

The Impact of Apollo 20 on Student Achievement: Evidence from Year One

by

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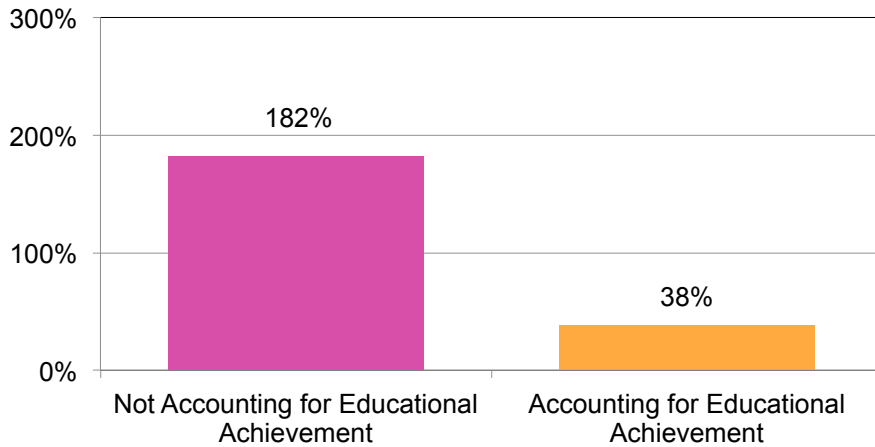
Road-map for the talk:

- A. The Achievement Gap in America
- B. The Five Tenets: Motivation and Implementation
 - 1. More Time in School
 - 2. Small-Group Tutoring and Differentiation
 - 3. Human Capital Management
 - 4. Data-Driven Instruction
 - 5. Culture and High Expectation
- C. Explanation of Empirical Methodology
- D. Year One Results
- E. Verification Checks
- F. Context and Wrap-up

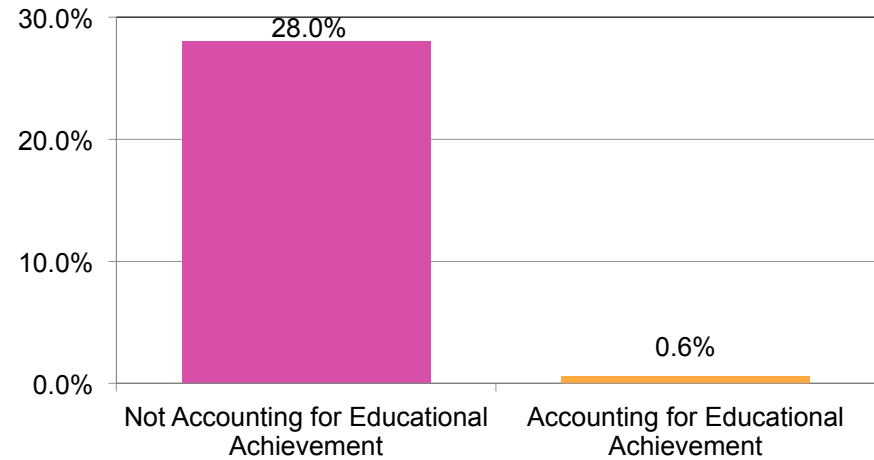
Educational Achievement Drives Life Outcomes

Accounting for educational achievement drastically reduces racial and socioeconomic inequality across a wide range of important life outcomes.

