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Examining Teacher Quality Gaps in the Philadelphia School District

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Abstract
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Keywords
teacher quality gap, education reform, charter schools, traditional public schools, value-added score

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Educational Assessment, Evaluation, and Research | Other Business

EXAMINING TEACHER QUALITY GAPS IN THE PHILADELPHIA SCHOOL DISTRICT

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ABSTRACT

This paper compares the presence of teacher quality gaps (TQGs) in charter schools to those present in traditional public schools (TPS) within the Philadelphia School District. No significant difference in TQGs was found to exist when student disadvantage was defined by socioeconomic status and teacher quality was defined by years of experience, but there was a significant difference favoring traditional public schools when student disadvantage was defined as identification with an underrepresented minority group (URM). An examination of the value-added score distributions of charter and traditional public schools found TPS to have higher minimum, median and maximum scores than charter schools. Despite these differences in distribution, the use of these scores to quantify TQGs according to both socioeconomic and URM status of students failed to show a significant difference except for when math value-added scores were the measure of teacher quality and student disadvantage was determined by socioeconomic status.

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INTRODUCTION

As the issue of rising income inequality in the United States has become a forefront issue in the society, so have the problems within the educational system which, at least in part, drive the phenomenon. While many agree that American schools and the educational system need improvement, there is no clear resolution as to what is the best method. One of the proposed solutions to this issue is school choice and the introduction of charter schools into the educational marketplace so as to widen the options available to parents and students beyond those of traditional public schools, private schools and homeschool.

It can be argued that by taking a market-based approach to the educational system, one will increase efficiency through competition between schools and allow for better student-school matches. Furthermore, school choice could potentially provide greater equality of opportunity by providing alternatives to families and students who may not be able to afford to move to a different residential area and/or attend a private school. Lastly, merit pay and other staffing differences which traditional public school incentive structures lack could encourage teachers to achieve better or different results. Since charter schools possess a greater degree of regulatory freedom and make the education market more competitive, pay for teachers and other personnel policies could be performance-based instead of fixed through union influence. These competitive pay and personnel practices would potentially allow charter and private schools to attract more qualified teachers than public schools.

Opponents of charter schools offer the following arguments to counter the points listed above. Firstly, it can also be argued that school choice negatively impacts the already low-performing traditional public schools to an even larger degree than they would be otherwise by taking away high-performers, funding and enrollment numbers. Secondly, charter schools are a

new, risky, unproven experiment in education which gamble with the lives of children and taxpayer dollars. Thirdly, charter schools undermine the ideal of equal and excellent education through mandating an application process which self-selects for students and parents who are informed enough to know to apply. This barrier-to-entry creates a system which only exacerbates the issue of inequality in schools instead of resolving the problem.

LITERATURE REVIEW

In accordance with the rising popularity of school choice and charter schools as an option for education reform, the number of charter schools in the United States has grown rapidly. Since 1991 when Minnesota passed the nation's first charter school law to today in 2018, the number of charter schools in the United States has grown from one school in St. Paul with thirty-five students to nearly seven thousand schools enrolling close to 3.2 million students (National Alliance for Public Charter Schools, n.d.). This rapid growth of charter schools as a percentage of our public school educational system has resulted in charter schools becoming a focus of academic research.

The question of whether or not charter schools are significantly more effective than traditional public schools at raising student achievement has been examined in multiple studies. Past research hoping to answer the question of charter effectiveness found that charter attendance through a lottery-based admission policies to an urban charter had a positive impact on student performance, but that the results for nonurban charters were mixed (Angrist, Pathak, and Walters 2013; Hoxby and Murarka 2009; Dobbie and Fryer 2011; and Gleason, Clark, et al. 2010). This apparent success of urban charters above that of traditional public schools in urban areas is despite evidence indicating students at urban charters are typical of the overall urban student population and thus effectiveness of charters above other urban schools is not driven by the type

