although it might be tempting to say that the combination works best, we can't know whether there's a difference between any of the conditions, but especially the other two conditions, without further information.

Let's turn the insomnia example into a repeated measures ANOVA.

### ? Exercise 17.3.2

For the future therapists again: The therapist has 50 clients suffering from insomnia. The order of the conditions didn't seem to matter, so this time all of the clients meditated for 10 minutes every day for two weeks, and then those same clients stopped meditating and exercised for 30 minutes every day for two weeks. The time it took to fall asleep was measured at the beginning of the study (before either treatment was started), end of the first set of two weeks, then at the end of the second set of two weeks. If  $F(2,98)=2.31$ ,  $p>.05$ , with it taking an average of 72 minutes to fall asleep before any of the treatments, 56 minutes to fall asleep after the meditation condition, and an average of 65 minutes to fall asleep after the exercise condition, which method to treat insomnia would you recommend, and why?

#### Answer

This is a double trick question! There is no statistical difference between the three groups, so neither method can be recommended. If the ANOVA's null hypothesis had been rejected, we still wouldn't know which condition was statistically better because the pairwise comparisons were not analyzed. Maybe meditation worked better than the other conditions for this sample, but we can't be sure unless we statistically compare the mean of each group to each other group.

Factorial designs and regression equations are difficult to interpret, especially when the results are presented in such short paragraphs, so we'll move on to looking at relationships between variables.

### ✓ Example 17.3.5

For future criminal justice professionals: Crime rates declined in U.S. cities for many decades, but are slowly increasing. What has also been increasing is wealth disparity (the difference between the highest earners and the lowest earners). If these two things seemed to be linearly related, we might be able to decrease crime by decreasing wealth disparity. Based on this hypothetical result looking at crime rates and wealth disparity (measured as the difference between the top 1% and the bottom 1% of U.S. households)  $r(48)=0.32$ ,  $p>.05$ , would looking at decreasing wealth disparity be one way to reduce crime rates?

#### Solution

Yes, based on the statistically significant positive correlation, as crime rates increase so does wealth disparity. You might be politically averse to decreasing wealth disparity, but based on the statistical results it might be a way to decrease crime rates.

Let's try this one on your own:

### ? Exercise 17.3.3

For students and future teachers: As a way to improve grades, some students re-write their notes while other students watch educational videos. Which one seems to work better at passing (or not) their classes if you conducted a study that found  $\chi^2(1)=4.83$ ,  $p<.05$ , with more people passing who re-wrote their notes than the number of people passing how watched educational videos (and more people failed who watched videos than people who failed who re-wrote their notes)?

#### Answer

Since there seems to be a pattern of relationship between passing and type of studying such that those who re-wrote their notes were more likely to pass (than fail) compared to those who watched educational videos, it looks like re-writing notes is the best way to study!

use null hypothesis significance testing in your future career.

Dr. MO also wrote: "Finally, some of you will fall in love with statistics, and become a researcher for a living!" This won't happen to all of you, or even most of you, but there's always one or two students who realize that they can help people but not in the way that they imagined (like being a therapist or nurse). Was this you?

## "Research shows that..."

The first chapter also had a short section on research studies. This section described how research hypotheses with measured IVs and DVS and representative samples tell you more accurate information than any other type information. Now that we've gone through many, many examples, hopefully this idea makes a little more sense.

## Learn How to Learn

In closing out this whole adventure in behavioral statistics, Dr. MO hopes that not only did you learn how to calculate and interpret statistical analyses, but that you also learned a little how to learn. If you ended up not learning as much as you'd like, here is a summary of information presented in chapter 1 of what you can do in your next class (or your next attempt at this class).

(Re-)Watch this five-part video series from cognitive psychologist Dr. Chew, for how best to learn (and what to do if you fail):

- [Part 1: Beliefs that Make You Fail](#)
- [Part 2: What Students Should Know about How People Learn](#)
- [Part 3: Cognitive Principles for Optimizing Learning](#)
- [Part 4: Putting the Principles of Optimizing Learning into Practice](#)
- [Part 5: I Blew the Exam, Now What?](#)

In his videos, Dr. Chew emphasizes how important time and effortful thinking is for learning; if it was easy, everyone would be learning a lot! [This article by Zanardelli Sickler \(2017\)](#) provides more activities that you can do before, during, and after the lecture to make sure that you learn and understand the material. Here are even more ideas for what to do during the time you spend studying before or after class:

- Use the Exercises in this book as practice.
- Weekly meetings with a tutor or time in your schools math lab.
- Work in pairs to check each others' work.

You can also decide what kinds of activities might work best to do on your phone (reading), and what activities you might want to wait until you have a bigger screen (quizzes) or have more space to write (practice problems).

College courses are hard, especially behavioral statistics (which combines math *and* English skills!), and you probably have more than just this one class and many other responsibilities. Be proud of yourself for what you've learned! And if you didn't quite make it this time, use the tips provided to learn the material for your next go around. Dr. MO has taught this class for years, and has **never** met a student that couldn't pass it (There have been a lot of students who didn't pass, but **none** who just didn't have the ability to pass it). That bears repeating: No students lacked the ability to pass. If you haven't passed yet, try putting more time into studying, and studying in ways that require more effortful thinking. You can do this! And if you did pass this class, you will undoubtedly hit a class or a work activity that is more challenging for you, so try to remember:

- More time
- More effortful thinking

And finally, correlation doesn't mean causation!

And with that, we're out!

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