What Can Latin America Learn from Rigorous Impact Evaluations of Education Policies?*

RICHARD J. MURNANE**
ALEJANDRO J. GANIMIAN†

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This PREAL Working Paper by Richard J. Murnane and Alejandro J. Ganimian distills four main lessons for pre K-12 education policy in Latin America from impact evaluations in developing countries throughout the world. First, reducing the costs of going to school and expanding schooling options increase attendance and attainment, but do not consistently increase student achievement. Second, providing information about school quality, developmentally appropriate parenting practices, and the economic returns to schooling affects the actions of parents and the performance of private schools. Third, more or better resources improve student achievement only if they result in changes in children's daily experiences at school. Finally, well-designed incentives increase teacher effort and student achievement from very low levels, but low-skilled teachers need specific guidance to reach minimally acceptable levels of instruction.‡

Introduction

Over the past decade, Latin American countries have made substantial progress in expanding access to schooling and increasing educational attainments. According to the latest household surveys, on-time enrollment in primary school has increased from 81 to 89% and primary school completion has surged from 65 in the early 1990s to 76% in the late 2000s. On-time enrollment in secondary school has increased from 45 to 59% and graduation rates have jumped from 32 to 46% (Bassi et al., 2013). The region has also made progress toward the United Nations' Millennium Development Goals (MDGs) during this period. Enrollment in pre-primary education increased from 54 to 73% and the adult literacy rate increased from 86 to 92%. Also, gender-based gaps in primary and secondary enrollment were virtually eliminated (UNESCO, 2014).

Yet, many children and youth in the region still do not attend school regularly, and student skills are low. In Brazil, Guatemala and Nicaragua, more than four out of 10 children do not complete elementary school. In Brazil, Paraguay, Uruguay, and most of Central America, fewer than one in two youths graduates from high school (Bassi et al., 2013). The ten Latin American countries that have participated in the Program for International Student Assessment (PISA)—Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Panama, Peru, Uruguay, and Trinidad and Tobago—have consistently ranked in the bottom-third (Bos et al., 2013; Ganimian & Rocha, 2011). Finally, in almost every educational attainment or learning metric, low-income and rural students lag far behind their high-income and urban peers (OECD, 2013; Pritchett, 2013).

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** Corresponding author. Thompson Professor of Education and Society, Harvard Graduate School of Education and Research Associate, National Bureau of Economic Research (richard_murnane@harvard.edu).

† Doctoral Student, Quantitative Policy Analysis in Education, Harvard Graduate School of Education and Doctoral Fellow, Multidisciplinary Program in Inequality and Social Policy, Harvard Kennedy School of Government (alejandro_ganimian@mail.harvard.edu).

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This paper distills the main lessons from rigorous impact evaluations of education policies in developing countries.[1] We reviewed 81 studies in 27 low- and middle-income countries. Like similar efforts (see, for example, Banerjee & Duflo, 2011b; Banerjee et al., 2013; Glewwe & Kremer, 2006; Kremer & Holla, 2009; McEwan, 2013; Murnane & Willett, 2010b), we focus on studies with plausible identification strategies.[2] We identified four lessons for K-12 education in Latin America:

1. reducing the costs of going to school and expanding schooling options increase attendance and attainment, but do not consistently increase student achievement;
2. providing information about school quality, developmentally appropriate parenting practices, and the economic returns to schooling affects the actions of parents and the performance of private schools;
3. more or better resources improve student achievement only if they result in changes in children's daily experiences at school;
4. well-designed incentives increase teacher effort and student achievement from very low levels, but low-skilled teachers need specific guidance to reach minimally acceptable levels of instruction.

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The first two lessons concern strategies for influencing the school enrollment and school choice decisions of families. The last two concern strategies for improving the quality of education. One theme of the paper is that it has proven much easier to design policies to influence families' school investment decisions—at least in the short run—than to design policies that increase educational quality. Of course, the demand-side and supply-side lessons are ultimately highly dependent: parents will only send their children to school regularly if they believe that schooling provides benefits. A second theme is that the strategies to move from an education system that provides most students with basic literacy and numeracy skills to a system that provides students with higher-order cognitive skills are quite different and much more difficult to implement than strategies to move from a totally ineffective education system to a minimally functioning one.

In this paper, we describe the evidence from well-designed evaluations of interventions that contribute to our four lessons. We report the effects that each intervention had on the group of students, teachers, or schools that experienced it (which we call the "treatment" group) as measured against outcomes for a group of comparable students, teachers, or schools that did not experience it (which we call the "control" group). To make the results of these evaluations comparable, we express these effects in standard deviations (SDs). SDs are a common metric used to express the difference between the treatment and control group means, which we refer to as the "effect size" of a policy intervention.

Lesson #1: Reducing the costs of going to school and expanding schooling options increase attendance and attainment, but do not consistently increase student achievement

Reducing the Costs of Going to School

While school fees have been abolished in most public school systems, families still must pay the costs of what economists call *complements*—i.e., goods that must be consumed concurrently with schooling. These often include school uniforms, transportation, eyeglasses, meals, and medication.

Commuting

Reducing the time that it takes children and youth to travel to school results in higher enrollments, and in some cases, in higher student achievement. One way to reduce commuting time is by building schools closer to the homes of potential students. Duflo (2004) found that an initiative in Indonesia in 1973 that built 61,000 primary schools increased the educational attainment of its beneficiaries by about .2 years. Mocan and Cannonier (2012) evaluated a primary school

construction program in Sierra Leone and found that it increased the educational attainment of girls by .5 years of schooling.[3] Burde and Linden (2009, 2012) assessed the impact of "community-based schools" (i.e., schools that serve only an individual village) in Guzara and Adraskan, Afghanistan, and found that their introduction boosted enrollment by 47 percentage points. They also found that the provision of community-based schools improved children's math and language achievement by .59 SDs.

Another way to reduce commuting costs is by providing a means of transportation to school. Muralidharan and Prakash (2013) evaluated a program in Bihar, India that provided girls who enrolled in secondary school with a bicycle to travel to school. The program increased girls' enrollment in secondary school by 30% and reduced the gender gap in enrollment by 40%.[4]

School Latrines

Equipping schools with latrines also raises enrollments, through a combination of improved hygiene and reduction of anxiety. Adukia (2013) studied the impact of a large school-latrine-construction initiative in India in 2003, which was implemented jointly with a hygiene education program and other small-scale investments (e.g., providing buckets for water). She found that the initiative increased the enrollment rate of students in grades one through five by 12% and that of students in grades six through eight by 8%. The latrines also reduced dropout rates in lower primary schools by about 12% and in upper primary schools by roughly 5%.[5] The enrollment and dropout impacts are larger for females. At younger ages, girls and boys benefit from both unisex and sex-specific school latrines. At older ages, girls only benefit from sex-specific latrines.[6] Importantly, the effect of the intervention persisted for three years.

Uniforms

Evans et al. (2008) found that free uniform provision in Busia, Kenya, reduced absenteeism by 44% for the average student and 62% for students who did not previously own a uniform. The program also increased test scores by .25 SDs after a year for children who received the free uniforms.[7]

Eyeglasses

Glewwe et al. (2012) assessed the impact of giving free eyeglasses to students in Western China. Students who benefited from the program for one year increased their test scores by .15 to .22 SDs, on average. Low-performing students benefited the most and the impact also depended on other characteristics of students and their families.[8]

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School Meals

Vermeersch and Kremer (2005) evaluated an initiative in Busia and Teso, Kenya that provided a fully-subsidized in-school breakfast on every school day to all students enrolled in pre-school. This policy increased school attendance by 30%. However, it only resulted in higher scores on a literacy test in schools in which the teacher had significant teaching experience.