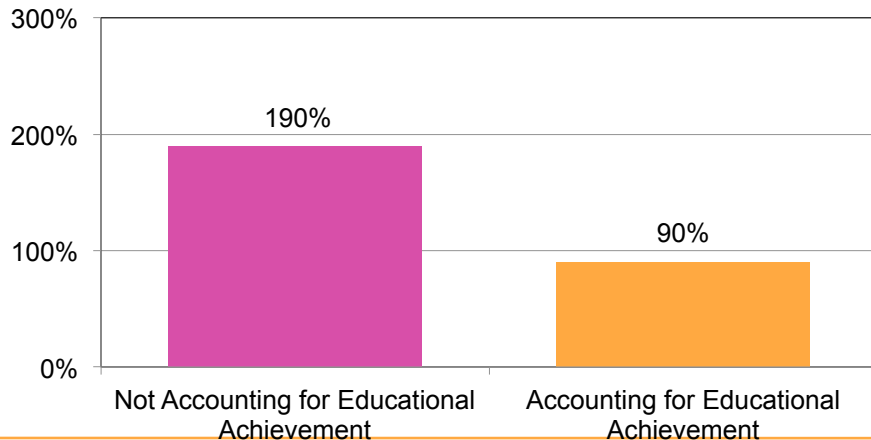
The Black-White Incarceration Rate Gap



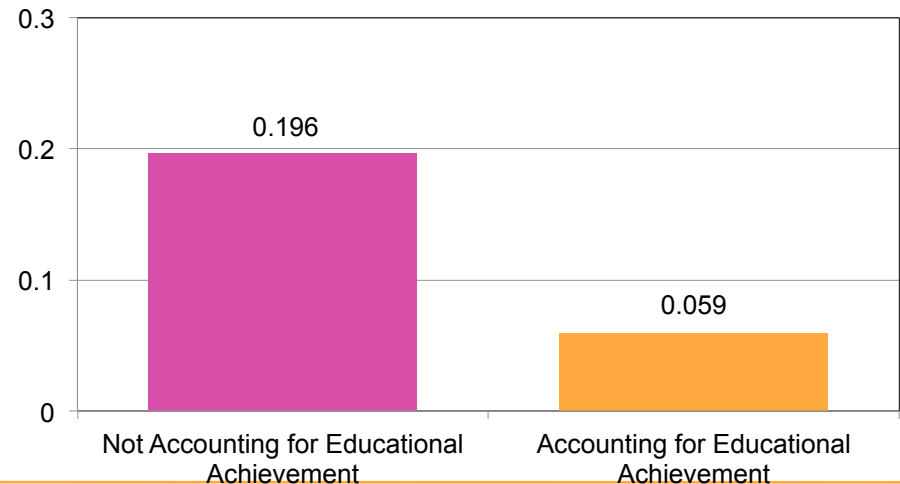
The Black-White Wage Gap



The Black-White Unemployment Gap

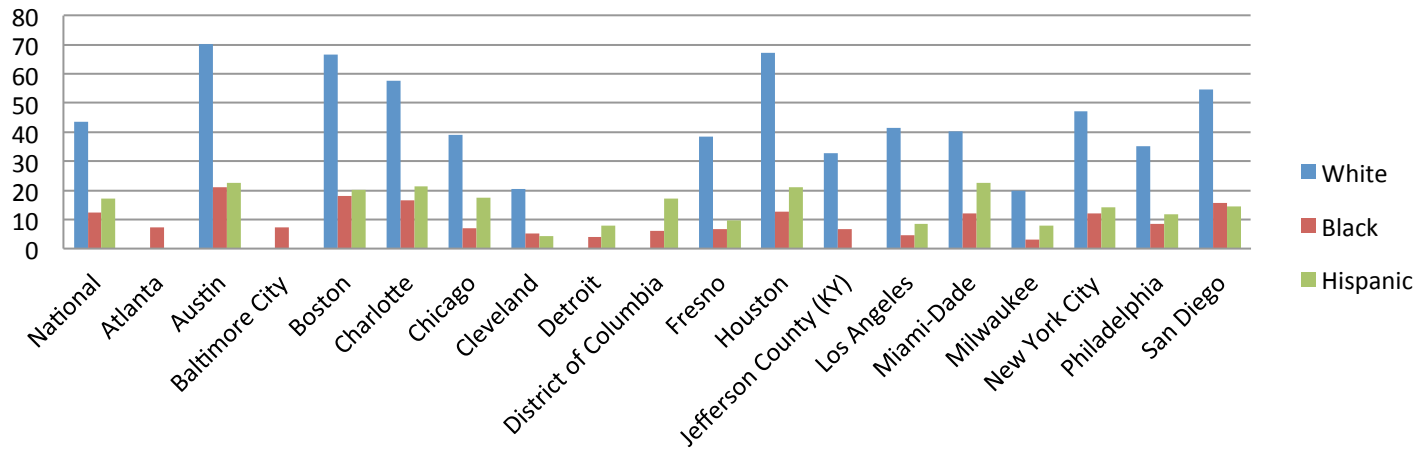


The Black-White Health Gap (in Standard Deviations)

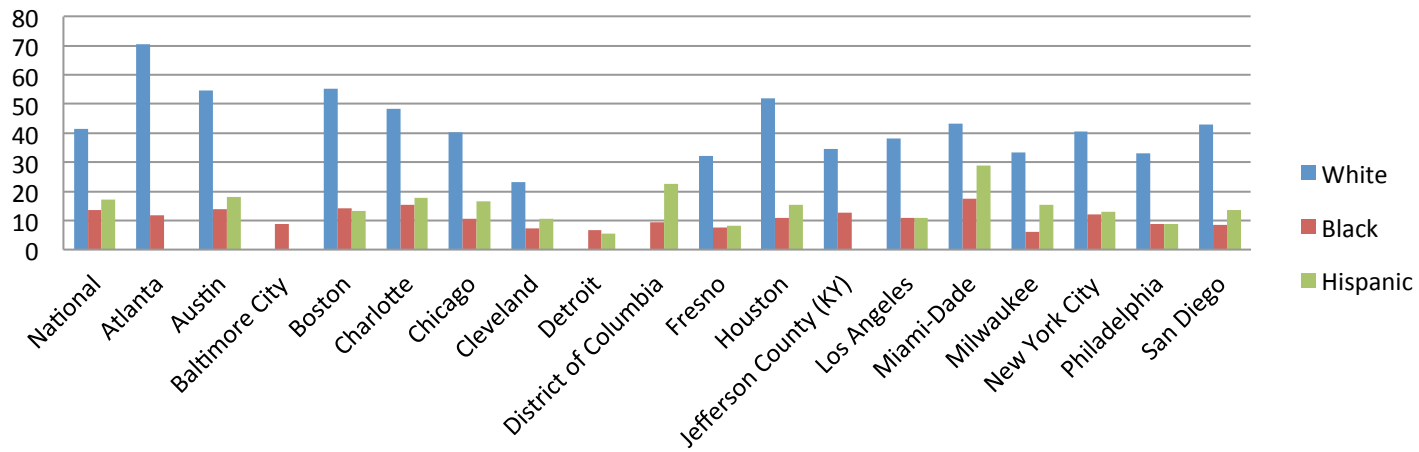


Among cities that participate in NAEP, the magnitude of racial differences in educational achievement is startling.

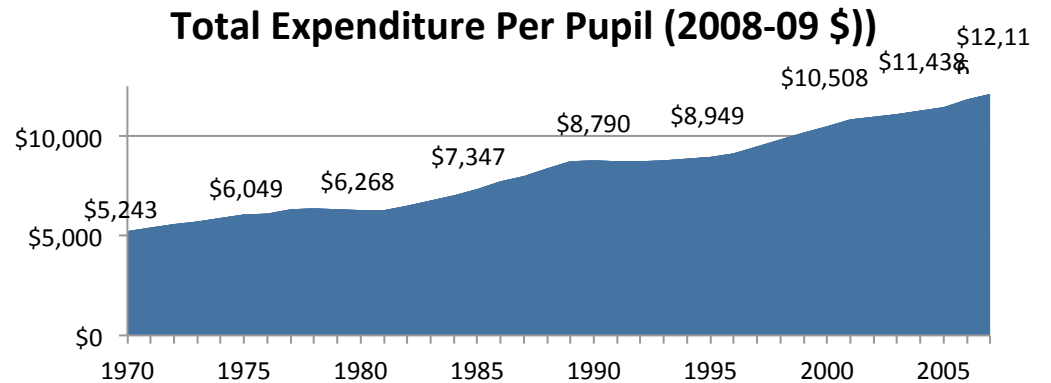
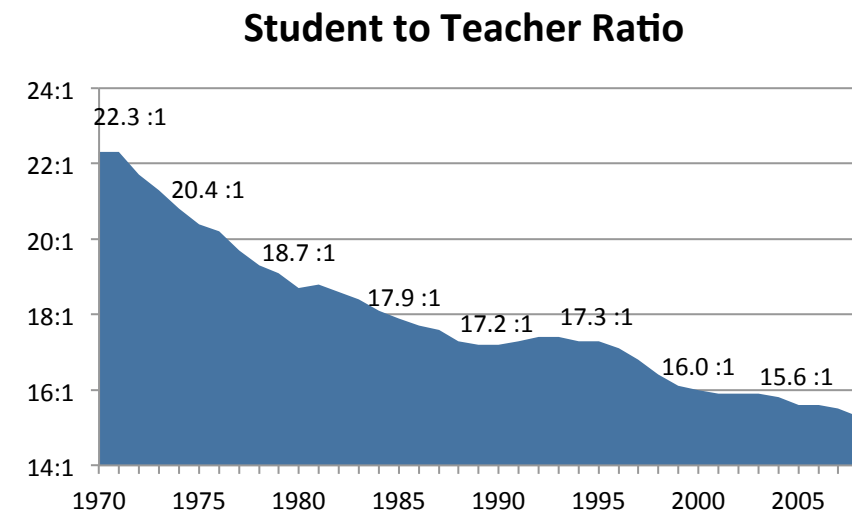
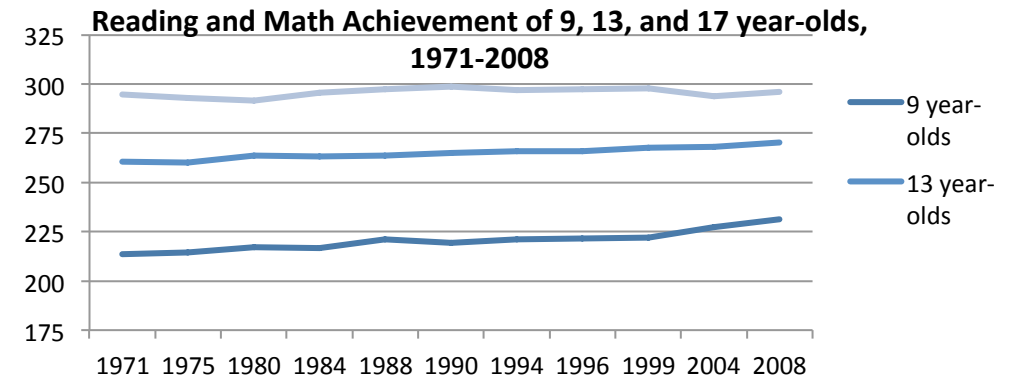
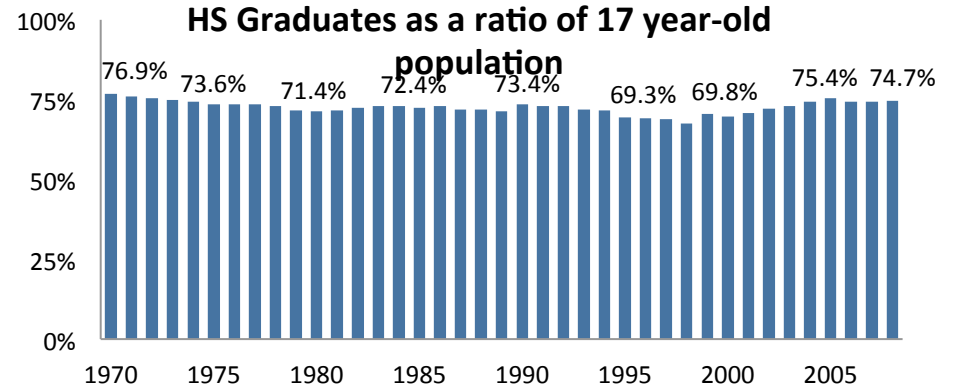
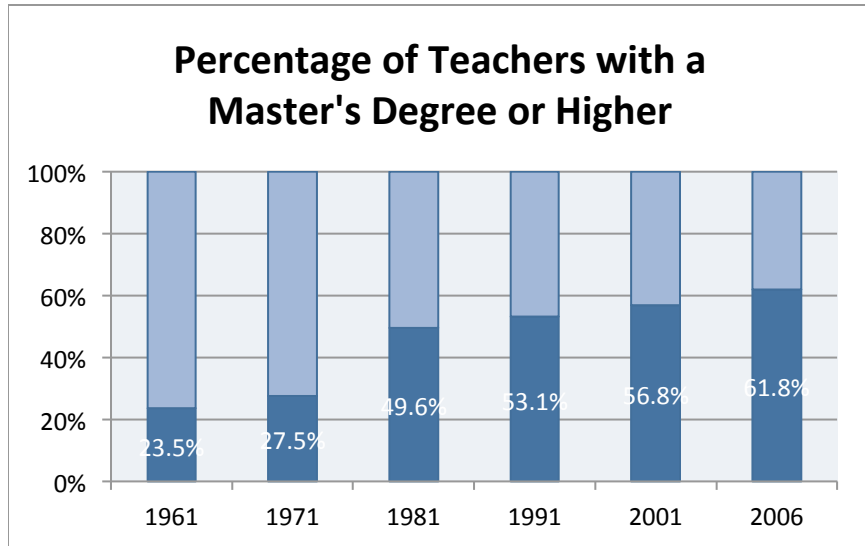
Math



