When does education drive growth and when does it not? Education policies for transformative growth

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Introduction

The Economic Commission for Latin America and Caribbean (ECLAC) was founded in 1948 and is now celebrating its 75th anniversary founded in 1948. On December 10th 1948 the UN General Assembly approved the Universal Declaration of Human Rights. Article 26.1 of that document declares:

> *Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all on the basis of merit.*

In 1955 the great Caribbean economist Sir W. Arthur Lewis published the *Theory of Economic Growth*, which had the basic framework that economic growth is the combination of "the effort to economize, the accumulation of knowledge, and the accumulation of capital." And while he is often remembered (caricatured?) for his emphasis on the need to raise savings and investment rates[1], or his dual labor market models, his 1955 book begins to discuss capital on page 201 *after* chapters on the will to economize, economic institutions, and knowledge. His discussion of the role of generating and applying knowledge in economic growth includes a discussion of the trade-offs acknowledging that "Economic development makes tremendous demands on education facilities at every level" listing primary education, secondary schools, training facilities, adult education, and universities and noting "The cost of providing all these services 'properly' is beyond the budget of any low-income country." (Lewis 1955, p 183). He then notes that "Fifty years ago"—early 20th century--"most nationalist politicians nailed their

[1] Even one of Lewis's most widely cited passages is often truncated: "the central problem in the theory of economic development is to understand the process by which a community which was previously saving, and investing, 4 or 5 per cent of its national income or less converts itself into an economy where voluntary saving is running at about 12 to 15 per cent of national income or more. This is the central problem because the central fact of economic development is rapid capital accumulation (including knowledge and skills with 'capital')" Lewis 1954.

flag to the mast of literacy; the supreme objective of educational policy was thought be to get all children into school" (p. 184)

I start with these historical references because there is a tendency to act as if the field of development broadly, or economists specifically, tended to "ignore" or "underemphasize" education. People will say that "human capital" was important for development and economic growth was "discovered" by Gary Becker in the 1960s (Becker 1964), or by either endogenous growth models (Romer 1986) or the neo-classical growth revival in the 1980s (Mankiw, Rome, Weil 1992) or by a shift to emphasize "human development" as an objective. But a broad consensus that national development broadly, and economic development specifically, would entail massive expansions in basic education (both primary and secondary) and expansions in both trainings and university education is very old[2]. Moreover, this consensus on the importance of education manifest itself in action. The expansion of schooling since 1950 has been one of the most striking successes of humankind of the late 20th/early 21st century.

But, as I pointed out over 20 years ago in "Where has all the education gone?" (Pritchett 2001), this huge expansion in schooling, and more particularly, the strikingly low variance of the expansion of "schooling capital" (which takes schooling and creates a measure of "capital" using an estimated return to schooling) across countries (Pritchett 2006), creates a puzzle. The fact that some (many) countries have had massive expansions in school and *not* experienced sustained or rapid economic growth implies it is definitively *not* the case that expansion of schooling alone is a "sufficient" condition for growth. Moreover, the growth in per worker output and the *percentage* growth in schooling (Pritchett 2001) or the growth in schooling capital (Pritchett 2006) are not robustly correlated[3]. This raises the question of the title: "Where does education drive growth and were does it not?"

The first section addresses the issues raised by the fact that "schooling ain't learning" (Pritchett 2013) and yet "schooling" measured as years or levels of schooling completed or degrees obtained and "education"--which properly should mean actual learning *outcomes* of improved knowledge, skills, competencies, dispositions, beliefs—are treated as synonyms. The primary argument is that schooling has expanded massively over the last 75 years, but schooling alone does not empirically, nor should it be expected to in theory, drive economic growth unless that schooling creates learning.

The second section shows that economic growth is quite strongly associated with new cross-national measures of the cognitive skills. The evidence is supportive of a view that the effect of schooling on growth is interactive with learning: the higher learning the greater the impact of

[2] Paglayan (2021) uses data over 200 years to show that expansion of primary education is very old and preceded widespread democratization by almost a century and that three-quarters of countries had more than half of the population in primary education before they became democracies.

[3] The caveat "robustly" allows for the fact that, as shown in Pritchett (2006): (i) there are some parameters such that a measure of "schooling capital" with those parameters produces a positive association of growth and schooling capital, but (ii) those parameters are relatively rare and unsupported by any ancillary evidence they are the best choices of parameters (e.g. one of the needed parameters for schooling capital is the association between the level of schooling and the return to schooling and the parameters needed for a positive association of schooling capital and economic growth are not consistent with the cross-national estimates of that relationship).

schooling on growth and the greater the schooling the higher larger the impact of improved learning.

The third section argues that the likely mechanism behind the correlation of learning and economic growth is not the narrow interpretation that the particular skills measured by assessments are the only, or perhaps even dominant path, but that youth with weak outcomes on the standard cross-national measures of math, science, and reading lack fundamental skills of applying knowledge in unexpected or non-routine situations and that is a deep and important aspect of equipping youth for the future.

The final section briefly discusses what it might take for countries to shift their systems of education to create the kind of learning that can support economies in LAC in expanding CEPAL's current objectives for "productivity, productive development, employment and inclusive growth"

I) Schooling Alone Does not Drive Economic Growth

This first section establishes two *descriptive* facts that any discussion of the relationship of education and growth must encompass.

First, a two-part fact is that (i) over the last 60 years expanded in LAC countries has expanded massively and (ii) this expansion of schooling has been much larger than a static cross-national association of economic growth and schooling would predict. This last fact implies that comparing the current situation versus, say, 1960: (a) schooling is much higher for countries today than for countries of equal income in 1960 and (b) the same situation can be described as saying countries today produce much *less* GDP per capita (GDPPC) with the same level of schooling than countries did in the past.

Second, a country's percentage rate of growth of years of schooling has been *completely uncorrelated* with the pace of growth of output per worker.

I.A) Massive success in expanding schooling

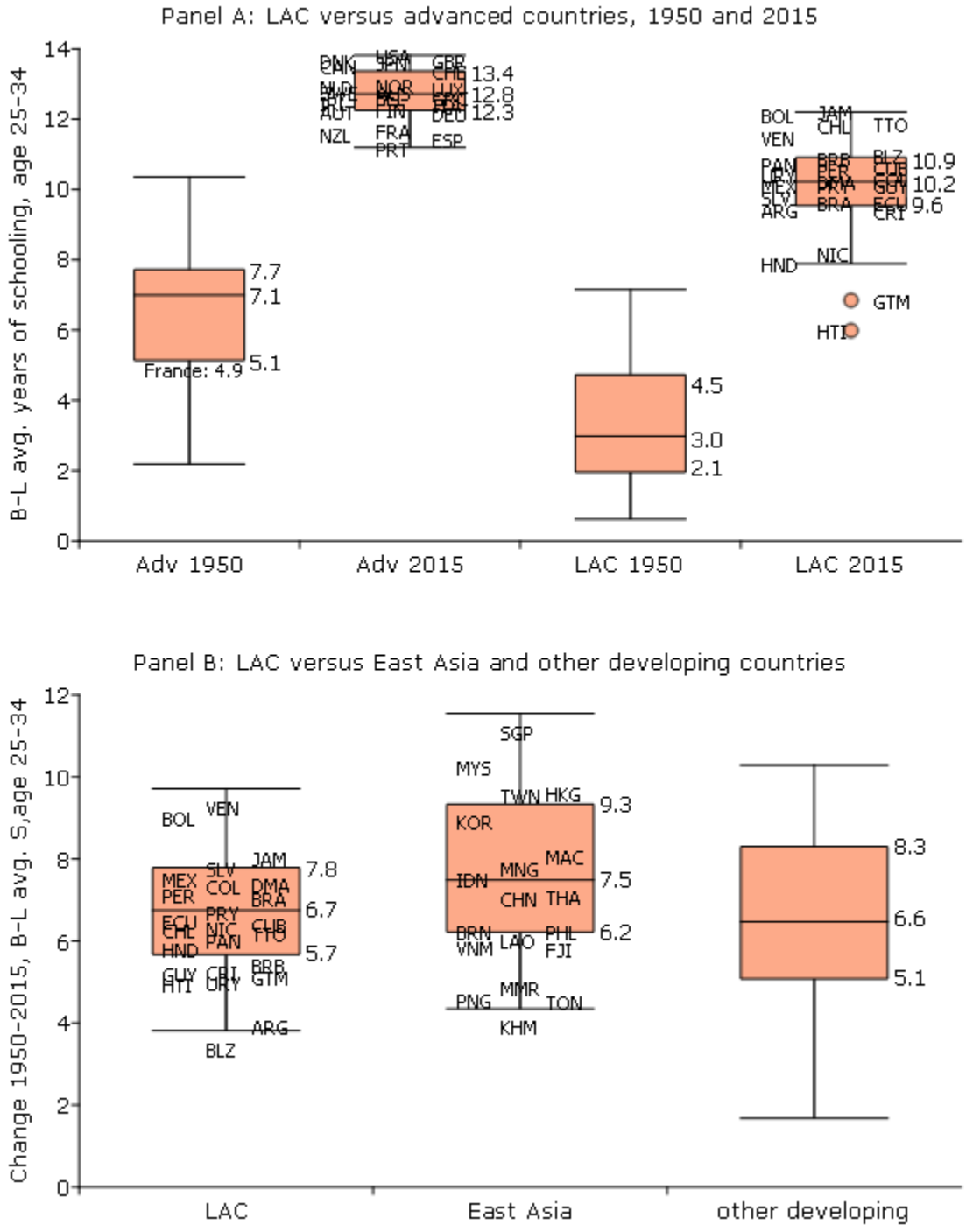
Figure 1, Panel A shows that between 1950 and 2015 the years of schooling of youth aged 25-34[4] more than tripled, from 3.0 (most youth had completed less than primary) to 10.2 (most youth completed at least junior secondary).