Medications

Providing basic medication to children is a cost-effective way to increase enrollment and attendance; however, its impact on student achievement is mixed. Miguel and Kremer (2004) evaluated an initiative that provided deworming drugs to schools in Busia, Kenya. Provision of the drugs reduced absenteeism in treatment schools by one-quarter, and was far cheaper than alternative ways of boosting school attendance.[9] However, it had no impact on test scores. Luo et al. (2012) provided fourth graders in the poorest counties of the Shaanxi Province of China one dose of iron supplements (multivitamins with mineral supplements) per day for five months. In addition to reducing the prevalence of anemia, the intervention improved students' test scores. Finally, Bobonis et al. (2006) found that combining deworming drugs with iron supplements in Delhi, India increased the student enrollment rate by 5.8 percentage points, reduced student absenteeism by one-fifth, and improved children's health, as measured by their weight. Unfortunately, the authors did not measure the effect of the intervention on student achievement.

Compensating Families for Foregone Opportunities

In many developing countries, low-income parents do not send their children to school because they need them to work at home or to earn money. Economists call this an *opportunity-cost* and it is equal to the value of the opportunities a family foregoes if a child attends school. For many poor families, this opportunity-cost is simply too high to justify school attendance.

Many developing countries have introduced programs that provide cash transfers to low-income families, conditional on their enrolling their children in school. Evaluations of these policies have found large positive impacts on primary and secondary school enrollment.

Cash Transfers

Many developing countries have introduced programs that provide cash transfers to low-income families, conditional on their enrolling their children in school. Evaluations of these policies have found large positive impacts on primary and secondary school enrollment (Fiszbein & Schady, 2009).[10] The size of enrollment impacts, however, have depended on the share of students already enrolled in school,[11] the size of the transfers,[12] the timing of the transfers,[13] the age and grade of recipients,[14] the poverty level of its beneficiaries,[15] whether transfers are made conditional on a specific behavior (e.g., sending children to school),[16] who receives the transfers,[17] and whether the child benefiting from the transfers has any siblings.[18]

The evaluations also find that while cash transfers improve educational attainment (Behrman et al., 2005a; Mo et al., 2013b), they do not typically result in improved student achievement as measured by test scores.[19] One potential explanation is that the quality of the education available to children whose families receive conditional cash transfers is very low (Behrman et al., 2005b; Ponce & Bedi, 2010).[20]

Expanding Schooling Options

Vouchers

Early evidence indicated that programs that provide low-income families with vouchers that paid all or part of the cost of sending their children to the private school of their choice increased educational attainments and student achievement. Angrist et al. (2002) evaluated a program in Colombia that offered vouchers that partially covered the cost of private secondary school for students in families living in low-income neighborhoods who maintained satisfactory academic progress.[21] After three years, voucher winners were about 10 percentage points more likely to have finished eighth grade (mostly, because they were less likely to repeat grades) and scored .20 SDs higher on math, reading and writing achievement tests. Angrist et al. (2006) later found that voucher recipients were five to seven percentage points more likely to graduate from high school and scored .04 SDs higher on the college entrance exam.[22]

However, recent evidence on vouchers has been somewhat different. Muralidharan and Sundararaman (2013a) evaluated a voucher program in Andhra Pradesh, India finding no difference between the test scores of voucher winners and losers on math and Telugu (the native language).[23] However, they also found the mean cost per student in the private schools was less than a third of the cost in public schools.

It is important to keep in mind, however, that the voucher programs in Colombia and India targeted low-income families. In contrast, a long-standing universal voucher program in Chile that provides all families with the same-sized subsidies to enroll their children in a private school has had quite different consequences. Hsieh and Urquiola (2006) showed that the Chilean universal voucher program, in operation since 1981, increased school segregation by income, with low-income students concentrated in different schools than those serving students from higher-income families. Moreover, these researchers found no evidence that the voucher system improved average educational outcomes as measured by test scores, repetition rates, or years of schooling.[24]

Subsidizing Private Schools

Yet another way of expanding schooling options for children from low-income families is to subsidize low-cost private schools. Kim et al. (1999) evaluated a program in Quetta, Pakistan that offered subsidies to private schools

for each girl that enrolled for three years, as well as additional funds to defray start-up costs. The program increased girls' enrollment by 33 percentage points.[25] More recently, Barrera-Osorio and Raju (2011) assessed the impact of a program in Punjab, Pakistan that offered low-cost private schools a per-student subsidy. The subsidy was conditional on these institutions offering free schooling for all of their students and on students achieving a minimum pass rate on a specially-designed standardized test. The program expanded enrollments by roughly 37%.

Lesson #2: Providing information about school quality, developmentally appropriate parenting practices, and the economic returns to schooling affects the actions of parents and the performance of private schools

Many low-income parents lack information relevant to developing the skills and enhancing the life chances of their children. Providing this information improves children's development outcomes in many settings. It also increases the cost-effectiveness of schools, especially private schools.

Giving Parents Information

Information on School Quality

In contexts in which private schools educate many children, information on school quality creates competitive pressure for schools to increase their quality. Andrabi et al. (2009) evaluated an initiative in Punjab, Pakistan that provided the parents of third graders attending public and private schools with school- and child-level learning "report cards." The initiative increased students' achievement in English, mathematics, and Urdu by 0.10 SDs and decreased school fees by 18%. The research team found that the initiative improved the performance of private schools more than that of public schools.[26]

Camargo et al. (2011) assessed another report card initiative in Brazil and found similar results. The authors found that releasing information about the test performance of students increased the achievement of those attending private schools by .2-.6 SDs, but did not increase the achievement of students attending public schools.[27]

Information on Parenting Practices

Low-income families benefit from initiatives that provide parents with information about how to stimulate their children's learning and support for changing their parenting practices. Gertler et al. (2013) evaluated the long-term effects of one-hour weekly visits from community health workers in Jamaica over a two-year period that taught parenting skills. The health workers encouraged mothers to interact and play with their children with stunted growth in ways that would develop their cognitive and personality skills. Twenty years after the intervention, stimulation had increased the average earnings of participants by 25% and the earnings of individuals in the treatment group caught up to those of a matched non-stunted comparison group.

Banerji et al. (2013) assessed three different interventions designed to improve the home learning environment among rural households in India: (i) adult literacy classes for mothers; (ii) training for mothers on how to enhance their children's learning at home; or (iii) a combination of the first two interventions. They found that mothers in the first three groups performed .11, .06, and .15 SDs better, respectively, on a language and math test. They also found that the three programs had statistically significant effects of .04, .05, and .07 SDs on children's math scores, respectively, but only the combined intervention had significant effects on language scores.[28]

Information on Returns to Education

Even when the costs of schooling are low, many poor families do not send their children to school.[29] One hypothesis to explain this pattern is that many parents do not anticipate benefits from their children's schooling. Two experiments found that showing students and their parents the financial benefits of schooling increases educational attainment. Jensen (2010a) provided information to students in the eighth grade in the Dominican Republic about the wages of adults with different levels of education. He found that recipients of this information reported dramatically higher increased perceived returns when re-interviewed six months later and, on average, completed .20 more years of schooling over the next four years.[30] In a different study, Jensen (2010b) provided three years of recruiting services to help young, unmarried women in Indian villages obtain jobs in the business-processing industry. He found that girls

in treatment villages were more likely to be in school and were healthier, as measured by their body mass index.

