

Does Curriculum Matter?

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September 24, 2019

Introduction

This research investigates the relationship between students' curriculum and the grade they received, specifically for Montana State University students enrolled in STAT 216. In the spring of 2015 students enrolled in either a "traditional" STAT 216 course or a "TEAL" based curriculum. The TEAL curriculum was a simulation based, hands-on course, taught in a interactive TEAL (Technology Enhanced Active Learning) classroom. This course had daily activities from a course pack, and very little lecture. The "traditional" curriculum was given in a typical lecture style classroom, with daily lectures, and select weekly activities similar to the TEAL course.

Research has shown that these TEAL classrooms increase student engagement and retention. Therefore, we wish to study if the TEAL curriculum provides an overall better outcome for student's grades in STAT 216.

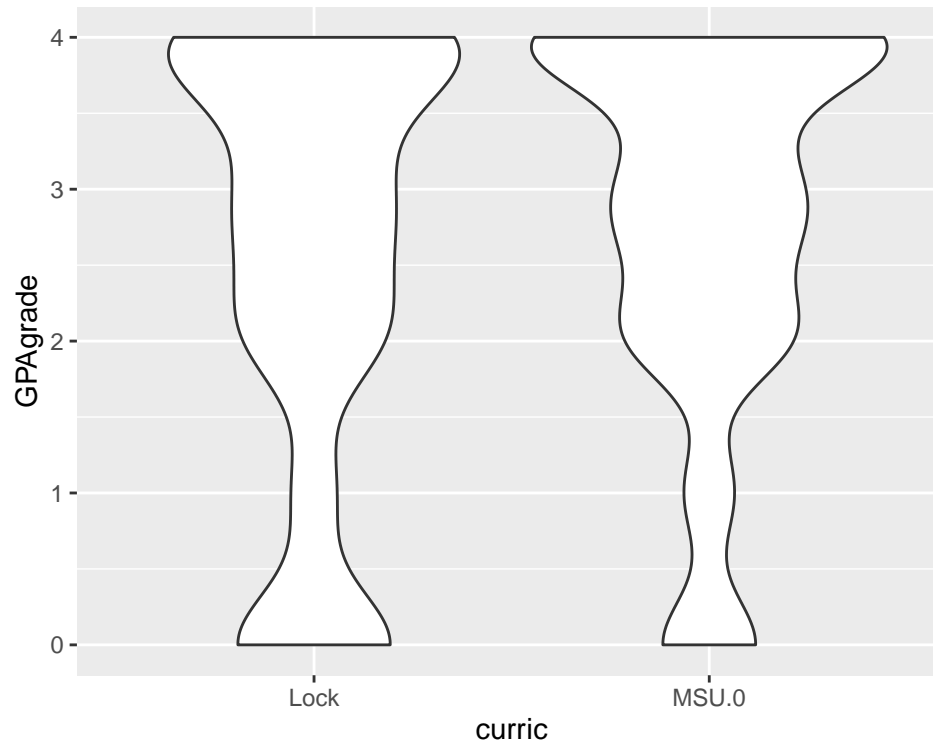
Data Collection

The data collected on students in STAT 216 in the spring of 2015 include the following variables:

- the student's unique identifier (number)
- what score they earned on the ACT math exam
- what score they earned on the SAT math exam
- what score they earned on the math placement exam (at MSU)
- when they took their most recent math course (30 = spring, 70 = fall, 50 = summer)
- the last math course they took (math subject plus math course)
- the grade they received in that math course
- similar information for their last statistics course
- what their AP Calc grade transferred as
- what their AP Stat grade transferred as
- what their cumulative GPA was the semester prior to enrolling in Stat 216
- the curriculum each student was enrolled in (Lock or MSU.0)
- their Stat 216 course grade, converted to the GPA scale (4.0 = A, 3.0 = B, 2.0 = C, 1.0 = D, etc.)

Methods

For the research question of interest, the explanatory variable refers to the curriculum which the students took, either the TEAL or traditional, and the response variable refers to the grade which the students received.



For the data of Spring 2015 the students in the “traditional” curriculum and the TEAL curriculum got the same mean grade with distributions looking the same via a violin plot of the data. We can see this visually on the violin plot

where the traditional and TEAL curricula have similar shaped distributions with equal centers and spread.

The statistical procedures we will be using to determine if there exists a difference in true mean student GPA between the TEAL curriculum and the traditional for the 2015 students is a two-sample t-test on 1192 degrees of freedom. To estimate the difference in true means between the two curricula, we will provide an approximate 95% confidence interval using t-based methods.

We will proceed with a t-test because we have met the assumptions of the method, (1) the data are independent, and (2) the two groups have similar distributions.

Hypotheses

For our research question we will test the following hypothesis,

$$\mu_{\text{traditional}} \neq \mu_{\text{TEAL}}.$$

Results

After running the statistical analysis we find that there is significant evidence to show that the mean grades of students in the TEAL program differ from the mean grades of the students in the traditional program

(p-value = 0, t = -3.9114). there is strong evidence supporting the alternative hypothesis that the spring 2015 TEAL curriculum has an effect on a student's course grade. Due to these results, we conclude that the TEAL curriculum increases students' course grade at Montana State University during the spring semester of 2015.

```
library(infer)

t.test(GPAgrade ~ curric, data = stat216)

##
##  Welch Two Sample t-test
##
## data:  GPAgrade by curric
## t = -3.9114, df = 1406.1, p-value = 9.616e-05
## alternative hypothesis: true difference in means is not equal to 0
## 95 percent confidence interval:
##   -0.4224354 -0.1402387
## sample estimates:
##  mean in group Lock mean in group MSU.0
##           2.502228           2.783565
```

Scope of Inference

The students in STAT 216 for spring 2015 were not randomly selected from a larger population of STAT 216 students, and therefore we cannot infer the findings of this research to a larger population. Rather, we can only infer the results of this study to those who wherein the study. In addition, the students were not randomly assigned to the different types of curricula, which prohibits us from being able to draw any cause-and-effect conclusions for this study.

Code Appendix

```
library(tidyverse)

stat216 <- read.csv("C:/Users/allisontheobold/Documents/Stat 511/Labs/stat-411-511-lab5/data/stat216_sp

ggplot(stat216, mapping = aes(x = curric, y = GPAgrade)) +
  geom_violin()
```