The historical and current contrast with the history in the "advanced" countries is instructive. Nearly every LAC country in 2015 had youth with far more schooling than was prevalent in the developing world in 1950. Youth in the lagging LAC countries (the 25th percentile) had 9.6 years of schooling in 2015 versus only 7.7 in the leading (75th percentile) advanced countries in 1950. Even the LAC country with the *least* schooling in 2015, Haiti, still had youth with more years of schooling complete (6) than did France in 1950 (4.9).The gap

[4] Using data on younger cohorts captures the dynamics of the shift in schooling better than comparisons of the entire workforce, which is a weighted average across all cohorts, including those who got their basic schooling 40 or more years ago.

between the stock of schooling of youth between LAC and the advanced countries narrowed considerably, from 4.1 years (7.1 versus 3) to only 2.6 (12.8 versus 10.2). No part of a failure of LAC to converge in labor productivity (GDP per worker) with the leading countries can be attributed to any "failure" to expand schooling as rapidly as the "developed" nations.

Figure 1: The expansion of years of schooling has been quite uniformly massive—even lagging developing countries now have more years of schooling complete than the average developed country did in 1960



Source: Author's calculations with Barro-Lee data on schooling.

Figure 1, Panel B shows the change in years of schooling of youth 25-34. The median LAC country in 2015 had youth with 6.7 more years of schooling than in 1950, a truly massive achievement. The expansion the LAC region in absolute years was no different from the non-LAC, non-East Asian, developing countries, which gained 6.6 years.

Even the difference between LAC and the East Asia region is not large, and there are massive variations within each region. The median East Asian country gained 7.5 years versus 6.7 for LAC, so the gain in years was massive for both and only about 10 percent smaller in LAC. And, while some of the star growth performers in East Asia did have larger gains in the stock of youth schooling (Korea, Taiwan, Hong Kong, Malaysia) there are two points. One, not all of the high growth performing East Asian countries had rapid schooling expansion compared to LAC (e.g. Indonesia, Vietnam, China). Two, Bolivia and Venezuela had just as rapid growth in schooling from 1950 to 2015 as did Korea, with strikingly different outcomes in economic growth.

Discussions about education and growth usefully being the basic historical facts about the evolution of schooling and of GDP per capita, as it can change the nature of the questions we then ask and try and answer with research.

One question that need not be asked is "Why did LAC have more success in promoting rapid economic growth than in expanding schooling?" Figure 2, Panel A shows the cross-sectional relationship between years of schooling and GDP per capita for 1960, 1985, and 2015. In each period countries with higher GDPPC have higher years of schooling (this is correlational no discussion of "causality" yet). What is interesting is that this relationship is shifting consistently *upward* so that at any given level of GDP per capita there is much more schooling over time.

Figure 2, Panel B decomposes the gains in years of schooling between the moves "along" the relationship (countries got more years because they were richer) and an upward shift of the relationship (countries got more years over time at any given level of GDP per capita). The average years of schooling of the work force aged population 15-64 increased from 3.45 to 9.01, about 5.5 years.[5] If we compare the actual years of schooling in 2015 versus those "predicted" by the 1960 cross-national relationship at 2015 values of GDPPC the data says that even if a country had constant GDPPC between 1960 and 2015 their years of schooling would be "predicted" be higher by 3.05 years. The reality is that countries have much, much, *more* schooling that growth alone (moving along the cross-sectional relationship) would have predicted.

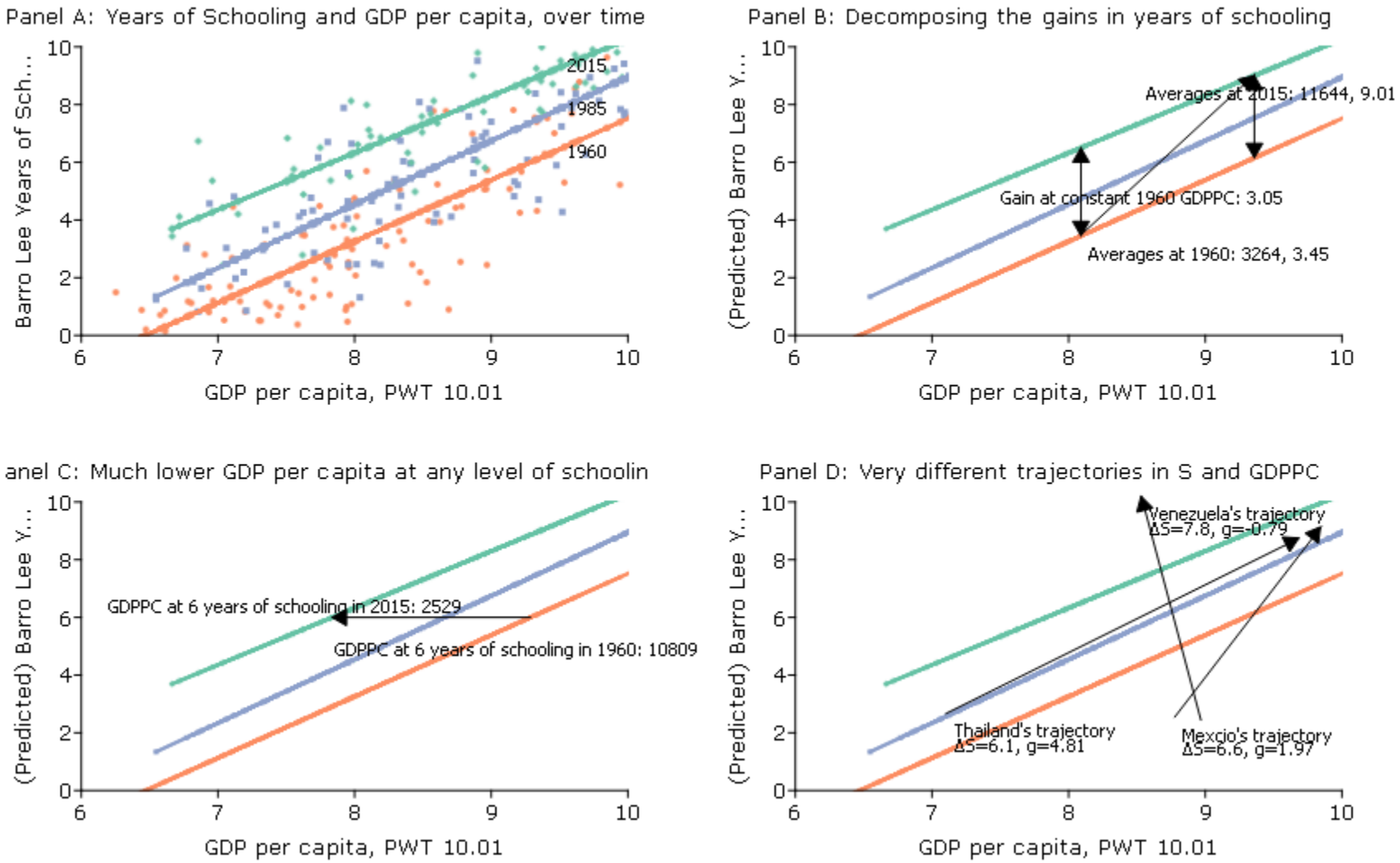
As Lewis (1955) articulates education is "both a consumer and an investment service" and "in so far as it is an investment it contributes directly towards increasing output." By the "consumption" aspect Lewis means that people enjoy fuller, better, more humane lives from being educated, even if this does not contribute directly to economic productivity. Panel C shows that the converse implication of more schooling for any level of GDPPC: less GDPPC for

[5] This is less than the changes in Figure 1 as this is for the entire labor force aged population, not just the youth aged 25-34 and since there was an upward trend this growth is larger for the younger cohorts than older cohorts.

any given level of schooling. In 1960 a country with six years of schooling had GDPPC of P$10,809 whereas a country in 2015 with six years of schooling had GDPPC of only P$2,529. France in 1960 had only 4.3 years of schooling among those 15-64 but with that level of schooling produced GDPPC of P$10,349. In 2015 Haiti has 5.3 years of schooling of those 15-64 but had GDPPC of only P$1,810. The expansion of schooling at lower levels of output is a good thing for human wellbeing, but does raise the question, why cannot countries generate the same levels of output as historically with these higher levels of schooling?