It is important to note that more information does not always lead to improved educational outcomes. In an intervention similar to the one Jensen studied, Loyalka et al. (2013) trained teachers in the Hebei and Shaanxi Provinces of China to give seventh graders in 131 junior high schools a 45-minute scripted lesson on the wages of individuals with different levels of schooling, wage differences between junior high school and high school graduates, and the availability and costs of high schools in their province. This intervention had no impact on dropout rates, math achievement, or students' plans to go to (academic or vocational) high school.[31] Using their survey data, the authors concluded that the financial constraints that students faced and the poor quality of their local schools may explain the lack of a positive effect.

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Lokalka and his colleagues found that a similar "counseling" intervention in another setting had *negative* effects on student outcomes. In this intervention, teachers gave seventh graders four 45-minute scripted lessons on career-planning: (i) discussing the importance of skills in China's growing economy; (ii) helping students identify their career interests; (iii) presenting the returns to high school education; and (iv) teaching students how to navigate China's education system after junior high.[32] This intervention *increased* dropout rates by two percentage points and negatively impacted math achievement by .14 SDs. Based on their data, the authors speculated that the high (and growing) wages for unskilled labor may have dissuaded students from going to high school.

Lesson #3: More or better resources improve student achievement only if they result in changes in children's daily experiences at school

By far the most popular policies in education have been the provision of additional resources to schools, whether in the form of more (or better) teaching materials, new computer hardware or software, smaller class sizes, or more instructional time. These interventions do not consistently increase student achievement because, with relatively few exceptions, they do not result in changes in teachers' instruction, and consequently do not produce changes in children's daily experiences at school.

Giving Schools More Learning Materials

A number of rigorous evaluations of interventions that provided schools with basic teaching inputs—such as textbooks, libraries, and flipcharts—show that these resources are sometimes not used, and when they are, they do not consistently increase student achievement.

Textbooks

Glewwe et al. (2009) evaluated a program in Busia and Teso, Kenya that provided free, official government books and teacher guides for English, math, and science to classes in grades 3–8. The program had no impact on the achievement of the average student. The only ones who benefited were those who already had relatively high achievement. The likely explanation is that most students could not read the textbooks, which were in English—the official language of Kenya but not the first language of most students.

Libraries

Borkum et al. (2012) evaluated a program in Bangalore, India that introduced libraries where librarians provided regular reading-focused educational activities and facilitated students' interaction with the books. Most schools used the libraries, but the program had no effect on students' language skills or attendance rates.[33]

Flipcharts

Glewwe et al. (2004) assessed a program that provided free flipcharts to primary schools in Busia and Teso, Kenya including two sets of science charts, a teacher guide for science, a set of charts for health, a set of charts for math, and a wall map of East Africa for geography. They found that students in schools that received flipcharts did not score better on eighth grade examinations than students in control schools. This occurred even though 98% of teachers were aware that their school had been given flipcharts, 91% claimed to have used them, and 92% claimed they found them useful and that they employed them in 10–20% of school days during the year.[34] One potential explanation is that teachers lacked the knowledge of how to use these resources to improve instruction.

Giving Schools Computer Hardware and/or Software

A number of interventions have provided schools with free computer hardware (i.e., computers) and/or software (i.e., computer programs). The evaluation results from these interventions are quite mixed, suggesting that the quality of the software and the details of implementation are critical.

Computers in Schools

Donating computers to schools does not, by itself, increase student learning. Barrera-Osorio and Linden (2009) evaluated a public-private partnership in Colombia that installed refurbished computers in public schools and encouraged teachers to use software that provided instruction on how to use the computers to teach reading. They found that the program increased the number of computers in schools but that it had no impact on test scores in any subject for any subgroup of students.[35] The main reason was that teachers of core subjects did not integrate them into their classroom instruction.

Giving students free laptops especially designed for educational purposes makes them more proficient on basic computing skills, but the evidence is mixed on whether this intervention improves students' performance in core school subjects. Cristia et al. (2012) evaluated the One Laptop per Child (OLPC) program, which provided free laptops with 39 educational applications and 200 age-appropriate e-books in poor rural regions of Peru.[36] Students in treatment schools had more computers than those in control schools and were more likely to use one at school and at home. While the provision of laptops improved students' basic computing skills, it did not increase achievement in math or language, or affect the time allotted to school-related activities.[37]

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Computers at Home

Giving students money to purchase their own computers leads them to acquire computing skills, but at the expense of their performance at school. Malamud and Pop-Eleches (2011) evaluated a program in Romania that provided low-income students in grades 1–12 in public schools with vouchers to purchase a personal computer. They found that voucher winners were more likely to own and use a computer, and that they had significantly higher scores on a test of computer skills and on self-reported measures of computer fluency (.25 SDs). However, voucher winners performed *worse* than voucher losers in math, English, and Romanian (.25–.33 SDs). The reason was that few computers were used for schoolwork: few parents or children report having any educational software for their computer and few children report using the computer for homework or other educational purposes.[38] Most children report playing computer games daily, and winning a voucher reduced the time they spent doing homework, reading, and watching TV.[39]

In fact, there is some evidence that the skills that children acquire by having a home computer may not be transferrable to computers different from the ones they receive. Beuermann et al. (2013a) evaluated a version of the OLPC program in which 1,000 students in primary schools in Lima, Peru received specially-designed OLPC laptops. Interestingly, the authors found that treatment students

scored .88 SDs higher in a test measuring proficiency in using the specific OLPC laptop, but no better than control students on objective and self-reported skills using a Windows PC and the Internet.

A recent evaluation of an OLPC program in Beijing, China, however, found very different results. The program distributed laptops to 150 third graders in 13 migrant schools, who were allowed to take the laptops home. However, in contrast to OLPC initiatives in other settings, the laptops included remedial math and Chinese tutoring software (i.e., animated reviews and remedial questions). This software was also aligned with the content that students were learning in their math class. Children were trained on how to use the software and were given an opportunity to practice using it with their parents at their side. Mo et al. (2013a) assessed the impact of this variation of the OLPC program and found that the intervention improved student computer skill scales by .33 SDs and standardized math scores by .17 SDs after six months of intervention.[40] In fact, the program also increased the time students spent using computer software for learning purposes and decreased the time they spent watching television.

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Computer-Assisted Learning

Banerjee et al. (2007) assessed a program in Vadodara, India that offered fourth graders two hours of shared computer time per week to play games solving math problems, the difficulty level of which responded to students' ability. One hour was during the school day and the second after the normal school day ended. The program increased math scores by .35 SDs in year 1 and .47 SDs in year 2. One year after the program, participating students at all levels of aptitude performed better in math (.10 SDs). Yet, it had a larger impact for students initially in the bottom third of the achievement distribution than for those in the top third (.42 versus .27 SDs, respectively).

One potential explanation offered by Banerjee and Duflo (2011a) for this pattern of results is that low-achieving students stood to gain more from the computer-adaptive software because the material taught during regular class time is too difficult for them. However, this hypothesis is not completely consistent with the results of a similar intervention evaluated by Linden (2008). This intervention consisted of two similar versions of the same program in Gujarat, India in which children were assigned to either an after-school or to a pull-out version of the program (in which children were pulled out of their regular classes to participate).[41] Linden found that students performed .28 SDs better than control peers in the version taught after-school, but .57 SDs *worse* in the version taught during school.[42] This pattern of results suggests that even low-performing students learn something from regular teacher-led lessons and that the difficulty of regular classes cannot fully explain the heterogeneous effects of these programs.

Computer-adaptive software does not always benefit low-achieving students more than higher-achieving students. Carrillo et al. (2011) evaluated an initiative in Guayaquil, Ecuador, in which schools received basic infrastructure for computer labs, four computers per school, software designed to facilitate students' learning in language and math, and training for teachers and administrators on the use of this software.[43] The intervention had a sizable impact on the math achievement of fifth grade students (about .30 SDs). However, this impact was much larger among students at the top of the achievement distribution, suggesting that the content of the software (not just the fact that it is computer-adaptive) and its alignment with test content may help explain which students stand to benefit the most from these programs.

