I. INTRODUCTION

The United States is the richest country in the world, but American ninth graders rank 28th in math, 22nd in science, and 18th in reading achievement.[1] Seventy percent of American students graduate from high school, which ranks the United States in the bottom quartile of OECD countries (Education at a Glance 2007). In large urban areas with high concentrations of blacks and Hispanics, educational attainment and achievement are even more bleak, with graduation rates as low as thirty-one percent in cities like Indianapolis (Swanson, 2009). The performance of black and Hispanic students on international assessments is roughly equal to national scores in Mexico and Turkey – two of the lowest performing OECD countries.

In an effort to increase achievement and narrow differences between racial groups, school districts have become laboratories of innovative reforms. These reforms include smaller schools and classrooms (Nye et al., 1995; Krueger, 1999), mandatory summer school (Jacob and Lefgren, 2004), merit pay for principals and teachers (Podgursky and Springer, 2007), after-school programs (Lauer et al., 2006), budget, curricula, and assessment reorganization (Borman et al., 2007), policies to lower the barrier to teaching via alternative paths to accreditation (Decker, Mayer, and Glazerman, 2004; Kane, Rockoff, and Staiger, 2008), single-sex education (Shapka and Keating, 2003), data-driven instruction (Datnow, Park, and Kennedy, 2008), ending social promotion (Greene and Winters, 2006), mayoral/state control of schools (Wong and Shen, 2002, 2005; Henig and Rich, 2004), instructional coaching (Knight, 2009), local school councils (Easton et al., 1993), reallocating per-pupil spending (Marlow, 2000; Guryan, 2001), providing more culturally sensitive curricula (Protheroe and Barsdate, 1991; Thernstrom, 1992; Banks, 2001, 2006), renovated and more technologically savvy classrooms (Rouse and Krueger, 2004; Goolsbee and Guryan, 2006), professional development for teachers and other key staff (Boyd et al., 2008; Rockoff, 2008), and increasing parental involvement (Domina, 2005). Jacob and Ludwig (2008), in a survey of programs and policies designed to increase achievement among poor children, report that only three often practiced educational policies pass a simple cost-benefit analysis: lowering class size, bonuses for teachers for teaching in hard-to-staff schools, and early childhood programs.

One potentially cost-effective strategy, which has yet to be fully understood or appreciated in urban public schools, is providing short-term financial incentives for students to achieve or exhibit certain behaviors correlated with student achievement.[2] Theoretically, providing such incentives could have one of three possible effects. If students lack sufficient motivation, dramatically discount the future, or lack accurate information on the returns to schooling to exert optimal effort, providing incentives for achievement will yield increases in student performance.[3] If students lack the structural resources or knowledge to convert effort to measurable achievement or if the production function has important complementarities out of their control (effective teachers, engaged parents, or peer dynamics, e.g.) then incentives will have very little impact. Third, some argue that financial rewards for students (or any type of external reward or incentive) will undermine intrinsic motivation and lead to negative outcomes. Only recently have urban districts begun to incentivize teachers and few programs currently incentivize parents for student achievement, attendance, and other important measures.

[1]Our calculations are based on data from the 2003 Program for International Student Assessment, which contains data on forty-one countries including all OECD countries.

[2]Many parents, teachers, public schools, and high-achieving charter schools [Knowledge is Power Program (KIPP) and Harlem Children's Zone, for example] use some form of incentive program in their schools. Fryer (2010) presents the results from the first large scale intervention project designed to test the effect of student incentives on achievement in urban public schools in America.

[3]Economists estimate that the return to an additional year of schooling is roughly ten percent and, if anything, is higher for black students relative to whites (Card, 1999; Neal and Johnson, 1996; Neal, 2005). Short-term financial incentives may be a way to straddle the gap between the perceived cost of investing in human capital now and the future benefit of investment.

