Lesson 4.2.3

4-72. Histograms or boxplots of the results will not show a clear relationship. The distributions for left hand and right hand will most likely show a great deal of variability and no clear difference between hands.

4-73. Control: The test should be redesigned so that the start button is equidistant from all nine boxes. Use dominant and non-dominant hands rather than left and right because handedness may have a bigger affect on reaction times. A matched pairs design where each subject is a block and reaction time is tested on both dominant and non-dominant hands would control for variability between subjects. (Some people are just slower than others.) Randomization: Randomly assign students to Treatment 1: dominant then non-dominant or Treatment 2: non-dominant then dominant. Replication: More subjects should be included in the experiment to reduce variability among subjects.

4-74. This time the relationship should be clearer. Reaction times for both hands will be less variable than before. Students should conclude that reaction times are faster for the dominant hand than the non-dominant hand.

4-75. Sample answer: Draft a group of volunteers *(replication)*. Randomly assign each person to a treatment group *(randomization)*. One group gets your new energy drink, another gets a leading brand, and a third group gets a placebo beverage *(control*). There are many possible variables to block. Have the volunteers perform a measurable task and compare the results of the groups.

4-76. Answers will vary.

4-77. Example of a completely randomized design: Gather a group of volunteers (replication). Randomly assign half to wear socks to bed (randomization). Describe a consistent number of hours of sleep, conditions of the room, etc., for subjects to adhere to (control). Ask subjects to rate the quality of sleep (or have them wear a device that can monitor sleep). Explanatory variable: socks or no socks; response variable: number of deep-sleep minutes. Many variables effect sleep, parenthood, odd work schedules, age, gender…

4-78. a. Obtain a list of all households in Grand Rapids and number them from 1 to 187,800. Use a random number generator to select 100 unique numbers, ignoring repeats. The households that correspond to the 100 numbers selected will be included in the sample.

b. It may be difficult to obtain an accurate list of all households in Grand Rapids. Once the simple random sample is selected, it may be time consuming to visit all the households if they are spread out randomly over a large area. A cluster sample would be less time consuming and more cost effective than a simple random sample.

c. Assuming each city block represents the city population reasonably well, the city could be divided up into blocks. Once a simple random sample of all city blocks are identified, the researchers would want to interview every household in the selected blocks.

4-79. See completed two-way table below left. See table with percentages below right. In this case, the percentages across rows are quite different, indicating an association between having a job and a driver's license. People with jobs tend have a higher likelihood of having licenses (93%) than those without a job (78%). There is an association between being employed and having a driver's license.

	Job	No Job	
License	54	76	130
No License	4	21	25
	58	97	155

	Job	No Job
License	93%	78%
No License	7%	22%
	100%	100%

4-80. a. residual = actual – predicted. 20 = 100 – predicted, so predicted = 80. To find music score, solve 80 = 112.0863 – 0.3813(music). Music score = 84.

b. The typical English scores is 11.28 points away from the predicted value, which means any reasonable margin of error would need to be at least 22 and probably up to 44 points wide (2*S* above and below the line). This is a very wide margin of error, making this a fairly useless prediction tool.

4-81. a. 18

b. See boxplot below; median = 70, first quartile = 58.5, third quartile = 83