Reducing Class Size

Evaluating the impact of policies designed to reduce class size or to limit the number of students in a class to a prespecified limit is especially difficult. The reason is that both families and schools typically have incentives to respond to the opportunities that class size initiatives offer, resulting in unobserved differences between students in large and small

classes. As a result, it is very difficult to determine whether any differences between the average achievement of children in small classes and those in larger classes stems from class size or from differences between the two groups of students.

For example, using data from Chile, Urquiola and Verhoogen (2009) showed that high-income parents are more likely to take their children out of schools with large classes and put them in schools with smaller classes. Also, private schools, which are quantitatively important in Chile, cap their enrollment before they reach the number of students that is needed to trigger the country's maximum class-size rule. Thus, the evidence is not clear on the impact of class-size reductions. However, in evaluating the promise of this politically popular policy, it is important to keep two things in mind. First, reducing class size is unlikely to improve student achievement unless it changes children's daily experiences. This is more likely to happen in classrooms serving very young children than in those serving older children. Second, reducing class size is extremely expensive.

Increasing Instructional Time

A number of developing countries have increased instructional time, typically by increasing the length of the school day.[44] The evidence indicates that additional time is much more effective at raising student learning when it is not used to extend regular instruction, but rather to devote more attention to the needs of low-achieving students.

Longer School Days

Reforms that lengthen the school day and provide additional resources to schools have had small impacts on student achievement. Cerdan-Infantes and Vermeersch (2007) evaluated the "Full School Day" program in Uruguay that lengthened the school day in poor urban areas from a half day (3.5 hours) to a full day (7 hours) and provided a number of complementary resources to schools.[45] Students in participating schools improved their test scores by .07 SDs in math and .04 SDs in language more than those in non-participating schools *per year* of participation in the program. Bellei (2009) assessed a similar program in Chile, which was mandatory in all publicly funded schools, and found positive effects of similar size: .05–.07 SDs in language and .00–.12 SDs in math on the official tenth grade test.[46]

After-School Tutoring

Tutoring programs that offer low-achieving students additional instructional time have not improved student achievement, but staffing arrangements may help explain why. Cabezas et al. (2011) evaluated a three-month program in two regions of Chile (Gran Santiago and Bío Bío) in which fourth-graders met 15 times for 90 minutes with college volunteers who read them age-appropriate texts. On average, the program had no impact on students' cognitive or non-cognitive skills. Yet, there were major differences in the implementation of the program in the two regions. In Gran Santiago, there was high volunteer turnover and, on average, each student was tutored by 3.5 different volunteers. In Bío Bío, volunteer turnover was lower and each student was tutored, on average, by two different volunteers. Students from the lowest performing schools in the Bío-Bío region scored .15–.20 SDs higher in a reading test than their control peers, suggesting that the connection between a volunteer and his/her students was an important factor.[47]

Lesson #4: Well-designed incentives increase teacher effort and student achievement from very low levels, but low-skilled teachers need specific guidance to reach minimally acceptable levels of instruction

In many developing countries, teacher incentives are not conducive to high levels of effort. Creating incentives for teachers to come to school regularly and to teach to the best of their ability throughout the day is a promising improvement strategy when teachers are not already doing these things.[48] However, creating incentives for people to achieve outcomes that lie beyond their capabilities often results in dysfunctional responses. Thus, improving the capabilities of the teaching force is an essential complement to appropriate incentives in moving from subpar to adequate education.

Rewarding Teacher Effort or Performance

Offering teachers more money for increasing their effort (typically measured in terms of attendance) or their students' achievement (often measured as gains in test scores) has achieved positive results in schools with very low

student achievement. However, the details of these incentive plans matter a great deal.

Pay for Attendance

Paying teachers to go to school reduces teacher absenteeism, but only when the method of monitoring attendance is reliable and clearly linked to the reward. Duflo et al. (2012) evaluated an intervention in Rajasthan, India, which provided a bonus to teachers based on the number of days they attended school. The researchers monitored teacher attendance by providing tamper-proof cameras and asking teachers to take a picture of themselves and their students at the start and end of each school day. The intervention halved teacher absenteeism from 44% at baseline to 21% in 30 months.[49] A year into the program, test scores in treatment schools were .17 SDs higher than in the comparison schools, and two-and-a-half years into the program, children from treatment schools were 10 percentage points (or 62%) more likely to transfer to formal primary schools, which require passing a competency test (and thus, were of presumably higher quality).

Pay-for-attendance programs that rely on monitoring by school principals or parents have had no impact on attendance or student achievement (Banerjee & Duflo, 2006). Kremer and Chen (2001) studied an initiative in rural Kenya that gave principals funds to reward the attendance of pre-school teachers. The program had no impact on teacher attendance, teacher pedagogy, student attendance, or students' test scores. In fact, principals distributed the full bonus to all teachers *regardless* of their attendance.[50] Kremer and Vermeersch (2005) assessed an initiative that provided school committees in Kenya with information on teacher performance, including absenteeism. This program had no effect on teacher attendance or any other meaningful outcome either.

Well-designed programs that offered teachers financial incentives for improving student achievement have resulted in higher student achievement in some settings in which student performance was extremely low.

Pay for Performance

Well-designed programs that offered teachers financial incentives for improving student achievement have resulted in higher student achievement in some settings in which student performance was extremely low (Bruns et al., 2011; Bruns & Luque, 2014).[51] Most impressive is the evidence from an experiment that Muralidharan and Sundararaman (2011) conducted in rural primary schools in Andhra Pradesh, India. These authors found that modest financial rewards to teachers for improving student achievement in mathematics and language, as measured by test scores, improved student outcomes by .27 and .17 SDs, respectively. However, as Bruns and Santibáñez (2011) have argued, the evidence from other experiments on pay for performance[52] indicates that the impacts of these programs on student achievement depend on the size of the reward (relative to the average teacher's salary),[53] the student outcomes being rewarded (e.g., test scores, changes in scores),[54] and whether the awards are for individual teachers who can directly influence these outcomes or to all teachers at a school.[55]

An important caution in considering such programs is to recognize that they sometimes elicit dysfunctional responses. Some merit pay programs have led teachers to unduly "teach to the test" and students to copy each other's answers. Kremer et al. (2010) evaluated a program in Busia and Teso, Kenya that rewarded schools based on the share of students in grades 4–8 who took the government exams and their performance on the exams. They found that the program affected students' performance on the government exam, but not on a complementary assessment of the same skills.[56] Behrman et al. (2012) assessed three monetary incentives schemes to reward improvements in math in Mexico: (i) one that only rewarded students; (ii) one that only rewarded teachers; and (iii) one that rewarded students, their teachers, and their principals. The authors found that the improvements in test scores in treated schools were partly due to student copying.[57] These studies highlight the importance of monitoring teacher responses to performance incentives and recognizing that

the potential for strategic, dysfunctional behavior becomes greater the higher the stakes, the longer the program is in operation, and the less capable teachers and students are of earning rewards simply by working hard.[58]

Hiring Contract Teachers

Hiring teachers on one-year, renewable contracts (i.e., rather than as civil service employees) has consistently led to higher student achievement. However, most "contract teachers" are hired as a *complement* to regular teachers, and since many of them aspire to regular teaching positions, the experiments do not provide evidence about the consequences of altering the contract terms for all teachers.