Lessons from EdLabs' Experience

In the 2007-2008 and 2008-2009 school years, HISD's research partner, the Education Innovation Laboratory at Harvard University (EdLabs) conducted incentive experiments in public schools in Chicago, Dallas, New York City, and Washington, DC—four prototypically low-performing urban school districts—distributing a total of $10 million to roughly 38,000 students in 261 schools. All experiments were school-based randomized trials. The experiments varied from city to city on several dimensions: what was rewarded, how often students were given incentives, the grade levels that participated, and the magnitude of the rewards. The key feature of each experiment consisted of monetary payments to students (directly deposited into bank accounts opened for each student or paid by check to the student) for performance in school according to a simple incentive scheme. In all cities except Dallas, where students were paid three times a year, payments were disseminated to students within days of verifying their achievement.

Traditional economic theory, under a simple set of assumptions, predicts that providing incentives based on output is socially optimal. The key idea is that students know the mapping from the vector of inputs to output and differ in their marginal returns across inputs. Incentives for inputs operate as price subsidies for those particular inputs. Incentives for output also operate as a price subsidy, but allow each student to decide which input from their production function to subsidize. Since students are assumed to have superior knowledge about how they learn, it is socially optimal to allow them to allocate their time across inputs. However, if this simple set of assumptions is violated (risk aversion, noisy output, or if students only have a vague idea of how to produce output, e.g.), then it can be more effective to provide incentives for inputs.

The programs in Chicago and New York City were "output" experiments, while the programs in Dallas and Washington, DC were "input" experiments. In NYC, EdLabs paid fourth and seventh grade students for performance on a series of ten interim assessments currently administered by the NYC Department of Education to all students. In Chicago, ninth graders were paid every five weeks for grades in five core courses. In Dallas, second graders received $2 per book that they read once they passed a simple quiz to confirm that they had read the book. In the District of Columbia, EdLabs provided incentives for sixth, seventh, and eighth grade students on a series of five metrics that included attendance, behavior, and three inputs to the production function chosen by each school individually.

The results from these incentive experiments are interesting and in some cases quite surprising. Remarkably, incentives for output did not increase achievement. Paying students for performance on standardized tests yielded treatment effects for seventh graders between -.018 (.035) and -.030 (.063) standard deviations in mathematics and .018 (.018) and .033 (.032) standard deviations in reading. The programs in which fourth graders were paid for their test scores exhibited similar results. Rewarding ninth graders for their grades yielded increases in their grade point average of .093 (.057) and .131 (.078), but had no effect on achievement test scores in math or reading.

Conversely, incentives can be a cost-effective strategy to raise achievement among even the poorest minority students in the lowest performing schools if the incentives are given for certain inputs to the educational production function. Paying students to read books yields a large and statistically significant increase in reading comprehension between .180 (.075) and .249 (.103) standard deviations, increases vocabulary between .051 (.068) and .071 (.093) standard deviations, and increases language between .136 (.080) and .186 (.107) standard deviations. The estimated impacts on vocabulary scores are not significant; increases in language are marginally significant. Similarly, paying students for attendance, good behavior, wearing their uniforms, and turning in their homework increases reading achievement between .152 (.092) and .179 (.106) standard deviations, and increases mathematics achievement between .114 (.106) and .134 (.122) standard deviations.

In summary, relative to achievement-increasing education reform in the past few decades—Head Start, lowering class size, bonuses for effective teachers to teach in high need schools—student incentives for inputs provide similar results at lower cost.

II. INCENTIVES 2.0

The results above were obtained simply by providing incentives for students. To push these ideas to the next level, we propose a very simple social experiment: align everyone's incentives—those of students and their teachers, parents and principals—around a common goal of student achievement. If done correctly, this has the potential to transform how we think about increasing the demand for education in public schools and is the most innovative experiment on incentives attempted to date.

The Incentives 2.0 experiment will be run by HISD and evaluated by EdLabs. Below, we provide some details about how we envision the program.

