Should Governments and Donors Prioritize Investments in Foundational Literacy and Numeracy?

David K. Evans and Susannah Hares

Abstract

Students around the world lack foundational literacy and numeracy (FLN) skills at striking rates. This essay examines the potential channels by which FLN investments and skills—which most systems teach in the early grades of primary school—may impact later schooling and subsequent life outcomes and the existing evidence for each channel. We find suggestive evidence for widening trajectories in school between students who master FLN skills in early grades and those who do not, although other factors may also explain the widening gaps. We find mixed evidence on the returns to FLN skills in earnings and other adult outcomes. We discuss new evidence from high-income countries suggesting that investments in pre-primary and early primary may not actually deliver the highest returns, and new evidence from low- and middle-income countries situating FLN investments among investments in other skills. We also discuss political obstacles to FLN investments. FLN skills are clearly essential for a growing, equitable society, but the distribution of investments in these and other skills—and the timing of those investments, in early primary or later in the course of an individual's education—requires clear-eyed thinking about the relative returns of these investments and the challenges in their implementation.

Keywords: foundational literacy and numeracy; education; cost-effectiveness

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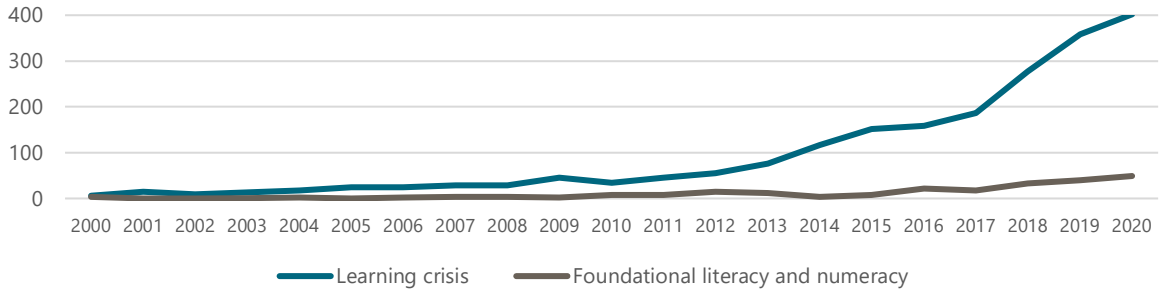
Contents

1. Introduction

How can education systems better equip children and youth to enter the workforce and the world more broadly? Education systems are tasked with building a wide range of skills: literacy skills, numeracy skills, reasoning skills, socio-emotional skills, technical skills, and others. Children and youth in many countries do not master basic literacy and numeracy skills, despite years of education (Pritchett and Sandefur, 2020; Spaull and Taylor, 2015). Likewise, students who exit high school, vocational training programs, and universities often lack the skills those programs are expected to deliver (Arias et al., 2019). Too few children have access to cognitive stimulation in early childhood (Grantham-McGregor et al., 2007). This wide range of needs yields the question: with education systems around the world struggling in many ways, which skills—and at what point in students' lives—make most the difference to students' long term outcomes?

One skill set that receives high priority from international orgnaizations is foundational literacy and numeracy (FLN) skills. One of the targets for the fourth Sustainable Development Goal (SDG4) is to "ensure that all youth and a substantial proportion of adults, both men and women, achieve literacy and numeracy" (United Nations, 2016). In recent years, both the concepts of a "learning crisis" (the problem) and of "foundational literacy and numeracy" (the solution) have gained in popularity (Figure 1). The World Bank has popularized the "learning crisis" (World Bank, 2018) and introduced the concept of "learning poverty," focused on reducing illiteracy in early years (World Bank, 2019a). The concept of the "learning crisis" now underpins the philanthropic strategy of large and influential foundations (Beeharry, 2021; Bill and Melinda Gates Foundation, 2020). In some cases, this case for prioritizing FLN above other skills is made explicitly (Beeharry, 2021); in other cases, if the vast majority of resources from a given donor are directed to FLN, the case is being made in practice.

Figure 1. Reports and articles with the phrases "learning crisis" or "foundational literacy or numeracy"



Notes: These results come from year-by-year searches for these phrases (in quotes) in Google Scholar.

There is a certain intuition to the emphasis on FLN: many other skills hinge on mastery of basic literacy and numeracy. But not all skills do. Many technical skills and socioemotional skills, while likely complemented by literacy and numeracy skills, may not strictly require them. These skills improve both longer term educational outcomes and life outcomes, increasing employability. For example, students in the U.S. who attend high schools that are better at developing socio-emotional skills—separate from their effectiveness at producing better test scores—are more likely to go on to four-year universities (Jackson et al., 2020). If the ultimate goal is not literacy and numeracy but rather the lifetime well-being of individuals, then these other skills may compete for attention. Likewise, education systems face trade-offs between investing additional resources to ensure that every child achieves FLN and using resources to ensure, among students already attaining FLN, that some become engineers, doctors, teachers, and other skilled professionals to generate employment opportunities for others (including for those who have not yet achieved FLN).[1] FLN skills may have inherent value beyond their instrumental value, but other skills (such as socioemotional skills) and other investments (such as keeping children safe from abuse or free from hunger at school) also have inherent value.

Thus, FLN skills are not the only candidate for marginal investment (e.g., the next $100 of spending). Governments, students, parents, donors, and other stakeholders may demand an emphasis on different skills. A recent survey of policy makers in low- and middle-income countries revealed that FLN was solidly in the middle of their list of stated priorities (Crawfurd et al., 2021). Furthermore, those policymakers, when faced with hypothetical funding trade-offs, were significantly more likely to choose technical and vocational education.

In this paper, we examine the evidence for investing in foundational literacy and numeracy skills, along with the evidence on when to invest in those skills. In this context, foundational literacy and numeracy skills refer to basic skills (usually included in the curriculum of early grades) in reading, writing, and mathematics, upon which other skills may be built. (However, we also provide evidence that these terms are often ill defined.) A variety of programs invest in FLN skills at different stages in the educational life cycle, from building blocks in early childhood to adult remediation. We discuss potential channels by which FLN may affect later outcomes—in school and in life—and synthesize the available empirical evidence on the effectiveness of those channels. We examine data on alternatives to FLN investments and their relative costs. We also discuss obstacles to FLN investments in low and middle income countries.