of student who attends (Angrist 2013). Angrist (2013) further investigates school-level factors, which could explain the success of some urban charters over others, to find that urban and lottery-sample charter effectiveness can be explained by adherence to a "No Excuses" approach to urban education. "No Excuses" schools advocate discipline, traditional skills and selective teacher hiring (Angrist 2013). Despite these positive findings regarding urban charter schools and the impact these schools have on student achievement, there is also some research which points to the damage to a student's performance if a student is enrolled in a new charter school. Studies have found that a student enrolled in a new charter school will actually experience a negative impact on their growth, but as years pass and faculty experience grows, this impact declines (Bifulco and Bulkley 2008). This accumulation of experience enhancing teacher quality could make a difference in charter school effectiveness, but charter schools have, on average, also been found to have significantly higher turnover rates than TPS due to variables such as age, perception of workload and union presence (Stuit and Smith 2010; Torres 2016). Furthermore, the teachers who possess the strongest academic backgrounds are the most likely to leave as opposed to their less academic peers (Stuit and Smith 2010).

This paper hopes to examine the degree to which teacher quality, as defined by value-added scores as well as certification and experience, differs between traditional public schools (TPS) and charter schools within the Philadelphia school district. Value-added scores have been commonly used as a measure of teacher effectiveness and quality in academic research completed over the past few years (Goldhaber, Quince and Theobald 2018; Hanushek, et al. 2005; Sass and Harris 2012; Koedel and Betts 2011; Chetty, Friedman and Rockoff 2014) and used as a measure of teacher evaluation. The use of this new metric was accompanied by a corresponding debate over whether or not these value-added scores were a good measure of the

impact of a teacher or biased by student sorting and teaching to the test. Chetty (2014) analyzed these value-added models and found they worked well in isolating a teacher's impact on student achievement from other factors

The reason for examining teacher quality as opposed to another input (such as students or funding) is as follows: research has consistently demonstrated that teacher quality has an outsized impact on student outcomes. A 2000 study by Darling-Hammond on teacher quality and student achievement analyzed data from all fifty states in a survey of policies, state case study analyses and the 1993-94 School and Staffing Surveys and National Assessment of Educational Progress to see how teacher qualifications and other school inputs related to overall student achievement. The study found through quantitative analysis that measures of teacher preparation and certification had the strongest correlations with student achievement in both mathematics and readings. This correlation was the strongest both before and after controlling for student poverty and language status (Darling-Hammond 2000). More recently a study on statewide end-of-course tests in North Carolina was conducted to examine the relation of teacher credentials to student achievement. Evidence was found that teacher qualifications impact student achievement in systematic ways. (Clotfelter, Ladd and Vigdor 2010). Interestingly enough, despite the above findings where urban charters are found to be more effective than urban traditional public schools, teacher qualifications through licensure were and are generally higher in traditional public schools. Traditional public schools must hire fully licensed teachers as per the No Child Left Behind Act. Private schools and charters can, and typically do, hire uncertified teachers. Ninety-three percent of teachers in traditional public schools hold regular state licenses as opposed to the approximately seventy-one percent in charter schools and the fifty-eight percent in private schools (Podgursky 2006).

Past research has not only identified teacher quality to be the most important determinant on student achievement, but it has also shown that disadvantaged students are much more likely to have low-quality teachers as measured by degrees, experience and advanced credentials (Clotfelter, Ladd, and Vigdor 2005; Kalogrides and Loeb 2013; Lankford, Loeb, and Wyckoff, 2002). Lankford's study on New York schools serves as a specific example for this phenomenon. Using data to determine differences in teachers across schools, Lankford found that urban schools have less-qualified teachers. This inequity of suburban versus urban disproportionately impacts low-income, non-white students (Lankford, et al. 2002). Kalogrides, Loeb and Beteille (2013) focus within one district on student and teacher assignments to find that disadvantaged students, defined as those identifying as a minority and/or low-income socioeconomic status, were more likely to have a novice teacher assigned. This phenomenon is known as a "teacher quality gap." Recent work by Goldhaber (2018) has continued to add on to this field of study through examining teacher quality using value-added scores in the states of North Carolina and Washington.

