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Comparisons of Students' Mathematics and Reading Achievement in Texas: Public versus Charter Schools

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Abstract: In the past two decades, charter schools have become increasingly prevalent and popular in the U.S. education landscape. The purpose of this study is to examine the Texas Assessment of Knowledge and Skills [TAKS] school level mathematics and reading test scores performances over time by school types. The specific research questions are: how does student academic performance differ for students enrolled in charter schools from non-charter public schools? How does minority student academic performance differ by each of the three comparison school types for minority students? The sample consisted of 7,220 Texas schools including charter schools. A hierarchical regression model with propensity scores as covariates and school type as the primary grouping variable formed the basic analysis. Public schools did not significantly differ from charter schools in terms of achievement. Charter and public schools traded performance across grades and subjects. We found that a multi-school charter system, Harmony Public Schools [HPS], consistently produced better achievement at grades 6-11 on mathematics and reading for all students. Findings and implications are discussed in light of developing more systematic studies to examine charter school systems.

Keywords: *Charter Schools; Harmony Public Schools; Mathematics, Reading, and Achievement.*

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Introduction

Since their inception in 1991, charter schools have been one of the most controversial topics in education. Charter schools were initially developed to respond to the academic challenges faced by public schools (Taylor, Alford, Rollins, Brown, Stillisano, & Waxman, 2011). They were conceptualized as an alternative to traditional public schools. The basic premise behind charter schools was to provide schools with greater autonomy in exchange for greater accountability for student outcomes. In the past two

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decades, charter schools have become increasingly prevalent and popular in the U.S. More than 6,800 charter schools have opened serving more than 2.9 million children in 42 states and the District of Columbia in the 2015-2016 school year (National Alliance for Public Charter Schools, 2016). Charter school students comprise more than four percent of the total public school population in the United States (National Charter School Study, 2013). “Enrollment in public charter schools has grown six fold in the past 15 years” (National Alliance for Public Charter Schools, 2016, p.1). Unsurprisingly, this number continues to grow every year.

The critical question about charter schools is whether they have met the original expectation upon which they were founded, which is to increase student achievement. Charter schools are free of charge, open to all children, and don’t have special entrance requirements that govern traditional public schools; therefore, charters are expected to improve student achievement in exchange for reduced oversight (Nathan, 1996; Shanker, 1988). The research literature contains mixed findings without a clear conclusion. This ambiguity keeps the charter school debate in the popular media.

Theoretical Framework

The research base was organized by content area and whether a preponderance of the evidence was predominantly for or against non-charter schools. Relevant literature focusing on (a) charter school research within the general population and for minority groups and (b) charter school movement and research in Texas was used to develop the "skeletal structure of justification" (Eisenhart, 1991). This served as a guide for data collection, analysis, and interpretation of the results.

Charter School Research

There have been numerous studies focusing on various aspects of charter school performance. Some of these aspects include a basic interest in learning how charter schools perform using passing rates on state tests (Tuttle, Teh, Nichols-Barrer, Gill, & Gleason, 2010), and whether charter schools manage

to attract better students from surrounding public schools (Fiske & Ladd, 2000; Tuttle et al., 2010; Zimmer et al., 2009). There have been questions concerning whether charter schools are less diverse than traditional public schools so student diversity has also been a focus (Lake, 2009). But the research has been less than conclusive.

Research on charter schools has yielded mixed findings. Some studies have found that charter schools perform at least as well as traditional public schools (American Federation of Teachers (AFT), 2004; Buddin & Zimmer, 2005; Guy, 2011; Taylor, et al., 2011). Other studies have found that some charter schools outperformed traditional public schools (Betts & Tang, 2008) while others underperformed (Betts & Tang, 2008; Loveless, 2002; Sass, 2006). For example, Bifulco and Ladd (2006) found that North Carolina charter students on average scored lower than observationally comparable students in traditional public schools both in reading and math. Even more confusing were studies that showed both schools performed similarly (Guy, 2011). Given the persistence of charter schools and the lack of definitive evidence, charter school research is intriguing for researchers and policy makers alike.

Recent studies have shown a positive trend in student performance in charter schools. Stanford University's Center for Research on Education Outcomes (CREDO) (2013a) found that charter school students in Louisiana performed better in reading and math compared with traditional public school students. The results were even more positive for New Orleans. In a 25-state study, 3-8 grade charter school students performed better in reading and about the same in math as their counterparts (CREDO, 2013b). The most recent reports seemed to be more equivocal.

The Charter Schools Movement in Texas

The 74th Texas Legislature in 1995 authorized the State Board of Education (SBOE) to open a new type of public school (Texas Education Agency [TEA], 2011). Charter schools are types of public schools generally defined as a “publicly funded, nonsectarian schools that operate under a written contract, or

charter, from an authorizing agency” (Texas Education Agency [TEA], 2005, p.1). Like traditional public school districts, charter schools are monitored and accredited under the statewide testing (Texas Assessment of Knowledge and Skills [TAKS]) and accountability system but are not locally controlled. Although there are several charter school types that exist in the U.S. education system, there are only two types in Texas- district or campus charters and open-enrollment (OE) charters.

