

## What benefits did I find with OpenIntro Statistics?

<http://openintro.org/os>

Obvious: Happy students saving money

Biggest Surprise: Students at the end of the course are *much* better at doing Hypothesis Tests.

This is accomplished by this textbook's unique "layering of concepts" so that Hypothesis Tests are begun in week #5 rather than week #8 (or week #7 if your lucky).

Surprise: Students have a much stronger understanding of using Confidence Intervals as a follow-up to every Hypothesis Test, identifying the added information that they give.

Surprise: The pdf file of the Textbook contains links to videos that cover the chapters in the textbook. And there are links to videos showing how to use the TI-83/84 and Casio fx-9750GII calculators.

Very Nice Extras:

- MyOpenMath (a free online learning management system) has OpenIntro course templates. I haven't played around with these yet; that will be a good summer project for me.
- Lecture Slides are available from the website (under "TEACHERS" tab).

Possible concerns (that I heard from other Instructors):

Does not cover the Classical Method for Hypothesis Tests.

Solution: An Instructor can cover this in their lecture.

In Chapter 5 all of the examples are Two-Tailed Hypothesis Tests.

Solution: In Chapter 4 they actually do show some one-tailed tests, and the homework has one-tailed tests. And more one-tailed tests can be shown in the lecture.

Some felt that since this textbook lacks a clear formula-based approach, then beginning instructors would have more difficulty in using it as their main text. So they felt there would be a need for formulas and supplementary documents to be combined with this textbook.

Some were concerned that it is missing some of the "helpful" aspects of a textbook, such as section objectives, chapter summaries, and a glossary of terms. So they felt they would probably focus on creating those supplemental materials.

For those who want MORE DETAILS on what pleased me with this textbook:

For starters, it just looks good; clean, uncluttered, explains concepts clearly, and in some cases, better than anywhere else that I've seen. It has a very nice collection of movies throughout the textbook. Good real-world homework exercises. Using the Bookmarks on the left side of the screen makes it easy to navigate around.

As I went through this textbook, there were a few places that I felt needed to be different. But as I continued on in the textbook it would dawn on me why they did what they did, and I was impressed.

At first I felt Chapter 1 shouldn't have "all that stuff" being shown so soon to the students. But when reflecting back on it, I see that they are helping me with one of my biggest obstacles: getting students to actually want to learn Statistics. They can see how it will be used to get the answers to our interesting questions about the world.

Here is what impressed me the most, but I didn't "see" it until I got through all of Chapter 4 and Chapter 5: they did an ingenious "layering" of the learning. Chapter 4 gave the first layer, which is MUCH easier for the students to grasp without the distracting details that were postponed until the later chapters (Ch 5 and 6). In so doing they have made it easy to learn without being superficial on how the methods work.

I like how the textbook shows how to use the tables and then the movies show how to use the calculator. Even if our emphasis is on using the calculator, the instructors for Business Statistics and Psychology Stats would appreciate having us, at the very least, introduce the students to how the tables are used.

Chapter 4.1: Their handling of the Sampling Distribution is different from what I'm used to, but now I see what they're doing, and I like it. They didn't give the students the task of calculating the probability of the sample mean being in an interval. Instead, they had them decide if a particular value for a sample mean would be "surprising" -- that's a fiendishly clever way to get students to focus on what's really important. Now later on they will have the students calculate these probabilities when they are calculating the p-values. They postpone that calculating until they really need it; it's very clear what the calculation is for this way. This is so much better than the way that I've been doing it my whole (academic) life.

Chapter 4.2: At first I felt it was too soon to bring up confidence intervals since I felt we had not spent enough time on the Sampling Distribution. But I changed my mind as I continued on. At first I was put off by their informal versions of the Central Limit Theorem, but I changed my mind about that too.

They give such a nice simple and clear explanation for confidence intervals.

Chapter 4.3: Hypothesis testing? It's too soon! Using the confidence interval to get the conclusion? Oh! This is a mess. Or so I thought at first. But they are subtly showing students the connection between confidence intervals and hypothesis tests.

This chapter has the most intuitive easy-to-understand explanation of hypothesis testing I've ever seen.