In summary, we find a wide array of evidence demonstrating associations between FLN skills and subsequent cognitive ability and staying in school, which seems to deliver its own benefits (Kaffenberger and Pritchett, 2020). We also find ample evidence of associations

[1] One might respond to this that education is a human right (UNESCO, 2020a) and so of course should be provided to all children. We unequivocably support the vision of a society where every child masters FLN (and much more). Unfortunately, in environments where many rights remain unfulfilled, policymakers must make decisions prioritizing some over others.

between FLN skills, economic outcomes in adulthood, and even human capital investments in the subsequent generation.

However, little or no evidence is able to isolate the impact of FLN skills from a host of other characteristics that may be associated with those skills. In other words, the students who master FLN skills may be different from other students in many ways (e.g., parental support, student motivation, and household income), and most studies cannot isolate those. While FLN skills yield certain inarguable benefits, the case for prioritizing universal FLN ahead of all other investments remains to be made quantitatively. This essay does not make a case against investing in FLN; rather, it highlights what we know and what we need to learn about the returns to FLN, and it proposes that other educational investments may deliver comparable returns even in the absence of universal FLN.

2. The current state of FLN in low- and middle-income countries

A first indication of whether individuals in low- and middle-income countries master FLN is the adult literacy rate, since adults have completed their education. The UNESCO data for 2018 suggest that adult literacy is under two-thirds in low-income countries (61 percent), but much higher in middle-income countries (86 percent). For younger cohorts, those numbers are higher: nearly three quarters of 15–24 year olds are literate in low-income countries (73 percent), and 93 percent are literate in middle-income countries (UNESCO, 2020b). These numbers should be treated with caution, as in many cases, literacy may be self-reported and so may include a broad range of levels of ability. A simple literacy test—literally, just asking women to read a sentence—included in the recent Demographic and Health Surveys reveals that literacy for women age 15–49 across 51 low- and middle-income countries is low: "57 percent of women could not read a single sentence" (Pritchett and Sandefur, 2020). Assessments with younger children likewise suggest a lack of mastery. Applications of the Early Grade Reading Assessment in low-income African countries and lower middle-income Latin American countries reveal far lower levels of fluency than in high-income environments (USAID, 2020).

Comparable numeracy numbers are even harder to come by (Gal, 2016). Botswana is the only country in Sub-Saharan Africa to take part in the 2011 Trends in Mathematics and Science Study (TIMSS), and those results show that Grade 6 students in Botswana performed far worse than Grade 4 students in other upper middle-income countries. On a regional test, students in Botswana performed better in math than those in most other Anglophone African countries (Bethell, 2016). In Kenya, the Uwezo survey reveals that less than half of third grade students (47 percent) can do second-grade math work, with numbers just slightly higher for girls than for boys. Between students from households classified as poor versus non-poor, the gap is nearly 15 percentage points (Uwezo, 2016). All of this evidence—and much more—demonstrates that many children and youth lack foundational literacy and numeracy skills.

3. What do foundational literacy and numeracy mean?

Foundational literacy and numeracy have no consentaneous, technical definition. The World Bank (2019b) references the importance of "foundational skills in literacy, numeracy, and basic reasoning" but without a clear definition of which literacy and numeracy skills those include. The Bill and Melinda Gates Foundation's Global Education Program places an emphasis on "foundational learning in primary grades" (Bill and Melinda Gates Foundation, 2020). Beeharry (2018) refers to "foundational learning" and provides "reading and mathematics in primary grades" as examples. But what exactly are these foundational skills?

We can start with a general definition of literacy and numeracy, provided by the Program for International Student Assessment (PISA) (Ball et al., 2014):

> "Literacy (or reading literacy) is the capacity to understand, use, and reflect on written texts in order to achieve one's goals, develop one's knowledge and potential, and participate in society.
>
> "Numeracy encompasses a range of skills from basic arithmetic and logical reasoning to advanced mathematics and interpretative communication skills."

Obviously, both of these definitions encompass a broad range of skills within literacy and numeracy. To narrow the field for this discussion of foundational literacy and numeracy, Nag et al. (2014) provide three targets for "foundation learning": (1) oral language skills (i.e., listening comprehension and recognizing parts of words, either syllables or phonemes, called "phonological awareness"), (2) a logical approach to problem solving along with "knowing how to count and the relations between numbers," and (3) "skills that underpin inference making." They reference these as true "foundational" skills, i.e., skills that "can be developed prior to primary school." The World Bank (2019b), in defining "learning poverty," sticks to literacy alone: "Learning poverty means being unable to read and understand a simple text by age 10." Belafi et al. (2020), alternatively, reference "foundational skills" as "basic literacy" and "basic numeracy" and—while not providing a strict definition—reference these as skills that most curricula expect students to have mastered by fourth grade. Chiplunkar et al. (2020) characterize foundational skills as those tested by the ASER instrument: "up to Grade 2 level reading skills and up to Grade 4 level mathematics ability." The Uwezo assessment in East Africa aims to cover student skills covered in the curriculum through Grade 2 and covers, for literacy, "reading a letter (letter sounds), reading a word, reading a paragraph and reading and comprehending a short story," and for numeracy, " number recognition, place value and performing basic operations of addition, subtraction and division" (Uwezo, 2013).