District charter schools, locally controlled with an elected school board from members of that district, can authorize the establishment of a campus school that will operate as a charter school. The campus’ education program, governing structure, and other conditions are described in the charter in exchange for less oversight and governance from the school district and school board. The state education agency holds the school district accountable for the academic and financial performance of charter campuses.

The State Board of Education (SBOE) grants eligible entities (e.g., public universities, non-profit organizations, and governmental institutions) charters to operate an open-enrollment charter school. Open enrollment charter schools may accept students from any school district, cannot charge tuition, and must provide transportation as traditional public schools do. Unlike traditional public school districts, OE charters may open campuses in more than one metropolitan area, serve only certain grades, and limit student enrollment. This broad definition facilitates another form although not directly established in state law, the Charter School System.

Charter school systems. The charter school system is a hybrid of the charter school model. It is comprised entirely of charter schools with a central administration as a school district but with campuses widely distributed. The individual campuses have a great deal of autonomy as compared to regular public school campuses in a traditional district, but central administration affords certain benefits of scale. The Texas Legislature did not authorize charter school systems, but education code does not prohibit it. Therefore, it

is important to consider how charter schools perform as they grow and develop into larger organization. There are greater layers of administration, increased bureaucracy, and all the benefits of large scale school districts along with all the associated difficulties of being large, with the added burden of individual schools being located as much as 750 miles from central administration.

Texas Charter School Research

Current research for the performance of Texas Charter schools is mixed. For instance, Booker, Gilpatric, Gronberg, & Jansen (2007) examined a panel of individual student on math and reading test performance in Texas to study the impact of charter school attendance. They controlled school mobility effects and found that students experience poor test score in their first year in a charter school. But they further explained that students who remained in charter schools recovered with a positive effect in subsequent years. Moreover, Booker et al., (2007) found that those who returned their previous public schools appear to recover from their performance drop in the first year of charter attendance. Another study done by Hanushek, Kain, Rivkin, & Branch, (2007) who studied the quality of charter schools on mathematics and reading. Hanushek et al., (2007) found similar findings--they did take student mobility into account-- that average charter schools are not significantly different from in traditional public schools after controlling initial start-up period.

Center for Research on Education Outcomes (CREDO), (2015) did a study on Texas charter schools and compared its results with their district school peers. On average, Texas charter schools show less progress in both reading and mathematics compared to the same groups in traditional public schools. But the same research also suggested that charters schools show improvement since 2009; indicating that charter schools overcame the difference in reading and have improved the math score to reduce the gap from 2009.

In a brand-new study, CREDO (2017) studied charter school students in Texas in comparison to matched traditional public school students. They found that charter school students had stronger growth in reading and similar growth in mathematics compared to the growth of their matched counterparts who enrolled in traditional public schools. Reading growth was statistically significant. In addition, further subgroup analyses revealed that Hispanic charter students and Hispanic charter students in poverty exhibit stronger growth than their TPS peers. Therefore, it may make sense to propose that charter schools that are run well and has been in education for longer years might perform better or roughly on par with traditional public schools.

The National Charter School Research Project's (NCSRP) Charter School Achievement Consensus Panel (2006) suggested two promising approaches for obtaining more accurate results: comparing selected and non-selected lottery students and also using a value-added model. Although we used school level passing percentage and it is not as rigorous as student level value-added model, the method we used is still stronger than regular school comparison or snapshot research and similar to the value-added model, thus providing a reliable comparison of achievement between charter and public schools." Students' performance was followed at the school level by grade over time and compared with the matching public school equivalent. This study also enabled us to determine differences by grade and ethnicity, allowing us to say which school type did better at what grade span by race, shedding light on how and in which grade the differences occurred. Assumptions of this model are discussed in the Methods section.

The research questions framing this study were: 1) How does student academic performance differ for students enrolled in charter schools from non-charter public schools? 2) How does minority student academic performance differ by each of the three comparison school types (Open-enrollment charter schools, Charter School System (CSS), and matched public schools) for minority students? Academic

performance at the school level for this study was restricted to the reported percentage of students passing the state standard for either reading or mathematics.

Method

We used propensity score analysis, post hoc analysis for all statistically significant results, and computed a standardized *Cohen's d effect size* for all results. We used Cohen's *d* calculation that takes the difference between means and divides by pooled standard deviation. The meaning of effect size varies by context; therefore, each effect size must be interpreted within the context of a given unit of analysis (Thompson, 2006). In general, effect sizes indicate the difference in standard deviations of one group compared to another. Means and standard deviations were reported for all variables for descriptive purposes.

Sample

The sample consisted of 7,220 Texas schools including charter schools. The population of Texas schools that included grades 4 through 11 were then selected for 2011. The initial population of Texas schools was combined with their previous grade's data in 2010 and the two data sets were merged. The sample was limited to schools that had student achievement data for a grade in 2011 and the earlier grade in 2010 (e.g. grade 3 in 2010 and grade 4 in 2011 up to grade 11). The number of charter schools that ranged from 4th grade to 11th grade changed from as low as 123 to as high as 193 after each grade was combined with their previous year. The same numbers for Texas public schools were 4,131 for the 3rd and 4th grade combination and 1,543 for the 10th and 11th grade combination before propensity matching. It should be noted that for each year-pair, the sample of schools differed somewhat, as schools were reconfigured, new schools added, and schools closed. This created a paired longitudinal grade performance based on the most current year's data for the population of Texas.

