

Analyzing Student Scores and Teacher Effectiveness Data in Detroit Public Schools

Travis Froberg

Email 1: Inference

Hello,

The analysis you requested concerning math proficiency scores and teacher effectiveness is ready for your review. Please see below.

School	Average Math Proficiency Rate
Wright, Charles School	0.6215000
Chrysler Elementary School	0.5633333
Bates Academy	0.4856667
Davison Elementary-Middle School	0.4661667
Dixon Elementary School	0.3670000
Burton International School	0.3541667
Pasteur Elementary School	0.2557500
Greenfield Union Elementary-Middle School	0.2406667
Thirkell Elementary School	0.2327500
Cooke Elementary School	0.2292500

The table above shows the top 10 schools in math proficiency (i.e. a score that was proficient or higher) for grades 3-8 in the Detroit City School District. As can be seen in the table, there were only seven schools, out of a total of 66, which had math proficiency rates above 25%. This suggests some large discrepancies between schools. This could be used as a compelling reason to be awarded more government money to fund schools with low math proficiency rates.

Regarding the question of if there is a relationship between math proficiency and educator effectiveness, I have created three plots (shown below) that give a general idea of any relationship between the two variables.

In each plot, it looks as though there may be a slight linear relationship between the two variables, with higher teacher effectiveness ratings corresponding to higher math proficiency scores.

If you look closely at the first plot, there is a pronounced increase in math proficiency when the percentage of teachers in a school being rated as highly effective reaches about 90%. A similar occurrence happens in the second plot, but the increase occurs when the x-axis variable, percent of teachers that receive a score of effective or highly effective, reaches about 98%.

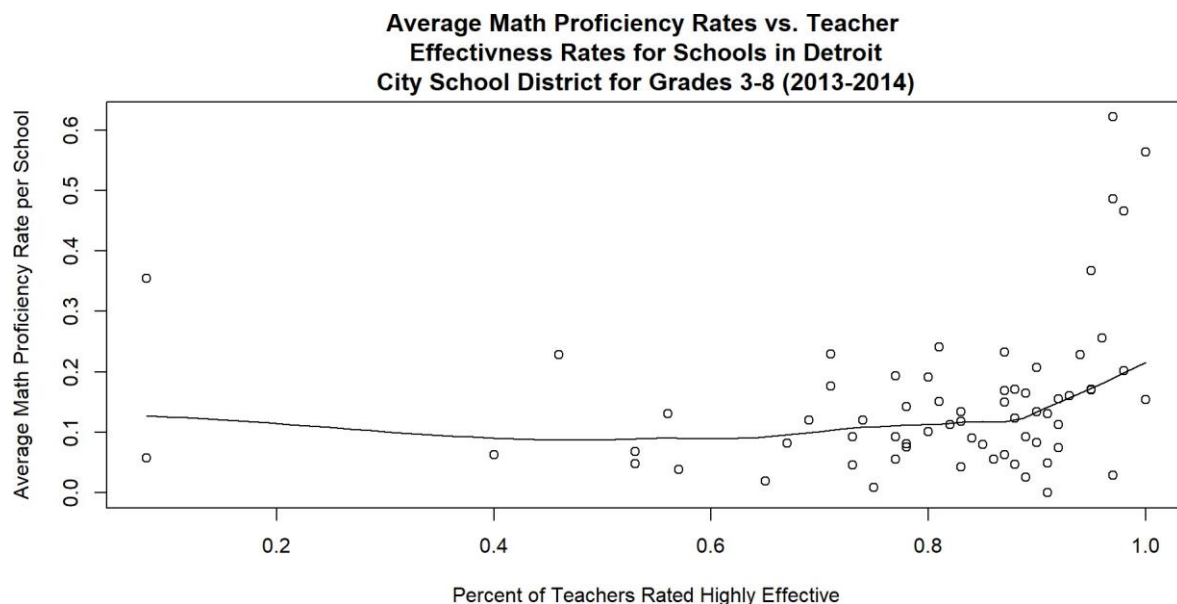
These sharp increases suggest that the correlation between the variables is not very constant and, therefore, could be non-linear.

I performed a hypothesis test which tested whether there was a linear correlation between the two variables. The test returned a 95% confidence interval of $(-0.00382, .45425)$. What this means is that if the experiment was run 100 times, the correlation coefficient would on average be within this interval on 95% of the experiments. What is important here is that the null hypothesis of the test I performed was that the correlation coefficient was equal to zero (i.e. there is no correlation between the two variables).