Despite the wealth of research regarding the importance of teacher quality and research on teacher quality gaps in traditional public schools, not much is written on whether or not the size of teacher quality gaps differs between TPS and charter schools. Ozek (2018) examined this in a working paper analyzing teacher value-added scores in Florida schools to find that teachers working in above-average poverty charter schools have significantly higher value-added scores as compared to TPS teachers in similar conditions. Secondarily, Ozek finds that cross-sector differences such as experience and educational attainment do not appear to explain the gaps in teacher effectiveness, but finds returns to experience are higher for teachers in the charter school

system and that there are considerable differences in teacher influence on policies and practices within the schools.

RESEARCH QUESTION & DATA

By examining the presence of teacher quality gaps in charter schools relative to traditional public schools, this paper hopes to address an old question through a new lens. Although there is a general consensus regarding the role of teacher quality in determining student outcomes, research analyzing charter school teachers or differences between teacher quality levels between charter schools and traditional public schools is lacking. This is primarily due to different data reporting requirements as well as the smaller number of charter schools in each district as compared to traditional public schools (Ozek, Carruthers and Holden 2018). Despite this issue at the nationwide level, Pennsylvania provides the necessary data to examine teacher quality gaps for both charter and traditional public schools in the Philadelphia School District. Hence, at hand is to examine the degree to which teacher quality gaps exist in the Philadelphia School District and the difference of gap size existing between charter and TPS. For the following analysis, this paper compiles data provided by the Pennsylvania Department of Education. Information on the makeup of the student body by racial identification and the qualifications for free or reduced lunch is public for each individual school in the district. For teacher data, the focus will be on both years of experience and value-added scores (PVAAS). The following table lists each variable used in the analysis as well as the corresponding boundaries for determining teacher quality and student disadvantage.

1. *Variable Definitions*

Variable	Definition
Student Race	Proportion of disadvantaged students is defined as percentage of population consisting of underrepresented minorities (URM)
Student Socioeconomic Status	Proportion of disadvantaged students is defined as percentage of population qualifying for free or reduced price lunch (FRPL)
Years of Experience	Low-quality teachers are defined as those with 2 years or fewer of teaching experience as used in a previous teacher quality gap study performed by Goldhaber (2018)
Pennsylvania Value-Added Score:	PVAAS is a teacher-specific estimation of teacher impact on student academic past as well as projected future growth by accounting for not only where the student is at the end of the school year, but also where said student started. Value-added models are increasingly being used in education literature to isolate an

	individual teacher's impact on a student from other demographic and socioeconomic factors (Goldhaber, 2015). Pennsylvania has denied access to teacher-specific scores, but school-level data is public. It is not appropriate to compare the growth measure values from these individual reports to each other as the different standard errors are unaccounted for. As a result, the department provided an additional average growth index for each district and school in PA which is discussed in the following section. The scores used in the analysis are thus derived from this growth index

PVAAS MODELING

Utilization of a growth measurement such as value-added scores in the context of teacher-student relationships allows one to measure student growth over a period of time and in relation to previous performance instead of the point-in-time comparison to PA core standards achievement method. Growth measurement typically has little to no relationship with student demographics whereas achievement data is highly correlated with demographics (Department of Education, "Pennsylvania Value Added Assessment System," 2019).

A value-added score is calculated using a student's current achievement compared to all prior achievement results as measured by previous assessments such as the PSSA and Keystone exams. Since 2006 Pennsylvania has used the SAS EVAAS methodology to calculate student scores. The methodology was originally published in 1998 and, since that data, has been nationally peer reviewed and is now supported by independent, non-partisan researchers at RAND and WestEd (Department of Education, "Pennsylvania Value Added Assessment System," 2019).The EVAAS system provides two categories of models with each's use dependent on data available.

A Multivariate Response Model (MRM) is used for when test data is from consecutive years such as grade 3-8 PSSA Math and English Language Arts Assessments. The district MRM which will be used is represented as:

$$\boldsymbol{y_{ijkld}=\mu_{jkld}+\varepsilon_{ijkld}}$$

Where "y_{ijkld} is the test score for i^{th} student in the jth subject in the k^{th} grade during the l^{th} year in the d^{th} district. μ_{jkld} is the estimated mean score for the district, subject, grade and year. ε_{ijkld} is the random deviation of the i^{th} student's score from the district mean" (Department of Education, "Statistical Models and Business Rules of PVAAS Analyses," 2019).