Contract teachers seem particularly effective when they provide remedial education to students who are so far behind that they get little out of regular instruction. Banerjee et al. (2007) evaluated a program in Mumbai, India that hired young women from the community with a high school education to take low-performing children in grades three and four out of their regular classroom for two hours a day (the school day is about four hours long) and work with them on basic numeracy and literacy skills. The program increased test scores in the treatment schools by .14 SDs in the first year and .28 SDs in the second year, and it was most effective with the lowest-performing students.[59]

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Typically, contract teachers are hired to teach regular classes that are broken up into smaller classes. Muralidharan and Sundararaman (2013b) evaluated a program in Andhra Pradesh, India that allowed school committees to hire an additional teacher on a contract that is renewed annually. These teachers were not protected by civil service rules, they were paid about a fifth of the average salary of regular teachers, and were much more likely than civil servant teachers to be young, female, local, and live close to their schools.[60] At the end of the two years of the program, the mathematics and language achievement of students in schools with an extra contract teacher were .16 and .15 SDs higher, respectively, than that of students in comparison schools. Contract teachers were also less likely to be absent than regular teachers (18% vs. 27%).

In some cases, the hiring of contract teachers has led regular teachers to work less. Duflo et al. (2012) evaluated a program in Busia and Teso, Kenya that gave school committees funds to break up first grade classes and hire contract teachers to teach the additional class. They found that the average math and reading scores of students of contract teachers were .23 SDs higher than those of regular teachers and that contract teachers were 28 percentage points more likely to be found in a classroom and teaching than their regular peers.[61] In fact, civil service teachers in schools that hired a contract teacher were 13 percentage points *less* likely to be found in class teaching than their peers in schools without contract teachers, suggesting that they took advantage of the presence of contract teachers.

Providing Teachers with Scaffolding to Improve Instruction

In most of the settings in which the introduction of pay for performance or contract teachers have shown positive impacts on student learning outcomes, student achievement and teacher attendance were extremely low.[62] In such contexts, incentives that reward outcomes that teachers can directly affect by increasing their effort (e.g., less absence or more "time-on-task") may produce gains that are "low hanging fruit."[63] However, once this fruit has been picked, further student learning improvements may be constrained by the low skills of teachers. Increasing student achievement in these settings may require clear and specific guidance for teachers on what to do in class.[64] We refer to such guidance as "scaffolding."

Providing Feedback to Teachers

Simply giving teachers diagnostic information about their students' performance with general tips on how to help them improve has had little impact on student learning. Muralidharan and Sundararaman (2010) evaluated an initiative in Andhra Pradesh, India that provided schools with diagnostic information on their students' performance.[65] At the end of the first year, teachers in the feedback schools

performed better on their classroom observations than teachers in control schools. However, there was no difference in student test scores. Thus, while teachers in "feedback" schools worked harder while being observed, the effort did not benefit students.[66]

Diagnostic feedback has only positively affected student achievement when combined with clear and specific guidelines on classroom instruction. Piper and Korda (2011) evaluated two uses of an independently-administered reading assessment for second and third graders in Liberia: one that used school report cards to communicate the results of these assessments to the community and another that also provided teachers with training on how to periodically assess student achievement; frequent, detailed pedagogic support; and teaching materials and books. The first intervention only affected two of seven literacy outcomes.[67] The second had a much larger effect on all seven outcomes (.39–1.23 SDs, depending on the outcome). This study suggests that there is little that low-skilled teachers can do about learning deficits if they do not receive guidance on how to change their practices.

In recent years, some interventions have attempted to circumvent low teacher skill levels by giving students a more central role in the classroom. Those interventions that have been rigorously evaluated have had limited or negative impacts on student achievement.

"Scripted" Lessons

Scaffolding that provides guidance on both *what* teachers should teach and *how* they should do it has proven effective in enhancing the skills of low-performing students. He et al. (2007) evaluated a program that provided classroom activities to teach English to first to fifth graders in Maharashtra, India using either a specially designed machine or flashcards.[68] The version in which local teachers and their assistants used either the machines or the flashcards or both interventions combined had a .30 SD effect on test scores in English.[69] It also improved students' math scores by .31–.33 SDs.[70]

The effectiveness of even scripted lessons may depend on teachers' skill levels. He et al. (2009) evaluated a scripted literacy program in three settings in Mumbai, India: first-grade classes in government schools, pre-school classrooms especially created for this program, and existing pre-school classes.[71] The program had two key components: (i) the use of storybooks, flashcards for word and letter recognition, and alphabet charts, and (ii) a "child library" with age-appropriate texts.[72] The intervention had a .12–.70 SDs effect on a number of literacy outcomes, but the magnitude of the effect varied considerably depending on its format.[73] One possible explanation for the wide variation in the impacts of the program is that some teachers may lack even the basic skills needed to implement scripted lessons.

Student-led Learning

In recent years, some interventions have attempted to circumvent low teacher skill levels by giving students a more central role in the classroom. Those interventions that have been rigorously evaluated have had limited or negative impacts on student achievement. Beuermann et al. (2013b) evaluated an initiative in Peru that sought to develop the scientific thinking of third graders by providing their teachers with resources to guide student-led experiments. They included laboratory equipment and LEGO kits, teacher training in how to engage their students in active learning, and continuous student assessment instruments.[74] This program only had a positive impact in one out of three modules assessed by a science test, and the positive results were driven by male, urban, and high-achieving students.[75]

Similarly, Berlinski and Busso (2013) evaluated an intervention in Costa Rica designed to give seventh graders a more active role in math lessons.[76] There were four versions of the program: (i) one that simply introduced a student-centered curriculum; (ii) one that combined the curriculum with an interactive whiteboard; (iii) one that combined the curriculum with a computer lab; and (iv) one that combined the curriculum with a laptop for every child in the classroom. The authors found that students who did not receive any of the interventions actually learned .16–.36

SDs *more* than those who did, depending on the version of the program to which they were compared.

The lesson here is that implementing student-centered instruction effectively requires skills well beyond those of a great many teachers in developing countries. Indeed, many teachers in developing countries lack even the basic skills that are required to deliver scripted lessons. These studies highlight the importance of matching instructional materials and support to the skill levels of teachers.

Conclusion

Our review of rigorous impact evaluations indicates that a variety of policies have proven effective in increasing the school enrollment of students from low-income families. More difficult is the challenge of improving the quality of education provided by schools. Well-designed incentives for teachers help in situations in which teachers are not coming to school regularly and doing their best to increase their children's skills. However, in many settings, strategies that employ incentives alone quickly run up against the constraint of teachers' limited knowledge and skills. Initiatives that provide teachers with hands-on, focused training on how to effectively teach highly scripted lessons have improved student outcomes from very low levels.

Interventions such as those described in this paper will not enable countries to develop high-performing education systems such as those in South Korea and Singapore. The remarkable progress of these systems result from system-wide efforts over several decades. These efforts included defining learning standards in core subjects for every grade level, developing curricula that are well-aligned with learning standards, producing assessments that measure student's ability to meet the standards, and developing teacher training programs that attract talented students and prepare them to teach demanding curriculum effectively. Designing and managing such systemic change successfully requires a remarkably high level of governmental capacity.

Unfortunately, providing even basic literacy and numeracy skills to millions of children remains a major challenge for many countries. In these cases, the evaluations discussed in this paper provide insights about the promise of alternative strategies to achieve particular goals. Attention to the following guidelines may help in making constructive use of these insights.

Providing even basic literacy and numeracy skills to millions of children remains a major challenge for many countries. In these cases, the evaluations discussed in this paper provide insights about the promise of alternative strategies to achieve particular goals.