And, while generally there has been an upward shift in the years of schooling at any level of GDPPC (Panels A and B) or less GDPPC per year of schooling (Panel C) there has also been very large variance across countries in the relative pace of expansion of S and GDPPC. Panel D shows three countries with very different trajectories in Schooling and GDPPC. Thailand had about average increase in S (6.1 years) but well above average growth, 4.81 percent per annum (ppa). Mexico had about exactly average growth in S (6.6 years, compared to a median of all other developing countries 6.6 in Figure 1, Panel B), higher than Thailand, and yet about average growth of 1.97 ppa, less than half of Thailand's. In contrast, Venezuela has had much more rapid growth in schooling than the typical country (more than Thailand, more than Mexico) but experienced negative growth averaged over the entire period from 1960 to 2015: -.79 ppa.

Figure 2: Years of schooling went up by much more than GDPPC would have predicted, or conversely, the level of GDP per capita for any level of schooling fell



Source: Author's calculations with Barro-Lee data on schooling and PWT10.01 data on GDP per capita.

I.B) Schooling expansion alone does not drive economic growth

The *percentage rate* of growth of schooling per worker was, on average, almost identical in low economic growth and high economic growth countries (Figure 3, Panel B) and actually slightly faster in the low-growth (2.23 pa) than high-growth (1.90 pa) countries. This seemingly odd fact is just a consequence that the per annum growth of output per worker and the percent per annum growth of the schooling years of the work force aged population over long periods (many decades) are just completely uncorrelated. This is shown for the entire period 1950-2015 (using the longest period of available data for each country) in Panel A and is also true for the 1950-1985 (Panel C) and 1985-2015 periods (Panel D).

Figure 3 shows only correlations but these are sufficient for this discussion, for two reasons. One, while correlations of course should not be confused with causal relationships or the estimates of a "parameter" of any economic model, correlations are raw facts about the world that our theory and understanding of economic processes need to encompass.

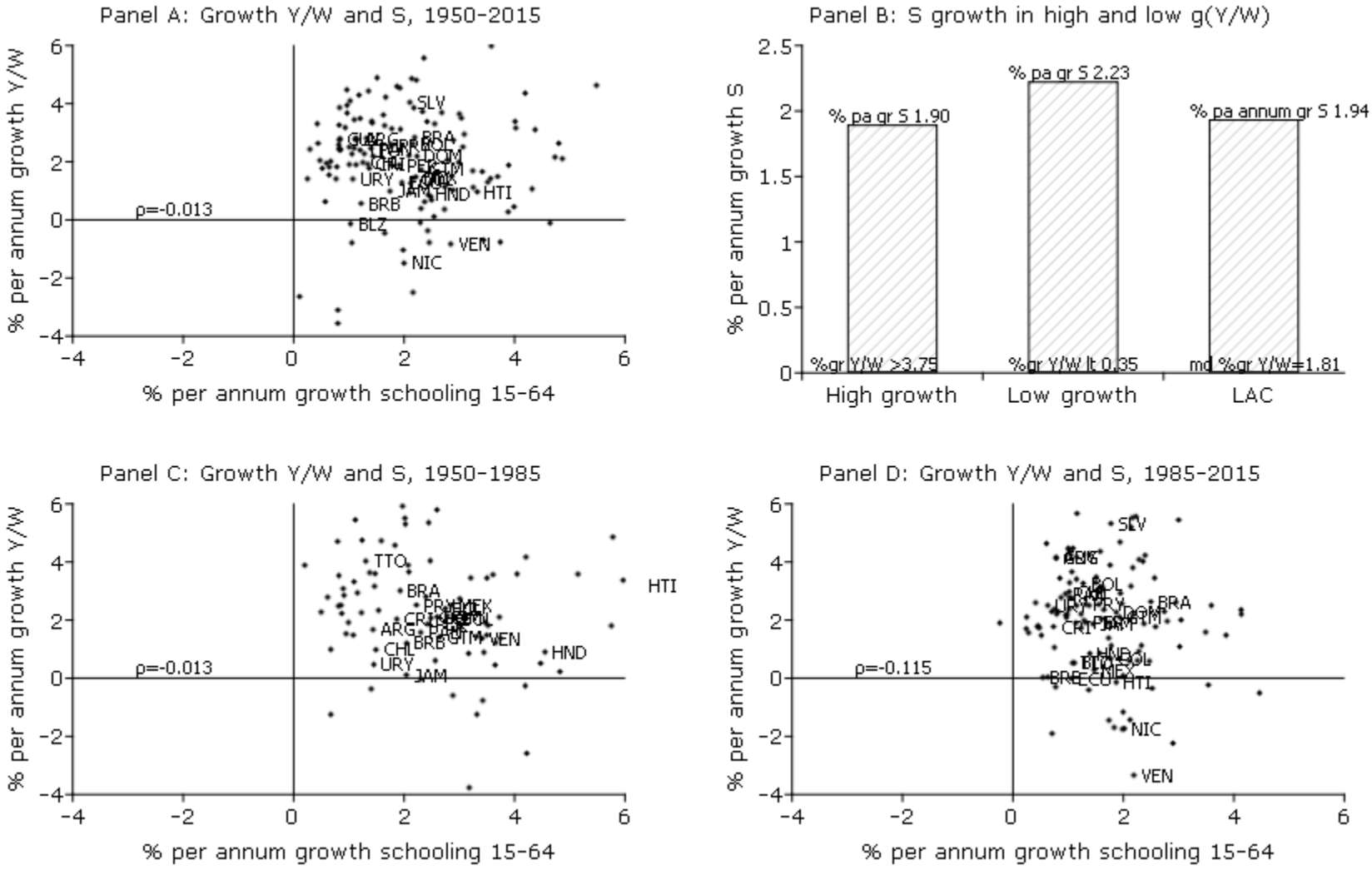
Two, my earlier papers show this finding of a zero correlation between schooling growth and economic growth persists with multivariate regressions that include capital per worker and convergence terms (Pritchett 2001), are robust to measurement of schooling (Pritchett 2001) and are robust across a variety of parameterizations that map from S (years of schooling) to "schooling capital" using micro-economic estimates of returns to schooling (Pritchett 2006)[6].

This lack of correlation drives the title of this paper: "*When does education drive growth and when does it not?*" If the correlation of schooling growth and economic growth was robustly high then the answer everyone expected—that schooling contributes to growth in nearly all/most places—might be adequate, but the correlation (and partial correlation) is not only not high, it is quite robustly very near zero.

The possible reasons why schooling does not uniformly lead to growth can be broken into categories. One is that schooling is not producing the education outcomes (skills, competencies, capabilities, characteristics) that lead to a labor force with higher productivity. The other is that the economy is structured in such a way that, even though the expansion of schooling is producing a labor force with more productive potential, this "higher human capital" is not being deployed into productivity.

[6] These earlier papers also explain why widely cited papers supporting the idea that schooling expansion promotes growth are unreliable. For instance, Mankiw, Romer Weil (1986) is a widely cited paper that estimates a "neoclassical" production function augmented with a measure of "human capital" that shows seemingly plausible magnitude. But they use the level of secondary school enrollment as a proxy for "growth of schooling" when in fact the two are *negatively* correlated (as countries with high secondary enrollment already had high levels of schooling and hence how lower rates of growth) and the use of a flow (enrollment) as a proxy for the growth of a stock (years) only holds as a steady state equilibrium condition, not during a period of large absolute and relative changes.

Figure 3: The percentage growth of schooling and output per worker are not correlated: both high growth and low growth countries had very rapid expansion of schooling, and LAC was typical in both



Source: Author's calculations with PWT10.1 and Barro-Lee updated data.

II) Measured cognitive skills are correlated with economic growth

Starting with the caveat that these are descriptive facts, not to be taken as causative and are less well established than facts in the previous section, I show in this section sectionthe previous two--(i) country economic growth is quite strongly associated with measures of student learning and (ii) there is some evidence of an interactive effect, such that countries gain more in growth from an additional year of schooling of their labor force when their learning is higher.