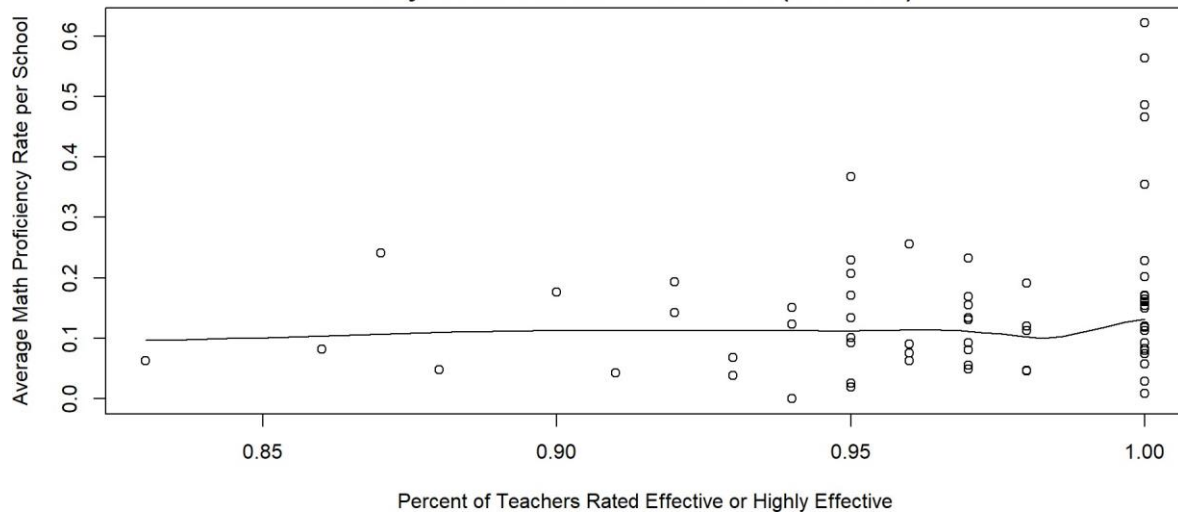
In order to reject the null hypothesis, the confidence interval would have to *not* include zero. In this case the confidence interval does include zero, therefore, the null hypothesis is not rejected. This does not affirm that the variables are not correlated. Rather, it shows that in this case the null hypothesis could not be rejected.

It is important to notice that the confidence interval was very close to *not* containing 0 (i.e. -0.00382 is very close to 0). This is important because if a lower confidence level was used the null hypothesis may be rejected. For example, if a confidence level of 90% was used, the null hypothesis would be rejected.

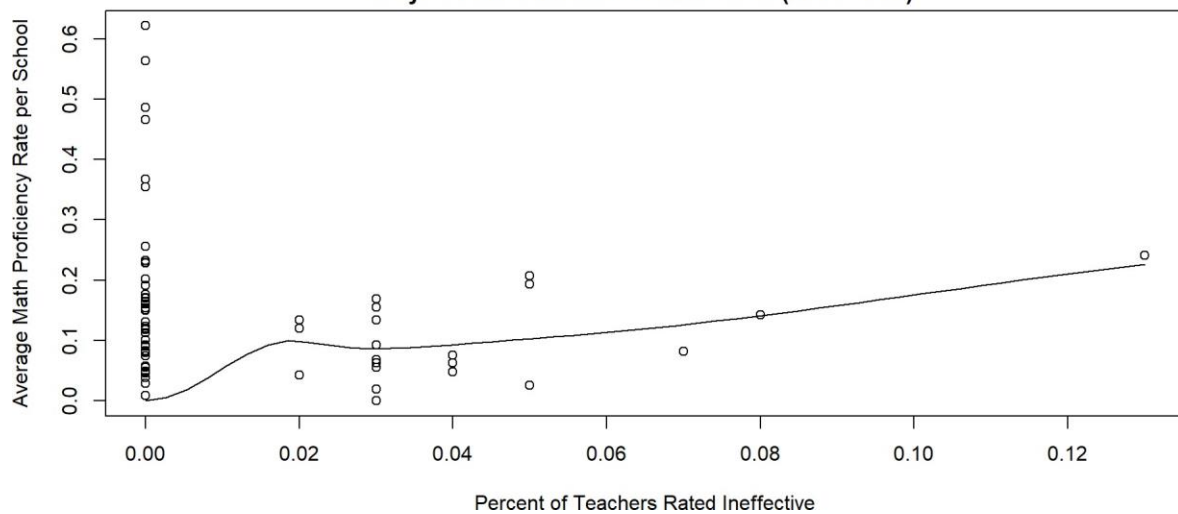
While a 95% confidence level is commonly used, a lower confidence interval is not necessarily wrong. In short, I think there may be a correlation between the two variables. If more data is collected in the future, I can get a better estimate of the true relationship between the variables: more data is better. I think it is a good idea to keep collecting this type of data, and while conclusions from the data I analyzed should be made with caution, a relationship between the two variables should be considered as a real possibility.



