White Paper: An Analysis of Teacher Educational Institution and Student Growth

The goal of this study is to evaluate the effect of the institution where a teacher was educated on student growth. The main question is if such an effect exists, and if so, what institutions produce higher performing teachers. To answer this question education data was obtained from teachers at many of the Grand Valley State University (GVSU) Charter Schools Office (CSO) authorized charter schools. This education data was then linked to fall-to-spring student growth data from the Northwest Evaluation Association (NWEA) Measures of Academic Progress® (MAP®) assessment. One Way ANOVA was used to look for relationships between teacher education and student growth. This relationship was analyzed separately for institutions granting bachelor's degrees and master's degrees. Other variables, including free and reduced lunch (FRL) percentage, student grade, and teacher years at a school, were also analyzed.

Summary Statistics

Education data was received for 999 teachers. Of these, 418 were able to be linked with student growth data. A teacher was linked to a student if they reported teaching that student both in the fall of 2014 and the spring of 2015. Teachers were linked with all qualified students and then an average growth score for each teacher was computed by taking the mean of that teacher's individual students' scores. Each teacher was linked with both math and reading growth scores. Average growth scores for math ranged from -2.5 to 38.5 with a mean of 14.4. Reading scores ranged from -1.2 to 35.0 with a mean of 11.4. Both scores were reasonable normally distributed. Histograms for each are included in Figure 1 below.

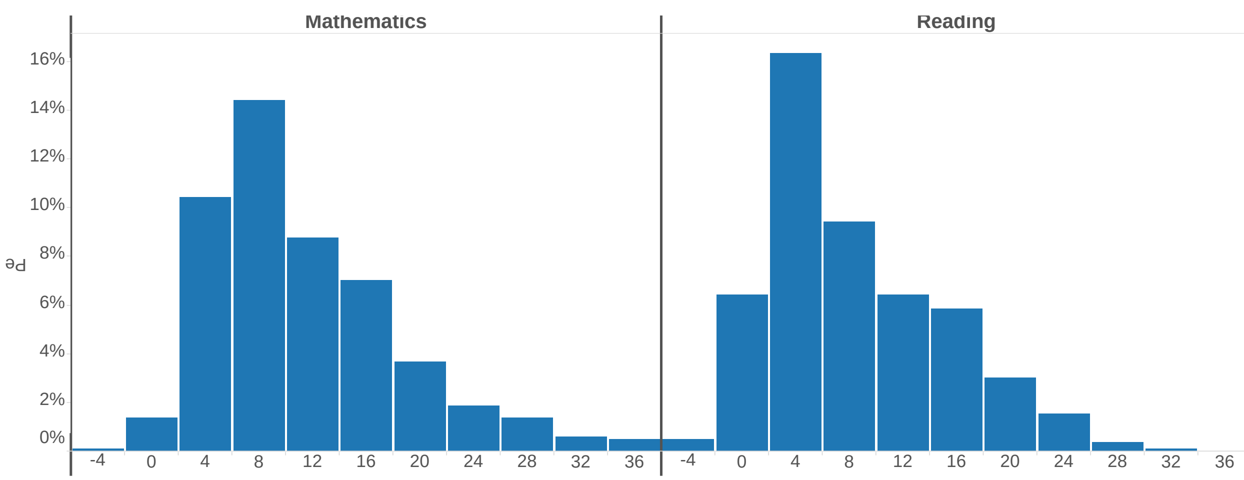

Figure 1: Histograms of student average growth scores by subject

The included teachers received their degrees from a large number of different institutions. For bachelor's degrees, any institution that graduated at least 10 teachers was included as a separate group. All institutions graduating fewer than 10 teachers were grouped together. The frequency of graduation from each institution is shown in Table 1. Of the 418 teachers include in the study, 191 had master's degrees. For master's degrees, any institution that graduated five or more teachers was included as a separate group. Any that graduated fewer than five teachers was grouped together. The frequency of graduation for each institution granting master's degrees is shown in Table 2. Degree-granting institutions in Michigan had the highest attendance, which was expected since all GVSU CSO authorized charters schools are in Michigan. Some out of state institutions were attended but not frequently enough to be included as a separate category.