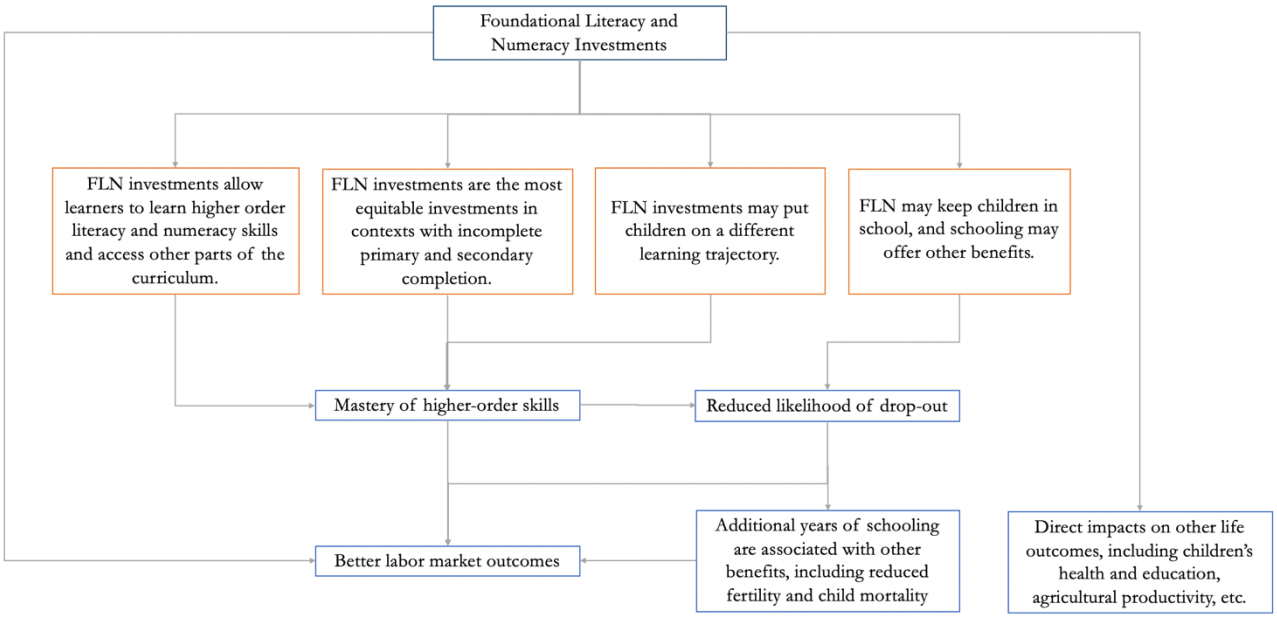
For the purposes of this paper, when we refer to "foundational literacy and numeracy," we follow the Uwezo example and reference the literacy and numeracy skills that are commonly covered in the curricula of the first two years of primary. Although those skills are usually covered in those initial years, they may in practice be covered at various stages in the life cycle, including in adulthood. But it is worth noting that these terms are often ill-defined in

common parlance, which means that different parties may be referencing very different sets of skills.

4. Potential channels by which FLN investments may yield benefits

There are several ways in which FLN investments benefit children and adults. In this section, we lay out those potential benefits or channels of impact and the evidence in favor (or against) each. An important distinction is between FLN investments in general and FLN investments in the first years of primary school. Adult education programs often focus on FLN, but many of the potential gains are distinct. Figure 2 maps several theoretical pathways between FLN skills and life outcomes.

Figure 2. Potential pathways between FLN skills and life outcomes



Notes: Constructed by the authors.

Potential benefits of FLN at any stage

4.1 FLN investments allow learners to learn higher order literacy and numeracy skills and access other parts of the curriculum.

Students cannot learn algebra without arithmetic, and they cannot read a history book or a mechanics manual if they cannot read a letter or a word. As we think through the channels of FLN skills, this is the most obvious. For example, students in Botswana were asked to do a simple mathematics problem involving fractions. Students who knew addition were 50 percent more likely to get the right answer than those who did not, and students who knew subtraction were 37 percent more likely to get it right than those who only knew addition.

Foundational numeracy unlocks the door to higher order operations in arithmetic and beyond (Angrist et al., 2021).

4.2 FLN investments may yield benefits separate from schooling.

Increased literacy rates are associated with other outcomes. One of those outcomes is educational outcomes for children in the subsequent generation. Adult literacy is associated with better children's educational outcomes at scale in India (Chudgar, 2009), and while that study does not separate the impact of literacy from education, experimental evidence from India shows that providing adult literacy classes for mothers increased children's math scores, at least modestly (Banerji et al., 2017). There are many studies indicating that more educated parents have more educated children, but again, many of these studies do not distinguish between parental education and parental literacy (e.g., Andrabi et al. 2012 or Abuya et al. 2015). Other studies show associations between activities like mothers' book reading (which one might presume requires literacy skills) and children's literacy skills, although it is difficult to infer a causal relationship since mothers who read books are likely different in ways the researchers are unable to control for (Ong'ayi et al., 2020; Yildirim and Roopnarine, 2019). That said, experimental evidence shows that even illiterate mothers can use storybooks to benefit their children: a randomized controlled trial in Kenya showed that providing culturally appropriate children's storybooks combined with training parents in how to use them increased reading together and children's vocabulary, and the benefits were just as large for the children of illiterate caregivers (Knauer et al., 2020). Ultimately, while there is wide evidence showing associations between parental education—especially mothers' education—and children's literacy, convincingly causal studies are few, mostly because few studies can separate literacy from schooling, with the exception of the experimental Banerji et al. (2017) study mentioned above.

Another area with a demonstrated association between literacy and outcomes is health outcomes in the next generation (Mathew, 2012; Mensch et al., 2019; Taylor et al., 2016). As with children's educational outcomes, most of these studies show associations between mothers' literacy (or educational attainment without literacy) and children's health outcomes without convincingly demonstrating a causal impact. Since women who attain literacy vary from those who do not in many ways, disentangling these impacts is a challenge. Most natural experiments are able to disentangle the impact of education from other factors but not literacy (Mensch et al., 2019).