First, the details of the design and implementation of educational interventions matter (Pritchett & Sandefur, 2013). For example, the equity implications of "targeted" vouchers are different from those of "universal" vouchers (Angrist et al., 2002; Angrist et al., 2006; Hsieh & Urquiola, 2006). Interventions that fall under the title of "computer-assisted learning," but differ in design and implementation details, have different effects on student learning (Banerjee et al., 2007; Carrillo et al., 2011; Linden, 2008). A corollary of this lesson is that blanket statements about the effectiveness of particular reform strategies, including vouchers or the use of computers in schools, are neither accurate nor helpful.

Second, the average effects of interventions typically mask considerable heterogeneity across groups. For example, high- and low-education parents responded very differently to initiatives aimed at empowering school councils in Niger (Beasley & Huillery, 2012); low- and high-achieving students derived different benefits from free textbooks in English in Kenya (Glewwe et al., 2009); and rural girls did not profit nearly as much as urban boys from the use of LEGO kits to teach science in Peru (Beuermann et al., 2013b). It is critical to understand the effects of an intervention for specific groups because they sometimes drive average effects and because these impacts shed light on whether an intervention will work with a different population.

Third, the consequences of any school improvement strategy are likely to depend on the nature of the education problem in the particular setting and on institutional

structures and cultures. In settings in which teachers are not devoting their best efforts to educating children, well-designed incentives have promise. However, the track record of performance-based pay in settings in which teachers are doing their best but lack the skills to teach effectively is much less encouraging. In settings in which governmental institutions operate relatively free of corruption, investing in improving the capacity of the public education system may make sense. In settings in which public institutions do not work well, investing in incentives for low-income families to enroll their children in private schools may make more sense. A frontier challenge for researchers is to build and test theories about the roles of institutions and cultures and other aspects of settings in determining the promise of specific educational reform strategies.

Fourth, most of what we know about these interventions concerns short-term outcomes for students. The effect of scholarships for girls on political outcomes in Kenya (Friedman et al., 2011), the effect of early childhood stimulation programs on adult earnings in Jamaica (Gertler et al., 2013), and the effects of vouchers on high school graduation and college performance in Colombia (Angrist et al., 2006) have highlighted the importance of understanding the long-run effects of educational interventions. In the United States, a number of interventions have had only short-lived impacts on test scores, but large and important effects on adult outcomes.[77] Finding ways to examine longer-term consequences for potentially promising interventions is an important research challenge.

Finally, the evidence described in this paper addresses the question of whether specific educational interventions improve schooling outcomes for low-income children. Of course, a critical question remaining is whether those interventions that do have positive impacts are cost-effective.[78]

Endnotes

[1] We refer to studies in developed countries, always in footnotes, when we want to contrast the evidence from high- and low-income nations, or when there are important insights from recent studies in developed countries that can help us interpret the evidence from the developing world.

[2] Specifically, it includes only studies that employ one or a combination of the identification strategies discussed in Murnane and Willett (2010a).

[3] Kazianga et al. (2012) found that a program devised to construct "girl-friendly" primary schools (i.e., schools with separate latrines for boys and girls, canteens and take-home rations, among other components) in Burkina Faso was even more successful in increasing the school enrollment of girls than increasing the supply of "conventional" schools.

[4] In fact, the initiative was more cost-effective than cash transfers for families (reviewed below).

[5] The initiative had no impact on the share of students achieving high scores in an official exam, but this could be due to the fact that the intervention incorporated less academically able students.

[6] The author hypothesizes that this differential impact by latrine type suggests that the initiative might be impacting school enrollment and dropout rates through different channels: in lower primary schools, latrines might improve student health, while in upper primary schools, they might improve student outcomes through improved privacy and sexual safety.

[7] A similar study by Duflo et al. (2006) in two other rural districts in Kenya—Bungoma and Butere-Mumias—found free uniforms reduced dropout rates. By prolonging the time students spend in school, the uniforms also reduced the rates of teen marriage and pregnancy.

[8] The authors found that girls were more likely to refuse free eyeglasses, and that lack of parental awareness of vision problems, mothers' education, and economic factors significantly affected whether children in the control group wore eyeglasses.

[9] In fact, deworming substantially improved health and school participation among *untreated* children in schools that received the medication, as well as in neighboring schools.

[10] Several of these programs are called "scholarships." However, since the cash transfers are conditional on school enrollment, we include them here.

[11] The lower initial enrollment, the larger the program's impact (Maluccio & Flores, 2005).

[12] Larger transfers do not always result in larger impacts. Some small cash transfers have had large effects (Chaudhury & Parajuli, 2010; Galasso, 2006). In fact, there is some evidence that there are diminishing marginal returns to transfer size (Filmer & Schady, 2008).

[13] Barrera-Osorio et al. (2011) evaluated different versions of a conditional cash transfer program in Bogotá, Colombia. They found that while all versions of the program increased attendance, the one that made part of the payment conditional on students' enrollment in the next grade increased the re-enrollment rate by 4 percentage points. This version, as well as one that made part of the payment conditional on high school graduation, increased enrollment in tertiary education by 9.4 and 48.9 percentage points, respectively.

[14] Schultz (2004) and Schady and Araujo (2008) evaluated cash transfers in Mexico and Ecuador, respectively, and found that these were most effective in the transitions from primary school to secondary school (grades 6-7) and from lower- to upper-secondary school (grades 9-10). Chitolina et al. (2013) evaluated a cash transfer in Brazil and found that it was most effective for males and when the child was the youngest in the household.

[15] The poorer the beneficiaries, the larger the program's impact (Behrman et al., 2005b; Filmer & Schady, 2008; Glewwe & Olinto, 2004; Maluccio & Flores, 2005; Oosterbeek et al., 2008).

[16] Ozler et al. (2009) and Benhassine et al. (2012) evaluated unconditional cash transfers in Malawi and Morocco, respectively, and found effects similar to those of conditional programs. Akresh et al. (2013) found similar results in Burkina Faso. In fact, Benhassine et al. (2013) found that simply labeling transfers as intended for education makes parents spend them on education-related expenditures in Morocco. Finally, Karlan and Linden (2013) found that a similar label on a savings account in Uganda increased savings and, when combined with a parent outreach program, increased expenditures on educational supplies.

[17] Benhassine et al. (2012) found the impact of cash transfers in Morocco did not depend on whether the payments were given to mothers or fathers. However, Ozler et al. (2009) randomly assigned households in Malawi to transfers that were divided differently between young women and their parents. They found that young women benefitted more when they received a larger share of the transfer.

[18] When parents receive cash transfers to send some of their children to school, they tend to reallocate household resources in ways that make the siblings of transfer beneficiaries less likely to go to school—especially girls (Barrera-Osorio et al., 2011; Del Carpio & Macours, 2010).

[19] Since cash transfers usually bring children into school who tend to be poorer than those already enrolled, a few studies have compared the achievement of beneficiaries and non-beneficiaries of these programs using household-based tests, which do not require that children be enrolled in school to take them. However, these studies have also not found any impacts on student achievement (Behrman et al., 2005a; Filmer & Schady, 2008). There are two important caveats to the conclusion regarding the effect of conditional cash transfers on students' achievement. One is that cash transfers that are allocated on the basis of student merit (as opposed to need) have shown positive impacts on student achievement (Barrera-Osorio & Filmer, 2013; Kremer et al., 2009). As Barrera-Osorio and Filmer (2013) argue, while this suggests that there is a tradeoff between efficiency and equity, it is not particularly stark if merit-based cash transfers are introduced into schools serving children from low-income families. Another is that cash transfers in the form of savings also influence children's achievement. Karlan and Linden (2013) compared a savings account fully-committed to educational expenses to one in which savings are available for cash withdrawal but intended for education in Uganda. They found the former had no impact and the latter increased scores on language and math by .14 SDs when combined with a parent outreach program.