Table 1: Frequency of Graduation from Bachelor's Institutions

Bachelors Institution	Count	Percent
Other University	80	19.14%
Grand Valley State University	54	12.92%
Eastern Michigan University	50	11.96%
Michigan State University	43	10.29%
Central Michigan University	31	7.42%
Western Michigan University	29	6.94%
Wayne State University	26	6.22%
Calvin College	21	5.02%
University of Michigan	21	5.02%
Oakland University	15	3.59%
Aquinas College	13	3.11%
Cornerstone University	13	3.11%
Baker College	11	2.63%
Spring Arbor University	11	2.63%

Table 2: Frequency of Graduation from Master's Institutions

Masters Institution	Frequency	Percent
Other University	52	27.23%
Grand Valley State University	42	21.99%
University of Michigan	15	7.85%
Eastern Michigan University	14	7.33%
Wayne State University	13	6.81%
Western Michigan University	13	6.81%
Marygrove College	12	6.28%
Michigan State University	9	4.71%
University of Phoenix	8	4.19%
Aquinas College	7	3.66%
Walden University	6	3.14%

Years of experience, student grade, and FRL were also included in the analysis to see if there was any relationship between them and student growth. Most of these variables have previously shown associations with student achievement. FRL at schools ranged from 10.5% to 98.7% with a mean of 59.5%. FRL is measured at the school level so the number of teachers with each FRL percentages depended on the number of teachers represented from each school. This causes the FRL variable to not be normally distributed.

The grade a student is in can affect the amount of growth a student shows. The NWEA MAP® test is usually taken only through 8^{th} grade; therefore only students in kindergarten through 8^{th} grade are included in the analysis. The distribution of teachers who teach each grade is shown in Table 3 below. The table indicates that there is a sufficiently large enough number of teachers in each grade to perform valid statistical analysis.

Table 3: Number of teachers by grade

Grade	Count	Percent
1	51	9.92%
2	46	8.95%
3	50	9.73%
4	42	8.17%
5	48	9.34%
6	68	13.23%
7	74	14.40%
8	80	15.56%
K	55	10.70%

Table 4: Number of teachers by years at school

Years at School	Count	Percent
1 year or less	61	14.59%
1 to 3 years	55	13.16%
3 to 5 years	103	24.64%
5 to 10 years	107	25.60%
10 to 15 years	53	12.68%
> 15 years	39	9.33%

The final variable included in the analysis is teacher years of experience. The length of time a teacher is at a school may have a relationship with student growth. Teacher years of experience is calculated based on a teacher's reported start date at the school. Teacher experience is counted through the 2014-2015 as this is the year the growth data in this study was collected. Teacher experience was categorized into six categories. These categories and the number of teachers in each are shown in Table 4.

Univariate Analysis

The relationship between each of the individual variables and student growth was evaluated. Of the included variables – FRL, teacher experience, and student grade – only student grade showed a significant relationship with student growth. Students average highest growth in kindergarten. The amount of growth then decreases as the student progresses through 8th grade. A one-way ANOVA shows that this relationship is highly significant for both math ($F=152.84$, $p <.0001$) and reading ($F=159.34$, $p<.0001$). Post hoc analysis corrected for family wise error showed significant differences between most grades. Detailed information about these differences in not shown here as it is not the primary questions of interest. A plot of student growth by grade is shown in Figure 2.