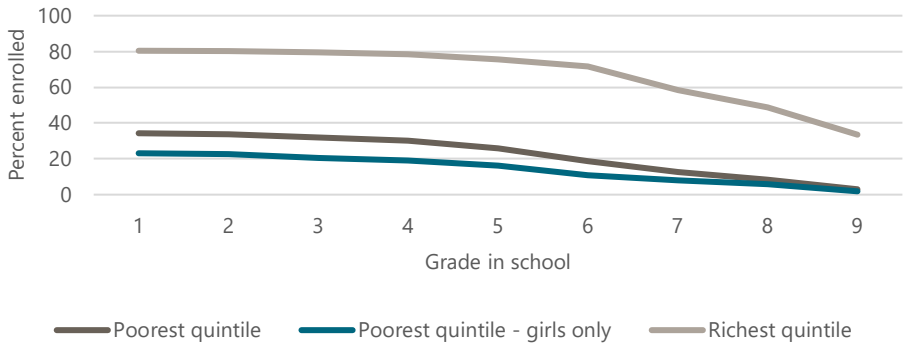
Another outcome with a demonstrated association with literacy is agricultural productivity. In India, one study showed a positive, significant link between literacy and both crop productivity and farm modernization (Mittal and Kumar, 2000). However, the study does not control for education, so the literacy variable may capture either the impact of other skills gained in school or the impact of other factors associated with literacy. Other studies show an association of education with agricultural productivity—for example, in Cameroon (Djomo and Sikod, 2012) or in India (Paltasingh and Goyari, 2018)—but these studies do not measure literacy and may not convincingly isolate a causal impact.

Potential benefits of FLN in the early years of primary school

4.3 FLN investments are among the most equitable investments in contexts with incomplete primary and secondary completion.

In low-income countries, only 65 percent of children complete primary school.[2] As a result, educational investments in the early years of school are more likely to benefit all children. Since poorer children are more likely to drop out of school, investments in the first years of primary school are among the most progressive. Figure 3 demonstrates this using data from Mali. If Mali were to spend $100 per student in first grade, then one in three children in the poorest income quintile (and nearly one in four girls in the poorest income quintile) would benefit from that spending. But by ninth grade, less than five percent of children in either of those groups is in school, so spending $100 per student in those higher grades would disproportionately benefit richer students.

Figure 3. School enrollment by grade for different groups in Mali



Source: Adapted from World Development Report 2018 (Figure 2.6), based on data from the Mali 2012 Demographic and Health Survey.

In many countries, enrollment in the initial grades of primary school is nearly universal and so spending in those years is relatively progressive. This is not inherent to FLN, but most teaching in the early years of primary school is focused on FLN. Likewise, even outside of primary school, second-chance education programs (e.g., remedial education for adolescents) often focus largely on FLN and, because they disproportionately benefit poorer learners, are likely to be the most progressive. That said, even within this channel, other broad-access investments compete for resources: school feeding in the early grades, for example, is arguably just as progressive as FLN instruction and delivers a range of benefits (Evans and Mendez Acosta, 2021; Wang and Fawzi, 2020).[3]

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[2] World Development Indicators for 2019.

[3] Although Wang and Fawzi (2020) is a protocol for a systematic review, it includes a detailed summary of previous reviews on the impacts of school feeding.

4.4. FLN investments may put children on a different learning trajectory.

Mastery of FLN skills, proponents argue, may not just increase the level of student learning: it may put them on a different trajectory, so that they subsequently learn at a faster rate than children who have not mastered those skills. Various studies provide suggestive evidence in favor of this, although we should not set the bar too low for establishing this channel. The simple fact that students who do poorly in school in the early years then go on to perform poorly in school in later years, while not contradicting this hypothesis, is also not clear evidence in favor of the importance of FLN mastery. Rather, it could be that students who perform poorly in both early and later years have poor parental support, low household income or lower baseline cognitive ability, and that these effects compound over time. Of course, cognitive ability can change, but initial endowments still likely matter. And studies may attempt to control for household income, but they usually do so very incompletely, proxying with assets or parental education.

We propose that there is suggestive but inconclusive evidence for the hypothesis that FLN investments put children on a different learning trajectory. There is significant evidence that students who do poorly in school in early years also do poorly in school in later years. Most recently, Carter et al. (2020) follow the same students in Ghana over time and find that students with initial low performance continue to have low performance later. But there is no evidence of widening trajectories over time; if anything, trajectories narrow over time (see Figure 4A below), going against the idea of a trajectory effect.[4] Alternatively, Spaull (2013) marshalls various sources to show that students in South Africa perform badly in early grades and also perform badly—and potentially worse relative to grade norms—in later grades (Figure 4B). Likewise, Muralidharan et al. (2019) show that the deficit between average attainment and grade-expected norms grows over time among students in urban India, but they are not following a given set of students over time (Figure 4C). The latter two studies are consistent with poor FLN making it difficult to catch up. But they are also consistent with low-productivity education systems where students fall further behind each year (regardless of their FLN mastery), or poor home environments that—again—lead students to fall further behind each year. It does not provide evidence that if learners mastered FLN, they would be immunized against subsequent widening trajectories.

Spaull and Kotze (2015) show that the gap between the wealthiest 20 percent and the poorest 60 percent of students increases by one total grade level over the course of the years between Grade 3 and Grade 9 (Figure 4D). They argue that "the later in life we attempt to repair early learning deficits in mathematics, the costlier the remediation becomes." Truly, any given learning deficit will be least costly to remedy before it compounds with other deficits, and since FLN skills are -- by definition -- the foundation, correcting those earlier will likely be cheaper.

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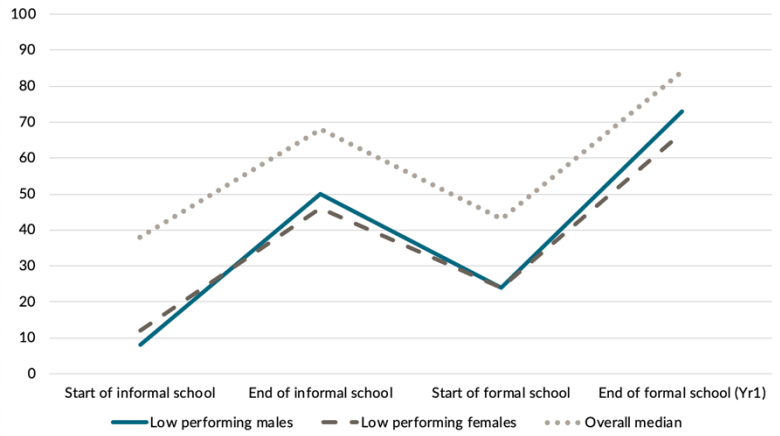
[4] Carter et al. (2020) seek to overcome the problem of mean reversion (i.e., that learning trajectories often appear to narrow just because the worst and best performing students reflect bad or good luck on a given test rather than true skill) by drawing on two assessments at baseline rather than one.