In recent years there has been a tremendous amount of work creating cross-nationally comparable estimates of the level of cognitive skills in mathematics, reading and science. This is a difficult task as creating comparable assessments as different countries have participated in different assessments at different ages or grades and hence various strong assumptions need to be made to create comparability. Nevertheless, three recent efforts using quite different methods emerge with broadly similar results on both the cross-national levels of learning and their implications for economic growth.

The World Bank Human Capital Index uses a country specific Harmonized Test Score (HTS), which like many assessments is normed so that the average of the advanced countries is 500, to adjust countries' total years of schooling by the amount learned per year. This produces an estimate of the "Learning Adjusted Years of Schooling" (LAYS) relative to a hypothetical country with an HTS of 600. Singapore has the highest HTS, 577, and its total expected years of schooling is 13.9 and its LAYS is 12.8, as the learning is about one grade level lower than the 13.9 LAYS had the learning pace been 600. Chile's HTS is 452 and hence its total years of 13.0 are a learning adjusted (LAYS) 9.4, whereas Guatemala's HTS is 405 (around the LAC median) and hence Guatemala's expected years of 9.7 produce only a LAYS of 6.3 and Dominican Republic, which has the second lowest HTS in LAC of 345 has an expected years of 11.9, an HTS of 345 and hence a LAYS of only 6.6.

The importance of these adjustments is that while, the Dominican Republic is only 2 years of schooling behind Singapore (11.9 versus 13.9) adjusting for learning implies that in "learning equivalents" the DR is far, far, behind Singapore with a LAYS of only 6.6, less than half the LAYS of Singapore.

Even more recently, Gust, Hanushek, and Woessmann (2023) have created estimates of the distribution in each country of the cognitive skills in mathematics and science and with that an estimate of the average student (enrolled in school) and an estimate (discussed below) of the fraction of youth not reaching a standard for "global universal basic skills."

The simple correlations show that countries' level of GDPPC has a much higher correlation with the level of cognitive skills by either measure (HTS was .71 and GHW was .72) than with schooling. Moreover, the additional multi-variate correlation with GDPPC of adding a measure of schooling to either measure of skills is very small.

But what we would really expect is an interactive effect of schooling and learning. With the new cross-national data on both the average years of schooling and data on the level of learning we can do a simple empirical exercise of examining the association of GDP per capita

with years of schooling, the measure of learning (HTS) and an interaction term. The interaction term allows the (partial) association of an additional year of schooling to depend on how much the average worker learned during their schooling and, symmetrically, the gain to improving the measured learning to depend on the average years of schooling. Both of these are, I think, "common sense" and intuitive if one imagines the extremes. What would you expect to be the economic gain (augment to labor productivity) of a worker who attended school for 10 years but learned nothing? While it may not be exactly zero, as people could be gaining some productivity just from the experience of attending school, it seems common sense the gain is smaller than if the person learned the knowledge, skills, and competencies expected from the curriculum and teaching. And conversely, the impact on the aggregate economy of having a spectacularly good system of basic education that no one attended would also intuitively be much smaller than if more people attended at got the education benefits of the schooling.

Angrist et al (2021) use the global learning data to examine how much schooling and learning contribute to explaining levels of GDPPC and growth rates. They show that the contribution of schooling to cross-national GDPPC differences is much higher when their estimates of learning are taken into account. They also show that in explaining growth 2000-2010 their harmonized learning outcomes measures of human capital are robustly associated with growth whereas measures of schooling alone (or the HDI) are not.

As an illustration of the consequences of this type of interactive effects that allow the impact of schooling to depend on learning I use the World Bank HCI data on harmonized test scores (HTS) and their estimates of the level of schooling and estimates of PPP adjusted GDP per capita from the Penn World Table. I run a simple regression of the level of GDPPC on the level of schooling, the HTS and an interaction between the two. Figure 4 presents the results, which I want to stress are meant to be primarily *illustrative* of the consequences of incorporating interactive effects of schooling and learning on economic outcomes rather than definitive "proof" or, even less, as representing causally well-identified estimates (hence I use terms like "impact" in scare quotes).

Figure 4, Panel A shows that there is a positive and strongly statistically significant interactive term of schooling and learning. Panels C and D of Figure 4 illustrate the implications of the estimated interactive term.

Panel C show the 'impact' of adding a school year at various levels of the HTS learning measure. At the low levels of learning in the Dominican Republic (DOM) adding a school year would add almost nothing to GDPPC (the threshold of HTS at which the contribution is zero is an HTS of 328) while at the very high levels of Singapore (SGP) adding a year of schooling would add almost P$10,000. At the LAC average HTS of 405 adding an additional year of schooling is associated with GDPPC higher by P$2,982. But learning outcomes are lower on average in LAC when controlling for GDPPC and the estimated "LAC HTS learning gap" (the value of the binary indicator for LAC in a regression of HTS on a cubic in GDPPC) is 21 HTS points. If the LAC learning gap were eliminated such that LAC countries had the level of learning expected for their level of GDPPC the contribution of an additional year of schooling would by P$3,815. While this is stretching the empirical results to near (or past?) breaking, we

saw in Figure 1 that LAC added, on average, 6.7 years of schooling between 1960 and 2015. If each of these added years had the contribution of higher learning then GDPPC would be higher by (P$3,815/S-P$2982/S)*6.7ΔS=P$5,581 higher, which is 36 percent of its current level.

Panel D shows the symmetrical implication of an interactive effect, which is that the impact of higher levels of learning is larger the higher the levels of schooling. The figures shows the predicted gain in GDPPC from eliminating the "LAC learning gap" of 21 HTS points at various levels of schooling. As LAC's expected years of schooling based on current enrollment rates is just over 12, this implies the gains to GDPPC from eliminating the learning gap would be P$3,985.

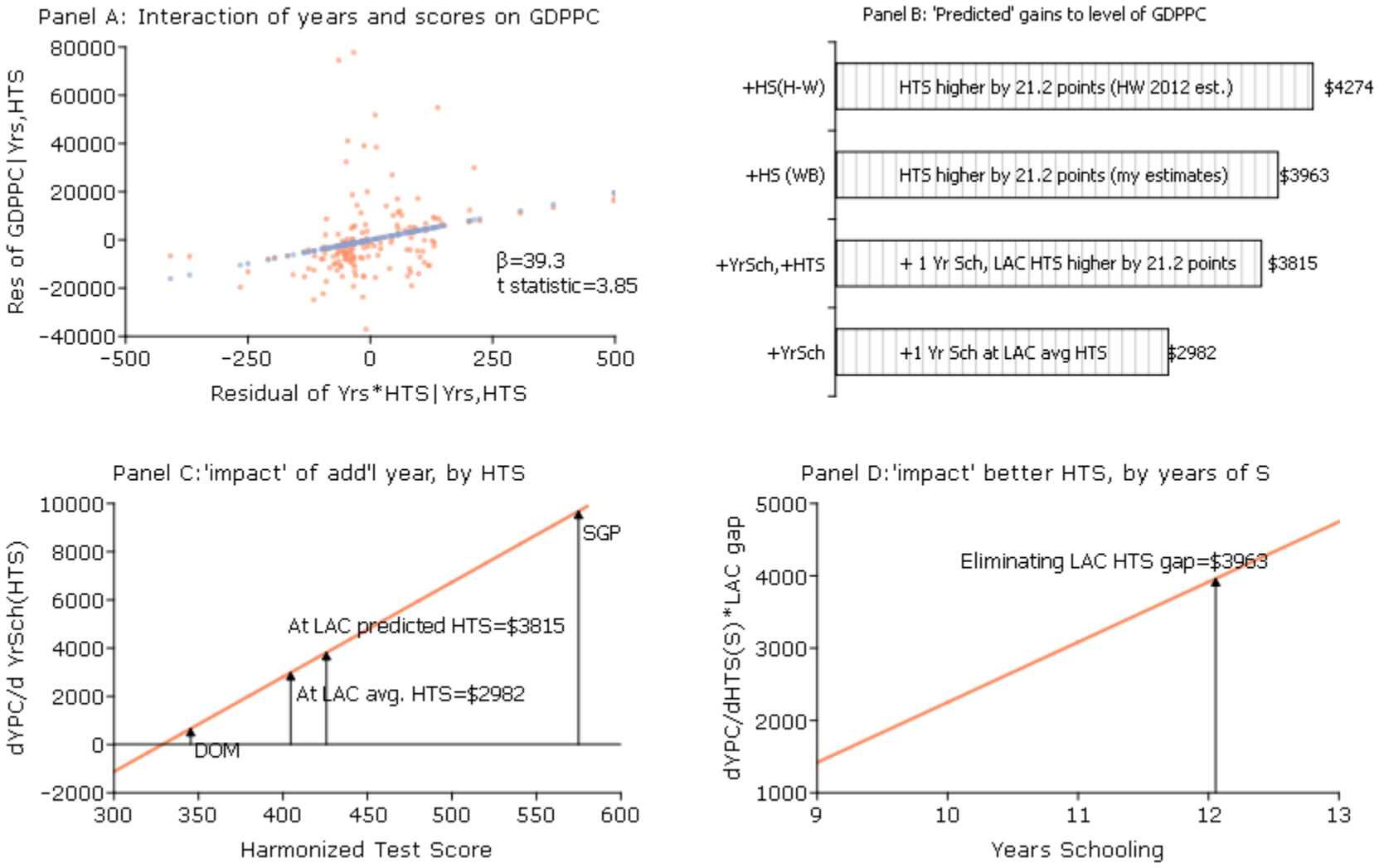
Panel B summarizes the results from the simple interactive regressions from the World Bank HCI data and adds one more estimate. Hanushek and Woessmann (2008, 2012) estimated the relationship between economic growth and a measure of learning they created and their preferred estimate was that a country with learning higher by 100 points (on a similarly normed scale) would grow by 1.98 percent per annum. A simple calculation therefore says that had LAC grown at the rate consistent with learning higher by 21 points from 1960 to 2020 then GDPPC would be higher in 2020 by P$4,274 as growth would have been .4 percent per annum higher (over the actual average LAC wide average of 1.81 ppa). This is consistent with the argument of Hanushek and Woessmann (2012) that a large part of the growth deficit of Latin American is due to its lagging learning outcomes.