A. Selection and Consent

1. Schools

Participation in the program will be offered to 70 low-performing schools with fifth grade students that are not part of Apollo 20 feeder patterns. Principals and fifth grade teachers will be required to commit to the program in order to be selected. We anticipate at least 50 schools will choose to participate; these schools will serve as the experimental group. Randomization into treatment and control groups (at least 30 schools each) will take place at the school level among the schools in the experimental group. The treatment group will include all fifth graders in the 30 selected treatment schools, which is approximately 70 students per school or 1,750 students across all 25 schools.

We are selecting elementary schools in HISD for three reasons.[4] First, elementary schools are smaller than middle schools, enabling us to select the same number of schools but treat a smaller number of students. As a result, our per-annum costs will be lower from the perspective of number of students and parents paid. Second, younger students have a higher marginal utility of income. This means that the average elementary school student will value making $5 more than the average middle or high-school student. From this fact, we hope that our incentive structure will be more effective with a younger cohort of children. Third, parents are more likely to understand and be capable of assisting their children with the math concepts in fifth grade.

2. Students, Parents, Teachers, Administrators

After treatment schools are randomly selected, information packets will be distributed to students at those schools. Included in each packet will be a consent form that students and parents will be required to return in order to participate in the program. Teachers' and administrators' consent to participate will be implied by their employment by the District.

B. Program Implementation

The District will use grant funds to hire a team consisting of two full-time managers and a finance associate responsible for school-facing communication, data collection, IT support, and payment

[4] One of the seventy schools that will be invited to participate is actually a PK-8 school, but was included because it serves fifth grade students.

distribution. In addition, each treatment school will identify a school coordinator to further manage the on-site operations of the program.

At the start of the school year, students at treatment schools will be given information packets to take home with them. These packets will include:

- A letter from the HISD superintendent with details about the program
- A parental consent/opt-out form
- A list of "frequently asked questions" about the program
- An overview of the program reward structure
- A program calendar with details about pay periods and payment dates

C. Incentive Structure

This proposed undertaking will incorporate all players in a child's achievement production function—teachers, principals, parents, and the students themselves—with the goal of aligning incentives towards student achievement. We envision rewarding these players for students' participation in *Accelerated Math*, an online assessment platform.

Math Incentives Program Overview

The *Accelerated Math* platform creates math assignments specific to each student's ability level, enabling students to take brief online assessments to gauge achievement in mathematics. *Accelerated Math* (AM) is aligned with the Texas Essential Knowledge and Skills (TEKS) standards, reflecting the sequence of instruction found in state textbooks. For fifth grade, objectives fall into the following subject areas: Number Sense and Operations; Algebra; Geometry and Measurement; and Data Analysis, Statistics, and Probability.

After students take an initial diagnostic (created by teachers) to measure mastery of math concepts, AM creates customized practice assignments that focus specifically on areas of weakness. Students are then able to print these assignments or check them out of the library; each assignment has six questions, and students must answer at least five questions correctly to receive credit. After students scan their completed assignments into AM using a vendor-provided scanner, the assignments are graded electronically. Teachers then administer an AM test that serves as the basis for potential rewards: students are given credit for official "mastery" by answering at least four out of five questions correctly.

Principals and teachers in HISD are already incentivized for student performance on test scores, and this incentives program will dovetail with these goals without altering the ASPIRE model.

The incentive structure that uses *Accelerated Math* would include the following:

- **Teachers:** Teachers at treatment schools will also be incentivized on a per student basis for monthly meetings with parents (see below), at a maximum of $40 per student. Half of these rewards ($20 per student) will be paid by HISD in the form of teacher stipends; the other half is built into the program budget.

- **Students:** Students will be eligible to earn $2 for every objective mastered (at least four out of five questions answered correct in the AM curriculum up to $400 (or 200 objectives). Students that complete 200 objectives will also receive a $40 completion bonus, bringing the maximum students can earn to $440 over the course of the school year. Additional non-monetary incentives (event tickets, special lunches, etc.) will also be provided to students who advance beyond the

fifth grade objectives in the AM curriculum. Given EdLabs' experience in implementing incentives schemes, students earn 50% of their eligible incentives on average. To be conservative in our assumptions, we will budget 60% of the total eligible incentives for students. This translates to $240 or 120 objectives.