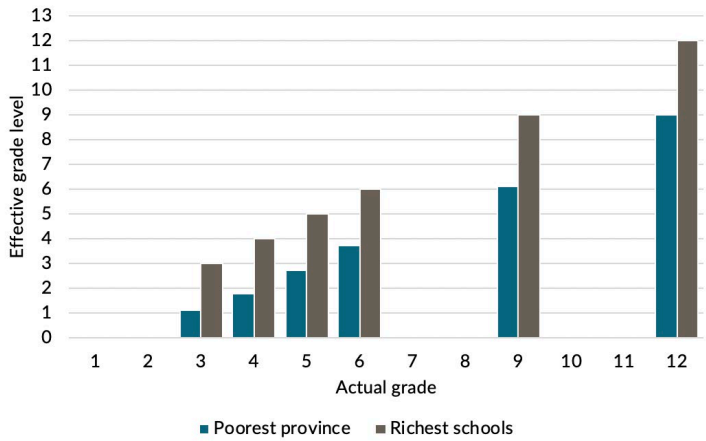
Figure 4. Evidence on student trajectories over time

Panel A: Numeracy scores for initially low performing students relative to the median in Ghana



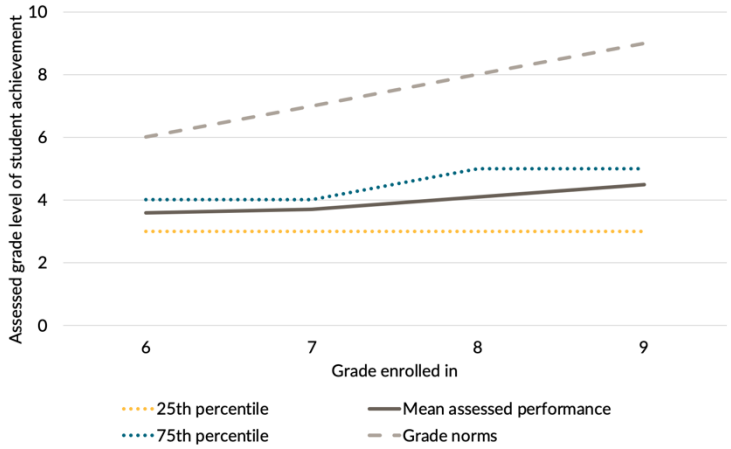
Source: Adapted by authors from Carter et al. (2020).

Panel B: Growing gap in between poor and rich students in South Africa over grades



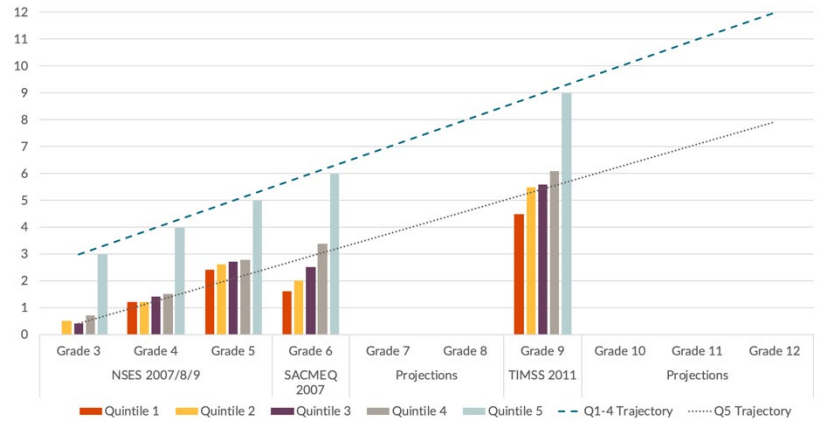
Source: Adapted by authors from Spaull (2013).

Panel C: Widening mathematics performance in India, both among students and relative to grade norms



Source: Adapted by authors from Muralidharan et al. (2019).

Panel D: Learning trajectories by socioeconomic quintiles in South Africa



Source: Adapted by authors from Spaull and Kotze (2015).

4.5. FLN may keep children in school, and schooling may offer other benefits.

Mastery of FLN skills may help students to keep up and, as a result, stay in school. Additional years of schooling are associated with other benefits, including reduced fertility and child mortality (Mensch et al., 2019; Psaki et al., 2019), even if the gains are higher with learning (Kaffenberger and Pritchett, 2020). If this channel is true, then we would expect poor performance to be an important driver of school dropout. In Kenya, Zuilkowski et al. (2016) find that poorer performance on literacy and numeracy assessments in fifth grade predict a higher rate of dropout by seventh grade, even after controlling for socioeconomic status (as proxied by household assets), parental education, age, and gender.[5] In the United States, longitudinal data for students shows that students who do not not read proficiently by the end of third grade are four times more likely to fail to graduate high school on time than students who do (Hernandez, 2011). For the worst readers, nearly a quarter do not finish high school on time. Another U.S. study likewise finds a clear correlation between third-grade reading ability and high school graduation rates (Lesnick et al., 2010).

The authors of that last study pose a caveat that is relevant to all of this literature: "The results of this study do not examine whether low reading performance causes low future educational performance, or whether improving a child's reading trajectory has an effect on future educational outcomes." Students who master FLN in early grades are more likely to stay in school, but this is not evidence of a causal link. Students who master FLN in early grades may have more supportive parents or more access to educational resources. Thus, again, this evidence is consistent with the importance of FLN investments but also with other factors.

5. The net return to FLN investments

A large collection of suggestive evidence points to returns to FLN skills. In high, middle, and low-income countries, researchers document an association between FLN skills and earnings. In high-income countries, workers with one standard deviation higher numeracy skills earn 18 percent higher wages (Hanushek et al., 2015). Controlling for parental education only slightly reduces the impact (to 16 percent), which the authors interpret as meaning that "any direct influences of families on earnings are unlikely to be a major driver of our baseline result." However, parental education is just one, limited proxy for family influence, engagement, and investment in their children's education. As another effort (among many) to isolate the causal impact, the authors examine the variation in compulsory schooling laws (in the US) and find that those laws are associated with higher numeracy skills and subsequently higher wages. Separate longitudinal analysis in the US finds an association between numeracy and earnings, mostly mediated through increasing the likelihood of attending college but also directly (Dougherty, 2003).

