The Effects of Teacher Cultural Trainings on Student Achievement

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# Intro (why should you care)

In 2023 Albemarle County Public School District had a program that allowed teachers to get certified in a cultural awareness program. This is because there has been research supporting culturally responsive teaching has demonstrated high rates of success in accelerating student learning for students of color with economic hardship. We were tasked with analyzing whether the cultural training some teachers received had a statistically significant impact on student academic achievement, specifically, on student reading and math test scores. The goal is to have unbiased knowledge of whether the teacher certification was impactful when it comes to growth of student test scores; by using multivariate linear regression and random forest models which highlight the prominent factors for the growth of the students in terms of their test scores. Another goal is what other combinations of variables lead to an increase in growth score. The results of this project will inform the Albemarle County Public Schools leadership team on whether or not to implement culturally responsive teaching for all classroom teachers for this next upcoming school year of 2024-2025.

This project will analyze students’ math and reading standardized test scores with classroom teachers going through the culturally responsive teaching and those who haven’t yet. The tools that will be used will be multivariate linear regression and random forest models which highlight the prominent factors for the growth of the students in terms of their test scores. The inputs of the model will be demographic information of the students and teachers and the outputs of the model will be evaluated on the growth of students’ test scores. The results of this project will inform the Albemarle County Public Schools leadership team on whether or not to implement culturally responsive teaching for all classroom teachers for this next upcoming school year of 2024-2025. The assumption is that all of the data for each student has been collected correctly, meaning that any analyses abstracted from it are correctly coded.

The goal as stated by our mentor is to have unbiased knowledge of whether the teacher certification was impactful when it comes to growth of student test scores. Our mentor told us that the most important feature for him in general was how the student grew over the year. He also would like for the findings to be statistically significant. He is also curious about whether the certification could work better for each subject.

However, he also has secondary achievements because he is curious to see what other combinations of variables lead to an increase in growth score. For example, he wants to see if the highest increase in scores could be due to some demographic of the teacher. He is also interested in knowing if the vertical scaled score (achievement scaled across grades and subjects) is influenced by any of the other features.

# Literature Review/Related Work

Other project with UVA SDS & Albermale County Public Schools: <https://github.com/roryblakc/3Cavs-ACPS/blob/main/README.md>

This project aimed to analyze the impact of the COVID-19 pandemic on the behavior, achievement, learning problems, and mental health of middle and high school students in Albemarle County Public Schools. IT compares data from pre-pandemic (2018-2019), the period of remote instruction (2020-2021), and the return to in-person instruction (2021-2022). The long-term goal is to establish data integrating education and medical records to enhance understanding and intervention in children’s well-being, development, and mental health called the Virginia Child Data Core (VCDC).

During the pandemic, school closures deprived students of social interactions and support from teachers and staff, leading to concerns about their well-being and mental health. The students that were most impacted were adolescents from low-income or marginalized families, who faced increased challenges due to limited resources and support.

The project involved an interdisciplinary team from the UVA School of Education and Human Development, School of Medicine, and School of Data Science. They analyzed education data from over 11,000 students and medical record data from 2,705 individuals to track trends in mental health issues and learning difficulties across different demographic groups.

The VCDC aimed to create a longitudinal connecting education and medical records of children and adolescents statewide, enabling comprehensive research and intervention efforts. Potential future collaborations include partnerships with other school districts and projects focusing on various aspects of children’s well-being and education trajections. They were hoping for future analyzes to explore the use of health services for mental health and learning problems, and integrate both datasets to examine patterns at the age/grade level.

# Data Description

Multiple iterations of two datasets were used for analysis. The data contains student demographic information (race, gender, English learner, disabilities, etc.), teacher demographic information (years experience, highest degree, birth year, gender, race, etc.), whether or not a teacher and a principle are certified as culturally responsible educators (and if so, what type of certification), and student results on Virginia SOLs (Standards of Learning) such as growth, expected and actual achievement, and vertical scaled score (achievement scaled across grades and subjects).

The main variable of interest was the growth variable, which measured

*Our data processing only consisted of cleaning the data to make sure the variable types were the same and matching variable names. Being that the goal of our project is to investigate if culturally responsive teaching has any impact on student outcomes, we will attempt to account for the impact of all other variables in relation with whether the teacher is culturally responsive certified. Our potential predictors variables therefore include the teacher and student demographic information (specifically investigating teacher experience/qualification) as well as whether or not a teacher is culturally certified and what type of certification there is.*

# Methodology

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With the goal of determining if culturally responsive certifications impact student outcomes, we planned to investigate a variety of models. First, we planned to look at multivariate linear regression, specifically looking at which variables are statistically significant. Additionally, we planned to investigate random forests and decision trees, seeking to understand which variables have a high “variable importance” score. Finally, we plan to conduct statistical significance tests on a variety of variable groupings.

As we began delving into our data we each took different aspects of the data to see what we thought was the most interesting. We looked into the certification types of the teachers and how they were distributed. We also looked into other variables such as gender and race of the teachers and students. We then did some base level random forest tests to try and get a direction we should follow. However, we learned very quickly that there is a lot of collinearity when it comes to testing for growth. Due to this the group decided to drop the columns relating to test scores except for growth.

Once we dropped the columns, we were more easily able to test for different assumptions that we had using the data. For example, we were then able to do a random forest to try and find the import features when it came to comparing growth and certification.

We also tested whether there were any correlating variables between race and teacher certification when it came to increasing students' growth score.

A stepwise selection was also used to see what were the most important factors when it came to growth, however the R^2 was also low.

## Teacher Certification in Isolation

The group still wanted to see if in isolation does having the certification have an impact on the growth in students. So, an ANOVA test was done because we were comparing 3 different groups of teacher certifications (none, micro, and full). However, due to there being too much collinearity with this dataset and only a very small number of teachers going through this program at this time, there was a high amount of collinearity in the dataset. Therefore, instead of using an ANOVA, a Kurskal-Wallis test was implemented. It should be noted that this test only tests if there is any statistical significance between any of the groups, but does not tell us which groups are statistically significant in the categorical variables. We then used a Dunn’s test to determine whether each category is statistically significant.

2 sections -- teacher cultural training only then all predictors

## All Possible Predictors

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# Results

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# Discussion\*\*\*\*\*\*\*

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# Conclusion / Future Work / Recommendations

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# References

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