Education in Africa: What Are We Learning?

David K. Evans and Amina Mendez Acosta

Abstract

Countries across Africa continue to face major challenges in education. In this review, we examine 145 recent empirical studies (from 2014 onward) on how to increase access to and improve the quality of education across the continent, specifically examining how these studies update previous research findings. We find that 64 percent of the studies evaluate government implemented programs, 36 percent include detailed cost analysis, and 35 percent evaluate multiple treatment arms. We identify several areas where new studies provide rigorous evidence on topics that do not figure prominently in earlier evidence syntheses. New evidence shows promising impacts of structured pedagogy interventions (which typically provide a variety of inputs, such as lesson plans and training for teachers together with new materials for students) and of mother tongue instruction interventions, as well as from a range of teacher programs, including both remunerative (pay-for-performance of various designs) and non-remunerative (coaching and certain types of training) programs. School feeding delivers gains in both access and learning. New studies also show long-term positive impacts of eliminating school fees for primary school and positive impacts of eliminating fees in secondary school. Education technology interventions have decidedly mixed impacts, as do school grant programs and programs providing individual learning inputs (e.g., uniforms or textbooks).

Keywords: education, human capital, sub-Saharan Africa

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The data for this paper is available here: https://www.cgdev.org/sites/default/files/evans-acosta-education-in-africa-data.xlsx.

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1. Introduction

Education has expanded dramatically in Sub-Saharan Africa over the last half century. From 1970 to 2010, the percentage of children across the region who complete primary school rose by almost 50 percent (from 46 percent of children to 68 percent). The proportion of children completing lower secondary school nearly doubled (from 22 percent to 40 percent).[1] Despite these massive gains, nearly one in three children still do not complete primary school. Efforts to measure the quality of that schooling have revealed high numbers of students who have limited literacy or numeracy skills even after several years of school (Bold et al. 2017; Adeniran et al., 2020). The international community has characterized this situation as a "learning crisis" (World Bank, 2018a). The last two decades have seen a large rise in evidence on how to most effectively expand access and increase learning,[2] but actual changes in access and learning in that period have not shown dramatic improvements.[3]

In this paper, we synthesize recent research on how to expand access to education and improve the quality of learning in Africa.[4] Our analysis reveals two trends. First, we observe growing sophistication in evaluating education programs in Africa. An increasing number of studies examine not only whether a given intervention is effective but also test multiple permutations. For example, Mbiti et al. (2019b) test two alternative teacher incentive programs, and Duflo et al. (2020) report on four alternative programs to target instruction to students' learning levels. Evaluations are also testing alternative combinations of interventions, such as teacher incentives, school grants, or the combination of the two in Tanzania (Mbiti et al. 2019a). Other studies compare alternative programs to achieve a common goal, as in education subsidies versus the government HIV curriculum to reduce sexually transmitted infections in Duflo et al. (2015b). Testing multiple treatments is certainly not unprecedented in African countries, but it is growing more common.[5] Second, we observe growth in evidence that previously was largely confined to other regions of the world, including early child development, mother tongue instruction, and public-private partnerships.

In terms of substantive findings, we identify that certain multi-faceted programs deliver large gains in education quality: a program that includes teacher training, teacher coaching, semi-scripted lessons, learning materials, and mother tongue instruction delivered sizeable gains in literacy both as a pilot and at-scale (Piper et al., 2018a, 2018b); the average impacts for second-grade students in Kiswahili and English are both above the 99th percentile of

[1] These initial numbers are regional aggregates provided in the World Bank's World Development Indicators. One challenge in tracking and reporting these statistics is the availability of data: in 2010, only about two-thirds of the countries in the region reported primary completion rates. Figures 1 and 2 provide a more detailed distribution.

[2] The number of impact evaluations on the topic of education in development settings rose more in absolute numbers than in any other sector except health, both from 2000-2009 and from 2010-2015 (Sabet and Brown, 2018).

[3] Section 2 provides evidence for these claims.

[4] Most of our studies are from Sub-Saharan Africa, but a handful are from northern African countries.

[5] Two earlier examples include Kremer and Miguel (2007) and Baird et al. (2011).

education interventions (Kraft, 2020; Evans and Yuan 2020). A literacy program providing a similar array of supports delivered literacy gains in Uganda (Brunette et al., 2019). The combination of teacher incentives and school grants delivered higher learning gains than either on its own in Tanzania (Mbiti et al., 2019a).

We also observe consistent gains across various other types of programs: mother tongue instruction seems to provide consistent learning gains across programs, eliminating school fees offers consistent gains in access, and school feeding offers consistent gains in access and learning. There are relatively few studies, but school construction also offers gains in both access and learning. Other inputs are inconsistent: cash transfers are reasonably consistent in increasing access to school but not at improving learning, which may be unsurprising given that the programs may relax an economic constraint to access for the children but do not directly affect the learning process beyond that. Similarly, eliminating school fees has inconsistent impacts on the quality of education.

Our collection of evidence does not offer a single solution to apply in every school system. Programs adapted to new contexts will often yield distinct impacts. In our discussion section, we elaborate on factors to consider when translating a program from one setting to another. Still, this accumulation of recent evidence offers promising areas for investment and wide avenues for further study.

This review updates findings from earlier reviews with results from new research. Evans and Popova (2016b) synthesize evidence from six reviews on how to improve learning outcomes from low- and middle-income countries, only one of which—Conn (2017)—focuses exclusively on evidence from Sub-Saharan Africa, while others include significant research from the region.[6] This review focuses on how research in Africa from the last five years updates our ideas on making education effective and accessible.

In section 2, we briefly review the current state of education in Africa. In section 3, we summarize earlier evidence on how to expand access to and improve the quality of education on the continent. In section 4, we discuss our strategy for collecting and analyzing new research. In section 5, we synthesize the findings. In section 6, we draw conclusions from our findings, highlight areas for needed future research, and discuss implications for policy.

2. A brief review of the current state of education in Africa

Education in Africa has expanded dramatically in recent years (Figures 1 and 2). The median proportion of children completing primary school across countries has risen from 27 to 67 between 1971 and 2015 (World Bank, 2020). The median proportion of children completing lower secondary school across countries has also risen dramatically, from a mere 5 percent in

[6] Lacking access to time travel technology, Evans and Popova (2016b) actually review an earlier version of the Conn work (2014) but the results of Conn's analysis do not change across the two versions.

1971 to 40 percent in 2015.[7] These are enormous increases: they also demonstrate just how far there is to go. Nearly one in three children in the median country do not complete primary school, and three in five fail to complete lower secondary. Africa is the lowest performing region in the world in terms of school access by a significant margin (Figure 3): for primary completion, all other countries achieve higher than 90 percent. For lower secondary, the next lowest performing region has a completion rate of 75 percent, more than 70 percent higher than Africa's numbers. Median completion rates at both levels of education have been increasing at a roughly consistent rate between 2000 and 2015, between 1.2 (primary) and 1.1 (lower secondary) percentage points a year. With linear improvements at that same rate, Africa would achieve universal primary education in 28 years and universal lower secondary education in 56 years. Yet access will likely not increase at a linear rate, given the increasing marginal cost of enrolling the most difficult-to-reach children (the "last mile" challenge), leading these to be underestimates.