[5] Alternatively, Mar and Ancho (2019) do not find an association between literacy and dropout in the Philippines, but they rely on school records and school-level averages, so the design is significantly weaker.

In a sample of eight low- and middle-income countries, researchers find a positive, significant association between literacy and earnings in seven countries (Valerio et al., 2016).[6] Studies in individual countries show mixed impacts. Nikoloski and Ajwad (2014) find a positive association between numeracy (but not literacy) and employment in Tajikistan and no association in Uzbekistan. Data from a labor force survey in Peru also finds a positive association between numeracy (but not literacy) and earnings (Díaz et al., 2013). A survey in Colombia finds a positive association between literacy and earnings, but without measuring numeracy (Acosta et al., 2015). Ultimately, this body of correlative evidence is—again—consistent with an FLN hypothesis but also with other, highly plausible channels.

Adult literacy programs provide another opportunity to gauge the impact of literacy, since they may be able to evaluate impacts within a shorter time frame. Unfortunately, most studies of adult literacy programs focus on whether they actually increase adult literacy, not on other aspects of well being. As discussed above, Banerji et al. (2017) use a randomized controlled trial to show modest impacts of an adult literacy program on children's test scores, and a quasi-experimental study in Ghana shows a negative impact of adult literacy training on children's mortality in rural Ghana (Blunch, 2013) and a positive impact on labor market participation and household expenditures (Blunch, 2017). However, Blunch highlights that those beneficial impacts may result from other benefits of participating in the training (e.g., health knowledge and better networks), as actual impacts on adult literacy are modest (Blunch, 2017). Again, convincing causal evidence of the impact of adult literacy is limited.

6. What evidence on the return to FLN investments would be more convincing?

At this point, the reader may have grown exasperated at our repeated assertion that the channels of benefit of FLN skills or the returns to FLN skills cannot be separated from other returns, such as the benefit of merely attending school or of family characteristics. Despite the large collection of suggestive evidence, virtually all of it is subject to the same potential biases.

This invites the question: what evidence would provide a more compelling case for the returns to FLN? Consider, for example, an intervention that specifically improves FLN, such as Kenya's Primary Math and Reading Initiative (PRIMR), its subsequent scale-up, Tusome (Piper et al., 2014, 2018a), or the Teaching at the Right Level (TARL) program in India (Banerjee et al., 2017). Both PRIMR and TARL were implemented as randomized controlled trials (RCTs), so students who benefited from those programs are likely to be comparable to students who did not. Following those students and evaluating their learning levels and

[6] The significance of that association disappears in all but three countries if one controls for years of schooling, but since additional years of schooling are associated with more cognitive skills (Evans and Yuan, 2019), for this exercise separating those effects is less helpful. Similarly, Aslam et al. (2010) find mixed results in India and in Pakistan, but they only report the association of literacy and numeracy conditional on years of schooling. Insofar as years of schooling capture some development of literacy and numeracy, these may be underestimates of the true association.

likelihood of staying in school later in primary and in secondary would provide direct evidence of the returns to FLN investments and skills. Even the Tusome program, which was implemented nationwide and so not via RCT, has been evaluated in the short run comparing trends in learning across cohorts over time, and one could use a similar strategy to evaluate longer run impacts. Likewise, longer term follow ups of adult literacy programs that have been shown to be effective in the short run and which can isolate the impact of literacy would be convincing. We hope and expect that researchers will invest in evaluating the long term impacts of these programs that clearly boosted FLN skills.

7. How does FLN stand up next to other human capital investments?

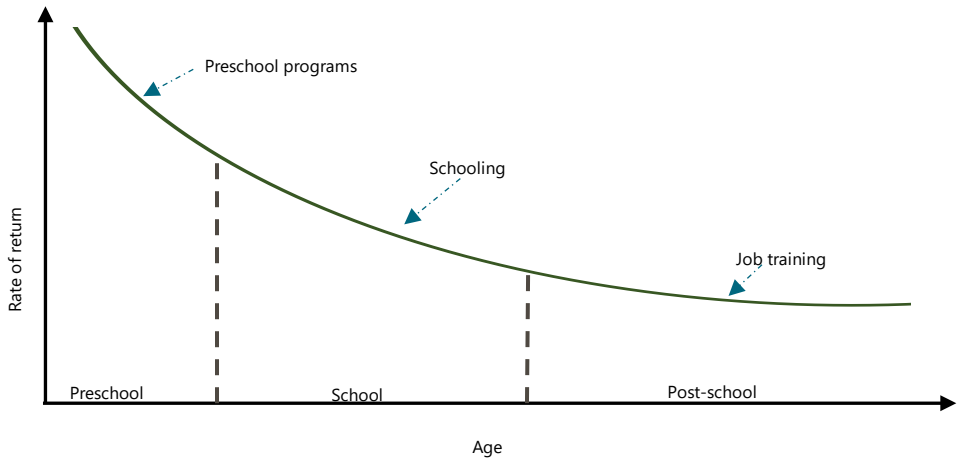
Given the importance of FLN skills, what is the relative value of investing in FLN versus other human capital investments? Education systems must balance investments of resources into early childhood education, primary education, secondary education, technical and vocational education, higher education, "second chance" remedial programs for out-of-school youth, and adult education.

One oft-repeated belief is that the rate of return to human capital investment will be highest in the earlier years, illustrated by the "Heckman Curve" (Figure 5), which suggests that the highest returns will be to pre-school programs, followed by early primary, etc., with job training yielding the lowest returns (Heckman, 2006). However, this curve is largely theoretical, combining intuition (skills developed early can increase the effectiveness of future learning) with evidence from a handful of early child development programs, some of which had small samples. Recently, Rea and Burton (2020) graphed the results of more than 300 programs based on the age of intervention (Figure 6). As a comparison of Figures 5 and 6 demonstrates, there is no evidence that interventions with older children or even adults yield lower returns than interventions for younger children.[7][8]

[7] Gelman (2020) includes a full discussion of this analysis.