Reading



What's more, "conventional wisdom" solutions have failed to solve the problem.



Given the current rate of “No Excuses” charter school growth, charters will take over half a century to educate every child in America and close the achievement gap.

That’s too long.

We are faced with two options:

1. Create a market in which only gap closing charters can survive (great idea, tough politics).
2. Boil down charter school successes into translatable, scalable practices for public schools.

One of the original missions of charter schools was to experiment and incubate best practices that could then be transferred to public schools.

Dobbie and Fryer (2011a) examine results from 106 charter schools in New York City in order to identify the practices most correlated with student achievement. They find that accounting for five factors explains roughly 40% of the variance in charter school performance.

The key strategies of Apollo schools.



More Time in School

- Extended day, week, and school years are all integral components of successful school models. In the case of Harlem Children's Zone's Promise Academy, students have nearly doubled the amount of time on task compared to students in NYC public schools.



Small Group Tutoring and Differentiation

- In top performing schools, classroom instruction is supplemented by individualized tutoring, both after school and during the regular school day.



Human Capital Management

- Successful charters reward teachers for performance and hold them accountable if they are not adding value.



Data-Driven Instruction

- In the top charter schools, students are assessed frequently, and then, in small groups, re-taught the skills they have not yet mastered.

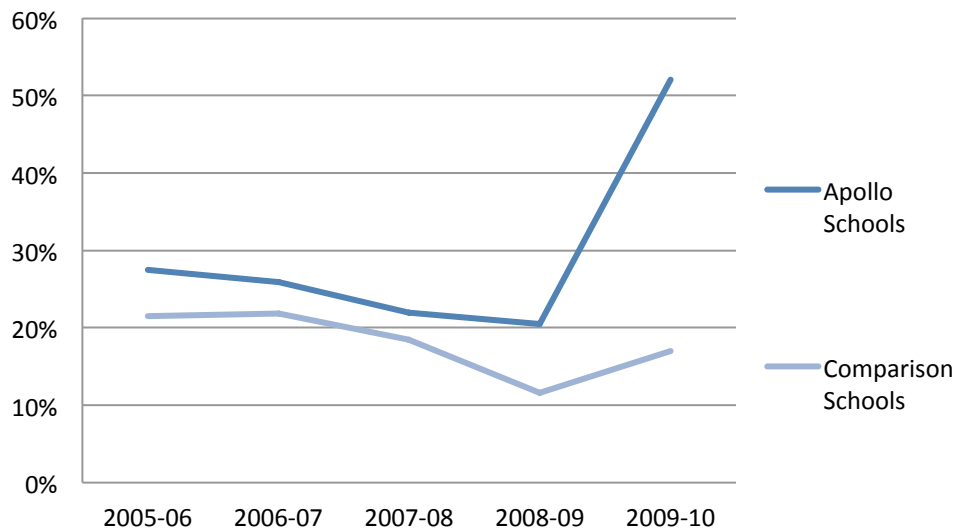


Culture and Expectations

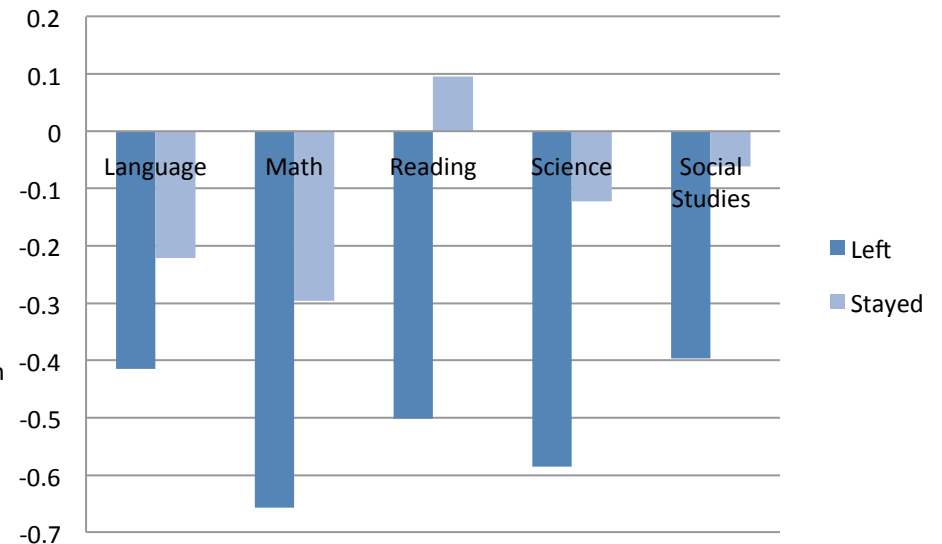
- In successful schools, students buy into the school's mission and into the importance of their education in improving their lives.