At the same time, education quality in Africa also suffers. Recent evidence across seven countries in Sub-Saharan Africa found that in third grade, less than two in three children could read a letter, and only about half of children could read a word or put numbers in order (Bold et al. 2017, Table 1).[8] The harmonized learning outcomes, an effort by Patrinos and Angrist (2018) to combine data from different tests across regions, finds learning outcomes for countries in Sub-Saharan Africa concentrated in the bottom half of the learning spectrum, although they are not substantively lower than would be expected for Africa's income levels (Figure 4). A combined measure of schooling quantity and quality—the learning-adjusted years of schooling (Filmer et al., 2020)—shows more African countries performing below what their income level would predict (Figure 5). Further, the quality of learning outcomes does not appear to be rising in recent years. Le Nestour and Sandefur (2020) document steady increases in adult literacy rates between 1940 and 2000, mostly linked to increases in enrollment. However, test score data from the World Bank's Human Capital Project shows that for 35 African countries with two data points between 2000 and 2017, scores fell for 18 countries and rose for 17 countries (Table 1) (Angrist et al., 2019). Some of the inconsistent gains in learning may result from expanding access: as children with less preparation gain access to school and participate in tests, average scores could fall even while learning is rising. Despite weaknesses in education quality, recent studies demonstrate significant returns to education in Africa (Appendix Section 1).

[7] We use the median rate across countries because education policy decisions are made at the country level. The World Development Indicators also provide a regional aggregate number with population weighting, which yields slightly higher completion rates (68 percent for primary and 43 percent for lower secondary).

[8] An assessment of student test scores in Nigeria reports that only 17 percent of the students meet the minimum literacy competency benchmark and 31 percent meet the numeracy benchmark. Students from poor households, in rural areas, and in government-owned schools are particularly worse off (Adeniran et al., 2020).

3. What do earlier syntheses say about education in Africa?

This is not the first study to synthesize evidence on education, even in Africa. Bashir et al. (2018) provide a comprehensive descriptive analysis of the current state of education across the continent, highlighting that many children remain out of school, that learning levels are low for those in school, and that "the problem of low learning emerges in the early grades." In terms of priorities for improvement, Evans and Popova (2016b) review six syntheses of evidence on how to improve the quality of education in low- and middle-income countries: Conn (2017), Glewwe et al. (2014), Kremer, Brannen, and Glennerster (2013), Krishnaratne, White, and Carpenter (2013), McEwan (2015), and Ganimian and Murnane (2016). Another review focused on learning, released slightly later, was Masino and Niño-Zarazúa (2016). Across the reviews that focused on boosting learning, authors recommend many different interventions, but Evans and Popova (2016b) identify two classes of interventions that are recommended with some consistency: pedagogical interventions that help teachers to tailor instruction to student learning levels, and individualized, repeated efforts to improve teacher ability and practice.

Of these reviews, only Conn (2017) focuses exclusively on Sub-Saharan Africa, although several others draw heavily on evidence from the region. Based on a meta-analysis of 56 studies available through 2013, Conn finds the largest learning impacts for programs that "alter teacher pedagogy or classroom instructional techniques." Snilstveit et al. (2015) is the most comprehensive review, examining 238 studies focused on both access and learning across low- and middle-income countries (not exclusive to Sub-Saharan Africa).[9] They find the strongest, most consistent gains in access from cash transfer programs and the best gains to quality from "structured pedagogy" programs, those that provide a variety of inputs to improve teaching, such as lesson plans and training for teachers together with new materials for students (similarly to Conn 2017). They also find promising evidence that school feeding programs can increase both access and learning. Glewwe and Muralidharan (2016) also examine both access and learning, finding strong gains from improved pedagogy—especially for foundational literacy and numeracy skills, improved governance—including teacher accountability, and cost reductions.

In this review, we complement this previous work with evidence published in 2014 or later, most of which came out later than the scope of the searches conducted by previous reviews.

4. Methods

4.1 Inclusion criteria

For this paper, we limited our focus to research studies that (i) were published in 2014 or later, either as a journal article, a conference paper, or a working paper, (ii) were conducted

[9] Snilstveit et al. (2016) provide a manageable summary of Snilstveit et al. (2015), which comes in at more than 850 pages.

in or used data from at least one African country, and (iii) report on outcomes from education-related interventions. We included interventions that may not focus exclusively on education outcomes but do report them, such as cash transfers and school feeding programs. We also limited our search to papers that include a quantitative analysis of results that seeks to establish a counterfactual including a variety of estimation designs such as randomized controlled trial, difference-in-differences, matching, regression discontinuity, and instrumental variable analysis. As a result, studies that report purely descriptive data or carried out a case study were not included in our primary analysis. Some descriptive studies are used to provide context to our discussion of results.

4.2 Search strategy

We began by compiling a database of papers that complied with the above criteria from published systematic reviews such as Conn (2014), Glewwe et al. (2014), Snilsveit et al. (2015), Evans and Popova (2016b), and Evans and Yuan (2019). We also reviewed papers from the National Bureau of Economic Research working paper series, the World Bank Policy Research Working Paper Series, the Centre for the Study of African Economies 2017-2020 conference papers, and the North East Universities Development Consortium conference papers 2017-2019. We included papers identified in the African Education Research Database (Education Sub Saharan Africa, 2020). Finally, we searched Google Scholar and journal databases using variations of the search terms "education", "learning", and "students" and confirmed the location of the intervention or the source of the data used. Journal databases searched included the American Economic Review, the Quarterly Journal of Economics, the Journal of Political Economy, the Journal of African Economies, World Development, the Economics of Education Review, the Journal of Development Effectiveness, the International Journal of Educational Development, and the International Journal of Educational Research. We included studies from other journals as turned up by our database searches. We also added studies known to the authors that are eligible but did not come up in the original search. We conducted the search between September 2019 and May 2020 and compiled a list of 195 papers eligible for review. See Appendix Table 2 for the breakdown of the papers by provenance. In this study, we review 145 of those papers on topics of current interest in education (excluding, for example, a study on the historical impact of Christian missions on education performance in later generations).

4.3 Analytical strategy

The purpose of this review is to understand the direction and scope of recent education research in Africa, including the choice of topics and interventions studied, the countries where these studies are being conducted, and the key trends and messages in their findings.

In order to answer these questions, we reviewed the title, abstract, and full text of the papers to extract and code the following data: country of intervention, year of publication, type of intervention (if there is one), type of intervention target (student, teacher, household, school, or system), type of outcomes reported (learning, access, or both), education level of intervention (pre-primary, primary, secondary, tertiary, vocational, or adult learning),

education level of outcomes reported, research method, scale (i.e., number of treatment arms and the size of the treatment sample), and key findings. We also encoded the choice of implementation partner (government agencies, non-government organizations, other partners, or researchers only) and any cost-effectiveness data provided in the paper.