The results in Figure 4 are robust to using the GHW measure instead of the HCI, so nothing hinges on the particular methods in estimate cross-national levels of learning.

An overview paper based on a keynote speech is not the place or time to present new results and these results and graphs are meant more as an intuitive and graphical illustration of existing findings in the published literature, which is that the empirical contribution of schooling to economic growth or levels of productivity depends on what happens during that schooling.

I find this completely intuitive as the twin ideas were always that "education" was important and that schooling would result in education. No one ever had the expectation that all of the important beneficial causative effects of schooling on economic (and other social outcomes) depended on "time served" in school alone. So what has really been learned from the experience of expansion to (near) universal basic (primary plus some secondary) education is that some countries have schooling systems that are effective and produce with their years of schooling high levels of learning (skills, competencies, capacities, etc.) and, perhaps more surprisingly, some countries just don't produce much education from their schooling.

Figure 4: More schooling (S) is associated with higher GDPPC the higher the learning (HTS), higher learning levels (HTS) are associated with higher GDPPC the higher schooling (S)



Source: Author's calculations with World Bank HCI data and PWT10.1 GDP data.

Before moving on, I want to emphasize that I am not justifying schooling on the basis of its (narrowly construed) "economic" benefits alone, nor does the idea that learning is key to achieving the goals of schooling apply only to market outcomes. For instance, it is widely accepted that girl's schooling results not only in increased wages but also associated with a variety of other benefits to the woman and her household: greater empowerment, lower child mortality, etc. In a recent paper (Kaffenberger and Pritchett 2021) we use the cross-nationally comparable data from the Demographic and Health Surveys on outcomes, schooling, and a measure of literacy to show that the extent of the non-market gains to women depend heavily on whether women learn to read in school. We show that "basic education"—having attended primary school and learned to read—has three times more impact on four different outcomes (child mortality, fertility, empowerment, and financial sophistication) that the standard estimates of the impact of just attending school.

The goals of education are broad, economic and non-economic benefits to education people and their households, but there is evidence that suggests that achieving those goals via schooling depends on the extent to which schools that are effective at promoting learning.

III) What do the assessments of cognitive skills (like Math) really reveal?

Before the last section, which addresses the second half of my title: "education policies", I want to suggest that empirical connections between specific measures of specific cognitive skills and economic outcomes should be taken very seriously, but not literally. When non-economists hear economists talk about the importance of "cognitive skills" using measures of mathematics, reading, science (or other specific subject domains) they often hear this literally and think some version of "back to basics" or (renewed) emphasis on the "three Rs" is being pushed. And this position is, rightly in many ways, criticized as being both an overly narrow view of what education and learning is about and, on the other side, as not being about "job relevant" skills of either the "vocational" type or the "21st century" skills. But what I am saying is in many ways the complete opposite.

What I am saying is that youth who emerge from their basic education without conceptual and procedural mastery of foundational skills are ill-equipped to apply their "book learning" to concrete life situations and are ill-equipped to adapt to new and novel situations and lack the foundations on which both "vocational" and "21st century" need to be built.

Recently Gust, Hanushek and Woessmann (GHW) (2023) estimated how many youth lack "universal basic skills." They define "basic skills" conceptually as:

> *Consistent with our focus on long-run economic growth, we think of development as minimally requiring individuals to have the skills that would allow them to be successful in economies that look like those of today's high-income countries.*
>
> *[our] definition of basic skill levels may be thought of as a modern definition of functional literacy. Without the necessary skills to compete and thrive in the modern world economy, many people are unable to contribute to and participate in development gains.*

To give that definition a measurable threshold they adopt the convention that "basic skill" requires youth to achieve at least PISA (Programme for International Student Assessment) level 2, which is defined by OECD (2019) as:

> *At Level 2, students can interpret and recognize situations in contexts that require no more than direct inference. They can extract relevant information from a single source and make use of a single representational mode. Students at this level can employ basic algorithms, formulae, procedures or conventions to solve problems involving whole numbers. They are capable of making literal interpretations of results.*

This is a very low threshold of "basic skills" as it implies only that youth are able apply their knowledge only in the simplest possible situations: "no more than direct inference" "extract relevant information from single course", "making literal interpretations of results."

Their estimates, like those of the World Bank HCI, bring together information from all of the cross-national (both global and regional) estimates to create an estimate for (nearly) all countries and hence global estimates. They estimate that in LAC 61.2 percent of those youth who are students, hence enrolled in school at age 15, lack even this low threshold of basic skills.

Table 1: Over 60 percent of youth in Latin America who are enrolled in school at age 15 are not reaching "universal basic skills" in mathematics and science

	Share of enrolled students below basic skills	Share of children not enrolled in secondary school	Share of all children below basic skills
	(1)	(2)	(3)
World	0.631	0.355	0.672
By region			
Sub-Saharan Africa	0.893	0.665	0.941
South Asia	0.850	0.402	0.892
Middle East & North Africa	0.639	0.195	0.679
Latin America & Caribbean	**0.612**	**0.210**	**0.652**
Central Asia	0.400	0.094	0.421
East Asia & Pacific	0.311	0.219	0.354
Europe	0.259	0.102	0.284
North America	0.222	0.069	0.239

Notes: Col. 1: Estimated share of current students who do not reach at least basic skill levels in math and science (equivalent to PISA Level 1). Col. 2: One minus net secondary enrollment rate (from WDI and own imputations). Col. 3: Estimated share of children (incl. those currently out of school) who do not reach at least basic skill levels in math and science. See section 3 for methodological details. Country groups follow World Bank classification.

Source: Gust, Hanushek, and Woessmann 2023, Table 2

This just emphasizes, again, that learning levels are low, but I want to make two novel points.

The first point is that any assessment of a learning domain such as "mathematics" or "science" or "reading" has both a "coverage" element and a "depth of understanding" element and hence, although a student gets a single number as the result of their assessment, this single number has two dimensions.

Two, the reason why many students get such poor results on international assessments is that the *depth* of their understanding of the subject matter is too low and they cannot apply that knowledge. The implication of these two points is that the deeply concerning outcome of poor learning assessment results is not (just) that students last mastery of simple arithmetic even on a procedural level, but that they have no ability to apply that knowledge to practical situations—and that is what is needed to be a productive worker in a modern economy.

III.A) Measures of cognitive skills: coverage and depth of understanding

The first point is that in any comprehensive assessment of the level of skill, competence, capability in any domain, whether academic or practical ("mathematics" or "carpentry" or "tennis") there will be a combination of assessment of skills in "coverage" across sub-tasks ("can you hit a forehand?" hammer?" "can you hit a backhand?") and the "depth" of mastery of those skills ("can you hit a forehand while running?" "can you hit a forehand under competitive pressure"). So conceptually any assessment, even one that produces a single number to characterize performance, is (at least) two-dimensional—one dimension is "coverage" across sub-tasks (a player might have a terrific serve but a very weak backhand) and one dimension is the extent of mastery in each sub-task (a player might hit a backhand well in static conditions but not while moving and under pressure).