- **Parents:** Parents of children at treatment schools will be eligible to earn the same amount of cash awards for their child's mastery of AM curriculum objectives ($2 per objective). Additionally, parents can earn up to $160 for attending eight parent-teacher review sessions ($20/each), in which teachers will present student progress using *Accelerated Math* Progress Monitoring dashboards. We will not instruct parents on how to help tutor or instruct students in math. However, by incentivizing parents based on completion of work and mastery of subject matter, the goal of the program will be to motivate parents to act as a resource for children at home. We have budgeted the same amount of incentive payments for student performance for parents. However, we assume 50% attendance to parent-teacher review sessions on average, or $80 in incentive payments.

D. Payment Process

1. Preparation and Set-up

Rewards for students will be distributed via direct deposit into savings accounts or by "pay cards" that are issued by bank partners and function as debit cards. Students will be able to choose their method of payment, but establishing savings accounts will be heavily promoted by schools as the safest distribution method and as a means of encouraging fiscal responsibility and increasing familiarity with banking. Parents will only be paid by pay card. HISD will process all payments.

2. Payment Logistics

Once payments are calculated and audited, a "pay list" will be uploaded by the HISD finance associate. Pay cards for students will be delivered to the HISD project management staff for distribution to school coordinators, who will then hand them out to students. Pay cards for parents will be made available for pickup at each school. Both students and parents will be required to sign for their pay cards upon receipt. The time between the end of a performance period (one month) and the distribution of payments will be approximately three school days.

E. Program Support

Throughout the program, targeted strategies will be employed to increase participation and awareness and to ensure smooth implementation in all schools. These strategies include the following:

- *Materials*: Treatment schools will hang posters and other promotional materials throughout their buildings to promote the program and to explain the AM curriculum and reward structure.
- *Certificates*: Participants will receive certificates displaying the amount of money earned based on their performance in each reward metric.
- *Knowledge Quizzes*: To gauge participants' understanding of the basic elements of the program, quizzes will be administered throughout the year.
- *Parents' Nights*: Community forums (or "parents' nights") will be held to inform parents, teachers, and administrators of the details of the program. Schools will also hold information sessions on an ad hoc basis.
- *Assemblies*: Schools will hold assemblies and pep rallies to further introduce the program, generate excitement about it, explain details about earning money and getting paid, and answer any questions students and parents might have.

- *Financial Literacy*: Representatives from bank partners will provide regular financial literacy sessions to students and parents to encourage fiscal responsibility.

III. RESEARCH METHODOLOGY

To conduct an objective and unbiased evaluation of our aligned incentives program, we will select the group of treatment schools at random from a pool of 70 under-achieving elementary schools identified based on grade-level performance on the math TAKS from 2009-2010.

By using this methodology EdLabs can compare the outcomes of students at participant schools (which we will call *Treatment*) with one another and with those of schools that were not selected, our Control group, and attribute any differences we observe over time across the groups to the treatments themselves. We aim to focus our analysis on the following outcomes of interest: student achievement as observed in standardized test scores, student behavior, student attendance, and teacher outcomes like migration and retention. As this study does not contain a survey component, we will not be able to look into other outcomes beyond that which are made available through administrative data.

By understanding the differences between outcomes in treatment schools and those in control schools, we can broadly understand the impact of treatment on student achievement.

IV. CONCLUSION

Aligning the incentives of all the players in a child's educational experience is an unprecedented and potentially revolutionary exercise. The findings from this proposed initiative have the potential to be transformative for both researchers in education, behavioral economics, and psychology, and for policymakers looking for the most cost-effective strategies to reduce inequality that decades of intuitive reforms have been unable to address. Previous work around student incentives was indeed the first step toward understanding how to increase the demand for education and improve educational opportunities for poor urban students. This proposed project may very well bring us one step closer and may be a fundamental component in our efforts to close the achievement gap effectively and permanently.