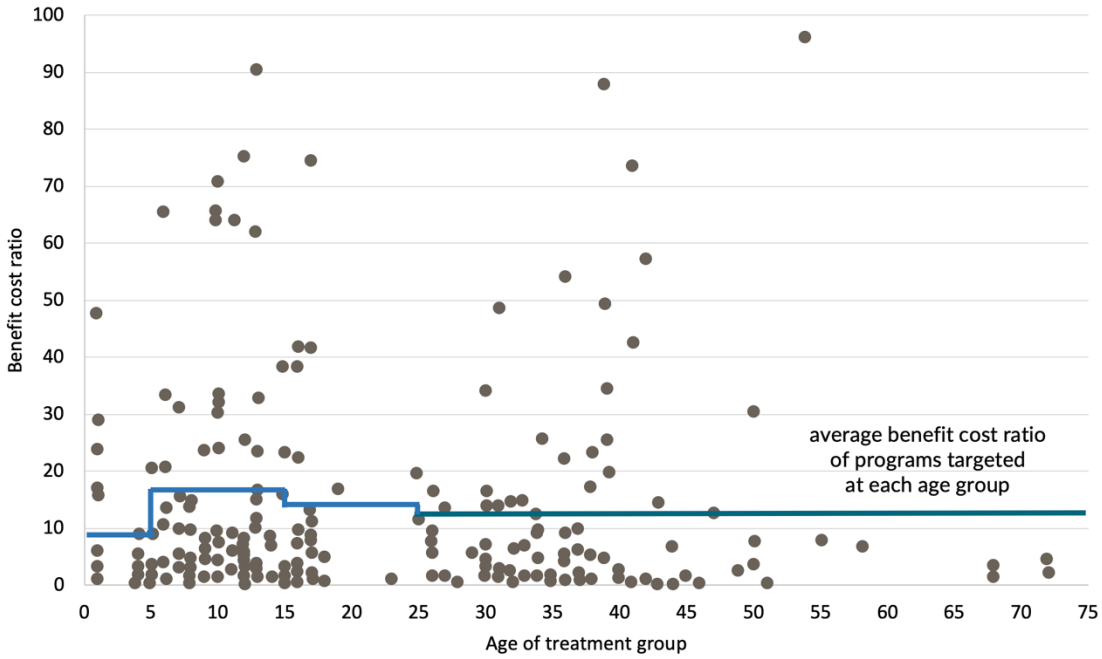
[8] One might argue that in contexts where few youth reach secondary school, the average cost of a secondary school investment would be higher, as one must educate many primary school children to yield a single secondary school attendee. If the main constraint to secondary school attendance were a lack of FLN skills, then this might be true. However, research suggests that many children still accumulate FLN skills through secondary school, even in middle income countries (Evans and Yuan, 2019) and that the reasons that many youth do not enter secondary have more to do with a lack of supply and financing than ability.

Figure 5. The Heckman Curve—a hypothesis regarding the relative benefit-cost ratios of investments at different ages



Source: Adapted by authors from Rea and Burton (2020) and Heckman (2006).

Figure 6. Empirical estimates of the benefit-cost ratio of more than 300 actual programs by age



Source: Authors' reproduction of figure from Rea and Burton (2020).

One challenge to carrying out a similar exercise in low- and middle-income countries is the paucity of cost-effectiveness data. A minority of studies report any cost-effectiveness data: for example, only about one quarter of studies in a recent review of education studies in Africa carried out cost effectiveness analysis (Evans and Mendez Acosta, 2021), and many of those are not calculated in consistent ways across studies.[9]

A recent ranking of the cost-effectiveness of education interventions for which we have data ranks—in order—providing information on the returns to education, targeted instruction interventions, structured pedagogy interventions, community involvement in school management, providing health products, teacher accountability and incentives, reduced travel time to schools, merit-based scholarships, etc. (Angrist et al., 2020). The second and third most cost-effective classes of interventions are directly related to FLN skills. Most of the evaluations of structured pedagogy interventions have focused on boosting literacy and, in fewer cases, numeracy. Targeted instruction interventions are also usually focused on FLN skills, although many of those are used in later primary or secondary education.

The ten most effective interventions reported in Angrist et al. (2020) are listed in Table 1 below. Four are arguably focused on FLN skills, and two of those are focused on FLN skills in early primary. (The programs arguably focused on FLN skills later than early primary are often carrying out remediation activities.) This is suggestive that FLN investments are among the most effective interventions, but also that they do not dominate all other interventions.[10] Among literacy and numeracy interventions, there are potentially high returns to investments not only in the first years of primary school but also in later years. Obviously some of the other interventions also contribute to FLN skills: preschools in Mozambique and Uruguay had large impacts, and part of what pre-primary education does is increase school readiness. That provides a reminder that even if the objective of a program is FLN skills, other complementary programs may help to achieve those goals.

[9] Furthermore, applying cost estimates from one context to another comes with all the same challenges as applying impact estimates from one context to another. When these two sources of uncertainty are combined, rankings should be taken with many grains of salt (Evans and Popova, 2016).

[10] An examination of the least effective interventions in Angrist et al. (2020) reveals even fewer FLN investments (results available upon request), suggestive that FLN investments are more strongly represented among the most effective interventions.

Table 1. Ten most effective interventions in generating learning-adjust years of schooling

Intervention	Country	Level	Study	FLN?	FLN in early primary?
Multi-faceted pedagogy intervention	Gambia	Primary	Eble et al. (2021)	Yes	Yes
Girls' pedagogy and fee relief	Tanzania	Secondary	Alcott et al. (2016) Sabates et al. (2020)	No	No
Multi-faceted pedagogy intervention	Kenya	Primary	Piper et al. (2014, 2018a)	Yes	Yes
Village-based school construction	Afghanistan	Primary	Burde and Linden (2013)	No	No
Computer-assisted learning	India	Primary	Banerjee et al. (2007)	Yes	No
Community-based preschools	Mozambique	Pre-primary	Martinez et al. (2017)	No	No
Computer-assisted learning	India	Secondary	Muralidharan et al. (2019)	Yes	No
Preschools	Uruguay	Pre-primary	Berlinski et al. (2008)	No	No
Merit scholarships for girls	Kenya	Primary	Kremer et al. (2009)	No	No
Ability grouping with extra teachers	Kenya	Primary	Duflo et al. (2011)	No	No

Notes: For the purposes of this table, FLN is defined broadly as including literacy and numeracy, as not all studies identify precisely which literacy and numeracy skills are being addressed.
Source: Adapted from Angrist et al. (2020), Figure 4.