Figure 5, which is drawn from Atuhurra and Kaffenberger 2020 and their empirical assessment of the "enacted curriculum" in Tanzania, illustrates this difference between coverage and depth of understanding with mathematics. The "coverage" is topics typically laid out in a curriculum from the concept of number and counting, to arithmetic operations and then more advanced branches and applications of mathematics (e.g. algebra, geometry, probability and statistics). The "depth" can be described in many ways but here I use the five-fold gradation of: "memorize" (just rote repetition) to "procedural/algorithmic" (e.g. knowing how to add two numbers or do division), and onto elements of a more conceptual mastery, "demonstrate" (the ability to demonstrate and explain to others what one is doing and, importantly, why), to "conjecture" (e.g. the ability to make conjectures about the topic and probe them) to "non-routine application" (e.g. the ability to apply skills in new and novel circumstances).

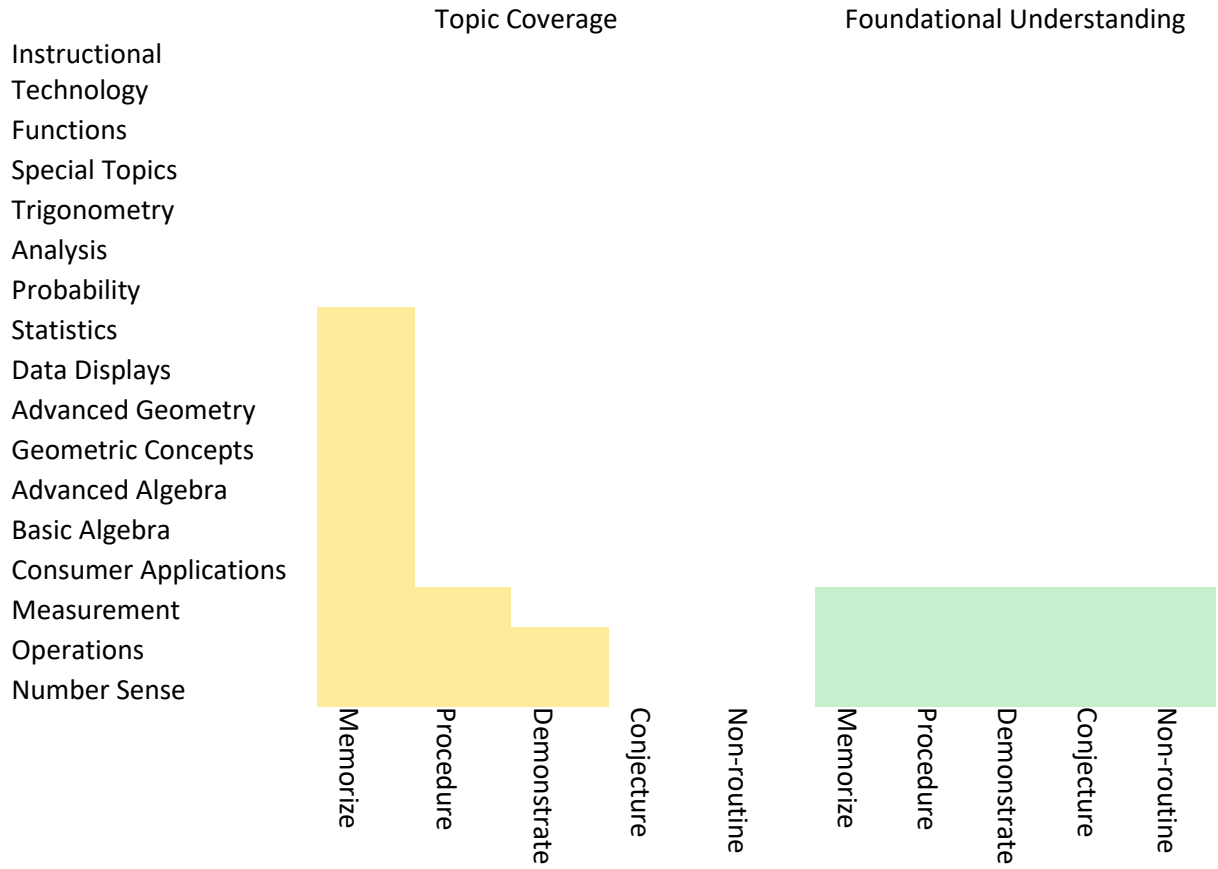
An anecdote and an example help illustrate the difference between "coverage" and "depth." A colleague and friend of mine was educated in "good schools" in South Asia and was the "math topper" on his large country's school leaving examination. He then attended an excellent liberal arts college in the USA and was reluctant to re-take calculus as a freshman as that was one of his strong suits but was forced to enroll to meet the school requirements. A week or so into the class the professor said, almost off-hand, "As we all know, the integral is the area under the curve." This struck my friend as he did not know that. He has been excellent at calculus examinations because he had memorized an enormous number of formulae for how to solve the formula for integration for a wide variety of functions. But nowhere in his "good" education had anyone mentioned or explained that "the calculus" was actually a tool for *calculating* and even what kinds of things (e.g. area under a curve) it was a tool for calculating. His depth of mastery was

A simple example of the kind of assessment question that probes conceptual understanding versus just rote or procedural is one question from assessment in India by Education Initiatives (2009). The assessment asked: "29*28 is more than 28*28 by how much?" If one has the conceptual understanding that multiplication is repeated addition, or skip counting by N, then the answer is obvious easy without doing any computations: 29 28s is is one more 28 than 28 28s so the answer is 28. Moreover, even if one doesn't see this immediately but can express the problem formally and has a sophisticated procedural understanding then one can see

that this question is: 29*28-28*28=(29-28)*28=1*28=28, again without actually doing any multiplications. And even if one cannot see that, one could carry out the two digit multiplications and subtract the results. But the study found that even children who could "do multiplication" when the question was presented in an entirely standard way as a simple procedure: "29*28=?" could not answer this question which is, which, with conceptual understanding, is actually a much easier question.

Figure 5 illustrates two alternative approaches to curriculum, instruction, and teaching across over the course of schooling. The "topic coverage" approach (in yellow) pushes ahead to give exposure to and some limited mastery (e.g. some things are memorized, some formulaic procedures can be carried out) of a variety of topics. The alternative approach, of "foundational understanding" which covers the same "area" (literally, each shape is 15 equal sizes rectangles)—which could represent time devoted or student ability in the given cell—covers fewer topics but pushes for deeper conceptual understanding and ability to use and apply the given topic. In both approaches students will have be taught arithmetic operations like multiple digit multiplication but in the "topic coverage" approach the students understanding will be "thinner" and hence they will be less able to apply their knowledge and skills in arithmetic procedures in either academic or real-like situations in which the need for the skill presents itself in a non-routine way.

Figure 5: Contrasting two approaches to curriculum and instruction that produce equal area in capability but in very different dimensions of coverage versus depth of understanding



Source: Author's illustration, based on Atuhurra and Kaffenberger (2020)

There are two major downsides of the "topic coverage" approach versus "foundational understanding" approach.

The first major downside is in the process of learning itself. The "topic coverage" approach often moves ahead too fast as the "coverage" of the curriculum is often "overambitious" (Pritchett and Beatty 2012) relative to the capability of the schools and teachers to teach and the capability of students to learn. This leads to three major problems.

First, when combined with automatic promotion (which has become the dominant approach to grade and level progression) these leads to students in higher grade classrooms with very heterogeneous abilities and often far behind the mandated curricular content. For instance in Rajasthan India Muralidharan and Singh (2023) found that (i) in eighth grade classrooms (terminal year of elementary) the typical child only had mastery of the grade four curriculum content and hence was many "learning adjusted grades" behind their enrolled grade and (ii) that in an eight grade classroom there were students a relative few students at the eighth grade level and yet many more students who only had mastery of the first or second grade curriculum. This

heterogeneity of student capability in the classroom makes effective classroom instruction extremely challenging.

Second, the instructional practice of moving ahead on topics before reaching conceptual mastery among all (or even most) students the ability to continue to build and expand capability can eventually stall. Beatty et al (2021) examine data on learning from Indonesia that tracked the same youth over time in a household survey (the Indonesia Family Life Survey) that asked some simple questions about "primary school" curricular arithmetic operations and they produced three important findings.