We grouped the studies according to common themes and interventions and present a narrative review of the findings. We avoid the other two main types of review (meta-analysis and vote counting) because of large variation in the design of interventions within categories: an average effect of a teacher training intervention—for example—is not informative when one is averaging across programs as varied as a one-time half-day lecture for teachers and a full-year program of classroom observations with feedback.[10] This narrative approach is more helpful for solving some problems and less helpful for others. Our approach is intended to help readers to update their prior beliefs within key classes of educational interventions that are commonly—and in many cases—increasingly used across the continent. It can guide the design of educational interventions within categories: for example, many countries have cash transfer programs or school feeding programs, and this analysis can guide decisions about the optimal design of those programs. On the other hand, not providing meta-analytic results means that this review will not answer the question: Should a given country implement a cash transfer program or a school feeding program (i.e., is the expected impact of one class of program greater than the other)? While there is certainly insight to be gleaned from that approach (and other reviews have used it, including Conn 2017, Snilstveit et al. 2015, and McEwan 2015), the wide variety of designs and effect sizes within categories incline us—in this review—to focus on characterizing the range of evidence within groups and encouraging researchers and policymakers to dig deeper into individual studies that may be most relevant to a context and class of program that they are considering.

4.4 The studies

The collection of studies reveals interesting findings on what is studied and where. We identify a high concentration of studies in Kenya (41 studies) and Uganda (21) with fewer but still significant numbers of studies in Ethiopia (17), Ghana (15), Nigeria (13), and Tanzania (13) (Figure 6). Most studies we identify focus on primary education (61 percent), and almost a quarter of studies examine secondary education (24 percent). Fewer studies examine pre-primary (8 percent), with just a handful examining tertiary, adult education or technical-vocational training (6 percent and under each) (Figure 7).

The majority of the interventions (72 percent) evaluated by the studies are administered through the school system, including interventions targeting teachers, school management and students, while only about 38 percent of the studies are targeted at the household-level (Figure 8). School-system interventions usually aim to increase students' enrollment and retention, and improve the quality of the learning environment. These interventions are (i)

[10] Evans and Popova (2016b) provide a detailed description of the advantages and disadvantages of different review methodologies.

teacher- and teaching-targeted programs such as pedagogy, mother tongue instruction, education technology, teacher incentives and trainings, and hiring practices; (ii) student-level interventions including health and nutrition programs (e.g., school feeding), incentives for students, and individual inputs such as uniforms, solar lamps, or bicycles; and (iii) school-level interventions such as school construction, school grants, public-private partnerships and other non-government school provision, and community-based monitoring. The household-level interventions usually aim to reduce the economic and social barriers that keep households from sending their children to school – providing cash transfers, providing low-cost early child development care centers, and providing learning and attendance information to parents.

A significant number of studies were implemented through government channels (Table 2). In addition to the 19 percent of studies that examined national policy reforms (such as free primary education), 46 percent of the 145 studies partnered with government agencies, most often the ministry of education for school construction, teacher trainings, or incentive policies, the ministry of health for school feeding, or the relevant government agency for cash transfers. 40 percent of the studies in our sample worked with non-government organizations such as BRAC, the World Food Programme, the Aga Khan Foundation, or Twaweza. A smaller number (17 studies) worked with private partners such as for-profit schools, clinics, or educational companies. About 15 percent of the studies did not employ any implementing partner aside from the research teams themselves. Some of these researcher-only studies evaluated smaller, less intensive interventions (e.g., a specific pedagogical technique). More than half of the interventions were evaluated using randomized controlled trials (58 percent of studies); the next most common empirical method was difference-in-differences (25 percent), which was the most common method for evaluating national policies.

A limited number of studies offer cost information (Table 3). Two out of five studies in our sample have no cost analysis at all. About one quarter provide a full cost-effectiveness analysis, and the others provide limited information on costs, usually only the cost of one specific input, such as a stipend for the trainer or the value of a voucher provided to students. A handful of studies make claims such as an intervention being a "cost-effective measure" or "scalable (low-cost)" without providing any cost details.

In terms of scale, 27 of our 145 studies evaluate national reform policies. For studies that are not national in scale and that report schools as treatment units, we find an average treatment group size of 96 schools (median: 66 schools). There are some larger studies: the 90th percentile includes 211 treated schools (Carneiro et al., 2016). Table 4 shows the average treatment group size for studies reporting other treatment units such as districts, communities, or individuals.

In addition to the 19 percent of studies that evaluate national policies, almost half of the studies evaluate the impact of a single treatment. The other 35 percent have multiple treatment arms (Table 5). 28 studies evaluate two treatment arms, 17 studies test three treatment arms, and six studies test four or more treatment arms. One outlier, Haushofer and Shapiro (2016) randomized cash transfers to gender of the recipient, frequency of

installment, and size of installment, in addition to the spill-over group (nine treatment arms in total).

5. Results

We review the studies in four broad categories. Studies in the first group focus on what happens in the classroom and on policies around the person who manages the classroom—the teacher. These include studies on mother tongue instruction, structured pedagogy, and policies around teacher pay, teacher professional development, and accountability. Studies in the second group focus on a variety of inputs: school feeding, education technology, school construction, and other inputs. Studies in the third group focus on financing: cash transfers, school grants, and the elimination of school fees. Studies in the fourth and final group focus on three other topics: early child education, for which there has been little experimental or quasi-experimental evidence in Africa in the past, but for which that literature is growing; girls' education; and public-private partnerships.

5.1 Teachers and pedagogy

Mother tongue instruction

Mother tongue instruction usually refers to teaching students basic skills in a language that they already know when they arrive at school. In many African countries, the historical norm has been to teach children in a colonial language (e.g., English, French, or Portuguese), even though most children arrive at school with little or no ability in that language.[11] Most earlier syntheses have little or nothing to say about mother tongue instruction, but evidence has grown dramatically in recent years (Appendix Table 3). Teaching children to read in a language they speak at home increased the rate at which children learn to read in Cameroon (Laitin et al., 2019), Kenya (Piper et al., 2016c), and Uganda (Brunette et al., 2019; Kerwin and Thornton, 2020).[12]

While impacts on initial reading ability in the mother tongue is promising, the objective of many parents is for their children to be literate in the colonial language, which may explain some of the resistance that parents have posed to mother tongue instruction reforms, as in Kenya (Piper et al., 2016c). Several recent studies suggest that mother tongue instruction has positive impacts on children's ability to subsequently learn a second language in Cameroon (Laitin et al., 2019), Ethiopia (Seid, 2019), and South Africa (Taylor and von Fintel, 2016). However, Piper et al. (2018c) find the effect is not as strong: students taught in mother-tongue do not perform any better in English and perform worse in mathematics compared to students taught in a non-mother tongue.

[11] Mother tongue instruction can also be used to refer to teaching children their mother tongue (e.g., formalizing knowledge of a language spoken from childhood). That is not how we use the term here.
[12] Brunette et al. (2019) examined interventions in 12 different mother tongues and found positive, significant impacts for three quarters of them.

Finally, there is some evidence of impact beyond literacy. In Ethiopia, where mother tongue instruction reforms took place in 1994, researchers have identified long-term impacts on educational attainment and civic engagement (Ramachandran, 2017; Seid, 2017).

