# Chapter 12 Introduction

Many people believe that students learn better if they sit closer to the front of the classroom. Does sitting closer *cause* higher achievement, or do better students simply choose to sit in the front? To investigate, an AP Statistics teacher randomly assigned students to seat locations in his classroom for a particular chapter and recorded the test score for each student at the end of the chapter. The explanatory variable in this experiment is which row the student was assigned (Row 1 is closest to the front and Row 7 is the farthest away). Do these data provide *convincing* evidence that sitting closer causes students to get higher grades?
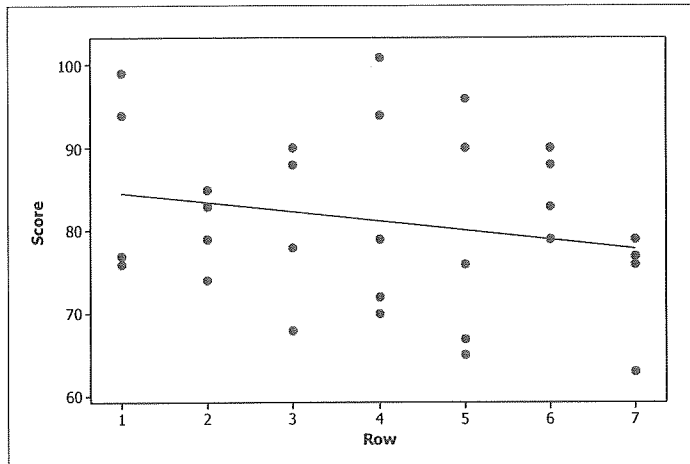
Row 1: 76, 77, 94, 99
Row 2: 83, 85, 74, 79
Row 3: 90, 88, 68, 78
Row 4: 94, 72, 101, 70, 79
Row 5: 76, 65, 90, 67, 96
Row 6: 88, 79, 90, 83
Row 7: 79, 76, 77, 63

Predictor	Coef	SE Coef	T	P
Constant	85.706	4.239	20.22	0.000
Row	-1.1171	0.9472	-1.18	0.248

S = 10.0673   R-Sq = 4.7%   R-Sq(adj) = 1.3%

1. Describe the association shown in the scatterplot.

Direction, Strength, Form, outliers

moderate negative linear association between row & score without many apparent outliers

2. Using the computer output, determine the equation of the least-squares regression line.

$$\widehat{score} = 85.7 - 1.1171(row)$$

3. Calculate the value of the correlation.

$$r = \sqrt{.047} = .2167$$

4. Calculate and interpret the residual for the student who sat in Row 1 and scored 76.

$$85.706 - 1.1171(1) = 84.6$$

residual = 76 - 84.6 = -8.6

The actual score is 8.6 points lower than expected, based on the row.

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5. Interpret the slope of the least-squares regression line.

The predicted change in score goes down by 1.117 pts at the row goes up †

6. Interpret the standard deviation of the residuals.

10.0673 When using the regression line to predict scores, we will typically be off by about 10.0673 points

7. Interpret the value of r^2.

4.7% of the variation in score is accounted for by the linear model relating score to row number.

8. Explain why it was important to randomly assign the students to seats rather than letting each student choose his or her own seat.

The nonrandom selection of seats would bias the results. Students may seat with other students that get similar grades which ~~make~~ another variable

9. Does the negative slope provide convincing evidence that sitting closer causes higher achievement, or is it plausible that the association is due to the chance variation in the random assignment? Let's do a simulation to find out!

Looking a t & pval fail to reject $H_0: \beta = 0$ not convincing evidence

The table below lists the 15 different inference procedures you should know for the AP exam. In each of the scenarios below, choose the correct inference procedure.

One-sample z interval for p	One-sample z test for p
One-sample t interval for μ, including paired data	One-sample t test for μ, including paired data
Two-sample z interval for $p_1 - p_2$	Two-sample z test for $p_1 - p_2$
Two-sample t interval for $\mu_1 - \mu_2$	Two-sample t test for $\mu_1 - \mu_2$
t interval for the slope of a least-squares regression line	t test for the slope of a least-squares regression line
	Chi-square test for goodness-of-fit
	Chi-square test for homogeneity
	Chi-square test for association/independence

1. Which brand of AA batteries last longer—Duracell or Eveready? *2 Samp t test for $\mu_1 - \mu_2$*

2. According to a recent survey, a typical teenager has 38 contacts stored in his/her cellphone. Is this true at your school? *1 Samp t test for μ*

3. What percent of students at your school have a Facebook? *1 prop Z int for P*

4. Is there a relationship between the age of a student's car and the mileage reading on the odometer at a large university? *t test for slope β*

5. Is there a relationship between students' favorite academic subject and preferred type of music at a large high school? *χ^2 Indep*

6. Who is more likely to own an iPod—middle school girls or middle school boys? *2 Samp Z int for $P_1 - P_2$*

7. How long do teens typically spend brushing their teeth? *1 Samp t int for μ*

8. Are the colors equally distributed in Froot Loops? *χ^2 GOF*

9. Which brand of razor gives a closer shave? To answer this question, researchers recruited 25 men to shave one side of their face with Razor A and the other side with Razor B. *Paired 1 Samp t test for μ_D*

10. How much more effective is exercise and drug treatment than drug treatment alone at reducing the incidence of heart attacks among men aged 65 and older? *2 Samp t int for $\mu_1 - \mu_2$*

Web resource for more problems like these:
http://www.ltcconline.net/greenL/java/Statistics/catStatProb/categorizingStatProblems13.html