One, progress on ability to answer these questions stopped completely, at every low levels, by about sixth or seventh grade. Of youth 18-10 who has *completed secondary school or higher* only about 11 percent could answer the question "1/3-1/6=?" (a quite simple subtraction of fractions) and less than 20 percent could recognize that 56/84 could be reduced to 2/3. On an index of ability to answer simple questions like this the ability did not increase at all between youth who completed just 7th grade and those who completed 11th grade. The likely explanation is what while students gain a memorization or procedural grasp of "number sense" and "arithmetic operations" they never gain a conceptual understanding or a very deep mastery so that, for instance, many students never understood "factorization" and hence arithmetic operations that presumed that capability and attempted to build on it (e.g. adding or subtracting fractions) could not be effectively taught. That learning progress might slow or plateau at higher grades because of limited learning in earlier grades is a huge concern as that means that expanding school years may have little or no impact on cognitive skills (Kaffenberger and Pritchett 2021).

Two, the Indonesia study found that students who dropped out at earlier grades often did not retain even the skills they had, so that their ability to answer even simple arithmetic questions was lower as they got older. Again, if students only gain procedural mastery in response to very specific prompts and do not gain either conceptual understanding or ability to apply to real-life situations then it is not surprising that the purely procedural skill deteriorates over time.

Three, they demonstrate with this data that, although youth in 2014 had much more schooling than youth in 2000 the average ability in the cohort to answer arithmetic questions actually got worse. This unexpected result that *more schooling* actually led to *less learning* was a combination of the fact that (i) the additional schooling was pushing along a flat learning profile and (ii) the amount learned in each grade fell over time so that students with, say, junior secondary complete in 2014 did less well than students in 2000.

Third, education systems come to be seen by students, parents, and even teachers as "selection" systems rather than "education" systems. Education systems that have a "topic coverage" approach also often employ high stakes for the student examinations to ration access to further education (e.g. secondary school leaving examinations). These high-stakes examinations often probe only for topic coverage and not for depth of understanding so that rote learning, memorization, and test preparation can produce successful results (Burdett 2017). This can result in a vicious cycle where students and parents are, not surprisingly, interested in

producing the test results that provide better life opportunities and don't themselves care about—or put pressure on the education system to promote--depth of understanding (and, in the worst cases, this high stakes pressure for examination results leads to large scale cheating by students and schools (Singh 2020, Berkhout et al 2020)).

III.B) A lack of depth of understanding implies an inability to apply knowledge

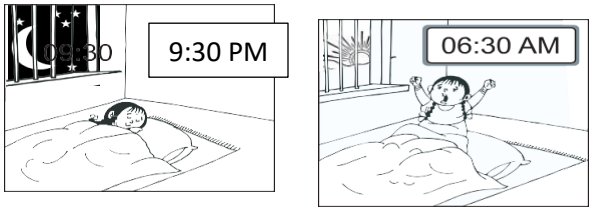
The second, perhaps much more important point, is that youth who emerge from schooling with very low scores on assessments of cognitive skills lack the ability to apply even the modest "procedural" skills or "factual" knowledge to new contexts, and life it itself is a never-ending stream of new demands to apply knowledge. I only have sparse information but I want to illustrate this with three examples of the inability to apply skills in context.

In 2018 the OECD did an assessment of *adults* in key information processing skills of literacy, numeracy, and problem solving (PIACC) which was intended to reflect skills actually needed and used in the labor force. Peru participated in PIAAC and *tertiary graduates* in Peru scored at 227 versus the average across the OECD of adults with *less than high school complete* was 230. The problem is not that tertiary graduates in Peru less functionally assessed literacy as adults than tertiary graduates in the OECD, it is that *tertiary* graduates in Peru have only about the *applied* literacy as adults of OECD *high school dropouts*. This is not to single out Peru, it has about LAC-wide averages on the GHW (402) or HTS (415). The point is that these low average assessments, which reflect a lack of ability to apply skills to non-routine applications, imply that as adults in the labor force workers are going to struggle to carry out functions that are routine in the OECD.

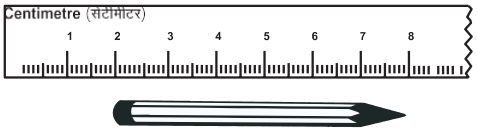
Recent examples of the lack of ability to apply knowledge from rural India are even more striking. In 2017 ASER surveyed Indian rural youth 14 to 18 on their ability to apply literacy and numeracy to simple practical tasks.

On one question in that survey of whether youth could calculate time from a question of how long a girl slept (see the figure in Table 2) only 41.8 percent of those with 8 or more years of schooling answered this correctly. More shock still was that only 54.4 percent of youth who had completed all 12 years of schooling and were enrolled in tertiary studies could answer this question correctly. And in the survey the visual cue was shown and the interviewer read out the question so no reading was needed.

Table 2: Even rural Indian youth enrolled in tertiary education had limited skills in simple practice tasks like calculation time or measurement with a ruler



If this girl sleeps at this time at night and wakes up at this time in the morning then for how many hours does she sleep



Using the scale shown, measure the length of the pencil. Give the answer in centimetres.

Calculating Time	
Level of Schooling	Percent Correct
Less than 8 years completed	41.4
8 or more years completed	26.8
Current Level of Enrollment	Percent Correct
Not enrolled	20.6
Enrolled in grade 12 or less	40.5
Enrolled in undergraduate or other	**54.4**
Measurement (hard)	
Level of Schooling	Percent Correct
8 or more years completed	43.0
Less than 8 years completed	25.4
Current Level of Enrollment	Percent Correct
Not enrolled	19.0
Enrolled in grade 12 or less	41.7
Enrolled in undergraduate or other	**60.1**

Source: ASER 2017, Beyond Basics

Another question on the survey probed their grasp of the *concept* of measurement. One question (not displayed here) showed a key with the base aligned on zero and the tip on 4 and asked "Using the scale shown, measure the length of the key. Give the answer in centimeters." Since this is exactly how measurement is taught in Indian textbooks 88.9 percent of those with 8 or more years of schooling as did 94.1 percent of those enrolled in tertiary. But when the visual cue shown in Table 2 was presented, where the base of the pencil was displaced and started on 2 and the same question was asked the results were strikingly different. Only 43 percent of those with grade 8 or higher answered correctly and only 60.1 percent of those enrolled in tertiary. This implies that 40 percent of youth *enrolled in tertiary education* could not handle even a small deviation of the question from its standard presentation and hence it is not obvious that they really understood the measurement of length at all.

A third example is that in the Indonesia survey above (Beatty et al 2021) youth 18-30 were asked "If 65% of citizens smoke, and the current citizen population is 160 million, how many people do not smoke?" While this question is moderately complex as it involves both calculating the number who smoke and then subtracting to get the number who do not, it is a

pretty standard, run of the mill, question using percentages to get to absolute number. But only 10 percent of students who had completed secondary school (or more) answered this question correctly (adjusted for guessing as it was multiple choice).

The point I am making here is that the concern with low marks on internationally-comparable assessments is not that children in school cannot answer questions about arithmetic operations—which might lead to a "3 Rs" or "back to basics" kind of response. The concern is that the poor performance on math and science reflect very deep lack of the kind of *conceptual* mastery of material that would allow people in their adult lives to use their skills as this *necessarily* involves applying skills to new and non-routine contexts. The response to that has to be a much more thorough-going overhaul of how teaching and learning is being carried out in schools and whether just "more of the same" with more intensity is going to make any difference at all to actual applied competencies.

III.C) The top of the learning distribution is a concern too

One last point on learning outcomes and what they reflect and how that may affect the path of "transformational growth" is that, while the previous sections emphasized that on average learning outcomes are low (WB HTS data) and that most youth in LAC fail to achieve "global universal basic skills" (GHW 2023), it is also the case that there are very few with high performance and even the "advantaged, socioeconomic status (SES) elite" students have very low learning outcomes.

The OECD PISA description for level 4 (or better) sounds like a skill set for the kind of youth one needs in a labor force to generate an ongoing structural transformation and sustained productivity growth:

> *At Level 4, students can work effectively with explicit models for complex concrete situations that may involve constraints or call for making assumptions. They can select and integrate different representations, including symbolic, linking them directly to aspects of real-world situations. Students at this level can utilize their limited range of skills and can reason with some insight in straightforward contexts. They can construct and communicate explanations and arguments based on their interpretations, arguments, and actions.*

Across the three subjects about 28 percent of youth in the OECD reach this level and so one might think of this as a "global quality university ready" level of learning outcomes and it is from students reaching this level that the professionals (engineers, doctors, teachers, scientists, academics, lawyers and judges, doctors) will be mostly drawn.