Structured pedagogy

Recent years have also shown growing rigorous evidence for approaches to improve literacy that incorporate a range of elements (see Appendix Table 4). Piper et al. (2014 and 2015) used a randomized controlled trial to evaluate a literacy program in Kenya that included teacher professional development, the provision of textbooks for students (including textbooks in Kiswahili), the provision of structured teacher guides for teachers, and classroom observation and feedback to teachers, among other elements. The program led to sizeable literacy gains. Seeking to isolate the most important elements of the program, Piper et al. (2018b) find that structured teacher guides are the most cost-effective element of the program. The program was effective at boosting literacy for low-income students (Piper et al., 2015). The program was subsequently scaled up nationally and continued to demonstrate literacy gains (Piper et al., 2018a). Similarly, a mathematics-focused version of the program provided teacher guides and teacher professional development training and yielded statistically significant improvements in test scores (Piper et al. 2016a).

A combination of training principals and teachers as well as mentoring for teachers and new instructional materials was effective in boosting literacy in Uganda but not in Kenya, potentially because the language of testing was different from the language used in instruction in Kenya, despite national policy (Lucas et al., 2014). Brunette et al. (2019), already discussed in the context of mother tongue instruction, evaluated a program that not only encouraged mother tongue instruction in 12 different mother tongue languages but also provided teacher training, detailed teachers' guides, textbooks for pupils, and feedback from school leaders, resulting in sizeable literacy gains.

Beyond these literacy interventions, many interventions seek to improve the quality of teaching particular skills using a particular method, such as using graphics (like Venn diagrams) in teaching to improve prose comprehension among secondary school students in Nigeria (Uba et al., 2017). These studies are of value mostly to others seeking to improve the teaching of these specific skills; as such, they are summarized in the appendix but not discussed at length here.

Teacher policies

Teacher remuneration and accountability

Because teachers play such an instrumental role in students' education, recent evidence on high rates of absenteeism and low levels of pedagogical and content knowledge suggest that better teacher policies may be useful to boost education outcomes (Bold et al., 2017; Mbiti, 2016). There is no general pattern in the level of teacher pay relative to comparable professions across Africa (Evans et al., 2020). There is evidence of a premium to civil service teachers relative to private school teachers (Barton et al. 2017). A new generation of evidence has arisen on bonus payments for teachers based on student performance. Earlier

evidence on performance pay for teachers in Africa was limited and mixed: a randomized trial in Kenya showed that performance bonuses for students increased test scores on the exams directly linked to the incentives, but not on general exams (Glewwe et al., 2010).

A new generation of studies adds much more to our knowledge base (Appendix Table 5). All these new pay-for-performance programs take place in primary schools. In one study in Tanzania, performance-based bonuses to teachers had positive impacts on student learning in only one of the two tests administered, but when those bonuses were coupled with school grants, students performed consistently better in both tests and across all subjects (Mbiti et al., 2019a). Schools that received grants alone showed no performance gains. Teachers also support these programs in Tanzania, both in theory and in practice, reporting higher levels of satisfaction in schools that have performance pay (Mbiti and Schipper, 2020). In Rwanda, a novel experimental design separates the impact of performance pay on recruitment and on effort and finds favorable effects on both, with a significant net increase in student test scores (Leaver et al., 2019). A pay-for-performance program in Uganda had test score impacts only for the subset of students who attended schools that had books, although it did reduce dropout rates, which were not directly incentivized by the program (Gilligan et al., 2019). In Kenya, using contracts that are renewable based on performance to hire teachers also boosted student learning (Duflo et al., 2015a), although an effort to scale up those contracts nationwide did not result in learning gains, potentially due to a combination of political opposition, reduced monitoring, and delayed salaries (Bold et al., 2018).

New studies are exploring the nuances of how to implement these programs. In Tanzania, researchers tested two alternative incentive designs – one, a pay-for-percentile system where a teacher's bonus is based on students' ranks against other students with similar baseline scores, and the other program, where a teacher's bonus is based on students achieving benchmark proficiency levels, which the authors argue is easier to implement and gives teachers clearer targets. Both designs boosted test scores, but the latter program had larger impacts at a lower cost (Mbiti et al., 2019b).

Recent evaluations have also shown impacts from non-remunerative accountability interventions. In Côte d'Ivoire, providing twice-a-week text messages to either parents or teachers reduced dropout by between 2 and 2.5 percentage points (about 50 percent of the dropout rate in control schools). Texting both parents and teachers resulted in a much smaller, statistically insignificant impact. For low-attendance teachers, all three treatments had positive impacts (Lichand and Wolf 2020). In Tanzania, a low-stakes nationwide program that simply published school performance on primary school leaving exams led to more students passing the exam among schools that initially performed poorly. However, in an example of how even a low-stakes intervention can also adversely affect behaviors, the program also increased dropouts (Cilliers et al., 2020c). In Niger, a low-stakes, randomized intervention that complemented regular class inspections with phone calls to the village chief, the teacher, and two randomly selected students to check on whether adult education classes were being held and how they were going led to improved student learning (Aker and Ksoll, 2019).

Beyond improving performance and accountability, dozens of countries have designed incentive programs to recruit and retain teachers in less attractive teaching posts, and these have had little rigorous evaluation in the past (Pugatch and Schroeder, 2014). Teacher turnover is high in Africa, especially in low-performing schools (Zeitlin, 2020), making teacher retention a policy priority. In Zambia, salary increases of 20 percent for rural teachers show at least some impact on an increased stock of teachers in beneficiary areas, albeit no impacts on student test scores (Chelwa et al., 2019). In the Gambia, a salary premium of 30-40 percent significantly increased the share of trained teachers in remote areas (Pugatch and Schroeder, 2014).[13] Ultimately, the impact of all of these teacher remuneration interventions – and their relevance to other settings – likely hinge both on existing teacher remuneration relative to other professions and on other aspects of the labor market.

Teacher professional development

Another class of teacher intervention seeks to boost their content and pedagogical skills. Earlier reviews showed promising evidence on pedagogical interventions (Conn, 2017), but that is not to say that most teacher professional development programs are effective. On the contrary, the vast majority of at-scale teacher professional development programs in Africa (and elsewhere) go unevaluated in any serious way, and many among those do not have the characteristics common to programs that have been shown to be effective (Popova et al., 2018). Still, recent evidence bolsters the view that teacher professional development—particularly coaching programs—can be effective at boosting student learning outcomes.[14] Importantly, most multi-faceted literacy programs highlighted earlier include teacher training as one aspect of the intervention.

Other interventions evaluate teacher professional development on its own. In Ghana, training teachers to target instruction to children's learning levels by dividing the class by ability group for part of the day increased student learning (Duflo et al., 2020). In another study in Ghana, training teachers to do targeted instruction (including by dividing students by learning level rather than grade level) increased student scores on a combined Math and English test (Beg et al., 2020). Additional training for school principals and school inspectors had no additional impact. In South Africa, the government tested traditional, centralized training for teachers versus in-class coaching, with the impact of coaching more than double that of centralized training (Cilliers et al., 2019). In the subsequent cohort of students, only those with teachers who benefitted from coaching show learning gains, although even those are half the size of effects for the first cohort (Cilliers et al., 2020a).