Average Math Proficiency Rates vs. Teacher Effectiveness Rates for Schools in Detroit City School District for Grades 3-8 (2013-2014)



Average Math Proficiency Rates vs. Teacher Effectiveness Rates for Schools in Detroit City School District for Grades 3-8 (2013-2014)



I have attached a document containing my code for this project in pdf format. I hope this analysis proves useful.

Best,

Travis Froberg

Email 2: Inference

Hello,

The analysis you requested concerning the spread of educator effectiveness ratings is ready for your review. Please see below.

Table 1 (shown below) shows some statistics that are indicators of data spread. The rows of the table are the percent of teachers in a given category of teaching effectiveness. These values encompass all schools in the data set. For example, the values for the row corresponding to the percent of highly effective percent are for all schools in the data set.

In the table, it can be seen that there is much more variability for highly effective teachers and effective teachers than for the other categories. For example, the range for both of these categories is 92%, and is below 20% for all other categories. What this suggests is that there are significant discrepancies between schools in terms of what proportion of their teachers are rated highly effective or effective.

This discrepancy could be used as a compelling reason to gain government funding for schools with lower teacher effectiveness scores. Low effectiveness scores can be caused by teachers not having enough resources to perform their jobs to a satisfying level. There are also many other factors that could be involved.

While this is all helpful to keep in mind, it should be noted that one reason the variance is low for the categories corresponding to *minimally effective percent* and *ineffective percent* is that most schools had zero teachers in these two categories. This can be seen by examining **Figure 3** below. The mean (i.e. dark black line) in the box plot is 0, which means many of the values must have been zero. This is good as it means that, on the whole, schools in the district do not have many teachers being rated as minimally effective or ineffective.

This can also be seen by looking at **Figure 1** below. While a relatively low number of teachers were rated effective compared with highly effective, when these two variables are combined (shown in the variable *Effective or More Percent*), the mean is quite high – with a small standard deviation. A low standard deviation corresponds with a more reliable mean because it shows that the data are less variable. This mean being high suggests that most teachers in the district received ratings of effective or greater.

Table 1. Statistics Related to Spread of Teacher Effectiveness Ratings

	Variance	Standard Deviation	Minimum	Maximum	Range
Highly Effective Percent	0.0338594172	0.18400929	0.08	1.00	0.92
Effective Percent	0.0317115152	0.17807727	0.00	0.92	0.92
Minimally Effective Percent	0.0008704196	0.02950287	0.00	0.14	0.14
Ineffective Percent	0.0005856410	0.02420002	0.00	0.13	0.13
Effective or More Percent	0.0014465501	0.03803354	0.83	1.00	0.17

Fig. 1

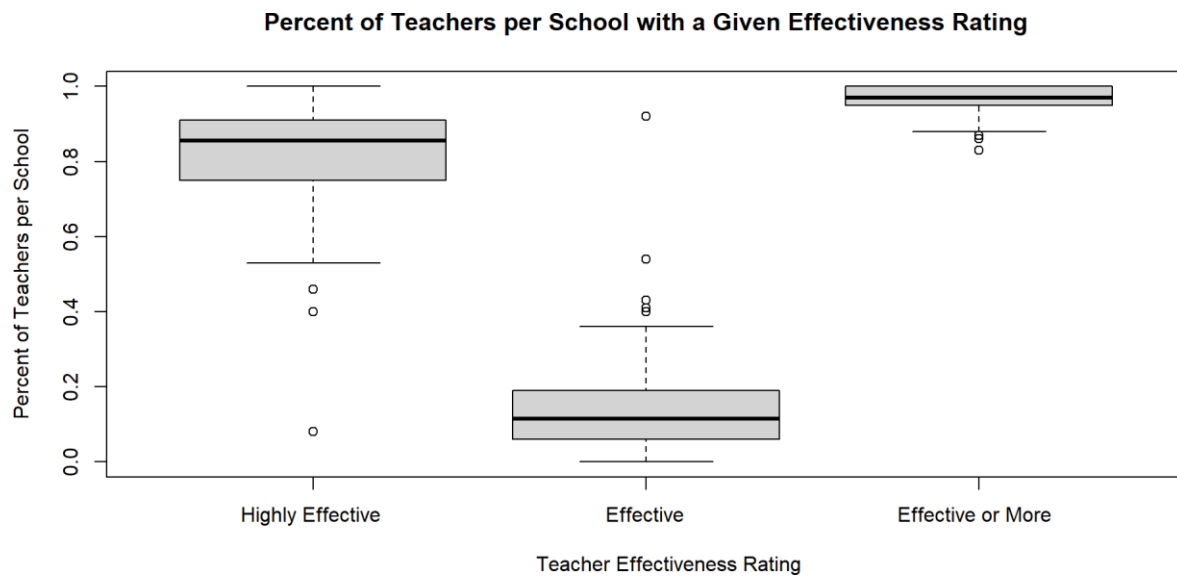


Fig. 2