In addition to finding nine new principals, teacher turnover spiked to 53% in Apollo schools over the summer of 2010. Value-added data shows that teachers who returned as Apollo teachers had a much stronger history of increasing student achievement in every subject, relative to those who left.

Teacher Departure Rates

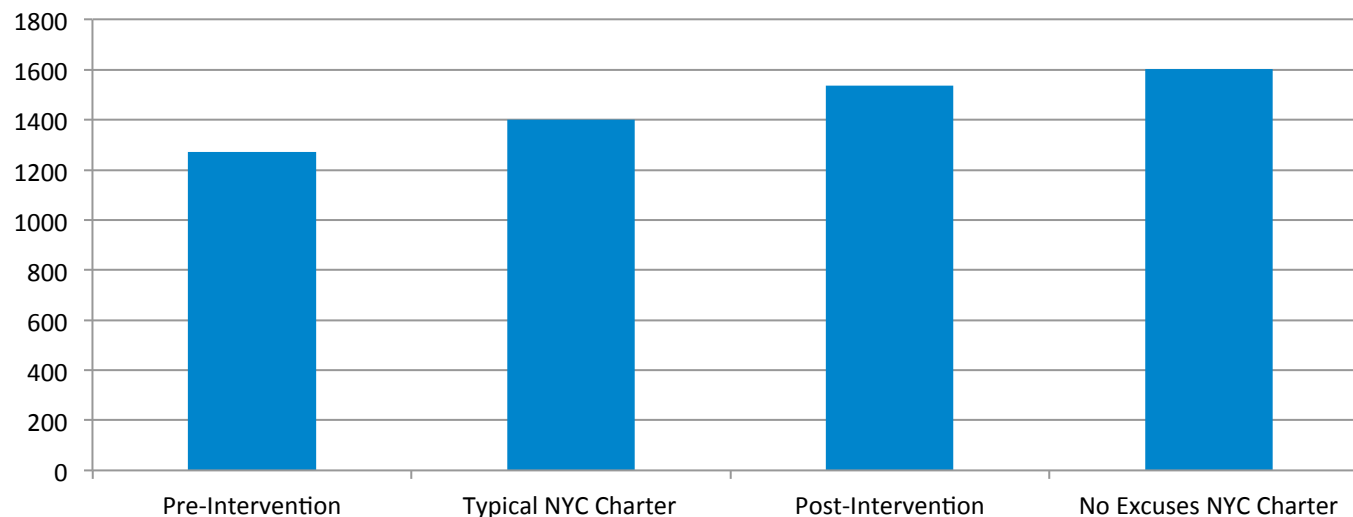


Teacher Value Added



The school day was extended in Apollo schools during the 2010-11 school year: 7:45am – 4:15pm Monday through Thursday, and 7:45am – 3:15pm on Fridays. This was an average of an hour longer per school day. The school year was extended by five school days. Apollo students reported for school on August 16, 2010, while the rest of the district began on August 23, 2010.

Instructional Hours per Year



Bottom line: The difference between instructional time in 2009-10 and 2010-11 amounts to approximately **30 school days** – that's **6 additional weeks** of school for students.

High Dosage Differentiation: Tutoring and Double-Dosing

Tutors were recruited both nationally and locally during summer 2010.

- 1158 total applicants (through August 9, 2010)
- 516 applicants participated in screening
- 319 offered a position
- 257 accepted a position in one of the nine schools
- 173 tutors qualified for end-of-year student performance bonuses, earning an average of \$3,346.
- 96 tutors are returning for the 2011-12 school year
- 1156 6th graders and 1585 9th graders received 2:1 tutoring in the 2010-11 school year.

Middle school students received approximately 215 hours of tutoring/double-dosing

High school students received approximately 189 hours of tutoring/double-dosing

Students were regularly assessed in order to provide teachers with accurate data on student mastery. In addition to the HISD 3-week interim assessments, the Apollo schools administered comprehensive benchmark assessments according to the schedule:

- Middle school reading – December, February/March
- Middle school math – December, February/March
- Middle school science – December, March
- Middle school social studies – December, March
- High school ELA – December, January
- High school math – December, March
- High school science – December, March
- High school social studies – December, March

After each assessment, teachers received student-level data and used this to have one-on-one goal-setting conversations with students.

There was a consistent emphasis on college matriculation at the Apollo schools, and students were supported in their efforts to apply to college.

Apollo High Schools College Application and Acceptance Rates				
	2-Year		4-Year	
	Applied	Accepted	Applied	Accepted
Jones HS	95%	95%	60%	44%
Kashmere HS	90%	90%	89%	42%
Lee HS	97%	97%	84%	47%
Sharpstown HS	94%	94%	81%	55%

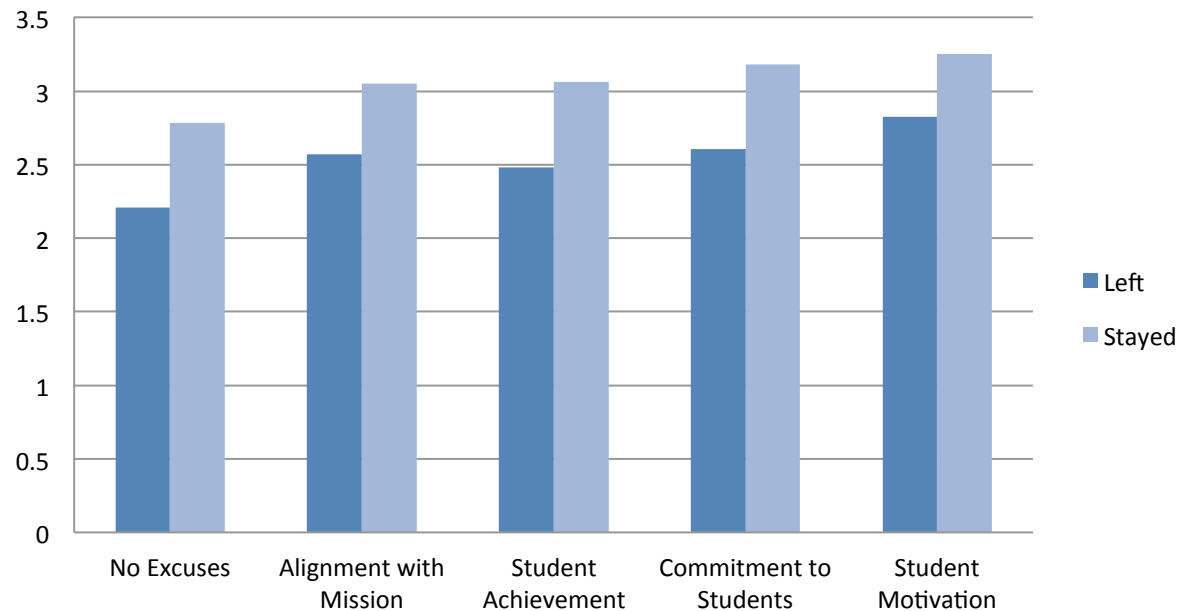
“It feels like we’ re actually going to school now.” – *Lee HS student*

“We have supports this year that we didn’ t have in the past.” – *Sharpstown HS student*

“School is harder...but it’ s good because we’ ll be ready.” – *Key MS student*

At the end of the 2009-10 school year, TNTP interviewed teachers in schools that would become Apollo schools for 2010-11. Teachers who returned as Apollo teachers scored higher on every type of question, including their commitment to the “No Excuses” philosophy and beliefs that all students are capable of high achievement.