A teacher training program combined with partially scripted lesson plans and weekly text message support for teachers improved teacher practice and children's literacy (Jukes et al., 2017). Three trials invested in boosting teacher skills focus on pre-primary education. In

[13] The Gambian program also had no clear impact on student test scores (Pugatch and Schroeder, 2018).
[14] Many teacher professional development interventions report impacts on participant knowledge and even practice—as do McDermott and Allen (2015) in Sierra Leone—but it cannot be assumed that teachers will be able to translate that knowledge into increased student learning.

Ghana, teacher training for preschool teachers led to small increases in children's school readiness. When that training was coupled with parental awareness meetings, the outcomes were reversed, potentially because parents preferred traditional teaching over age-appropriate play-based learning in preschool (Wolf et al., 2019). Attanasio et al. (2019) evaluate a program—also in Ghana—that trained volunteer mothers and kindergarten teachers in stimulation and play curriculum; the intervention improved kindergarten children's cognitive and socio-emotional skills. In Kenya, a combined package of teacher coaching and training, along with instructional materials, boosted learning in early child education centers (Donfouet et al., 2018). In Malawi, teacher training only boosted outcomes in informal preschools when combined with parent training (Özler et al., 2018). Finally, a teacher training program in Rwanda designed to complement a new entrepreneurship curriculum in secondary schools did not improve student test scores, although it did boost student participation in school business clubs (Blimpo and Pugatch, 2020).

An alternative is to train teaching assistants to assist teachers. In Ghana, schools were randomly assigned to hire teaching assistants from among the country's youth employment program to either work with students who had fallen behind during school, work with students who had fallen behind after school, or just to work with half of the class, thereby reducing class size (Duflo et al., 2020). All three interventions improved student learning, although the first two had the largest impacts. Interestingly, relative to the Ghana-based teacher-led targeted instruction intervention mentioned above, the remedially targeted teaching assistant interventions had double the impact on student test scores but also double the cost, so cost-effectiveness was comparable.

5.2 Inputs

School feeding

Just one earlier review highlights school feeding as a possibility for boosting both access and learning (Snilstveit et al., 2015), and most of the evidence behind that recommendation stems from other regions in the world. Recent evidence from Africa supports that finding (Appendix Table 6). From a randomized evaluation of Ghana's nationwide school feeding program, Aurino et al. (2019) find gains in test scores as a result of school feeding, with particularly large gains for girls and for children from the poorest households. In rural Senegal, Azomahou et al. (2019) use a randomized design to find gains in both enrollment and test scores from the provision of school meals, as do Diagne et al. (2014) in an earlier evaluation of the same program. Mensah and Nsabimana (2020) exploit staggered implementation of a school feeding program in Rwanda and find small (less than 0.03 standard deviations) but significant impacts on student test scores. Nikiema (2019) uses a difference-in-differences strategy to show that providing take-home rations in Burkina Faso increases school attendance for both boys and girls and increases enrollment for girls in particular. Parker et al. (2015) measure only health outcomes (hemoglobin and anemia) in a cluster randomized trial of school feeding in rural Burundi and find no clear impacts.

In addition to evaluating the impact of providing school meals, studies are venturing into the details of the meals themselves. Hulett et al. (2014) examine the impact of introducing animal protein into school meals in Kenya with a randomized trial and find that the "meat group" showed higher test score gains than other groups.

These results greatly strengthen earlier global evidence that school feeding is a promising strategy for boosting cognitive outcomes as well as access to school, particularly in food-insecure areas and especially for girls.

Education technology

Previous syntheses that highlighted the promise of education technology such as McEwan (2015) highlight evidence from 32 different treatments in five different countries, none of them on the African continent. Recent years have shown a rapid increase in evidence in this area with a mixed track record (Appendix Table 7).[15] In some cases, technology complements existing inputs. In Kenya, researchers experimented with different technology complements (e-readers for students, tablets for teachers, or tablets for instructional supervisors): none boosted literacy scores significantly relative to a non technology-based intervention (Piper et al., 2016b). In South Africa, a randomized trial comparing on-site teacher coaches with virtual teacher coaches (i.e., coaches who communicated with teachers by tablet) led to comparable outcomes in the first year, but over time, the gains from in-person coaches translated to other skills, whereas the gains from virtual coaches did not (Kotze et al. 2019; Cilliers et al. 2020b). A quasi-experimental evaluation of the impact of introducing interactive whiteboards—a complement to teachers—found higher test scores for urban students in Senegal (Lehrer et al., 2019). De Hoop et al. (2020) evaluate a program in Zambia where teachers receive tablets (and projectors) with lesson plans for teachers and interactive lessons for students. Complemented with weekly teacher professional development, the program shows gains for first graders in both reading and math.

In Angola, a randomized controlled trial of learning software together with the technological equipment needed to use the software had no consistent impact on primary school student learning, although it did boost teacher and student familiarity with technology (Cardim et al., 2019). An experimental evaluation that provided secondary school students in Malawi with access to Wikipedia—the students otherwise had little to no internet access—had small, positive impacts in two subjects but not in others (Derksen et al., 2020). Also in Zambia, a phone-based literacy game provided to a few hundred randomly selected first grade students boosted their spelling ability relative to a control group (Jere-Folotiya et al., 2014). In

[15] Some studies provide proof of concept of technological interventions in very small samples. These studies should not inform large-scale policies yet, but they can point to promising directions for future testing. In a very small pilot study in Kenya, primary school teachers and students had access to an "interactive, multimedia literacy software" for ninety minutes per week, resulting in gains in end-of-year subject exams (Abrami et al., 2016). Another small pilot provided electronic career guidance for secondary school students in Nigeria, with promising results (John et al., 2016).

Kenyan primary schools, interactive literacy software coupled with a library of digital books and stories boosted reading scores (Lysenko et al., 2019).

In other cases, technology seeks to substitute for other inputs. Providing e-readers to secondary school students in urban Nigeria only increased learning if they included curricular content and were distributed in areas with limited textbook access, essentially substituting e-readers for traditional textbooks (Habyarimana and Sabarwal, 2018). In Ghana, broadcasting live instruction – where students can interact with the instructors – from teachers in the capital to students in rural areas improved literacy and numeracy scores, essentially substituting for teacher ability (Johnston and Ksoll, 2017). Alternatively, technology can fill an input gap in terms of role models: Riley (2019) finds that showing secondary students in Uganda a film featuring a low-income adolescent Ugandan girl succeeding at chess improved student test scores and closed the gender gap in enrollment in subsequent years.

While the findings are certainly not universally positive, they suggest that technology in education can effectively complement or substitute for existing inputs when the infrastructure is in place to support it. This pattern is consistent with earlier evidence suggesting more consistently positive impacts of education technology interventions in low- or middle-income countries than in high-income countries (Bulman and Fairlie, 2016). However, most of the technology evaluated in the studies are used in school settings, with more stable access to electricity and internet connectivity (with the exception of e-readers that students can take home). There is still limited discussion and even less evidence for technology that allows for distance learning where access to school is not available.

