

Practicing Statistics: Guided Investigations for the Second Course

Chapter 2: Connecting the Two-Sample t-test, Regression, and ANOVA

Instructor Notes

Statistics courses often teach the two-sample t-test, linear regression, and analysis of variance (ANOVA) as very distinct approaches to analyzing different types of data. However, this chapter makes connections among these three techniques by focusing on the statistical models. Statistical software has made it easy to calculate statistics and p-values. But without understanding the underlying model assumptions, it is easy to draw incorrect conclusions from the sample data. As studies become more complex, models become fundamental to drawing appropriate conclusions.

R and Rstudio: If students are new to R and Rstudio, the following handout outlines some nice YouTube videos and short assignments to get students started: [Introduction to Rstudio](#). Updated [Chapter 2 R Instructions](#) are also available.

PowerPoint Slides, Updated Datasets, Step-by-step software instructions and Instructors guides are available upon request. All the materials on the textbook CD are also at: <http://www.pearsonhighered.com/mathstatsresources/> (just select K).

Below is a Chapter 2 syllabus appropriate for an introductory class, a full semester syllabus appropriate for a senior seminar or graduate level class is here: [Advanced Syllabus](#).

Day 1: Do Distracting Colors Influence the Time to Complete a Game?

This section focuses on understanding the basics of designing and analyzing a particular study involving the [Shapesplosion](#) game. While the video is not directly related to the text, it is very useful in preparation for Chapter 2.2.

1. **Watch the VIDEO [C2a: Building a Statistical Model](#)** (A version with embedded quizzes is also available at <http://www.screencast.com/users/Stat2labs/folders/Comparing%20Models/media/9b1076ba-d701-4037-b6a8-e80ff8b96c3b>)
This video demonstrates the formal model assumptions within a basic 2-sample t-test.
2. **Read: Chapter 2.1** of the textbook (and work through the corresponding textbook questions)

Day 2: Comparing the two-sample t-test, ANOVA, and Regression

We start with a discussion on how to develop a statistical model for this study. Then we write out three models, one for the t-test, one for ANOVA and one for regression.

1. **Watch the VIDEO [C2b: Comparing the two-sample t-test, ANOVA, and Regression](#)** (A version with embedded quizzes is also available at <http://www.screencast.com/users/Stat2labs/folders/Comparing>)

[Models/media/9a8e0aec-f047-4c92-98da-8ce77a342218](#))

This video compares the underlying model assumptions between these three techniques.

2. **Read: Chapter 2.2** of the textbook (and work through the corresponding textbook questions)

Note: Question 5 and 6:

It is important to recognize that question 5 is focusing on hypothetical populations, not samples from a population. Students should know how to determine whether μ or \bar{Y} should be used within a statistical model. It is often best to demonstrate either question 5 or question 6 in class and then assign the second as a homework problem.

Day 3/4: Calculating p-values for a Regression Model and ANOVA

The **C2b** video on Day 2 discusses the model assumptions for sections 2.3 and 2.4. This is a good time to review regression and ANOVA if students have not seen these techniques before. With the Minitab and R instructions freely available, students tend not to have difficulty with the calculations, but it is worthwhile spending some time reviewing what these tests really tell us and when they are appropriate to use.

1. **Read: Chapter 2.3 through 2.7** of the textbook (and work through the corresponding textbook questions)

Day 4/5: Normal Probability Plots

1. **Watch the VIDEO [Normal Probability Plots](#)** (A version with embedded quizzes is also available at <http://www.screencast.com/users/Stat2labs/folders/Comparing%20Models/media/38ee3f7b-eb2c-418e-a62c-d53ec578024f>)
This video uses Minitab to demonstrate how to create and interpret normal probability plots.
2. **Read: Chapter 2.8** of the textbook (and work through the corresponding textbook questions)

Day 5/6: Transformations

This is a nice time to incorporate the [TigerSTAT](#) lab that collects data and asks students to predict a tiger's age based upon a transformed regression model.

1. **Read: Chapter 2.9** of the textbook (and work through the corresponding textbook questions)