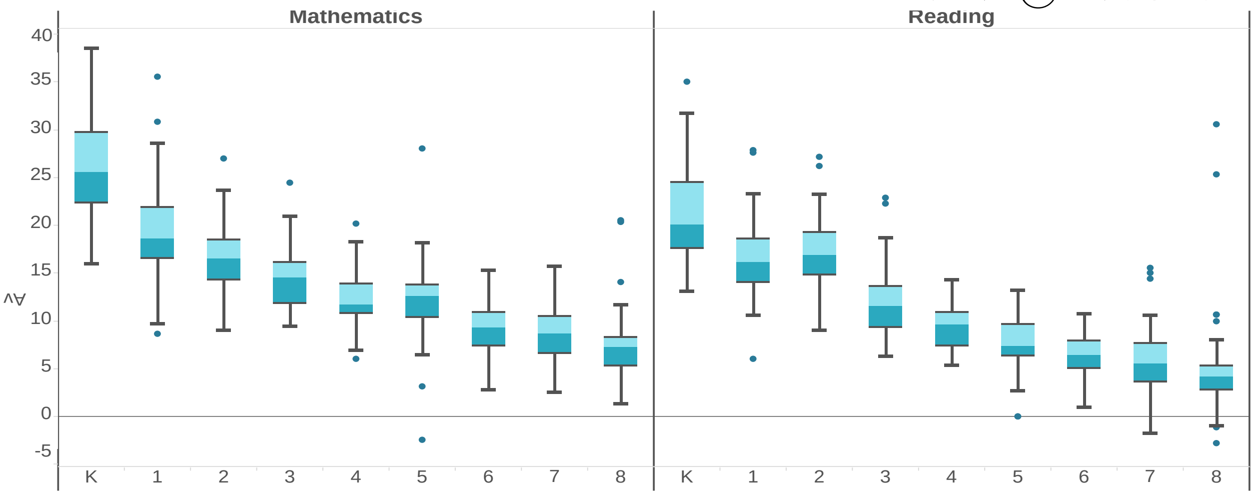

Figure 2: Growth by Grade

A simple linear regression was used to assess the relationship between FRL and student growth scores. No significant relationship was detected for math (F=1.33, p=.2495) or reading (F=.81, p=.3678). This was expected. While FRL does have an established relationship with student achievement, student growth is known to be less affected by FRL.

The relationship between a teacher's length of time at a school and student growth was assessed using a one-way ANOVA. This relationship was also not found to be significant for math (F=.88, p=.4934) or for reading (F=.72, p=.6080). Since neither FRL nor teacher experience showed significant relationships with student growth, they will not be included in any further analyses.

Teacher Education and Student Growth

The relationship between teacher education and student growth was first examined using a one-way ANOVA. Separate models were run for bachelor's and master's degree granting institutions. The relationship between bachelor's institution and average growth was not significant for math ($F=1.57$, $p=.0906$) or reading ($F=1.50$, $p=.1143$). All post hoc analysis showed no significant differences between the average growth scores of the schools. These scores are shown in Figures 3 and 4 below.