[20] Cash transfers increase the share of household expenditures devoted to education (Ambler et al., 2013). Therefore, in contexts where parents can use additional funds to send their children to better schools, transfers could have a much larger role in increasing children's academic skills. Yet the emerging evidence supporting this theory of action has not been encouraging so far (Wong et al., 2013).

[21] Initially, vouchers could be used for both for-profit and non-profit schools, but after 1996, for-profit schools were excluded. To qualify for a voucher, applicants must have been entering secondary school, be less than 16 years of age, and must have been admitted to a participating secondary school.

[22] The range of plausible estimates stems from initial differences between voucher winners and losers, which make the magnitude of the estimate of the effect of the program sensitive to the choice of pre-treatment covariates. Graduation was measured through a proxy, which was registration for the college entrance exam. At the time, 90% of all graduating high school seniors took this exam.

[23] The authors measured student achievement two and four years after the introduction of the program. The lack of effects on achievement in mathematics and Telugu may have been a result of private schools spending significantly less instructional time than public schools on these subjects, using the extra time to teach more English, Science, Social Studies, and Hindi. The authors note that voucher winners scored .13 SDs higher on average on a composite of all tested subjects (and that students who attended private schools scored .23 SDs higher on this composite). Yet, it seems inappropriate to emphasize this since the composite is an average of scores on tests in different substantive areas. These authors designed their study in a way that allowed them to examine the individual and the aggregate effects of school choice—including spillovers. They found no evidence that the voucher program affected public-school students who did not apply for the voucher or students who started out in private schools.

[24] As part of a major educational reform initiative, the Chilean government changed the voucher program in 2008. Under the new program, low-income families receive educational vouchers that have substantially greater value than those provided to higher-income families. One goal of the educational reform is to reduce the socioeconomic segregation of schools.

[25] Boys' enrollment also rose, partly because boys could attend new schools created under the program and because parents would not send their girls to school without educating their boys.

[26] In response to the initiative, student achievement in formerly low-quality private schools increased by 0.34 SDs, while relatively effective private schools reduced their fees. Public schools improved student achievement by .10 SDs.

[27] The range of estimates stems from sensitivity to the number of students included around the cutoff of 10 students that made disclosure of test information mandatory. The authors interpreted these results as suggesting that the main mechanism driving the differences in performance was the increased levels of effort by students, teachers, and principals. They did not find evidence that treatment private schools adjusted their inputs or that there were major changes in the student composition of treatment schools.

[28] The authors also found that the interventions increased women's empowerment, mothers' engagement in their children's learning, and the presence of education assets in the home.

[29] Banerjee and Duflo (2011a) argue that this is because poor parents believe schooling pays only if a student can graduate (that is, that there is little value in each additional year of schooling). Therefore, parents only send and/or keep a child in school if they believe that he or she has a good chance of graduating.

[30] Another way of making people aware of the returns to schooling is by making schooling compulsory. This type of policy impacts educational attainment, but at a much greater cost than the interventions above. Spohr (2003) found that a law in Taiwan that expanded compulsory (and free) schooling from 6 to 9 years increased the schooling of males by .4 years and of females by .25 years. Fang et al. (2012) also found that a similar law in China raised overall educational attainment in the country by about .8 years of schooling.

[31] These results are consistent with another informational intervention. Hicks et al. (2013) evaluated an intervention that informed individuals about the returns to vocational education and found no effect on educational attainment.

[32] This lesson was in fact identical to the one described in the previous paragraph.

[33] In fact, when the authors disaggregated the impact of the program by mode of delivery, they found that there were no effects when the libraries are provided directly to schools (i.e., "hubs"), but there were sizeable *negative* effects when the libraries are provided through a visiting librarian (i.e., "spokes"). One reason was that in the latter, librarians visited schools on a pre-arranged schedule and could only interact with students during that time. Therefore, these visits disrupted the normal school schedule, and teachers adjusted by reducing the time spent on language arts.

[34] While teachers might have over-reported how often they used the flipcharts, over 90% of them gave specific answers that required experience with the materials.

[35] There were no changes in the share of students who liked their school or the content that they were learning, or in their propensity to talk to teachers outside of class.

[36] These included: (i) standard applications (e.g., to write, browse, paint, calculator, chat); (ii) games (educational and a variety of puzzles); (iii) music (to create, edit and play music); (iv) programming; (v) other (including sound and video recording and specific sections of Wikipedia).

[37] The majority of treatment students showed general competence in operating the laptops in tasks related to core applications and searching for information on the Internet.

[38] These findings are consistent with that of the largest-ever field experiment that randomly provided free home computers to students. This experiment, which Fairlie and Robinson (2013) conducted in California, had no effects on any educational outcomes, including grades, test scores, credits earned, attendance or disciplinary actions. Student surveys indicated no change in homework time or other "intermediate" inputs.

[39] Importantly, the presence of parental rules regarding homework helped mitigate some of the negative effects of winning a computer voucher without affecting the gains to computer skills and cognitive skills. Also, the rules regarding computer use diminished the positive impacts on computer skills without improving academic achievement.

[40] Less-skilled students improved more in computer skills after the program.

[41] This was not the only difference between the two programs. Unlike the program in Vadodara, the one in Gujarat entailed only one hour of computer practice per day and assigned a computer to each child. Also unlike the one in Vadodara, this one was designed to complement everyday math instruction and was delivered in such a way that children required no support from their teachers.

[42] Lai et al. (2013) evaluated an after-school computer-assisted learning program in the Shaanxi Province of China and found similar results. The authors implemented a remedial, game-based program in math in poor rural public schools and found that it improved the math achievement of the participating students by .12 SDs. Students from low-income families benefited more from the program.

[43] Like the interventions in Vadodara and Gujarat, this one also used computer-adaptive technology to allow students to learn at their own pace. It provided them with exercises based on their initial performance on a diagnostic test and reviews of key concepts before, during, and after each exercise. Also, as with the intervention in Gujarat, the one in Guayaquil did not require teachers' guidance and students could potentially use the computers and software during and after school.

[44] A number of initiatives in developed countries have increased the length of the school year for low-achieving students by introducing mandatory summer school (Jacob & Lefgren, 2004; Linden et al., 2011). We do not know of any published studies on similar initiatives in the developing world, although a recent experiment in India seems to have yielded promising results (Banerjee et al., 2011).

[45] These included additional time devoted to students with special needs, community service, and teacher meetings, and additional inputs to schools (e.g., new classrooms, class size reductions, complementary classroom activities, nutritional and health care support for students, increased participation of parents, teacher training and teaching materials).

[46] Like the program in Uruguay, the one in Chile lengthened the day by switching from two "shifts," consisting of two different groups of students attending the same school in the morning or afternoon, to an extended school session that included the morning and half of the afternoon. It also included a one-time investment in school facilities (to construct or renew classrooms, the cafeteria, bathrooms, etc.) and a permanent increase in the amount of the monthly public per-student subvention.

[47] Battaglia and Lebedinski (2013) evaluated a similar tutoring program in Serbia that also suggests that staffing arrangements matter. In the Roma Teaching Assistant Program, all the tutors were Roma and had backgrounds similar to those of their students. This led the authors to hypothesize that tutoring programs might have "role-model" effects, in which assistance from a successful person belonging to the same community motivates children (and in turn, their parents) to believe they can succeed. The authors found that parents of students in treated schools expected higher returns to education for their children and were more likely to expect them to graduate from high school.

[48] In contrast, the track record of incentives to improve teaching performance in the United States is quite poor.

[49] When schools were open, teachers in control and treatment schools were equally likely to be teaching, which suggests that the problem was primarily getting teachers to show up regularly.