8. Challenges to FLN investments

Investing in FLN comes with certain political challenges. Investments in FLN are fundamentally investments in improving the quality of education rather than expanding access to education. Using survey data from Kenya, Harding and Stasavage (2014) find that voters do not reward politicians for quality improvements in education, although they may reward access improvements (such as the abolition of school fees). In Tanzania, Habyarimana et al. (2020) also find no evidence that voters reward politicians for quality improvements, although their estimates are imprecise. One reason for this may be that many quality improvements—e.g., changes in test scores—are less visible or less salient than fee elimination or school construction. Yet parents in urban Kenya during qualitative interviews highlighted aspects of quality that are known to affect learning as reasons they might avoid public schools: teacher absenteeism, overcrowded classrooms, and even poor test

performance (Zuilkowski et al., 2018). So even if some parents do pay attention to these quality indicators, they may not reward politicians for them.

An additional challenge for investments in the earlier years of education is that students in higher education are old enough to vote, or perhaps more saliently, to strike, protest, or agitate in most countries. As youth complete primary and are unable to find jobs, they enter into a period referred to as "waithood" (Honwana, 2014), and politicians may feel particular pressure to invest in expanding secondary education or vocational training in order to keep these youth occupied.[11] The beneficiaries of most FLN investments—children in the first years of primary school—are far from the age of agitation or voting (Crawfurd, 2019). Furthermore, policy makers—even when they recognize the existence of a learning crisis—tend to overestimate the literacy rate among their countries' schoolchildren, so they may underestimate the gravity of the situation (Crawfurd et al., 2021).

Parents may likewise not always be responsive to interventions intended to enhance FLN investments. In Kenya, providing parents with information about their children's literacy and numeracy skills and materials on how to get involved in improving those skills had no impact on either parents' private activities or collective activity at the school level (Lieberman et al., 2014). In Pakistan, providing report cards with school-level average test scores (compared to those of other schools) did improve subsequent test scores (Andrabi et al., 2017). On the whole, the evidence on providing information about either individual student or school level test scores has been mixed (Read and Atinc, 2018).

In Kenya, some parents have pushed back against the implementation of mother tongue instruction, an intervention known to boost literacy outcomes (Piper et al., 2016). This could be either because, on the one hand, parents are ignorant of the benefits of mother tongue instruction or, on the other hand, because they are skeptical either that increased literacy in mother tongue will translate to increased literacy in a national language or that their children will be in school long enough to benefit. Indeed, while most research suggests that mother tongue instruction translates to better outcomes in subsequent learning (Evans and Mendez Acosta, 2021), research in Kenya calls into question the impact of mother tongue instruction on subsequent literacy and numeracy (Piper et al., 2018b).

Further research on new ideas and interventions to provide parents with greater visibility of their children's FLN outcomes (and ways to respond if they are dissatisfied) would be helpful, as would the far less researched area of highlighting the potential benefits of improved FLN to parents through targeted information campaigns. These obstacles are not excuses not to invest in FLN, but they may be motivators to explore if there are ways to make quality improvements—including quality improvements in the early years of primary school—more salient to parents (who also happen to be voters), to whom politicians in democratic nations may respond.

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[11] De Hoyos et al. (2016) quantify the number of youth in this period of waithood (neither studying nor working) in Latin America: 20 million youth as of 2015, with rising numbers over time.

9. Conclusions

There are many reasons to believe that investing in FLN is the right thing to do. The "technology" to teach children how to read exists and almost every child is capable of learning how to read. It is difficult to argue against foundational numeracy and literacy for every child as a good thing or even a human right (UNESCO, 2020a) in its own right, no matter what their long term impact on life outcomes is.

But for governments and donors, education investments involve trade-offs. Choosing to invest more in universalizing FLN inevitably means choosing to invest less in something else. Faced with these tradeoffs, policy makers must be armed with evidence on which investments will most improve life outcomes for children, and this creates the demand for a demonstrated causal link between these investments and long term wellbeing. While there are indeed various channels through which better FLN benefits children (some established and some hypothesized), there is not yet evidence to demonstrate the causal link between early investments in FLN and a better learning trajectory or more years in school. Nor is there compelling evidence demonstrating an association between better FLN skills and future earnings.

That is not to say that the causal link between FLN and life outcomes does not exist, only that research has not yet adequately disentangled other factors that might drive better life outcomes from FLN skills themselves. It should be possible to generate this evidence through following up big foundational literacy RCTs (such as the Tusome program in Kenya) to measure the longer term outcomes of children who did and did not receive the treatment that led to better FLN skills. Investing in follow ups like this should be a priority for education donors. In the meantime, FLN interventions seem comparably cost-effective to other education interventions and so there is no argument to stop investing in early literacy and numeracy.

However, lots of investments matter for children's short- and long-term wellbeing, and the evidence base as it stands does not support solving the early grade learning crisis above all else, nor is it apparently what developing country governments want to do. Beeharry (2021) makes the argument for international organizations establishing global leadership in prioritizing FLN; but the uncertainty of the evidence base may leave room for deferring much of the priority setting to policy makers and civil society in the target nations.[12] Making sure that children are safe in school, that they are not hungry, that they are able to complete primary school and transition to secondary school are all important considerations, and that a society generates professionals who generate jobs, rightly competing for attention and investment by policy makers. Policy makers will need to decide which tradeoffs and which investments are the right ones to make in each context. Those decisions will be better informed as more compelling causal evidence is developed on the long-term impacts of each class of investments on children's well-being.

[12] In the context of public health, Yi Dionne (2017) discusses the adverse consequences of failing to heed local priorities.

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