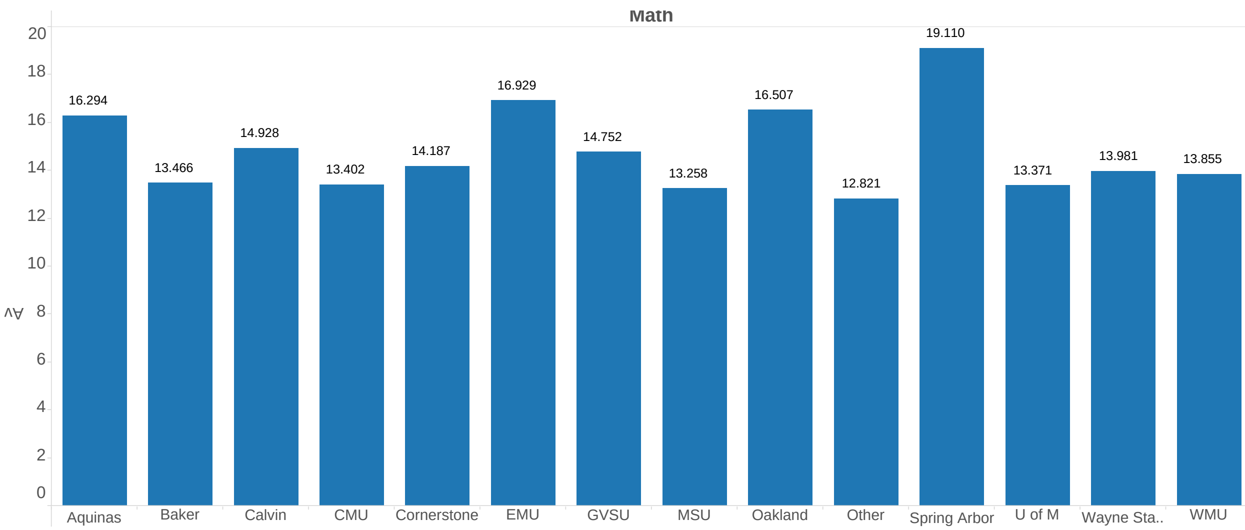

Figure 3: Average scores by Bachelor's University for Math

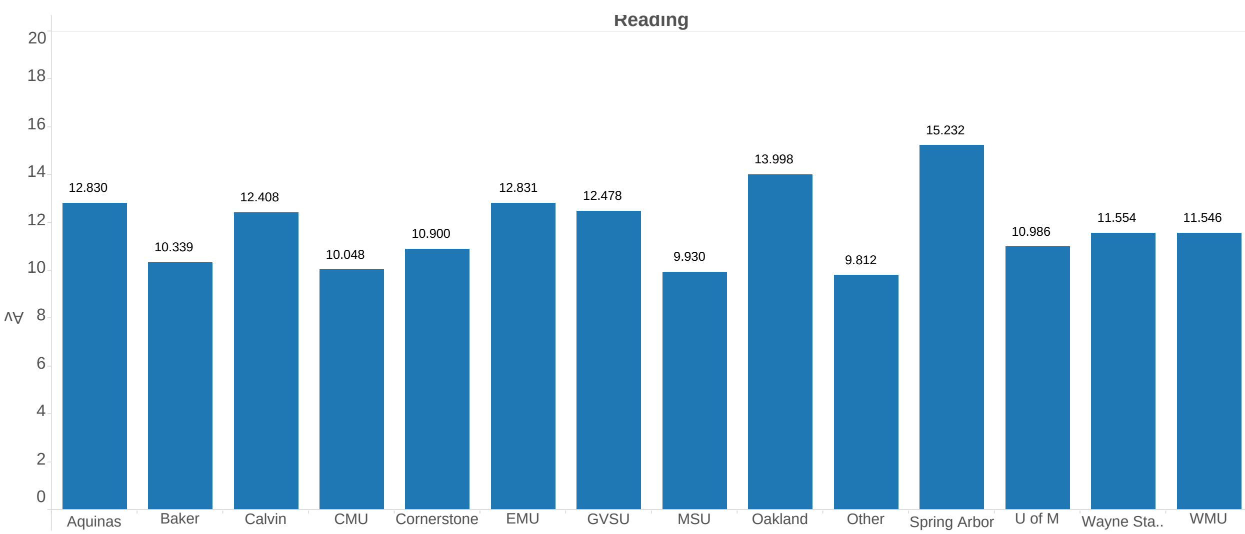

Figure 4: Average scores by Bachelor's University for Reading

For the analysis of master's granting institutions, a one-way ANOVA design was used. A significant relationship between master's institution and academic growth was found for math ($F=2.17$, $p=.0212$) but not for reading ($F=1.66$, $p=.0926$). For math, post hoc analysis using a Bonferroni adjustment for multiple testing was performed. This found that Eastern Michigan University graduates averaged significantly higher growth than graduates from Michigan State University and the grouping of

Other Universities. No other significant differences were found. Scores by master's institution are shown in Figures 5 and 6 below.