Selection Criteria for the Study

With the 2001 of the Elementary and Secondary Education Act (ESEA) of 1965, each state developed their own assessments and set their own proficiency standards to measure student achievement (Bandeira de Mello, 2011). This resulted in great variation among the states in statewide student testing practices in the United States. Naturally, this caused problems in understanding the achievement levels of students across the states.

The National Center of Education Statistics (NCES) has encouraged research that uses the proficiency standards of the National Assessment of Educational Progress (NAEP) with those of individual states (Cited in Baneira de Mello, 2011). NAEP adjusted each state's state assessment to a common scale that is used in NAEP testing so they could compare states' proficiency standards to NAEP and each other.

Although, Texas TAKS scores ranked around the bottom of NAEP in mathematics and reading, we preferred to use it for the sake of its availability and comparability among school types in Texas. This might be one of the limitations of our study.

The criteria used for selecting public and charter schools for this study were they had to be serving students across grades 4-12 with at least 10 students per grade level at each grade. This strategy removed very small schools and school systems that would jeopardize the robustness of the study because of instability of data estimation. Data was obtained from the Texas Education Agency. The TAKS data was gathered for OE charter schools and regular public schools from 2009-2010 and 2010-2011. The purpose was to compare mathematics and reading TAKS performance among OE charter schools, an OE charter system, and state public schools for two consecutive school years accounting for students' past academic history. While considering the characteristics for a charter school, there were overwhelmingly single schools or multiple schools comprising an elementary, middle, and high school. There were only 9 charter

school groups on the verge of becoming systems but only one, Harmony Public Schools (HPS) in Texas, was comparable to the public schools². HPS's population was similar to the median non-charter school district size in Texas, excluding non K-12 schools amongst the 1,241 public schools (National Center for Education Statistics, 2012). The HPS resembled a traditional public school system more than any other charter school as well as it had a centralized administrative unit, regional administration, and many school campuses at each of the grade levels. To make comparisons reflective of the real world, the many campus charters, which more closely resembled a regular non-charter public school with all the logistical and size affordances and challenges were compared on their own, while smaller charter schools comprised the charter school sample. There may be a belief that charter schools achieve greater academic success because they are small and highly responsive. This may make higher student achievement easier than in school systems where there are multiple administrators and teaching staff with each needing to be aligned to the vision. There are positives and negatives to our approach, but this one provides important insights about the influence of size on student academic performance and prevents the charter school results from being skewed by a single large charter. This allows us to answer the question: Do charter schools achieve their student performance because of their much smaller size?

HPS is an open-enrollment Texas-based charter management organization (CMO) that operates 48 schools in Texas serving more than 30,000 students. Of which 61% of students receive free or reduced price lunch and 68% are under-represented minorities. HPS schools are serving K-12 grade students with a strong focus on science, technologies, engineering, and mathematics (STEM) providing opportunities for underserved communities. Because HPS are public schools, they must follow all federal laws that apply to any other public school. Therefore, they have to accept students by lottery and cannot choose its students based on their interests or achievements. Within the international context, HPS can be thought of

¹ HPS 1) had more than three campuses in each comparison year, 2) served grades K-12, 3) was the fastest growing charter school system in Texas (Deis, 2011), and 4) had a total student population greater than 10,000 (24,000 as of 2013).

as regular public schools that have more autonomy in areas such as choosing their own curriculum and accepting students from any distance like private schools. Although implications of this study should be interpreted within HPS context, it could be informative for different schools, school districts, or education systems around the world.

Variables

Independent variables. The primary independent variable was charter school type, which was coded to compare all available public schools with selected charter schools. These schools were grouped together for primary analyses and then ungrouped for within-charter comparisons. Schools were grouped to examine the characteristics across schools and then ungrouped to examine specific within school characteristics alone. This method provided the most robust and stable estimates of the effects. The sample of charter schools totaled 130, although the number varied by grade level and year. A total of 210 charter schools were in the original database.

Propensity matching was employed to find treated and control groups with similar covariate values (Rosenbaum & Rubin, 1983). There is no intent to claim causal mechanisms due to charter school status in this study. Propensity³ matching permits selection of schools in the two school conditions that are similar in general composition, a better basis for comparison in a non-experimental situation. Since we covary on the propensity score in our analyses, our generalization is to schools similar to those that charter systems develop. Each charter school was matched with its nearest neighbor public school on the propensity score. In a few cases several charter schools were next to each other on the propensity score, and those without a nearest neighbor public school were omitted, under an assumption of random deletion. Each school's propensity score was included as an independent variable to adjust for between propensity

³ Propensity variables included prior grade percent passing rates for reading and mathematics, and current grade school size, percent African-American, Hispanic, special education, limited English proficient, economically disadvantaged, and at-risk classification for students in the school.

score variance. All matched pairs differed only minimally from each other compared to variation in the propensity score distribution, typically less than 1%. While the propensity score was always significant, inspection of the distribution of scores indicated that the great majority of charter schools were placed in the fifth quintile of the school score distribution. Consequently, consideration of a many-to-one match was infeasible because of this distribution, so that the original propensity score was deemed the best covariate possible. Power was estimated at above .8 for a medium size (0.5) effect.