Similarly, the school MRM is represented as:

$$\boldsymbol{y_{ijkls}=\mu_{jkls}+\varepsilon_{ijkls}}$$

The equation is the similar to that of the district but with s for s^{th} school replacing d for d^{th} district (Department of Education, "Statistical Models and Business Rules of PVAAS Analyses," 2019). Solving this equation the gives a vector which contains the projected mean score for each

school or district, subject, grade and year. This mean score accounts for student mobility through a weighted average of schools that fed students into the school, grade, year and subject which is being analyzed. A series of calculations can then be used to find an average student growth.

A Univariate Response Model (URM) is used for non-consecutive year tests such as Keystone exams with similar models for district and school-level calculations with a slight variation for multiple teachers using team teaching. The equation is as follows:

$$y_i = \mu_y + \alpha_j + \beta_1(x_{i1} - \mu_1) + \beta_2 (x_{i2} - \mu_2) + \ldots + \varepsilon_i$$

Where y is the dependent, response variable and predicted score, the covariates are scores on previous tests the student has completed and the categorical variable is the teacher(s) the student has learned from in the subject/grade/year of y (Department of Education, "Statistical Models and Business Rules of PVAAS Analyses," 2019).

Each of the models described above provides a projected growth as well as a standard error which serves to indicate the amount of evidence that students either exceeded or missed the PA Academic Growth Standard. This growth standard is thus used to index schools accordingly using the growth standard (expected growth) as zero and measures the amount of evidence regarding the difference of a growth relative to the expected Pennsylvania Academic Growth Standard (Department of Education, "Statistical Models and Business Rules of PVAAS Analyses," 2019).

METHODOLOGY

The methodology for calculating teacher quality gaps in each school mirrors the approach used by Clotfelter, et al (2005), Goldhaber, et al (2018) and Ozek et al. (2018). The paper thus presents the method as described in Goldhaber (2018). For each measure of teacher quality,

either years of experience or value-added score, X_{ST} will be the proportion of "low-quality" teachers in school *S* in school type *T* (charter or TPS). Similarly, for each measure of student disadvantage, either socioeconomic status or URM status, D_{ST} is the proportion of disadvantaged students in school *S* of type *T* while ND_{ST} is the proportion of non-disadvantaged students. The school-level exposure rate of disadvantaged students in the Philadelphia schools to teachers classified as "low-quality" is thus a weighted average where the proportion $E_D(\bar{X}_{ST})$ is bounded by zero and one:

$$\boldsymbol{E_D(\bar{X}_{ST}) = \frac{1}{\sum_S \sum_T D_{ST}} \sum_S \sum_T X_{ST} D_{ST}}$$

Similarly, the exposure rate of non-disadvantaged students can be calculated using this equation but replacing D_{ST} with ND_{ST} to find $E_{ND}(\bar{X}_{ST})$. For the given student disadvantage and teacher variable, the teacher quality gap is thus:

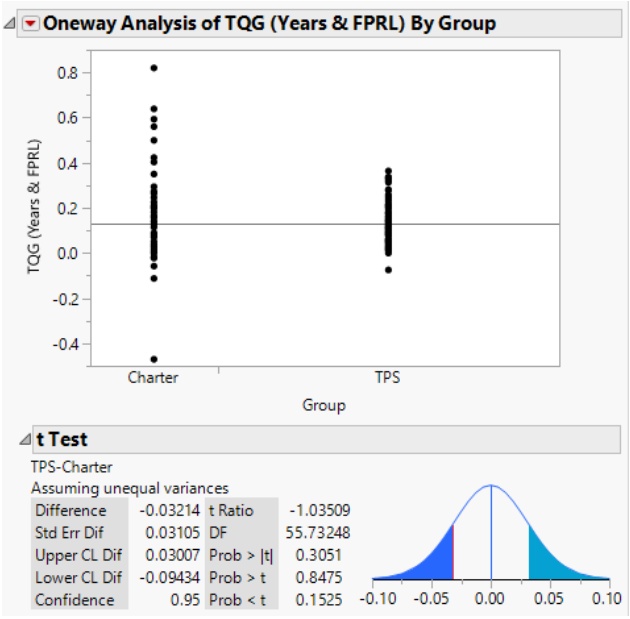
$$\boldsymbol{E_{ED}(\bar{X}_{ST}) - E_{ND}(\bar{X}_{ST})}$$

