1.3 Data and Methods

In this study, I aimed to test whether or not the location of oven rack and muffin type had a significant effect on muffin bake height. Specifically, I measured the top and bottom oven rack, and two different types of muffins (Chocolate Chip and Blueberry.)

The sample size consisted of 48 muffins, baked in 4 different batches with randomized combinations of both muffin types in each batch. Two batches were baked on the top rack, two on the bottom. I included muffins that had the same general recipe and bake time, as well as muffins from two different brands so as not to generalize to only one brand and type.

In order to randomize the muffin assignment per spot in each muffin rack, I used a random matrix creator to assign 1s and 0s to a three by four matrix four different times (0 = Chocolate Chip, 1 = Blueberry). To randomize the trial order after that, I performed the same procedure, this time letting 0 = bottom rack, and 1 = top rack.

To measure muffin bake height, I marked a toothpick with millimeter measurements, and stuck it directly in the center of the fully baked muffin to determine the approximate height. Again, muffins were baked for the same amount of time (20 minutes) and used the same general recipe.

The variables incorporated in this study were: type of muffin (blueberry, chocolate chip) which is an explanatory categorical and nominal variable of two levels, type of rack (top, bottom) which is an explanatory categorical and nominal variable of two levels, and muffin bake height (measured in millimeters) which is a quantitative response variable.

The data was analyzed using SAS, and the t-test procedure was used to determine if the type of rack had a significant effect on muffin bake height.

There were a couple of flaws in designing and carrying out the study. One of these was the muffins used in the study. Initially, both muffins were going to be chocolate chip, but due to a shortage of one brand, a substitute for blueberry was made instead. Both muffin flavors likely have different baking heights, so this posed as a confounding variable in analyzing the results.

Another potentially flawed factor was measurement of the muffins. The precision of such varied due to a roughly estimated demarcation of a toothpick, and observing the height at eye level. Some muffins had various lumps around the middle and some were somewhat flatter, so measurements varied based on how each rack of muffins turned out.

Table 1 Summary Statistics

Muffin Height (mm)

	Muffin Type / Rack			
	Blueberry		Chocolate Chip	
	Bottom	Top	Bottom	Top
Mean	52.17	46.83	37.67	39.33
SD	3.93	3.61	3.80	2.67
Minimum	45.00	39.00	32.00	34.00
Lower Quartile	49.75	44.75	35.50	38.00
Median	52.00	47.00	38.00	39.50
Upper Quartile	55.25	49.25	40.00	41.25
Maximum	58.00	52.00	45.00	43.00

Muffin Type
Blueberry
Chocolate Chip