Dependent variables. The assessment program of the State of Texas was the basis for selecting dependent variables. The State's assessment process for 2002- 2011 school years was termed TAKS. While TAKS has received increasingly difficult level changes over the last 15 years, from the 2003- 2004 school year onward it has been essentially constant in format and structure. TAKS was replaced in 2012 with the State of Texas Assessments of Academic Readiness (STAAR). In this study, overall school percent passing rate, as well as reading (grades 3-9) and mathematics (grades 3-8) school percent passing were the primary dependent variables examined. English Language Arts was assessed at grades 10 and 11. High school mathematics testing focuses on Algebra I, Geometry, and Algebra II, which were assessed in grades 9 to 11 respectively. Percent of students passing the reading TAKS, math TAKS, and all assessments of TAKS for the grade comprised the dependent variables for each school in the study.

Analyses

The primary method for analysis was based on general linear model regression. For all passing rates, a hierarchical regression model with propensity score as covariate and charter school condition as the primary grouping variable formed the basic analysis, calculating Type I sums of squares sequentially. Possible charter condition x covariate interactions were then considered, such as charter condition by special education percent and Hispanic/Latino percent, which reflect current possible situational differences between charter and public school performance. For each subject area and overall pass rate, a

separate analysis was performed. Charter school condition by covariate interactions was also investigated hierarchically by adding them singly after the charter school main effect in the Type I analysis.

Overall pass rate was evaluated for Black and Hispanic students separately. Again, a requirement that there be at least 10 Black (or Hispanic) students at a grade level was employed, which reduced the number of schools for these analyses substantially, yet maintaining a large number of schools for each analysis⁴. Because results were not provided by the state separately for these defined groups for reading and mathematics at the grade level, those analyses were not possible.

Results

We performed two sets of analyses for the study. First, we compared TAKS passing scores on mathematics and reading of OE charter schools with regular public schools. In addition, we examined the largest minority groups' performances, Black and Hispanic students. Only overall passing rate was available for these analyses. Upon completing the first group of analyses for all charter schools, because there was only one charter school system sufficiently comprehensive for comparisons with public schools and other charter schools, the HPS, this set of analyses constituted the second part of the study.

In the first set of analyses, Table 1 summarizes means and standard deviations for overall public and charter schools TAKS passing rates and public and charter schools' mathematics and reading passing rates. Corresponding sample sizes are reported in the table as well.

⁴ Texas has a high percent minority student proportion at every grade, and the numbers were sufficient to examine whether charter schools perform as well or better for these students based on power considerations beyond .80.

Table 1

Passing Rate Descriptive Statistics for School Types (Public versus Charter Schools)

Group	Types	Grades								
		4	5	6	7	8	9	10	11	
Overall Passing Rates	P ⁴	M ¹	71.33	78.11	75.3	68.7	64.17	57.94	44.48	71.2
		SD ²	14.966	14.565	14.813	18.574	22.907	26.095	21.465	21.425
		N ³	131	133	88	120	132	63	141	120
	C ⁵	M	68.85	73.27	76.76	73.48	70.22	64.81	50.38	70.19
		SD	18.833	16.761	16.39	20.959	22.087	25.091	24.788	21.839
		N	131	131	88	120	127	63	141	120
Math Passing Rates	P	M	50.85	88.77	82.36	75.41	81.07	58.63	53.34	77.45
		SD	33.751	10.259	12.269	17.99	18.878	27.562	25.077	21.442
		N	131	133	88	120	128	62	140	119
	C	M	81.18	87.7	83.31	78.74	83.61	65.7	58.67	76.12
		SD	16.462	11.008	14.909	19.964	17.955	26.132	25.077	20.842
		N	131	133	90	120	127	63	141	119
Reading Passing Rates	P	M	82.11	90.34	85.86	82.8	90.25	83.65	79.99	90.72
		SD	10.845	8.425	9.885	13.236	11.674	19.596	16.922	10.267
		N	131	133	88	120	128	62	141	119
	C	M	80.42	90	85.18	85.75	93.45	86.87	82.65	88.57
		SD	15.607	9.63	12.672	15.856	9.704	16.039	15.726	12.219
		N	131	133	90	120	127	63	141	120
Overall Black Passing Rates	P	M	67.91	70.09	67.07	55.58	53.51	33.1	32.1	62.56
		SD	17.47	18.318	16.668	21.912	23.467	26.93	22.168	27.889
		N	70	67	41	36	29	10	40	32
	C	M	67.13	69.69	72.05	70.7	71.73	63.5	40.98	64.11
		SD	22.17	17.633	20.49	23.9	27.351	33.338	28.648	23.673
		N	61	54	43	44	41	18	40	35
Overall Hispan. Passing Rates	P	M	70.47	77.83	75.92	66.31	61.62	51.27	38.95	68.38
		SD	16.865	15.203	14.554	18.84	23.51	27.939	20.3	23.299
		N	115	116	79	104	108	44	108	92
	C	M	66.47	71.53	74.12	77.33	70.9	65.95	51.94	67.71
		SD	18.988	18.275	18.343	17.582	20.816	24.857	26.137	25.733
		N	94	98	65	89	88	43	108	86

Note: ¹ M stands for mean. ² SD stands for standard deviation. ³ N stands for sample size. ⁴ P stands for public schools. ⁵ C stands for charter schools.