As it is only possible to know the average value-added growth score for each school rather than each teacher, the analysis is completed using an artificially constructed dataset. The paper assumes that since the average score is the average score of all combined teachers in each school, it may be assumed that each teacher in the school has the same score as the average as the average score would thus stay the same. This then allows schools to be ranked in terms of their average scores. Using the total sum of students and number of teachers in each type of school in the district, one can then artificially construct a dataset which allows one to find the bottom quartile of teachers as per their value-added scores.

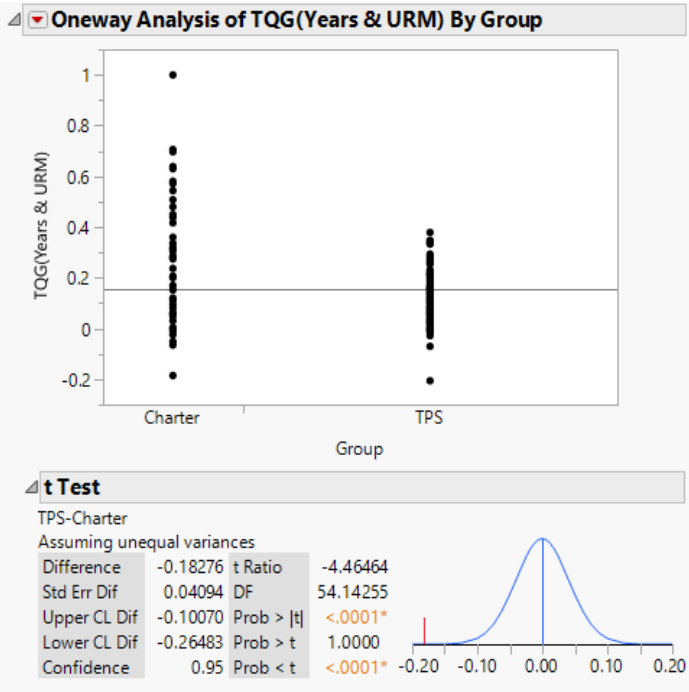
RESULTS

This paper found small and statistically insignificant differences between charter and traditional schools in comparing the teacher quality gap between advantaged and disadvantaged students where student disadvantage was defined by socioeconomic levels and teacher quality was determined by years of experience where a teacher with two years or less of experience was defined as low-quality (Table 2). However, when student disadvantage was instead defined as identification with an underrepresented minority, the paper found there to be a significant difference in the teacher quality gap (Table 3). According to this analysis, traditional public schools are more likely to have more experienced teachers. This finding is further supported by research stating that the labor force in traditional public schools tends to have less turnover and more experience as compared to that of charter schools due to a union presence (Stuit and Smith 2010; Torres 2016).

2. *Analysis of Teacher Quality Gaps: Teacher Quality as Years of Experience and Student Disadvantage as Socioeconomic Status*