School construction

School construction rarely features in reviews of the best investments, but when there are few schools, construction is essential to achieving the last mile (or last twenty miles) of enrollment. Recent studies bolster this (Appendix Table 8). In Burkina Faso, a program to construct schools improved enrollment, attendance, and student learning both seven and ten years after the program (Ingwersen et al., 2019; Kazianga et al., 2019).[16] A similar program in Niger also boosted enrollment and learning (Bagby et al., 2016). These programs of course will be most effective when there are few schools: a school construction program in Benin boosted enrollment principally in rural areas (Deschênes and Hotte, 2019). Furthermore, the Burkina Faso program led young women to put off marriage and childbearing (Ingwersen et al., 2019), and the Benin program reduced tolerance of domestic violence (Deschênes and Hotte, 2019). Ashraf et al. (2020b) find that school construction benefitted girls' education in Zambia only among ethnic groups with a bride price tradition. Ultimately, construction is likely a necessary condition for other interventions to work when there are insufficient schools.

[16] That program also seems to have increased children's participation in household chores (de Hoop and Rosati, 2014).

Other inputs

Fewer recent studies evaluate the impact of providing simple, non-technological in-kind inputs for schooling (although a previous generation of evaluations yielded several of those), but recent studies still provide some insight into this area (Appendix Table 9). Two studies in Kenya provided free school uniforms: one provided them to girls in upper primary grades and found reductions in school dropout, pregnancy, and marriage; another provided them to children in lower primary grades and found significant reductions in absenteeism in early years, but no evidence of enduring effects several years later (Duflo et al., 2015b; Evans and Ngatia, 2020)

Previous studies examining the simple provision of additional textbooks to schools found either no impacts or selective impacts in Kenya and Sierra Leone (Glewwe et al., 2009; Sabarwal et al., 2014), but a new randomized trial providing textbooks together with a combination of financial and non-financial incentives to simply take the books home increased both language scores and the likelihood of students taking the end-of-year exam in the Democratic Republic of the Congo (Falisse et al., 2019).

In Kenya, randomly selected seventh-grade students who lived in rural areas off the electrical grid received solar-powered lamps. In some classes, a higher proportion of students received solar lamps, and the authors use that variation to estimate the externalities on non-recipient students. The program found significant gains in math scores for students who received lamps, and smaller gains for students who did not receive lamps in classrooms where many students did (Hassan and Lucchino, 2016)

5.3 Financing

Cash transfers

Cash transfers are a richly studied area of analysis, with the first generation of analysis coming out of Latin America and the Caribbean (Fiszbein et al., 2009). Early evidence from Africa showed promising results in that setting as well (Davis et al., 2016). The most recent evidence shows impacts not only of giving transfers but also of testing a variety of designs (Appendix Table 10). In terms of simple impacts, a randomized trial of unconditional transfers in Malawi showed an increase in school enrollment and reduced dropout rates (Kilburn et al., 2017). In Kenya, unconditional transfers did not translate to improved educational outcomes after nine months (Haushofer and Shapiro, 2016). In Lesotho, unconditional child grants boosted primary enrollment but not completion or the transition to secondary (Pellerano et al., 2014). Conditional cash transfers in Tanzania boosted primary school completion (Evans et al., 2014). Baird et al. (2016a) compare conditional cash transfers for already enrolled and unenrolled adolescent girls in Malawi: they find enrollment gains for both groups and mixed effects on test scores. Eyal and Woodard (2014) find that expanding a child support grant in South Africa increased educational enrollment in South Africa but that higher enrollment does not translate into higher levels of attained education. An unconditional cash transfer program in Rwanda increased educational investments (more children had school uniforms) but did not affect school attendance (Sabates et al., 2019).

Other evaluations inform the design of cash transfer programs. De Walque and Valente (2019) compare cash transfers directly to children and to parents as well as simply providing information (with no cash) about their children's attendance to parents. Providing attendance information delivered 75 percent of the gains of cash in terms of children's attendance. Transfers to children and to parents performed comparably. Akresh et al. (2016) compare a variety of transfer designs and find positive impacts on children's education outcomes across designs in Burkina Faso, with larger impacts on school attendance for older children from conditional transfers relative to unconditional transfers. Benhassine et al. (2015) found that unconditional transfers labelled as education support in Morocco increased both school participation and parent views of the value of education investments; adding explicit conditions and targeting a particular parent (mothers versus fathers) had no additional impact. In Malawi, conditional cash transfers had larger impacts on school attainment, but unconditional cash transfers had larger gains on other outcomes (Baird et al., 2019).

On the whole, these findings are consistent with earlier work that suggests that cash transfers –especially but not limited to conditional transfers – can be an effective way to boost school enrollment but may not by themselves translate into broader educational gains. We also observe significant variation in cash transfer performance.[17] Evaluations on this topic, among others, signal a maturing literature in testing alternative designs.

School grants

Grants to schools can be an effective way to distribute resources, and there is evidence from other regions of the world that they can boost enrollment: in Haiti, grants to schools conditional on not charging fees to students boosted enrollment and reduced grade repetition (Adelman et al., 2017). Recent evidence in Africa confirms that grants are not a silver bullet but can yield benefits, mostly when complemented with other programs (Appendix Table 11). In Senegal, school grants led to improved test scores for younger students, particularly in schools that used the grants for training teachers and school administrators (Carneiro et al., 2020). Grants to school committees in Niger increased enrollment for young children but did not affect learning (Beasley and Huillery, 2017).

School grants alone had no impact on student learning in Tanzania, although when coupled with teacher incentives, outcomes improved (Mbiti et al., 2019a). School grants alone in the Gambia had no impact on student attendance or on learning outcomes, but in concert with management training, the program did boost attendance and—in some communities—even learning (Blimpo et al., 2015). Grants alone do not consistently solve access or learning problems, but when attached to conditions or complementary programs that relax other constraints, they can boost both access and learning.

[17] Evans and Yuan (2019) find cash transfers among both the most and least effective interventions to increase girls' access to schooling worldwide.

Eliminating school fees

An obvious constraint to education is the cost, including both formal school fees and myriad other fees that schools charge (Williams et al., 2015). An array of recent papers seek to quantify the impact of reducing those costs, mostly at the primary level (Appendix Table 12). İşcan, Rosenblum, and Tinker (2015) use regression analysis to show that the introduction of school fees reduced enrollment and subsequent completion of primary school across seven African countries. Moussa and Omoeva (2020) use a fuzzy regression discontinuity design to examine the impact of universal primary education policies in Ethiopia, Malawi, and Uganda: they find an increase in educational attainment, as well as a decrease in adolescent pregnancy and marriage. They do not observe impacts on labor force participation or employment. In Kenya, free primary education—rolled out in 2003—increased educational attainment as well as subsequent employment and income (Ajayi and Ross, forthcoming). There is some evidence that the expansion of access led to a fall in quality (Atuhurra, 2016). Free basic education increased girls' attainment and reduced adolescent fertility and marriage in Ghana and Uganda (Boahen and Yamauchi, 2018; Masuda and Yamauchi, 2018). The elimination of primary school fees in Ethiopia led to more schooling for men and women, along with reduced fertility (Chicoine, 2019, 2020). In Tanzania, free primary education increased access and had positive returns across sectors, even in the agricultural sector (Delesalle, 2019; Valente, 2019). Lesotho also saw dramatic gains in access with the elimination of fees (Moshoeshoe et al., 2019). Informal fees in public primary schools continue to keep students—especially poor, rural students—away from school (Sakaue, 2018).