With a simple count of passing rate across all comparisons, charter schools outperformed public schools 5-3 across grades. There is no obvious trend with grade level. Without considering the kind of student enrolled, however, this result is not interpretable. Covariate adjustment for causally prior variables provides an identifiable model (Pearl, 2009) on which to base a causal inference about charter school effect on student achievement.

All Students

Table 2

Overall TAKS Math and Reading Passing Rate Contrasts and Effect Sizes for 2011 Public vs. Charter Schools

Passing Rates	School Types	Grades							
		4	5	6	7	8	9	10	11
<i>Overall</i>	P ¹ vs C	2.86*	4.13*	-1.60	-2.62	-1.86	-1.52	-2.79	2.56
<i>Passing Rates</i>	<i>d</i>	0.15	0.3	-0.09	-0.24	-0.28	-0.27	-0.25	0.05
<i>Math</i>	P vs C	-29.85*	0.97	-0.26	-2.56	-0.27	-3.92	-3.96	2.89
<i>Passing Rates</i>	<i>d</i>	-1.14	0.1	-0.07	-0.18	-0.14	-0.26	-0.21	0.06
<i>Reading</i>	P vs C	2.34	0.26	0.69	-1.63	-0.78	-0.11	3.23*	1.88
<i>Passing Rates</i>	<i>d</i>	0.13	0.04	0.06	-0.2	-0.3	-0.18	-0.16	0.19
<i>Overall</i>	P vs C	2.83	1.99	-4.78	-7.86*	-1.43	-6.73	-6.84	1.20
<i>Black</i>	<i>d</i>	0.04	0.02	-0.27	-0.66	-0.71	-0.97	-0.35	0.06
<i>Passing Rates</i>									
<i>Overall</i>	P vs C	2.41	4.54*	0.91	-4.04*	-1.42	-2.73	-7.07*	4.33
<i>Hispanic</i>	<i>d</i>	0.22	0.38	0.1	-0.6	-0.42	-0.36	-0.56	0.03
<i>Passing Rates</i>									

Note: ¹ P stands for Public Schools, C stands for Charter schools

* P<0.05

Overall subject passing rates. ANCOVA results are reported as contrasts between public schools as the reference group and all charter schools in Table 2. The propensity score was a significant predictor for every analysis. Public schools had significantly higher passing rates for grades 4 and 5 with 0.15 and

0.30 effect sizes respectively, but had mostly lower although non-significant overall passing rates for grades 6-10, with small effect sizes for those grades.

Mathematics passing rates. Charter schools and public schools traded both significances and performance across grades. Grade 4 was the outlier for the entire analysis, with charter schools drastically outperforming public schools significantly (effect size -1.14). The other non-significant differences occurred at grade 5 (public higher, 0.10), grade 6-10 (charter higher, effect sizes ranged from -0.07 to -0.18) and grade 11 (public higher, 0.01).

Reading passing rates. Public schools performed non-significantly better at 4-6, grade 10 and 11, while charter schools performed non-significantly slightly better at grades 7-9. Significant differences occurred only at grade 10 (-.016) favoring public schools.

Black and Hispanic Student Pass Rates

Only overall pass rates for all TAKS tests were available for Black and Hispanic students in charter schools, while the reading and math pass rates are available for public schools, in part because the charter school within-grade numbers for these students may fall below 10, the State cutoff for reporting. Table 2 provides results for these groups across school type. For Black students, public schools produced higher although non-significant effects at grades 4, 5, and 11 while charter schools had consistently higher results for grades 6-10 and only significant difference occurred at 7th grade favoring charter schools with -0.66 effect size. A similar result was found for Hispanic students, and although some significant effects were found favoring public schools at grades 5 with effect size of 0.38 and charter schools at grades 7 and 10 with effect sizes -0.60 and -0.56.