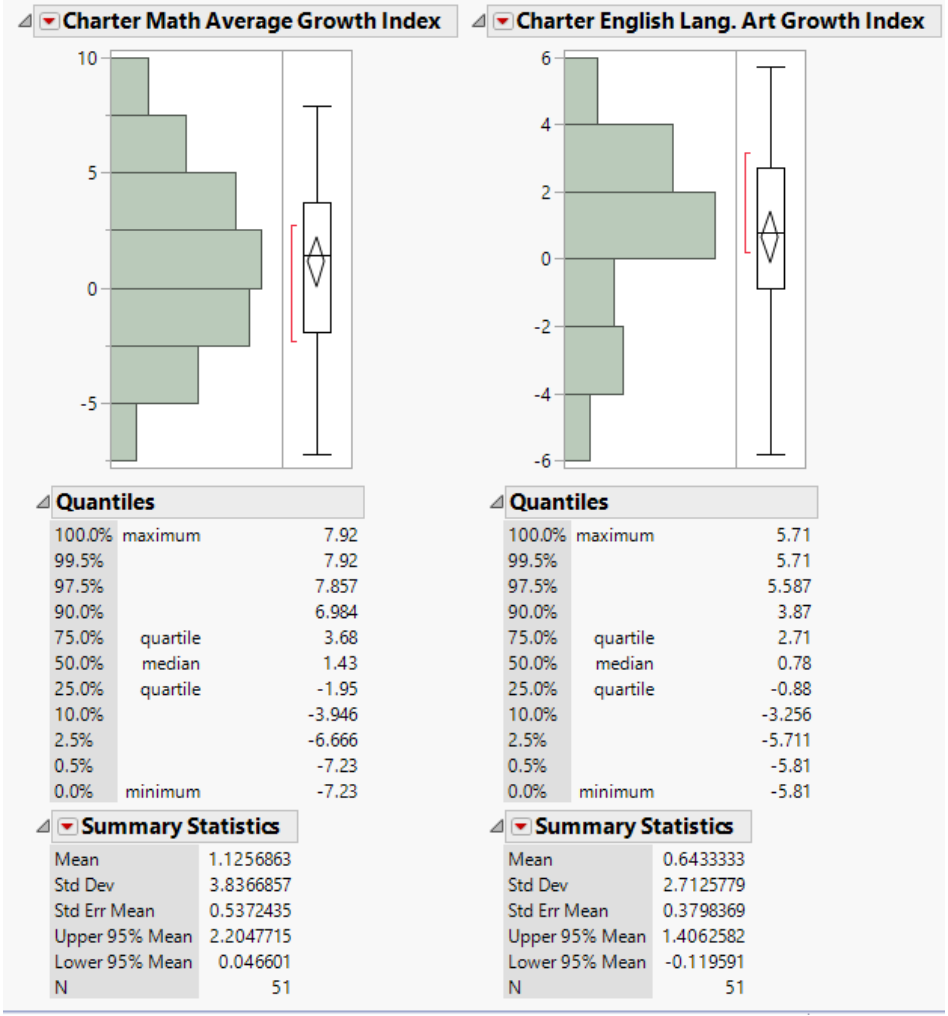
3. *Analysis of Teacher Quality Gaps: Teacher Quality as Years of Experience and Student Disadvantage as URM status*



The paper will now move on to an analysis of teacher quality gaps where teacher quality was defined according to value-added scores with teachers possessing the bottom quartile of scores in the district labeled as low-quality. The paper has included tables below to demonstrate the distributions of the teacher value-added scores with the median, 10th, 25th, 50th, 75th, and 90th percentiles of the distributions for both Math and English Language Arts exams (Table 4 and 5). Through examining these distributions, it is apparent that traditional public schools in the Philadelphia School District have higher median value-added scores with a median score of 1.76 in Math and 1.19 in English as opposed to charters' median scores of 1.43 in Math and 0.78 in English. Additionally minimum value-added scores for traditional public schools are higher than those of charters with traditional public schools' minimum being -3.48 for Math and -4.09 for English as opposed to charters' minimums of -7.23 for Math and -5.81 for English. Lastly,

maximum scores for traditional public schools were also higher than those of charters with 10.54 for Math and 8.02 for English while charter schools' maximum scores were 7.92 for math and 5.71 for English.

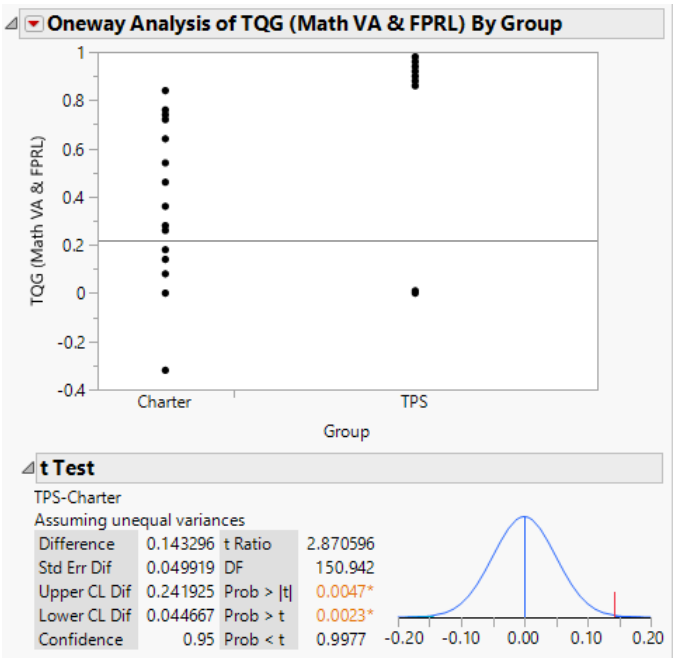
4. *Charter Schools' Distribution of Value-Added Scores for Math and English Language Arts*