[50] The authors see this outcome as surprising, given that principals could use any funds not allocated to teacher bonuses for other school expenses. Yet, it is not obvious that the authority to use these discretionary funds provides a clear incentive for principals to do the right thing. Principals may not want the money if the bureaucratic processes in accounting for how it is spent are too burdensome or if it creates conflict inside schools about how to allocate it.

[51] This has not been the case in the United States. See, for example, studies on merit pay plans in New York (Fryer, 2011), Tennessee (Springer et al., 2011) and Chicago (Glazerman & Seifullah, 2012). The only exception to these null findings is a study that capitalizes on the potential influence of loss aversion in Chicago (Fryer et al., 2012).

[52] The impact of merit pay programs that reward test scores is positive (Lavy, 2009; Muralidharan & Sundararaman, 2011). The impact of programs that do not (primarily) reward test scores is mixed (Contreras & Rau, 2012; Lavy, 2002; McEwan & Santibáñez, 2005). However, these studies are also the ones that use less rigorous methods and monitor results for shorter time horizons, so it is not clear what explains their mixed results.

[53] Larger rewards do not always result in larger impacts. To date, the program with the smallest average reward (relative to teachers' monthly pay) has the largest reported impacts on student learning outcomes (Muralidharan & Sundararaman, 2011).

[54] We know of no merit pay program that has compared rewards based on levels and gains, but we do know that gains in test scores are "noisier" than levels (i.e., more likely to be determined by factors outside the agent's control) (Barrera-Osorio & Ganimian, 2013; Chay et al., 2003). Currently, there is no clear trend that indicates that bonuses based on levels or changes are more effective.

[55] Muralidharan and Sundararaman (2011) compared school- and teacher-level incentives in Andhra Pradesh and found that the two affected student achievement equally well in the first year, but the latter outperformed the former after two years. At this time, schools with group incentives performed .15 SDs above control schools and those with individual incentives performed .28 SDs above control schools. However, Behrman et al. (2012) found that a merit pay program in Mexico that rewarded students, teachers, and principals based on students' math test scores was far more effective than one that only rewarded teachers, suggesting that aligning incentives across the different agents at a school is important.

[56] In fact, the authors found that teachers in treatment schools were no more likely to show up for work or assign homework. However, they were more likely to offer test-prep classes and to instruct students not to leave blanks on the multiple choice questions. Students in treatment schools were more likely to answer multiple choice questions correctly but not fill-in-the-blank questions; and the largest program effects were in subjects for which memorization was important.

[57] The authors noted an unusually large rate of agreement in correct and incorrect answers in test booklets. The estimated percentage of copiers was between two to six percent in the control group and the treatment group that provided incentives only for teachers. Yet, the estimated percentage of copiers reached 20 and 24 percent in the first and third treatment groups, in which students received a monetary reward.

[58] Strategic behavior on the part of teachers does not always invalidate the gains of an incentives program. Behrman et al. (2012) evaluated three monetary incentives programs in Mexico that rewarded high school students, teachers, and principals for improvements in math test scores. They found part of the apparent impact of the program was attributable to students copying each other's answers on the exams. However, even after adjusting for the effects of cheating, schools receiving either incentives solely for students or incentives for students, teachers and principals still performed .17-.31 SDs better than their peers in schools without any incentives in the first year of the program—and these copying-adjusted effects were still high (.23-.57) by the program's third year. Schools with incentives for teachers only saw negligible effects, with and without copying.

[59] These gains outlasted the program: one year after leaving the program, initially low-scoring students who were in treatment schools scored .10 SDs higher than their control peers.

[60] These teachers usually taught their own classes and were not 'teacher-aides' who supported a regular teacher in the classroom. New hires were supposed to go through a brief accelerated training program before starting to teach, but this was imperfectly implemented in practice.

[61] However, these effects faded out once students were reassigned to regular classes in grade two.

[62] Two exceptions are merit pay programs in Mexico (Behrman et al., 2012) and Chicago (Fryer et al., 2012), discussed in earlier footnotes.

[63] For example, Bruns and Luque (2014) document time "off task" as a major constraint to teacher effectiveness in Latin America and the Caribbean.

[64] This is consistent with the lessons from the whole-school reform programs in the U.S., which target the lowest-performing schools, in which teachers are typically not well prepared (Borman et al., 2007).

[65] This included a baseline test at the beginning of the school year, detailed written diagnostic feedback on the performance of students on the baseline test, a note on how to read and use the performance reports and benchmarks, an announcement that students would be tested again at the end of the year to monitor progress in student performance, and low-stakes monitoring of classrooms during the school year to observe teaching processes and activity.

[66] The pay-for-performance study by the same authors that we reviewed in the previous section included baseline assessments for *both* control (non-bonus) and treatment (bonus) teachers. The authors seem to conclude from this study that diagnostic feedback improves student achievement when combined with monetary bonuses. Yet, it seems inappropriate to conclude this since the two groups that the authors are comparing in that study are receiving the baseline assessments, so they are estimating the impact of bonuses *over and above* the effect of the baseline assessments.

[67] These included letter naming, phonemic awareness, familiar word fluency, oral reading fluency, reading comprehension, and listening comprehension. The two impacted outcomes were letter naming (.21 SDs) and phonemic awareness (.18 SDs).

[68] The electronic machine resembles a small notebook with a hard plastic shell. Children can use a stylus to point to pictures and hear a word pronounced aloud, practice identifying words, and take quizzes to check their understanding. The 440 flashcards, delivered together with instructional booklets for teachers, include activities (e.g., drills, chants, and games) to promote oral communication and conversation.

[69] The effect was roughly the same across the three treatment arms, ranging from .295 to .301 SDs.

[70] Another version of the program was delivered by externally hired tutors. The version of the program in which external tutors combined the machines and flashcards had a .29 SD effect on English achievement.

[71] In fact, the authors evaluated four different variations of the program over three years. In the first year, they assessed two versions of the program for first-grade students in government schools: a version taught in the school during the regular school day and a community-based version taught during out-of-school hours. In the second year, the authors evaluated the impact of the program on pre-school classes specially designed for this intervention. In the third year, they assessed the impact of the program on existing pre-school classes, either run by a non-profit or run by the government.

[72] The program was highly structured. It indicated both the activities that should be carried out and when they should be conducted. It was also highly supervised. In-field supervisors monitored teacher performance twice a week and "zonal heads" met supervisors once every 10 days to make sure that program implementation met the requisite standards.

[73] First-grade participants outperformed non-participants on a number of literacy outcomes (identifying letters, reading words, reading paragraphs, and understanding stories) in both the in-school and out-of-school versions of the program. Pre-school students in the specially-designed classes only improved in their ability to identify letters. Finally, students in regular pre-school classes saw improvements of similar magnitude to those of the first-grade participants.

[74] Students were expected to elaborate their own experiments and record and report their results. The teacher was supposed to motivate students to explore new ideas and formulate interesting questions.

[75] The three modules included the human body, the environment, and the physical world. The program had an average impact of .18 SDs on the third module.

[76] The specific focus of the program was on improving student achievement in geometry.

[77] See, for example, Chetty et al. (2011) on classroom quality, Kemple (2004) on career academies, or Ludwig and Miller (2007) on Head Start.

[78] The Abdul Latif Jameel Poverty Action Lab includes multiple cost-effectiveness comparisons about teacher attendance and incentives (http://www.povertyactionlab.org/policy-lessons/education/teacher-attendance-incentives), student learning (http://www.povertyactionlab.org/policy-lessons/education/student-learning) and student participation (http://www.povertyactionlab.org/policy-lessons/education/student-participation).

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