Best explanation on WHY you must determine your hypotheses ( $H_0$  and  $H_A$ ) BEFORE collecting the data (page 192).

Very clear explanation for appropriate value for the significance level, followed by examples (page 193).

Chapter 4.4: They give their “informal definition” for the Central Limit Theorem, making it easy to understand while emphasizing what’s most important. I love the visual on page 195 along with their explanation on why a sample size of 30 (for quantitative data) is NOT ALWAYS large enough. It’s good to teach this now and it doesn’t feel like “too much information” with this textbook.

At first I was put off by the t distribution not being brought up yet, but that’s before I grasped the “layering of the learning” that they were doing. By giving the student the standard error for each example and exercise it makes it so much simpler to grasp the concepts, and they’ll get those details later.

Chapter 4.5: On page 199 in the box they list the steps. At first I found fault with it, claiming the last sentence in step #4 should be moved to step #5 (because you can’t shade the area until after you’ve calculated the test statistic). It took me quite awhile until I saw the benefit to their way. Their way forces the student to focus on what’s appropriate for the given situation: a one-tailed or a two-tailed test (i.e. what supports the alternate hypothesis?). In the last paragraph on page 202 we will need to explain to the students that they are referring to what’s called “The Power of the Test” and it’s covered in detail in chapter 5.4

Chapter 6.1: Never in my life have I thought or seen the sample proportion being presented in the way that it is shown here (that it can be described as a sample mean). Sure, at first I was aghast, but I’ve grown to like it.

They show how to calculate the sample size WITHOUT the formula; they derive it, forcing the students to see where it came from. Another great idea, and after they’ve been exposed to this we could ask the class if anyone can think of a shortcut to going through all those steps on every sample size calculation. When someone invariably says to just use simple algebra to rewrite the equation for the margin of error, we can act surprised and say “Are you saying that learning algebra wasn’t a complete waste of your time?” – “Do you think something like this could come up again, either in this class or one of your others that involve formulas?”

NOTE: This textbook does NOT cover the sample size formula for quantitative data, and we can use that to our advantage. Why not wait for a student to bring that up in class, while we feign surprise “What? Do you think we can take the margin of error formula for quantitative data and solve it for n, and then use it to determine the sample size we need?”

[I should mention that this textbook DOES go into the more complex analysis of looking at the Power of the Test to determine the “proper” sample size – not too big and not too small -- in chapter 5.4]

Chapter 6.2: Interesting examples! They explain the complexities involved in clinical trials; It’s good to expose this to students now and it doesn’t feel like “too much information” with this textbook.

Chapter 7.1: This explanation is so simple, intuitive, and effective: “Creating a residual plot is like tipping the scatterplot over so the regression line is horizontal.”

Of course, everything else in this chapter was clearly explained and shown in images.

Chapter 7.2: They blew my mind again with how they were able to keep it simple and still show how the method works (no easy task with this topic whose hand calculations are tedious). I've never seen it shown this way before: estimating the slope with the formula they gave, use the point that's always on the regression line ( $\bar{x}$ ,  $\bar{y}$ ), and put those into the Point-Slope form of a line and solve it for  $y$  until you have your regression equation. This makes the hand calculations very simple without being superficial in covering the topic. By Jove, they've done it again!

I agree with their emphasis, which they explain so clearly, on interpreting the parameters in the regression model.

I do enjoy the humor they slip in here and there.

Chapter 7.3: This book does a much more thorough job than our current one in explaining and visually showing the different types of outliers and their affect on the regression line.

Chapter 7.4: Nicely done, as usual.

Odds & Ends:

This textbook does such a good job, on every example, of verifying that the conditions are met.

This textbook avoids the things I disliked about the last book we evaluated (OpenStax Statistics):

They only use "=" in  $H_0$  (i.e. NO inequalities in  $H_0$ )

Use  $\hat{p}$  for the sample proportion (i.e. NO  $p'$ )

Show MODIFIED Box Plots

They show and explain how the methods are developed (they don't just show "the recipe of steps")

They use " $z^*$ " to represent the critical value (I like that better than  $z_{\alpha/2}$ )

In Summary:

Yes, this textbook takes awhile to get used to. But it's worth it! If you have time this summer to look it over, see if you observe the same things that I mentioned in this document.

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