Appendix A: Incentive Treatments by School District

	Dallas	NYC	DC	Chicago
School Selection				
Pool of Schools for Selection	43 opted in *	143 opted in	34 DC middle schools opted in	70 opted in a pre-determined subset of 40 chosen
Randomly Selected	22 (x HS, x MS)	63 (x HS, x MS)	17 MS	20 (x HS, x MS)
Student Population of Selected Schools				
Grades	2nd grade: 4,008	4th and 7th grade students: 17,744	6,039 6th-8th grade students:	10,628 9th grade students:
Summary of High-Needs Status	23% black, 74% Hispanic, 58% free lunch eligible	43% black, 42% Hispanic, 90% free lunch eligible	85% black, 9% Hispanic, 72% free lunch eligible	55% black, 38% Hispanic, 93% free lunch eligible
Financial Incentives				
Interventions	<u>BOOKS</u> $2 per book read for up to 20 books per semester. (per book quiz to confirm)	<u>TEST SCORES</u> 4th graders: $5 for completing the exam and $25 for a perfect score, up to a maximum of $250/ year. 7th graders: Incentives doubled for 7th graders.	<u>BEHAVIOR & ATTENDANCE +</u> rewards for behavior and attendance and schools then selected another three intermediate metrics, such as wearing school uniform	<u>REPORT CARD GRADES</u> grades per semester and per year
Average rewards (per student)	$13.81 ($80 max).	The average 4th grader earned $139.43 ($244 max). 7th graders could earn up to $50 per test and $500 per year. The average 7th grader earned $231.55 ($495 max).	Students could earn up to $100 every two weeks, $1500 per year. The average student earned $532.85 ($1322 max).	Students could earn up to $250 per report card and $2,000 per year. (A=$50, B=$35, C=$20, D=$0, F=$0) Half of the rewards were given immediately, the other half on graduation.

				The average student earned $695.61 ($1875 max).
Frequency	3 times per year	5 times per year	Every 2 weeks	Every 5 weeks / report card
Basis of Outcomes				
Source of Achievement Data	ITBS and Logramos reading scores	New York state assessment ELA and math scores	DC-CAS DC-BAS reading and math scores	PLAN English and math scores
Operations				
Total Costs of Program	Total: $360,000 Total disbursed to students: $42,800	Total: $4,100,000 Total Disbursed to Students: $2,700,000	Total: $4,700,000 Total distributed to students $2,300,000	Total: $3,400,000 Total distributed to students: $3,000,000
Cost per student: Based on Total Program Costs	$14	4th graders $139 7th graders $232	$533	$696
Compliance	80% consent rate.	66% opened bank accounts. 82% consent rate. 90% of students understood the basic structure of the incentive program.	99.9% consent rate. 86% of students understood the basic structure of the incentive program, based on a survey.	88.97% consent rate. 91% of students understood the basic structure of the incentive program.

Staff	One dedicated project manager	Three dedicated project managers.	Two dedicated project managers.	Two dedicated project managers.

*NOTES: *opted in implies voluntary election to be selected for the study. The number of students given is the number in our ITT samples; that is, students who were in the treatment or control schools and grades at the beginning of the treatment school year (2007-08 for Dallas and 2008-09 for NYC, DC, and Chicago).*

- *in addition to student incentives, schools were incentivized to implement the program with quality and efficiency*