As countries expand secondary education, more studies are studying impacts at that level. In Uganda, free secondary education significantly but not completely reduced expenditures (Omoeva and Gale, 2016), consistent with earlier work that school fees are not the only out-of-pocket expense. In the Gambia, eliminating secondary school fees for girls increased the number of girls taking the high school exit exam by more than 50 percent. Test scores also rose, despite the increase in access coming mostly from poorer areas (Blimpo et al., 2019b). An earlier evaluation of the same policy eliminated mandatory school fees for girls in public secondary schools and increased female enrollment for both secondary and primary schools (Gajigo, 2016). Similarly, a study in Kenya found that the abolition of tuition in public secondary schools increased access, delayed childbirth, and did not reduce test scores (Brudevold-Newman, 2019). In Uganda, eliminating secondary school fees via public funds to private schools increased the number of students taking the exit exam by 16 percent, with no fall in test scores (Masuda and Yamauchi, 2018). Finally, a randomized controlled trial of scholarships for students in Ghana who had already passed the entrance exam but lacked financing increased secondary and tertiary attainment and – ten years later – reduced fertility and improved labor market outcomes (Duflo et al., 2019).

5.4 Other topics

Early child education

Earlier syntheses have little to say about early child education in Africa, largely because of a paucity of studies. Martinez et al. (2017) highlight that most evidence from low- and middle-

income countries stems from Latin America and do not identify a single paper that predates 2015 in Africa. Since then, several studies have come out, most of which examine the impact of access to early child education (Appendix Table 13). Martinez et al. (2017) use a randomized controlled trial to estimate the impact of community-based preschools in Mozambique and find that enrolled children are much more likely to be in primary school at the right age and that their test scores are higher, with larger effects for children from poorer households. Bietenbeck et al. (2019) take advantage of the expansion of pre-primary education in Kenya and Tanzania to compare siblings with access to siblings without; they find that children with access to preschool education are more likely to be in primary school, more likely to have advanced, and have moderately higher scores on cognitive tests (0.10 standard deviations). Aunio et al. (2019)—with a simple cross-sectional regression approach and the selection challenges that entails—find a significant, positive correlation between kindergarten attendance and later numeracy skill in South Africa, even when controlling for other current skills (language and executive function). Krafft (2015) compares siblings with and without access to early child education in Egypt and finds that access translates to an additional year of total schooling. Woldehanna and Araya (2017) use an instrumental variables approach with Young Lives data in Ethiopia and find that preschool attendees in urban areas are 25 percent more likely to have completed secondary education than non-attendees. Finally, Blimpo et al. (2019a) evaluate random assignment of community-based early child development centers in the Gambia and find that children from less-disadvantaged families do worse, consistent with some evidence from high-income countries (Baker et al., forthcoming).

Six studies examine the quality of early child education services. Blimpo et al. (2019a) also compare children who attended preschools that were randomly assigned to receive intensive teacher training, finding much higher language skills in children attending those schools. Morabito et al. (2018) evaluate children randomly assigned to high-quality versus low-quality preschools: they find no average effect on test scores, although there is evidence that high-quality preschool has a positive impact for children with poorly educated fathers (compensating for inequality) and a negative impact for children with poorly educated mothers (reinforcing inequality). Four other interventions trained early child education providers—in Ghana, Kenya, and Malawi—and were discussed in section 5.1.

Finally, at least one study examines a home-based program to strengthen children's emergent literacy skills before they even begin school. In Kenya, randomly selected parents of young children received either children's storybooks or storybooks with training on how to read the storybooks with children (Knauer et al. 2020). Children whose parents received both books and training demonstrated increased vocabulary.

This new generation of early child education evidence suggests that there is value in these investments and capacity of governments and others to provide them on the African continent.

Education for girls

Education for girls has long been cited as a potential high-value investment, by both researchers and policy makers (Evans et al. 2020). Discussing girls' education as a separate category can be problematic, since earlier sections covered studies that reported impacts on girls. For example, the elimination of school fees for secondary school has shown consistent impacts in reducing adolescent marriage and fertility, and school construction in several countries has focused on ensuring that girls' needs are met and have improved outcomes for girls. In this section, we discuss work on girls' education that does not fit naturally into our other categories. A recent synthesis, not restricted to Africa but drawing heavily on research from the continent, suggests that the most effective investments to improve girls' educational outcomes may be a mix of targeted and nontargeted investments (Evans and Yuan, 2019). Recent work in Africa backs that up: Duflo et al. (2020), in their evaluation of targeted instruction interventions in Ghana, find larger impacts for girls despite the fact that girls are not targeted by the intervention.

Among targeted interventions not discussed earlier, providing negotiation training to secondary school girls in Zambia—including teaching them to advocate for their own education—improved educational outcomes over the subsequent several years (Ashraf et al., 2020a). Providing sanitary pads to schoolgirls in Kenya reduced absenteeism significantly (Benshaul-Tolonen et al., 2019). A program that provided bicycles to schoolgirls in Zambia reduced girls' commute time and their absenteeism from school, with modest impacts on mathematics learning (Fiala et al., 2020). Unlike a similar program in India, the program had no impact on dropout rates or grade advancement (Muralidharan and Prakash, 2017).

Several recent studies look beyond educational outcomes to examine the impact of school-based programs to improve other outcomes for girls (Appendix Table 14). Bandiera et al. (2020) find—using a randomized controlled trial in Uganda—that simultaneously providing vocational training as well as information about reproductive health to adolescent girls increased self-employment and reduced adolescent pregnancy and sexual violence four years later. A similar program in Tanzania had no impacts (Buehren et al., 2017). In Sierra Leone, a program provided similar services in the context of girls-only after-school clubs but was interrupted by the 2014 Ebola outbreak. Girls in participating communities were protected from the significant school dropout and adolescent pregnancy effects of the outbreak (Bandiera et al., 2019). A mentoring program intended to develop social and emotional life skills in Liberia increased primary school completion and the transition to secondary school (Koroknay-Palicz and Montalvao, 2019). Another girls-only safe space program—this one in Ethiopia—used longitudinal analysis and found gains in both literacy and the likelihood of accessing health services (Medhin and Erulkar, 2017). The findings demonstrate variation of impacts across settings even within countries.

Private schools and other non-government school provision

Private schools are an important part of the education landscape in Sub-Saharan Africa. On average across countries, fourteen percent of primary school students and nineteen percent of secondary school students were enrolled in secondary schools as of 2014, and that number had grown since the year 2000 (Baum et al., 2018). Private schools are perceived by

many parents to be of higher quality: in Kenya, even poor families were willing to undergo financial hardship to pay for so-called "low cost" private schools (Zuilkowski et al., 2018). Distinguishing the impact of private schools on student learning is generally difficult because of student selection effects: often, students with better off parents or parents more invested in education may be more likely to attend private schools. Beyond purely private schools, many African governments are entering into agreements with private school chains where they receive public resources to educate students at no charge. These public-private partnerships often seek to leverage the physical and human capital of private schools to increase access and learning. The last several years have seen some new work on private schools and public-private partnerships in Sub-Saharan Africa (Appendix Table 15). Most previous work on private schools has taken place in other regions, and to our knowledge, this topic is not covered in previous reviews focused on Africa.