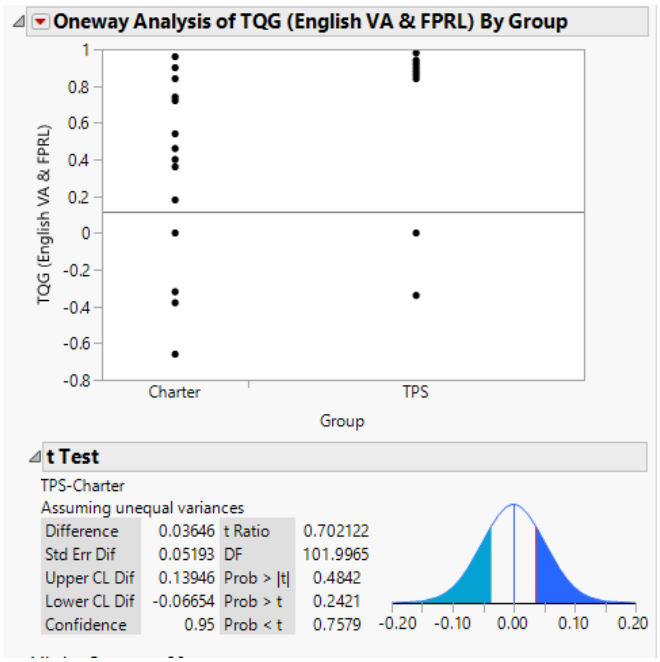
5. *Traditional Public Schools' Distribution of Value-Added Scores for Math and English Language Arts*

The first step in an analysis of value-added scores examined the difference in teacher quality gaps between charter and traditional public schools by examining value-added scores in both types of schools and defining student disadvantage by socioeconomic status. The paper found a significant difference in the size of the gap in TPS as compared to charter schools through an analysis of the math value-added scores (Table 6), but an insignificant difference when the value-added score was that of English language arts (Table 7).

6. *Analysis of Teacher Quality Gaps: Teacher Quality as Math Value-Added Score and Student Disadvantage as Socioeconomic Status*

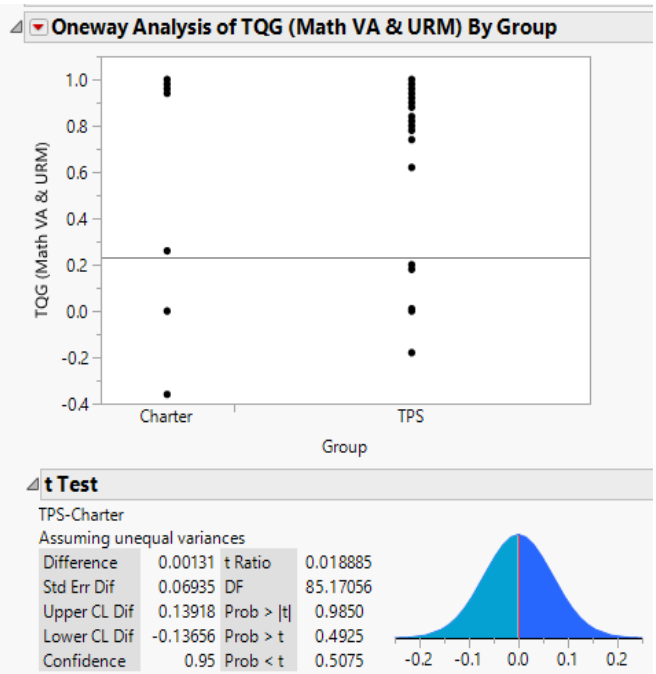


7. *Analysis of Teacher Quality Gaps: Teacher Quality as English Value-Added Score and Student Disadvantage as Socioeconomic Status*