Interview Response Scores



Given that we don't have a randomized experiment in year one, we use several empirical methods to assess the impact of Apollo 20.

- *Ordinary Least Squares Regression*

$$score_{i,s,g} = \beta_0 + \beta_1 \cdot Apollo_s + \beta_2 \cdot X_i + \gamma_g + \varepsilon_i$$

- Advantages: Simple and easy to interpret
- Disadvantages: Assumes linear functional form to allow comparisons between students of different statistical profiles, cannot control for unobservable differences between treatment and control students

- *Nearest Neighbor Matching*

$$d(i, j) = \sqrt{(X_i - X_j)' V(X_i - X_j)}$$

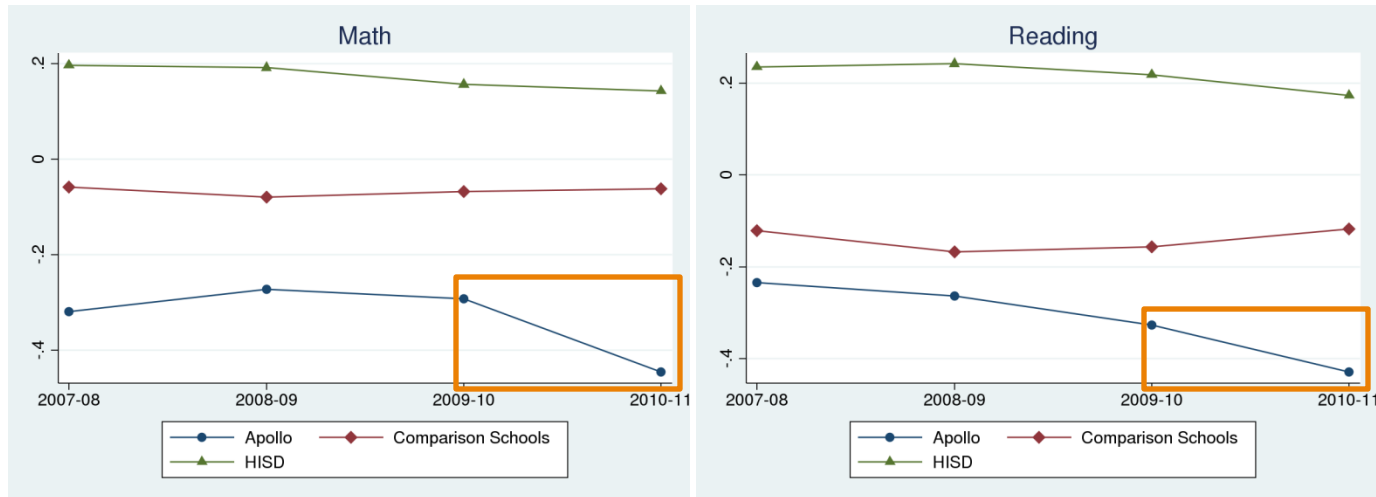
- Using the distance function defined above, we locate each students' four closest statistical neighbors and compare them to the group average.
- Advantages: No functional form assumption, focuses attention on students from similar backgrounds
- Disadvantages: Cannot control for unobservable differences between treatment and control students.

- *Difference in Differences*

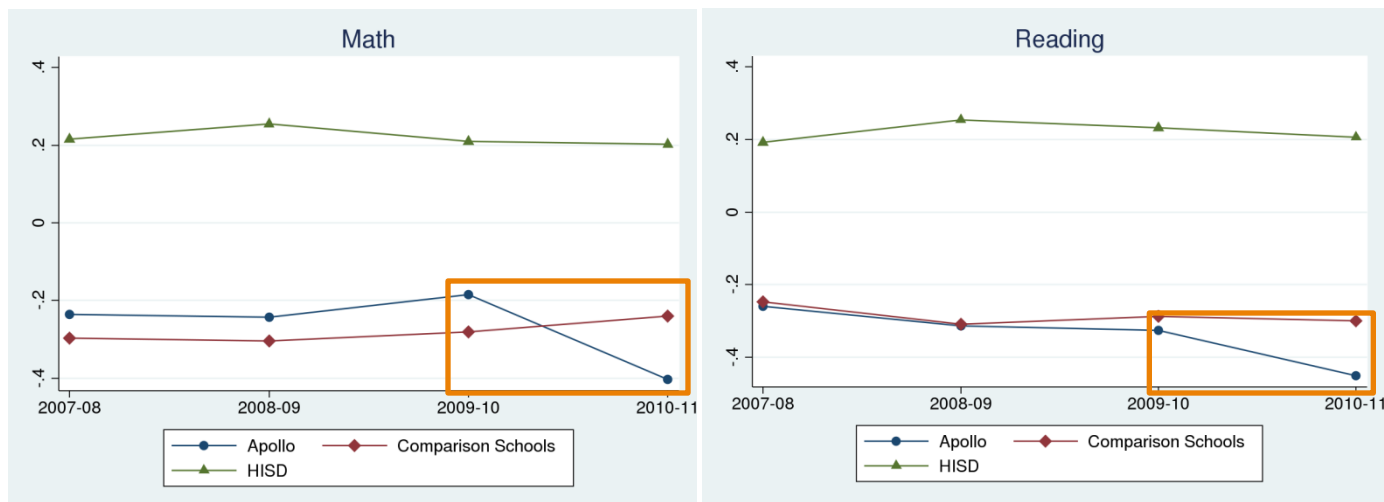
$$\Delta score_{i,s,g} = \beta_0 + \beta_1 \cdot Apollo_s + \beta_2 \cdot X_i + \gamma_g + \varepsilon_{i,s}$$

- Advantages: By focusing on year-over-year changes in scores, we account for baseline variation that we do not otherwise observe.
- While these methods have their advantages, all three will be biased if students selectively opt in or out of Apollo schools.