Public vs. Charter School Type Analyses

Table 3

Passing Rate Descriptive Statistics for 2011 Public and Charter School Types

Group	Types	Grades								
		4	5	6	7	8	9	10	11	
Overall Passing Rates	Other C	M	68.0	72.9	76.5	71.8	68.3	61.2	48.6	68.0
		SD	19.2	17.2	16.7	21.4	22.3	25.2	24.5	20.3
		N	118.0	121.0	81.0	107.0	113.0	54.0	132.0	100.0
	Public	M	71.3	78.1	75.3	68.7	64.4	57.9	44.5	68.9
		SD	15.0	14.6	14.8	18.6	23.0	26.1	21.5	20.2
		N	131.0	133.0	88.0	121.0	133.0	63.0	141.0	101.0
	HPS	M	76.3	77.1	79.2	87.3	85.9	86.4	77.1	92.9
		SD	13.4	11.4	14.3	8.1	11.4	7.3	10.2	4.3
		N	14.0	12.0	9.0	13.0	13.0	9.0	9.0	7.0
Math Passing Rates	Other C	M	80.3	87.5	83.4	75.2	82.4	62.1	56.7	74.1
		SD	17.0	12.2	15.2	20.5	18.6	26.4	224.7	19.8
		N	118.0	136.0	81.0	107.0	113.0	54.0	132.0	99.0
	Public	M	50.9	92.4	82.4	75.4	81.2	58.6	53.3	75.6
		SD	33.8	6.9	12.3	18.0	18.9	27.6	25.5	20.5
		N	131.0	133.0	88.0	121.0	129.0	62.0	140.0	100.0
	HPS	M	88.9	90.0	82.9	91.5	92.7	87.2	86.6	96.3
		SD	7.5	8.7	13.0	5.7	6.4	7.6	10.6	5.2
		N	14.0	15.0	9.0	13.0	13.0	9.0	9.0	7.0
Reading Passing Rates	Other C	M	79.6	90.0	84.5	84.6	92.9	85.1	81.7	87.6
		SD	16.2	9.9	13.0	16351.0	10.1	16.6	15.9	12.5
		N	118.0	121.0	81.0	107.0	113.0	54.0	132.0	100.0
	Public	M	82.1	90.3	85.9	82.8	90.3	83.7	80.0	89.6
		SD	10.8	8.4	9.9	13.2	11.7	9.6	16.9	3.9
		N	131.0	133.0	88.0	121.0	129.0	62.0	141.0	101.0
	HPS	M	87.0	91.4	91.4	95.5	98.0	97.6	94.3	96.3
		SD	5.3	7.0	7.2	4.1	1.5	3.1	5.3	3.9
		N	14.0	12.0	9.0	13.0	13.0	9.0	9.0	7.0

Table 4

Passing Rate Descriptive Statistics for 2011 Public and Charter School Types by Overall Black and Hispanic

Group	Types		Grades							
			4	5	6	7	8	9	10	11
Overall Black Passing Rates	Other C	SD	22.81	17.13	20.12	24.55	27.92	34.54	28.13	23.28
		N	55.00	52.00	38.00	37.00	36.00	15.00	38.00	30.00
		M	67.91	70.09	67.07	55.58	54.57	33.10	32.10	59.70
	Public	SD	17.47	18.32	16.67	21.91	24.06	26.91	20.17	26.47
		N	70.00	67.00	41.00	36.00	30.00	10.00	40.00	27.00
		M	76.17	96.50	84.80	81.29	92.50	85.67	77.00	96.00
	HPS	SD	12.98	4.95	20.86	17.95	9.00	14.50	1.41	5.66
		N	6.00	2.00	5.00	7.00	4.00	3.00	2.00	2.00
		M	65.07	71.37	73.77	75.86	68.38	61.77	49.98	65.72
Overall Hispanic Passing Rates	Other C	SD	19.49	19.12	16.56	18.29	21.18	25.52	26.12	24.71
		N	80.00	86.00	56.00	76.00	74.00	35.00	99.00	71.00
		M	70.47	77.83	75.92	66.31	61.92	51.27	38.95	66.42
	Public	SD	16.87	15.20	14.55	18.84	23.61	27.94	20.30	22.15
		N	115.00	116.00	79.00	104.00	109.00	44.00	108.00	79.00
		M	74.43	72.67	76.33	85.92	83.46	84.25	73.44	90.71
	HPS	SD	13.82	10.92	15.65	9.03	12.56	8.57	14.65	7.91
		N	14.00	12.00	9.00	13.00	13.00	8.00	9.00	7.00

All students. Summary statistics are reported in Table 3 and 4 for public, HPS, and all other Charter schools for overall passing rates and Black and Hispanic student passing rates respectively by grade for 2011.

Overall passing rates. ANCOVAs were conducted with contrasts comparing public schools to each charter school type, reported in Table 5 as contrasts and effect sizes. Results favored public schools at grades 5 (0.33) versus other charters and HPS at grade 7 (-1.04). No other comparisons were significant, but for grades 7-10 the contrasts comparing public to HPS favored the latter (effect sizes ranging from moderate practical significance (-0.27) to large practical significance (-1.55)). Similar differences favored other charter schools over public schools for grades 7-10 with small effects between -0.13 and -0.18.