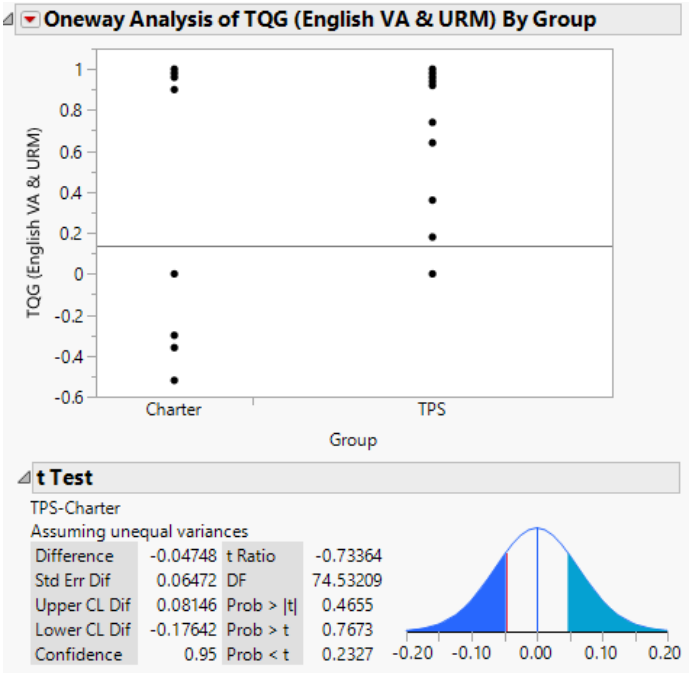


While the difference in the degree of teacher quality gaps was found to be significant when student disadvantage was defined by identification with an underrepresented minority and teacher quality was defined by years of experience, there was no significant difference found in the degree of teacher quality gaps between traditional public schools and charters with teacher quality defined by value-added scores and student disadvantage defined as identification with underrepresented minorities (Table 8 and 9). Combining value-added scores to analyze the difference between types of schools also failed to produce a statistically significant difference.

8. *Analysis of Teacher Quality Gaps: Teacher Quality as Math Value-Added Score and Student Disadvantage as URM Status*



9. *Analysis of Teacher Quality Gaps: Teacher Quality as English Value-Added Score and Student Disadvantage as URM Status*



CONCLUSION

This study compares the presence of teacher quality gaps in traditional public schools to those in charter schools within the Philadelphia School District. The paper presents a few main findings. No significant difference was found between teacher quality gaps in charter schools and TPS when student disadvantage was defined by socioeconomic levels and teacher quality was defined by years of experience; however, this paper did find a significant difference, favoring TPS, when student disadvantage was defined as identification as an underrepresented minority. In an examination of the distributions of value-added scores of charter and TPS value-added scores, traditional public schools were found to have higher median scores as well as lower standard deviations than charter schools which also have comparatively lower maximum, median and minimum scores. Despite these differences in distributions of scores, the use of value-added

scores to quantify teacher quality gaps according to both socioeconomic and URM status of students failed to produce a statistically significant difference between school types except for the teacher quality gaps identified using math value-added scores and FPRL statuses of students.

The hope for this research was that the results would be of interest to politicians and academics in the continuing debate regarding the effectiveness of charter schools and traditional public schools. The results from this study demonstrate that, in the Philadelphia school district, there is not much of a difference in teacher quality gaps between the two school types except for teacher experience. Charter schools would benefit from considering ways to reduce teacher turnover as there was a significant difference found in teacher quality as per years of experience. Future research regarding the presence and level of teacher quality gaps between charter and traditional public schools among urban and non-urban settings would be beneficial as this study strictly examines the urban school district of Philadelphia. Future research examining various urban settings and comparing various cities to each other would also be informative and help to inform the debate of charter schools vs. traditional public schools.

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