Figure 5: Average score by Master's University for Math

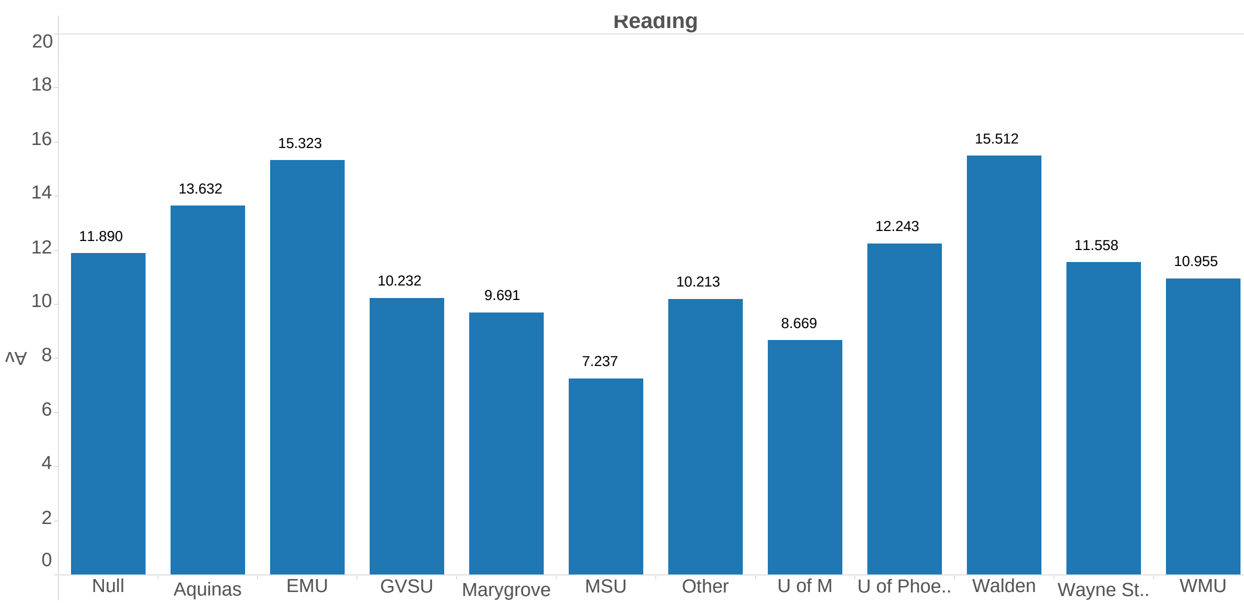

Figure 6: Average score by Master's University for Reading

It is possible that the difference in the average growth scores for graduates from specific universities may be in part due to the grades that the specific teachers are assigned to. There is a strong relationship between student grade and average growth scores with lower grades averaging much higher growth than higher grades. If teachers from a given university happen to teach predominantly high grades, then their scores would be lower simply because of the grades they teach. Conversely, if graduates from an institution primarily taught lower grades, their growth scores would appear much higher. Unfortunately this is not something that can be statistically evaluated with the current data set. There are not enough teachers from each university to further divide them into their respective grades. Each grouping would be too small to be valid for statistical tests.

In addition to assessing the effect of degree-granting institution on student growth, the effect of having a master's degree was also assessed. The expectation is that having a master's degree should result in higher student growth stores. Surprisingly this was not found. Summary statistics found that teachers with a master's degree had a mean average growth of 13.9 while those without had a mean average growth of 14.8 in math. While a t-test found that this difference was not significant. (t=1.32, p=.1882), it was still unexpected. In reading the difference was even greater. Those with a master's degree had a mean average growth of 11.9 while those with had a mean average growth of 10.8. This difference was also not significant (t=1.65, p=.0998).

Again, this difference might be due to the grades taught by the different teachers. If a larger proportion of teachers with master's degrees teach higher grades, then their scores would appear to be lower because of this. Because we are only dividing teachers into two groups (have masters vs don't have masters), it is possible to further divide them into grades and still have sufficiently large enough samples for valid statistically analysis. The frequency of teachers with and without master's degrees for each grade was determined. This is shown in Table 6 below. The table shows that while there is some increase in the number of non-master's teachers at the lower grades, it is not extreme. A chi-square test shows no significant relationship between having a master's degree and grade (χ^2=10.76, p=.216).