But the PISA (together with PISA-D) results in Table 3 show that very few youth in LAC are reaching levels 4, 5 or 6. In the lowest performing countries (Guatemala, Paraguay, Dominican Republic, Honduras) less than 1 percent of youth reach this modest level. In the middle tier LAC countries (including the large population countries of Mexico and Brazil) between 2.3 and 5.6 percent reach this level. And even in the "high performing" countries of Uruguay, Trinidad and Tobago, and Chile only about 10 percent of students are emerging from their basic schooling with this level of competence. The LAC average is less than a fourth of the ASEAN (4.3 vs 17.2) and about one seventh of the OECD (4.3 vs 28.3). I include Vietnam as it

is very high performing poor country—with 26 percent reaching level 4 or above--which demonstrates that achieving OECD levels of learning is possible even in a very resource poor country.

Table 3: Very few youth in LAC reach PISA level 4 or above, achieving much lower levels than ASEAN or OECD

Country	Mathematics	Reading	Science	Average
Guatemala	0.1	0.7	0.1	0.3
Paraguay	0.0	1.3	0.2	0.5
Dominican Republic	0.2	1.4	0.3	0.6
Honduras	0.6	1.2	0.3	0.7
Ecuador	1.2	4.2	1.4	2.3
Peru	3.1	3.8	2.2	3.0
Mexico	3.5	4.5	2.5	3.5
Costa Rica	2.3	5.9	2.9	3.7
Colombia	2.7	8.0	4.5	5.0
Brazil	4.0	7.8	4.9	5.6
Uruguay	7.9	11.8	8.7	9.5
Trinidad and Tobago	10.0	11.6	8.7	10.1
Chile	7.8	14.7	10.3	11.0
LAC average	3.3	5.9	3.6	4.3
ASEAN average	19.4	14.0	18.2	17.2
Viet Nam	27.5	18.5	32.1	26.0
OECD average	29.3	28.8	26.7	28.3

Source: Author's calculations with data from OECD PISA results 2015 and PISA-D combined, Tables 9 (reading), 30 (Mathematics), and 51 (Science).

While inequality in educational opportunity and learning outcomes across social groups and between the poor and the rich is a major concern, the main problem LAC faces is not that certain groups are "excluded" from a high quality education available in the public sector schools to the "middle class" or even "the elite" but rather that even the advantaged and better off students in public schools are receiving a globally mediocre education. Pritchett and Viarengo (2023) look at learning outcomes for students who are "advantaged" (male, urban, non-immigrants, native speakers of the language of instruction) and who are in the top 5 percent of the PISA SES indicator (and hence, in a sense, the SES elite) who are in public schools. They show than the predicted PISA Math score for this advantaged, elite group of students was 369 in Honduras and Paraguay, 383 in Guatemala and 413 in Ecuador—whereas the GHW standard for "global universal basic skills" is 420. So in the low to medium performing LAC countries the advantage elite are mostly "excluded" from a quality public sector education, not because of who they are but because the system is so weak for anyone.

IV) Education systems that creating valued learning outcomes

Being clear about my three points about the first question of the title: "When does education drive growth and when does it not?" does has taken up a lot of words and so leaves little space in my 10,000 word limit to address the second half of the title: "education policies for transformative growth." Fortunately, as I recently completed a separate 10,000 word essay on how to address the learning crisis (Pritchett 2024), which draws on an earlier policy brochure which synthesizes the lessons from the RISE (Research on Improving Systems of Education) project (Pritchett, Newman, Silberstein 2022) I can be brief and point the interested reader to these more elaborated explanations elsewhere.

First, what will need to happen in order to improve existing education systems to provide the education needed to drive and sustain transformative growth is not well described as just "policies." A much broader change to the "system" of education (which is much, much, more than the "policies" being implemented by the Ministry of Education). The existing systems of education were built to do what they did do: get every kids butt in a seat, year after year, until they could be given a degree. These systems are built around "high modern" bureaucracies (in the sense of James Scott 1998) which are aimed at achieving accomplish logistical tasks (e.g. expand enrollment) using the perennial tools of bureaucracies: process compliance and the utilization of "thin" in puts (as the opposite of "thick" in the sense of "thick description" of Clifford Geertz 1973). They therefore are not "fit for purpose" for promoting the kind of learning needed for transformative growth as they are fundamentally not accountability systems that are "coherent" for learning (Pritchett 2015, Kaffenberger and Spivack 2022) or "purpose" driven systems focused on learning (Kaffenberger 2022b). Attempting to tack learning promoting "policies" onto the existing systems will mostly fail.

Second, everyone should expect sustained progress in accelerating learning to be hard, indeed, very hard for three reasons--but, thankfully, improvement is not impossible. One reason we should expect system reform to be hard is that sustained, successful, reforms that produce large gains in learning are rare whereas outcomes that are "good" and "easy" are common (like expansion of schooling). McKinsey Global Institute's (MGI) (2024) recent report on improving education systems details that most education reforms fail (and lists the many ways that even promising reforms tend to fade). A second reason why we should expect education system reform to be hard is that it requires a strong and sustained political commitment. The politics of "schooling" is just much easier than the politics of learning. Narratives of education reform by academic outsiders (see Schieder, Estarellas, and Bruns 2019 on Ecuador's reforms 2006-2017) or by insiders (see Saavedra (2019) on Peru) reveal just how many stars have to align to initiate and sustain reform (and many/most of the accomplishments in Peru are being reversed). Three, we should expect education system reform to improve learning to be hard because the existing education systems succeeded at their objectives. What is needed for "education policies for transformative growth" is going to one of the hardest things for organizations, systems, or countries to do: shift from a strategy that has produced success to a new strategy. The tendency to "stick with what works" and resist change is strong, deep, and old: even 2000 (or so) years ago Jesus taught that "No man also having drunk old *wine* straightway desireth new: for he saith, The

old is better." (Luke 5:39) (and I use the old King James Version translation to make my point about thinking the old is better).

That said, not impossible. Vietnam is a striking exception to the "rule" that learning performance is low in low-income countries as it has OECD level learning outcomes. A careful study of Vietnam's success gives hope (to me at least) as it was not the result of some masterful, well-executed, top-down plan of a few heroes, but rather the emergent outcome of a complex and messy struggle (London and Duong 2023). Crouch (2020) examines lessons from four successes, two sub-national (Sobral in Ceara Brazil, the Puebla state in Mexico) and two countries (Kenya and Chile)[7]. The MGI study examined 14 systems that were "beating the odds" including 7 countries that were "sustained and outsized improvers" (only one, Peru in LAC), two "emerging improvers," and four sub-national improvers (again, only one, Caera Brazil, in LAC).

Third, successful changes in education systems are going to be based on common principles, with the exact instantiations of those principles to be worked out in a highly contextual way. That is, there is no "blue print" and the likelihood of just transplanting even "evidence based" policies from one context to another is slim (Muralidharan and Singh 2020)—even transplanting "demonstrated effective" policies from one implementer (NGO) to another (government) in the same country often fails (Bold et al 2018). Just as every country has its own past, every country will have to write its own future.

Fourth, and last, here is my best shot at the five actions that will drive success (Pritchett 2024, Prichett, Newman and Silberstein 2022).

- *Commit* to learning results, and in particular, early universal conceptual and procedural mastery of foundation skills.
- *Measure* learning outcomes in ways that provide information that is regular, reliable, and relevant to the key actors within the system, including much more use of formative assessment.
- *Align* the system around learning, moving from a focus on expansion to a focus on learning.
- *Support* teaching, moving the emphasis from a bureaucratic approach to creating the possibility that teachers consistently engage in effective teaching and learning practices.
- *Adapt* what is adopted so that, even when copying lessons from successful places, these are adapted to existing contexts and capabilities.

These might all sound like "common sense" or "truisms" but each is a substantial departure from the widespread and common practice of most education systems.

Conclusion

A 75th anniversary is a time to reflect on the achievements of the past and consider what it will take to create the next state of needed achievements over the next 75 years.

[7] Stern, et (many) al (2021) identified eight candidates for "learning at scale" but was focused on successful *programs* that operated at scale rather than country or system wide reforms.

The old strategy of thinking of “more human capital” and “spending more years in school” and of thinking of “invest in human capital” as “spend money on schools” was wildly, phenomenally, successful. Countries in LAC have done in the last 75 years from completing basic schooling and even higher secondary schooling being rare and limited to a small elite, to being ubiquitous, nearly universal.

But the success was limited to schooling and has, and is, producing youth who are schooled but not educated. The response to raising concerns about the quality of education within schools has always been met with the response that just building out the system and providing schools with adequate inputs, trained and adequately compensated teachers were the order of the day and that “we will cross that bridge when we come to it.” Well, LAC has come to the bridge. More of the existing systems, even with tinkering here and there, or more spending on this and that, will produce more of the same. It is time for countries—and this includes intellectuals, educational professionals, politicians, parents, business, and students—to agree what is needed is the commitment to build the bridge into a future of better education for all.

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