Incoming Sixth Graders



Incoming Ninth Graders



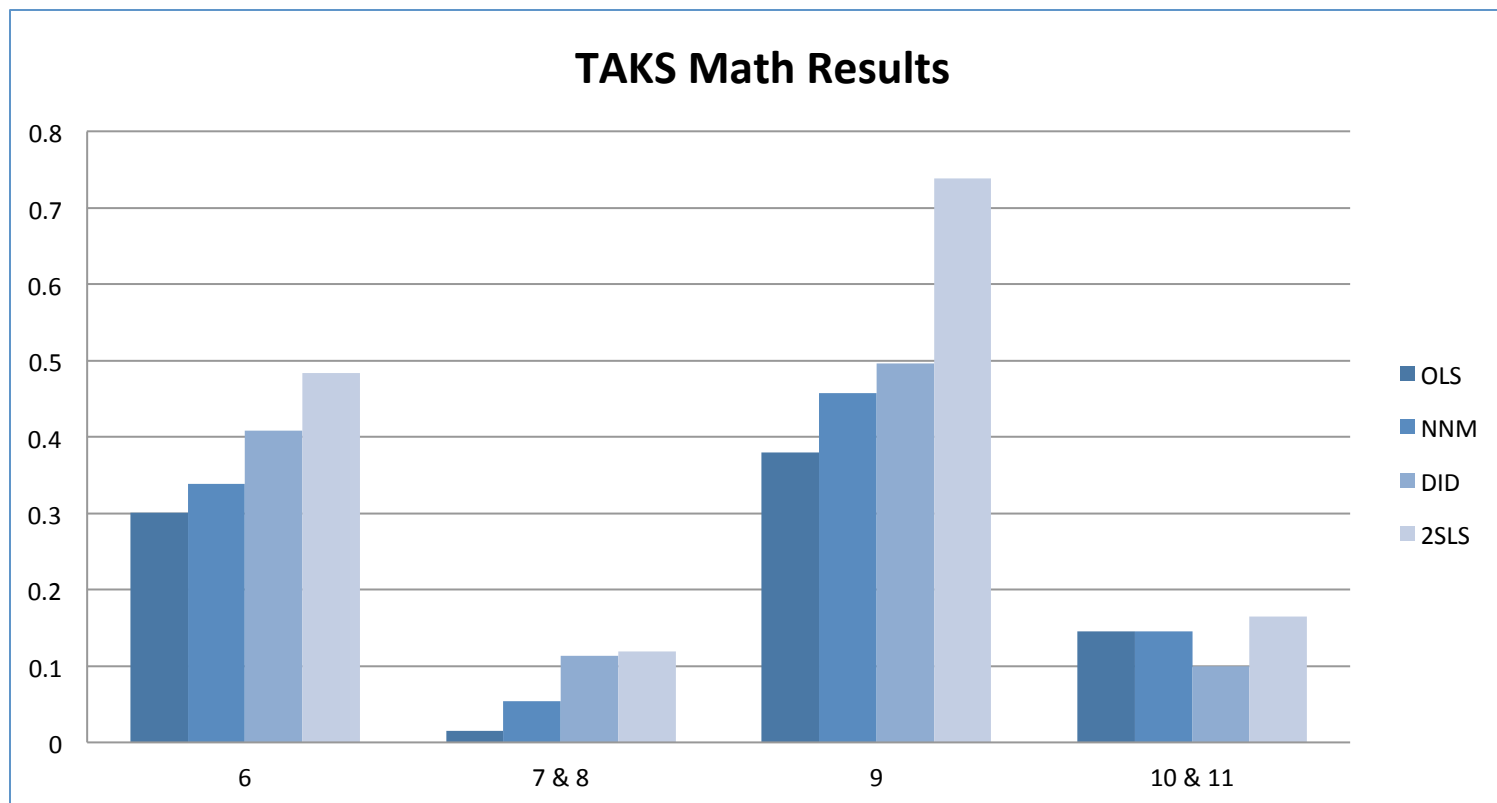
- To account for the decline in baseline ability in Apollo schools, we need a way to identify which students would have enrolled in the absence of such significant changes. This leads us to our final empirical strategy, which uses a student's home enrollment zone to predict which students are likely to attend Apollo schools.

- *Two-Stage-Least-Squares Difference in Differences*

$$Apollo_{i,s,g} = \beta_0 + \beta_1 \cdot zoned_i + \beta_2 \cdot X_i + \gamma_g + \varepsilon_i$$

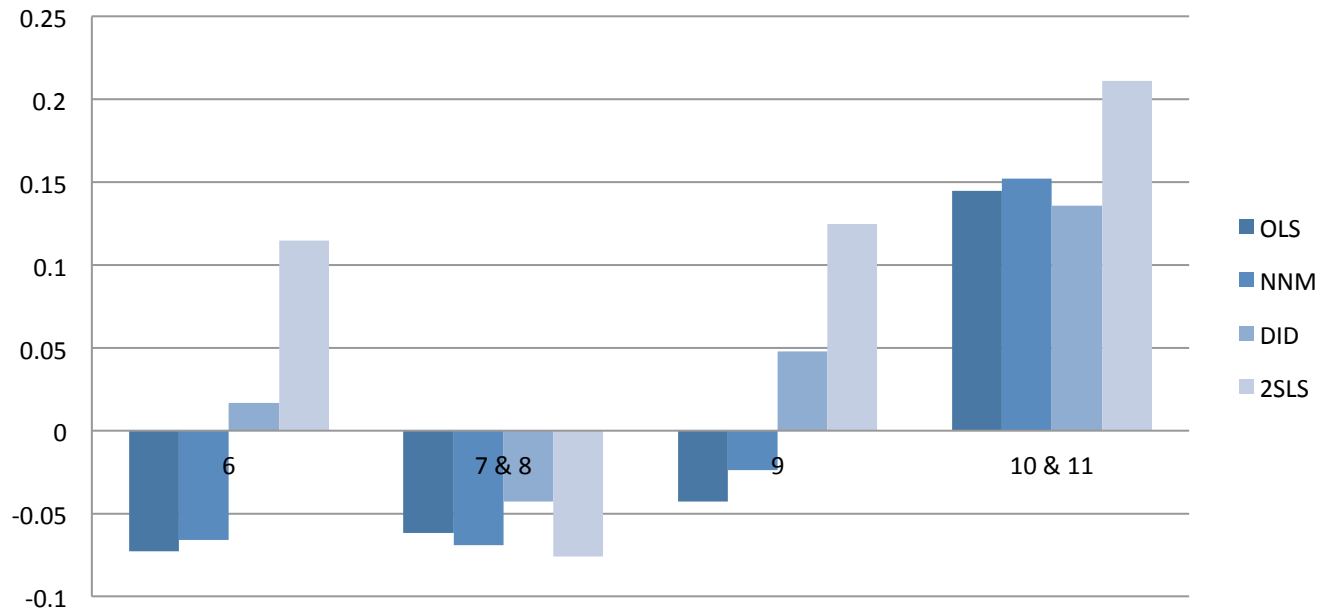
- Advantages: Solves selection issue.
- Disadvantages: Possibly vulnerable to critiques based on the exclusion restriction.

In Math, we see positive and statistically significant results in both middle and high school. The gains in grades that received high-dosage tutoring were dramatic.



In Reading/ELA, the results are mixed. While high schools performed extremely well, there is little evidence of success in middle school – indeed some estimates are negative.