Table 6: Teachers with Master's Degrees by Grade

		Grade								
		K	1	2	3	4	5	6	7	8
Master's Degree										
No	Count	30	33	28	29	16	30	34	38	39
	Percent	10.8%	11.9%	10.1%	10.5%	5.8%	10.8%	12.3%	13.7%	14.1%
Yes	Count	25	18	18	21	26	18	34	36	41
	Percent	10.6%	7.6%	7.6%	8.9%	11.0%	7.6%	14.4%	15.2%	17.3%

To assess the relationship between grade, master's degree and student growth, a two-way ANOVA including an interaction term was used. Average growth scores by each grade for the two groups are shown in figure 7. The overall model was significant for both math (F=72.73, p<.001) and reading (F=76.37, p<.0001). Looking at the individual factors, the interaction term was not significant in either model (Math: F=1.26, p=.2616; Reading: F=1.62, p=.1170). This indicates that there is not significant evidence of a difference in the effect of having a master's degree between the different grades. No significant effect of having a master's degree was found for either subject (Math: F=.02, p=.8974; Reading: F=.01, p=.9112). For both subjects, grade was the only significant factor (Math: F=152.33, p<.0001; Reading: 158.51, p<.0001). The results of this analysis suggest that most of the difference between those with and without master's degrees is due to the grades taught by those teachers. This result is still somewhat unexpected as you would expect higher performance by those with master's level teachers. Additional research in this area is recommended.

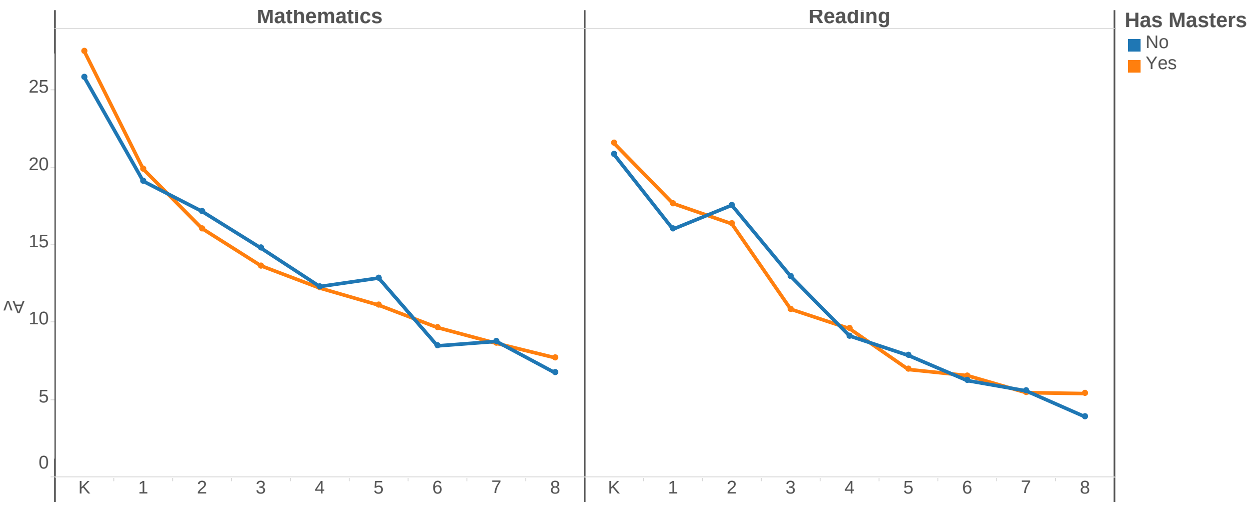

Figure 7: Average Growth by Education Level and Grade

Conclusion

The overall goal of the analysis was to detect if there was a difference in student growth by teacher's degree granting institution. While some differences in student growth did exist based on the institution from which teachers received their bachelor's degree, this difference was not significant. There was a significant relationship between institutions granting master's degree and student growth. While differences existed between all institutions, only two differences were found to be significant. These significant findings were that graduates from Eastern Michigan University had significantly higher mean average growth in math than both Michigan State University graduates and graduates from the grouping of Other Universities. Increases in sample size may lead to an increase in significant findings. A larger database would also allow us to assess if the relationship between teacher educational institution and student growth is due to the grades that teachers from each institution happen to teach or if it is a true difference.

It was also found that teachers without a master's degree averaged higher student growth than those with a master's degree. While this finding was not significant, it was unexpected. You would expect that teachers with advanced degrees would show higher student growth than those without. While grades taught by these teachers does explain some of the findings, further research in this area is recommended.