Table 5

Overall TAKS Reading and Math Passing Rate Effects for 2011 Public versus Charter School Types

Passing Rates	School Types	Grade							
		4	5	6	7	8	9	10	11
Overall Passing Rates	P vs OC ¹	3.09	4.45*	1.99	-1.98	-1.49	-2.76	-3.11	2.09
	d	0.2	0.33	0.08	-0.16	-0.17	-0.13	-0.18	0.05
Math Passing Rates	P vs HPS ²	0.83	2.10	2.02	-8.96*	-7.6	-9.30	-3.33	5.74
	d	-0.33	0.07	-0.27	-1.04	-0.97	-1.15	-1.55	-1.22
Math Passing Rates	P vs OC	-29.50*	0.97	-0.56	-1.88	-0.54	-4.01	-3.84*	1.70
	d	-1.09	0.1	-0.07	-0.09	-0.07	-0.13	-0.14	-0.08
Reading Passing Rates	P vs HPS	-32.30*	1.18	2.55	-8.98*	-0.75	-14.44*	-1.34	1.54
	d	-1.18	0.06	0.04	-0.93	-0.63	-1.1	-1.33	-1.04
Reading Passing Rates	P vs OC	2.74*	0.22	0.85	-1.05	-0.75	-2.26	2.14	1.26
	d	0.18	0.05	0.12	-0.12	-0.23	-0.08	-0.11	0.17
Reading Passing Rates	P vs HPS	-1.34	0.20	-0.79	-7.16*	-0.63	-6.08	1.60	-1.29
	d	-0.47	-0.13	-0.58	-1	-0.69	-0.75	-0.87	-0.65

Note: ¹OC stands for other charter schools.

* p<.05.

Mathematics passing rates. Differences favored both types of charter schools vs. public at grade 4 and 7-11, but were mostly non-significant ($p>.05$) except at grade 4 (-1.09 for other charters, -1.18 for HPS), grade 7 for HPS with the effect size of -0.93 grade 9 for HPS with the effect size of -1.10, and grade 10 for other charters with the effect size of -0.14. Effects were more variable than for overall passing rate, but significance was affected by much more variability in school passing rates within and across school types.

Reading passing rates. At grade 4 public schools significantly outperformed other charter schools with the effect size of 0.18. At grade 7 HPS significantly outperformed public schools with the effect size of -1.00. At all other grades results were non-significant, with public schools performing slightly better than other charter schools at some grades, not as well at others, but not as well as HPS at all grades with the effect sizes ranging from -0.47 to -0.75 except at grade 5 and 10 favoring public schools.

Black and Hispanic Student Pass Rates for Public, Other Charter, and HPS Schools

Only overall pass rates were available for Black and Hispanic students for these analyses. Results of the ANCOVA contrasts are presented in Table 6. For Black students HPS performed better at all grades than public schools, significant for grades 6-8 and 11 with effect size ranges from -.48 to -2.09, while other charter schools performed better than public schools at grade 6, 7, 9, and 10, although only significantly for grade 7 with effect size of -0.56.

Table 6

Overall TAKS Black and Hispanic Rate Contrasts and Effect Sizes for 2011 Public vs Charter Schools

Grades	Overall Black Achievement				Overall Hispanic Achievement			
	P vs OC	<i>d</i>	P vs HPS	<i>d</i>	P vs OC	<i>d</i>	P vs HPS	<i>d</i>
4	3.61	0.09	-6.38	-0.48	1.73	0.3	0.97	-0.24
5	2.39	0.07	-14.48	-1.45	4.93*	0.38	3.40	0.35
6	-3.14	-0.18	-17.62*	-1.04	0.87	0.14	6.58	-0.03
7	-8.26*	-0.56	-11.46*	-1.2	-358	-0.5	-7.91*	-1.09
8	2.18	-0.55	-12.60*	-1.64	-0.63	-0.29	-5.05*	-0.95
9	-3.28	-0.82	-7.39	-2.09	-2.37	-0.39	-12.53*	-1.26
10	-4.63	-0.28	-20.69	-2.05	-7.83*	-0.47	-3.55	-1.73
11	0.65	-0.04	-9.04*	-1.42	3.34	0.03	-0.15	-1.13

Note: * $p < .05$.

For Hispanic students HPS significantly outperforming public schools at grades 7-9 with effect sizes -0.95 to -1.26 and non-significantly for grades 10 with the effect size of -1.73 and 11 with the effect size of -1.13, while differences favored public schools at grades 4 to 6 and 11 over other charter schools. Significances were noted at grade 5 for public schools over other charter schools with effect size of 0.38, and at grade 10 for other charter schools over public schools with the effect size of -0.47.

Discussion

In this study, we compared matched schools on overall passing rate and mathematics and reading passing rate performances across three types of schools; public, charter, and a charter system across all grades, to understand how these groups performed. Overall passing rates did not differ much between public and charter schools in Texas, although there was a persistent small difference favoring charters above grade 5.

When we looked more closely at student academic performance, we found that for mathematics achievement scores, charter schools and public schools traded both statistical significance and performance across grades. Importantly, there was no meaningful or statistical difference from grades 6 to 11. While charter schools outperformed in grades 4, 6,7,8,9, and 10, and public schools outperformed charters in grade 5 and 11, and the only statistically significant difference was at grade 4 favoring charter schools, unimportant practically, these swings indicate situational conditions rather than systematic effects for charter schools. These findings are congruent with the research done so far in which mixed results have been found (e.g., Guy, 2011; Taylor et al., 2011). When looking at a comprehensive charter school system, the HPS, a consistent result emerged supporting greatly improved performance in both reading and math in the upper 6-11 controlling for previous performance and school conditions.