TAKS Reading

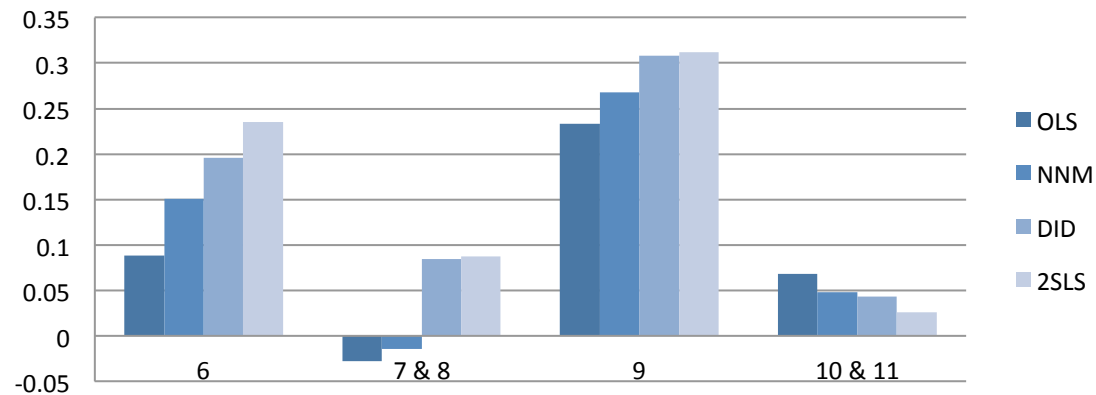


The results presented so far are extremely promising. However, some have argued that the gains on state exams can be driven by test-specific preparatory activities at the expense of general student learning (Jacob 2005, Heilig and Darling-Hammond 2008).

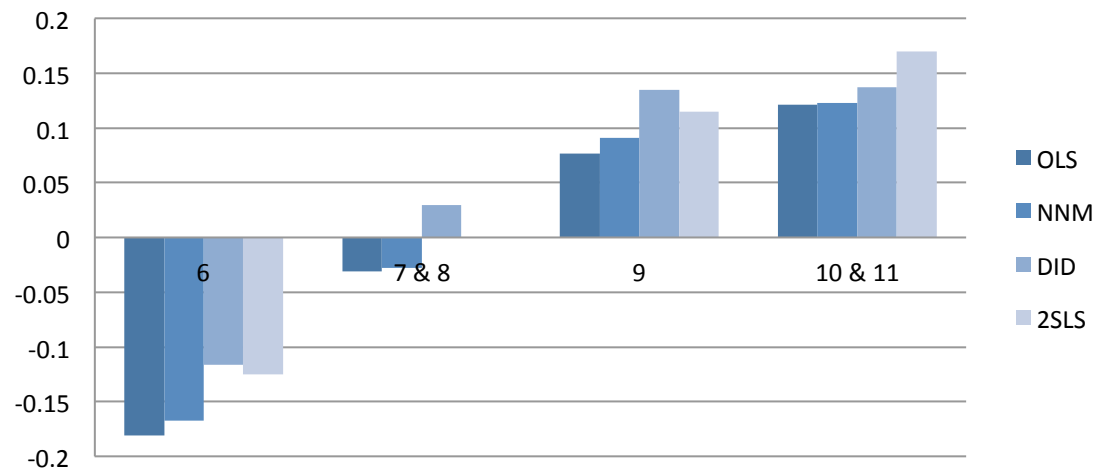
To provide some evidence on this matter, we also looked at Stanford 10 scores. This test is nationally normed and not tied to any accountability measure, so the incentives to teach to the test or otherwise manipulate results are minimal

Stanford 10 tests show a similar pattern to TAKS, suggesting that our results are not driven by teaching to the test.

Stanford Math



Stanford Reading



A second potential threat to our results is attrition from our sample. Our main results use the sample of students who enroll in an Apollo school or a comparison school at the beginning of the 2010-11 school year *and* for whom we have test score data in the spring of 2011. If Apollo students are more likely to miss the Spring 2011 TAKS examination, this could bias our estimates.

Given the major and sudden changes that occurred in Apollo schools, it is plausible that parents might choose to move their children to a private school or a charter school like KIPP or YES. In these instances, we would not observe their test scores. To examine this issue, we estimate the impact of Apollo on the probability of entering our analysis sample.

We estimate that Apollo students are 0.6% more likely to miss an exam than comparable students in comparison schools, though this estimate is not statistically significant. Dropping the top 0.6% of Apollo students from the analysis does not change our findings.

For the difference-in-difference estimates, we must also be able to match students to their 2009-10 score to calculate a trend. We find that Apollo students are roughly 4% more likely to be missing baseline scores. Since we are able to replicate our DID results with other models that do not require baseline scores, this is not problematic.

Outcome	Marginal Effect	Outcome	Marginal Effect
Missing 2011 Math	.006	Missing 2010 Math	.040***
	(.005)		(.017)
Missing 2011 Rdg.	.006	Missing 2010 Rdg.	.038
	(.005)		(.017)

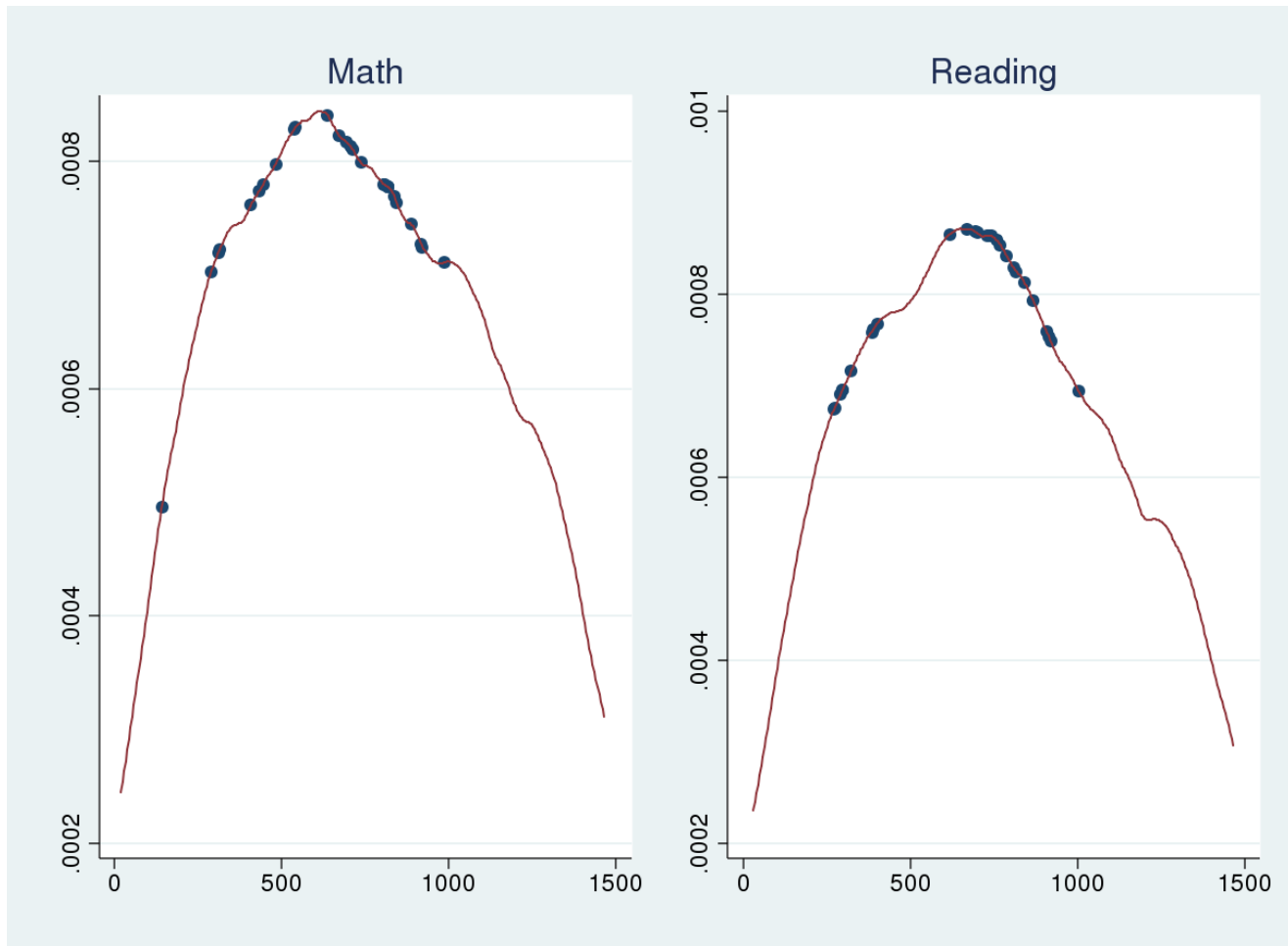
Notes: Standard Errors reported in parentheses.