Appendix B: Schools Invited to Participate in Program

Rank	Campus	Campus Name	Mean 5th Grade Math Score	Percent 5th Graders Commended in Math	Number of Students in 5th Grade
1	156	FROST EL	586.8	8.3	60
2	187	KELSO EL	604.0	9.8	61
3	378	KANDY STRIPE ACADEMY	610.9	11.8	34
4	282	GREGORY-LINCOLN ED CTR (EE-5)	616.6	19.1	47
5	127	WOODSON EL	634.7	9.4	32
6	194	LEWIS EL	635.0	18.8	117
7	283	GARCIA EL	639.6	16.2	105
8	253	WALNUT BEND EL	642.7	21.6	74
9	181	JANOWSKI EL	644.0	17.6	68
10	223	PUGH EL	645.2	18.8	48
11	121	BRUCE EL	646.2	15.1	53
12	182	JEFFERSON EL	646.3	15.4	91
13	160	GORDON EL	646.6	16.2	37
14	237	SCARBOROUGH EL	650.9	27.4	95
15	106	ATHERTON EL	651.3	20.0	40
16	109	BERRY EL	653.8	19.0	58
17	180	ISAACS EL	654.0	23.2	56
18	219	PINEY POINT EL	655.0	22.9	83
19	164	GRIMES EL	655.3	26.8	41
20	154	FOSTER EL	655.4	21.8	55
21	234	RUSK EL	656.1	20.0	45
22	259	WOODROW WILSON MONTESSORI	660.9	23.5	34
23	144	DURKEE EL	661.2	26.8	97
24	140	DOGAN EL	662.1	16.1	31
25	174	HIGHLAND HTS EL	664.1	18.8	69
26	225	REYNOLDS EL	665.9	26.0	50
27	162	GREGG EL	666.3	25.0	60
28	257	WHIDBY EL	667.1	25.4	59
29	372	RODRIGUEZ EL	669.6	31.9	116
30	244	SOUTHMAYD EL	670.1	29.3	82
31	396	RAY DAILY EL	671.4	31.0	87
32	112	BONNER EL	671.9	25.0	96
33	125	BURRUS EL	672.6	14.7	34
34	204	MEMORIAL EL	673.0	27.3	44
35	217	PECK EL	673.7	27.8	54
36	186	ROBINSON EL	673.8	32.5	80
37	155	FRANKLIN EL	674.4	34.4	64
38	297	DAVILA EL	674.9	35.3	85
39	120	BROWNING EL	675.0	23.5	51
40	157	GARDEN OAKS EL	675.7	32.1	56
41	295	BENAVIDEZ EL	676.8	28.7	87
42	210	NORTHLINE EL	677.4	26.8	82

43	299	A A MILNE EL	677.6	36.1	83
44	246	STEVENSON EL	677.6	32.4	34
Rank	**Campus**	**Campus Name**	**Mean 5th Grade Math Score**	**Percent 5th Graders Commended in Math**	**Number of Students in 5th Grade**
46	252	WAINWRIGHT EL	679.9	35.6	73
47	105	ANDERSON EL	680.9	30.2	86
48	209	NEFF EL	681.5	27.7	101
49	196	LONGFELLOW EL	681.7	34.6	104
50	286	HERRERA EL	682.8	33.6	122
51	369	GROSS EL	682.9	30.7	101
52	152	FIELD EL	682.9	28.3	46
53	239	SHEARN EL	684.2	36.4	55
54	254	WESLEY EL	684.4	38.5	52
55	149	EMERSON EL	685.2	36.6	82
56	115	DURHAM EL	685.8	35.4	65
57	163	SUGAR GROVE EL	686.4	33.5	173
58	389	KETELSEN EL	687.4	28.9	76
59	245	STEVENS EL	687.6	38.7	80
60	135	CROCKETT EL	687.7	32.0	50
61	298	MARTINEZ R EL	688.1	30.5	59
62	290	CRESPO EL	688.9	36.2	94
63	136	CUNNINGHAM EL	688.9	37.5	72
64	203	MADING EL	689.5	37.1	70
65	170	HELMS EL	690.0	38.7	62
66	240	SHERMAN EL	690.4	38.8	67
67	172	HENDERSON N EL	690.4	38.5	39
68	167	HARRIS R P EL	690.5	32.7	55
69	353	SCHOOL AT ST GEORGE PLACE	691.0	31.4	51
70	249	TRAVIS EL	691.6	30.9	94

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