Charter schools have been founded on the ideals of providing first class educations for students in high-need, underserved communities. Our findings indicate that Black students at public schools mostly performed as well as Black students in charter schools for lower grades, with a general although non-significant superior performance in charter schools for grades 6-10. Hispanic students at public schools in grades 4-6 outperformed charter schools. Charter schools did a better job with 6-10th grade Hispanic students, but with not much practical significance. It has been thought that some sort of selection mechanism might favor charters, and as with Black students, there appears to be a small benefit for grades

6-10. However, the HPS charter system consistently outperformed public schools from grades 6 through 11 for both Black and Hispanic students with moderate and large effect sizes ranging from -0.48 to -2.09. This finding indicates that HPS as a system promotes better achievement in Black and Hispanic populations. This could be due to their persistent presence in high-need, low-SES communities with large Black and Hispanic population or due to their unique mix of teachers. HPS is similar in size to a large public school but exhibits better performance with regard to Black and Hispanic students. In that sense, HPS is fulfilling its founding mission and closing the achievement gap between students of minority and white. This study's findings are also parallel with CREDO's 2017 findings where Harmony students outperformed matched traditional public schools in reading and mathematics regardless of students' ethnicity. Therefore, it might be reasonable to say that charter schools that are run well and longer might have either better results than public schools do or perform on par.

This study contrasts Betts and Tang's (2008) review study in which charter schools outperformed public schools in elementary reading and middle school mathematics, but public schools outperformed in high school reading and mathematics. Our study shows that in Texas, public and charter schools performed about on par (Guy, 2011; Taylor et al., 2011) for most grades given the control for previous performance and school conditions with some evidence for small benefit for charter schools in the upper grades. This does not speak to what might be the case for students who spend most of their educational career in 6th through 12th in one setting or the other, since we did not control for cross-school mobility or student patterns in school choice. The different findings may stem from the fact that we used school level data for Texas charter schools while Betts and Tang examined the studies that used either experimental or a student-level growth-based method to study student performance on the national level. These researchers underlined their problem with their meta-analytic study by using published studies that lacked rigor in their analysis. In that sense, our study used a better method by utilizing propensity score matching

controlling thoroughly for confounding and prior effects of family background (Fuller, 2012). Propensity score matching was used to match schools according to their demographics⁵ in the selection of school for analyses so all comparisons were apples to apples. We fall short of proclaiming causal results, however, given the incomplete control of variance in the propensity analysis.

What makes this study important was that we found that there was a separate multi-school charter system, HPS, which constantly produced better student achievements at grades 6-11 for mathematics and reading. One way to explain these findings would be to look at the findings of Betts and Tang (2008) study. They found that some charter schools outperform public schools in some locations, grades, and subject. In order to say HPS outperforms at each campus, one needs to compare each HPS school with a matching public school by that assumption's criteria so one can determine the validity of the assumption. In examining the propensity matches, it was difficult to find individual matches on most relevant variables. To some extent propensity scores are used to overcome this problem, but it remains at the campus level. Further, it is important to examine the school/system culture, educational practices, and policies to determine how it might differ or be the same as other charter schools and/or other public schools.

This research had several limitations. This study is primarily limited by its school level data and did not include student level data in which we could track individual students over time to compare how students' mathematics and reading scores from different schools changed. Future study with multiple years of student level performance scores would portray the picture of how school type differs better. Also, had more data been available for matching without sacrificing sample size, more waves of data would have greatly improved the robustness of the study. Similarly, having greater detail about the missions and visions for the matched schools also might have revealed important details, which could have clarified the findings. For example, the inconsistent academic performance between charter and

⁵ Percentage African-American, Hispanic, special education, limited English proficient, economically disadvantaged, and at-risk classification

public schools could be due to student mobility, choice given an older sibling moving from one to the other or parental expectations expressed in choosing to try a charter or to remain in the district school. These issues are not new to this hot button topic but remain to be answered until large scale funding is provided to explore these nuanced differences at a suitably small grain size but on a large-scale level.

Implications for Charter Schools

Texas has one of the most extensive charter school programs in the U.S. While conditions vary across states, the processes in Texas permit a significant variation in how charter schools deliver instruction. This variation was reflected in the variation in various demographic characteristics of the 130+ schools in the analyses with respect to minority proportion, special education proportion, at-risk or low SES proportion, and prior achievement, for example. Charters in Texas, although heterogeneous, are not as heterogeneous as the public school population. The potential for selection of students remains the most significant problem with most charter schools. Having matched as well as we could charter schools with public schools by grade, the analyses are quite consistent with most of the charter school research over the last decade that generally there are no differences between the two systems. The benefit of a system such as the HPS for reading and math achievement seems plausible given that system focuses on those areas, especially for secondary grades. A better propensity match may have been with magnet or specialty public schools with a similar focus but they select students based on their GPAs thus not feasible.

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