Apollo schools were also subjected to unprecedented levels of scrutiny and accountability – the nine principals, in particular, earned bonuses for meeting performance goals and could be terminated if they fell short. One might worry that such a high-stakes environment might induce school officials to cheat when reporting scores.

Accordingly, we examined student responses on the 2010-11 TAKS and ranked every grade in every school according to four measures designed to detect suspicious patterns in student answers:

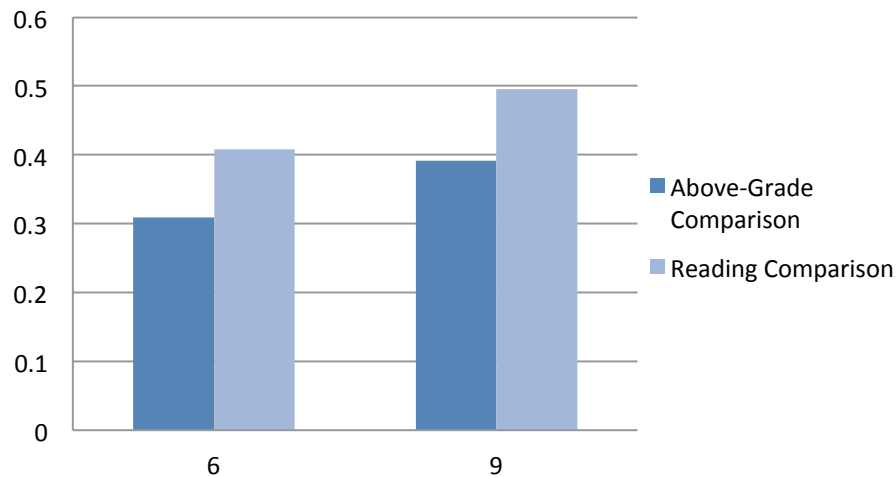
1. Unusual blocks of consecutive identical answers given by multiple test-takers
2. Unlikely correlation in answer responses within grades
3. Unusually high variance in these correlations
4. Unlikely combinations of correct answers – for instance, getting easy questions wrong and hard questions correct

After adding the ranks of all schools and grades on each of these four measures, we find that the average Apollo school is in the 43.9 percentile in math and 43.1 percentile in reading.

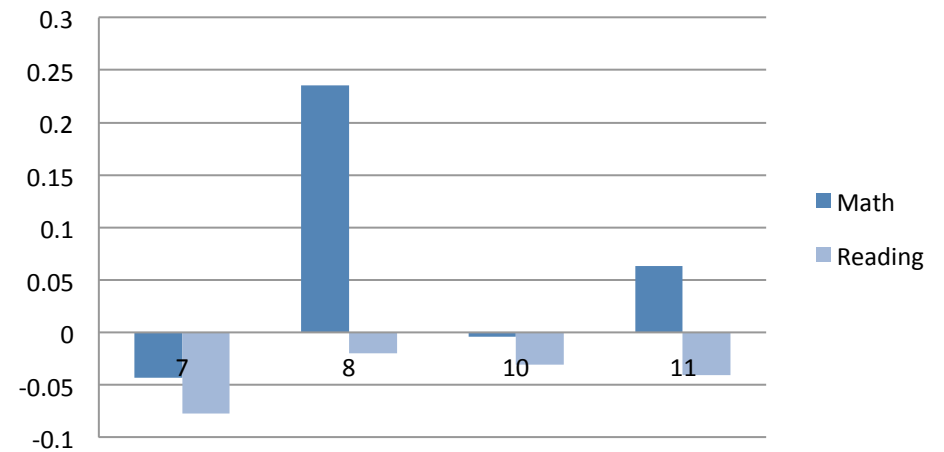


Unsurprisingly, our triple-difference analysis shows that tutoring was highly effective in increasing achievement. The double dosing results, however, are all statistically zero except for a large positive effect in eighth grade math.

Tutoring Effectiveness



Double-Dosing Effectiveness



The Apollo results are strikingly similar to the effects of attending the Harlem Children’s Zone Promise Academy Middle School, KIPP Lynn Middle School, and a group of “No Excuses” Boston-area charters.

	Apollo 20	Harlem Children’s Zone	KIPP Lynn	Boston Charter Schools	
				<i>Oversubscribed</i>	<i>All Urban</i>
<i>6th Grd. Math</i>	.484	.249			
<i>MS Math</i>	.234	.229	.346	.359	.148
<i>MS Reading</i>	-.014	.047	.120	.198	.098
<i>9th Grd. Math</i>	.739				
<i>HS Math</i>	.368			.265	.122
<i>HS Reading</i>	.189			.364	.169

Sources: Dobbie and Fryer (2010), Dobbie and Fryer (2011b), Abdulkadiroglu et al (2011), Angrist et al. (2010)

Implementing Apollo cost roughly \$2,042 per student. A back-of-the-envelope calculation shows that that internal rate of return from this investment is 20.16%. Compared to other educational interventions, this return is large.

Initiative	IRR
Apollo 20	20.16 %
“No Excuses” Charter School	18.50 %
Early Childhood Education	7.99 %
Reduced Class Size	6.20 %

Sources: Curto and Fryer (2011), Heckman (2010), Krueger (2003)

The main takeaway from Apollo Program in 2010-11 is that a ***fully loaded*** Apollo program in which all five tenets are implemented with fidelity produces large, significant gains in student performance.

We must think hard about how to scale-up tutoring in a manner that maximized student performance while controlling the costs of the program.

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