Recent studies seek to compare student outcomes in private and public schools in African countries. Wamalwa and Burns (2018) compare public school versus private school siblings within the same household (i.e., household fixed effects) in Kenya and identify literacy and numeracy gains in attending private schools. Despite efforts to gauge the potential extent of bias, the challenge remains of unobserved child characteristics determining whether a child is sent to private or public school. Also in Kenya, Zuilkowski et al. (2020) compare student scores over two academic years in low-cost private schools and government schools in Nairobi and find that, in general, the low-cost private schools do not produce better student outcomes over time. However, private schools yielded more learning gains when they received an instructional improvement intervention than did public schools. Lipcan et al. (2018) compare test scores, costs, and management practices across public and private schools in Lagos, Nigeria, and find that one international chain of private schools has higher student test scores relative to other private schools and public schools in literacy and relative to public schools only in mathematics. Adjusting for a set of observed student characteristics reduces the gains by a small amount. The authors make no claim to causality, as unobserved characteristics of students may still play a role in the results. A third study does not find any differences in management practices between public and private schools in Uganda, although it does find a significant association between the quality of management and student performance overall (Crawfurd, 2017). Two randomized controlled trials examine the impact of public-private partnerships, one for primary schools in Liberia and another for secondary schools in Uganda. In Liberia, the management of 93 randomly selected schools was delegated to one of eight different private organizations (Romero et al., 2020). Government teachers taught in both publicly and privately managed schools, but privately managed schools received more funding, and some raised additional funding independently. Ultimately, the privately managed schools achieved significantly higher test scores but at a significantly higher cost per student. In general, management of teachers was better at privately managed schools, but one chain kicked out students when their enrollment cap was reached and transferred less effective teachers to non-evaluated schools. Three years after implementation, the learning gains in privately managed schools failed to compound over time (Romero and Sandefur, 2019). Ultimately, private management of public schools proved to be a mixed bag.

In Uganda, a program randomized which private secondary schools participated in the public-private partnership and so documented the impact on private school performance (Barrera-Osorio et al. 2020). Participation in the partnerships boosted both enrollment and student performance. There is evidence of both an increase in inputs at the partnership schools and changes in student composition, favoring students with more educational advantage. The evaluation did not measure the impact relative to public schools.

Non-profit school providers are another option, especially in the context of extreme poverty and poor state provision of schooling. In Guinea-Bissau, a non-profit randomly selected villages to provide four-year primary schools to substitute for existing government education (Fazzio et al. 2020). The schools had a custom-made structured pedagogy program and frequent monitoring and assessment of teachers and students. Students in intervention schools performed dramatically better on early grade reading and math tests.

The private school and other non-government school evaluation literature is still nascent in Africa. While there is no compelling evidence that private schools or private management of schools deliver more learning than public schools, the revealed preference of many parents and demonstrated improvement in private schools suggests merit in continuing to examine the issue.

6. Discussion

6.1 What we learn

The last five years of education and economics research in Africa demonstrate that there are a range of promising ways to continue to expand access to schools and to improve their quality. Earlier reviews of the evidence had little examination of mother tongue instruction programs and inconsistent coverage of structured pedagogy programs, both of which show sizeable impacts on learning. Likewise, a range of teacher policies show promising results, including teacher pay-for-performance programs at the primary level but also non-remunerative interventions, such as teacher coaching and training teaching assistants. School feeding programs appear to be beneficial for both access and learning outcomes.

As evidence on inputs – including education technology inputs – grows on the continent, its track record is decidedly mixed. Technology proves effective in some cases and not in others, reflecting the education technology findings in high-income countries and the fact that technology is a means to an end rather than an end in itself (Bulman and Fairlie 2016). Public-private partnerships likewise are proving no panacea to education systems in Africa.

The last few years have provided several long-term studies on the elimination of primary school fees, showing positive results on later life outcomes, and a new generation of studies on reducing fees for secondary school similarly show gains both in access and in increased employment and reduced early fertility. Of course, the first step of constructing schools in places where there are no schools is likely an essential condition for further educational investments.

6.2 What we still need to learn

The weaknesses of this evidence base are the same weaknesses of economics of education research throughout low- and middle-income countries. The first is the duration of impacts. The vast majority of interventions measure outcomes within twelve months of the onset of the intervention, with little information on the longer run time path of impacts (McEwan, 2015). There are recent exceptions to that in the region, with studies studying impacts of experimental interventions two years after implementation (Cilliers et al., 2020a), three years after implementation (Bagby et al., 2016), seven years after implementation (Evans and Ngatia, 2020), and even ten years after implementation (Baird et al., 2016b; Ingwersen et al., 2019). But most interventions still lack any long-term follow-up. Quasi-experimental studies that examine policy changes are showing much longer-term impacts, as in several of the fee elimination studies.

The second is scale. Many evaluations of interventions are at relatively small scale. Outside of the interventions evaluating national policies, the median number of treated schools is just 66 (Table 4), often implemented under the careful eye of a cautious researcher. Obviously, going to scale entails a host of challenges—both political and implementation—and sometimes those challenges ultimately undermine whatever worked well in the original evaluation (Bold et al., 2018). Design elements in pilots can facilitate moving to scale by, for example, testing a variety of elements to increase confidence in the optimal policy design, drawing on government systems when possible, and providing cost analysis (Gove et al., 2017).

Interventions where scale requires a large increase in financial resources but not a proportional increase in human resources (e.g., cash transfers or fee elimination) present a distinct set of challenges than those where scale requires a corresponding increase in human resources (a structured pedagogy program, for example). In some ways, the financial resources are easier to come by at large scale than the human resources, especially in education systems that historically have had difficulty recruiting and training qualified workers.

A third challenge is cost-effectiveness. A natural response to the array of evidence we have presented is: But isn't the benefit just half of the investment decision? Unfortunately, less than 30 percent of studies report cost-effectiveness (Table 3), which may be an increase from a few years ago (McEwan, 2015).[18] Programs that provide consistent benefits in boosting access—including fee elimination, school construction, and school meals—also tend to have high fixed or recurrent costs (or both). Cost effectiveness analysis is essential for better policy decisions, and hopefully the new generation of studies will do more of that.

[18] Even if one had those data, comparing costs across settings entails many of the same challenges that comparing effect sizes entails (Evans and Popova, 2016a).

6.3 Applying research findings to policy

These findings can help policymakers to update their existing beliefs as to the best starting points for discussions about education policy. Every place and time are different, and so synthesizing effective results is not intended to promote simple wholesale adoption of one program to another context. Achieving high-quality education in Africa will require a host of interventions at each education level – early child education, primary education, secondary education, etc. As a result, policymakers and the researchers who advise them can learn from successful interventions in two key ways. First, most simply, successful interventions in one context provide a starting point for discussions in another context (World Bank, 2018a).[19] Would that work here? Why or why not? Second, we can examine the principles behind the success of interventions rather than focusing on specific point estimates (Muralidharan, 2017). Specifically, we can ask what the theory behind the program is, whether the required conditions in a new context hold for that theory to apply, whether the same behavior change would be expected in the new context, based on existing evidence, and whether the program could be well implemented (Bates and Glennerster, 2017). In some cases, a different program design may be more effective at achieving the same change in teacher or student behavior in a new country because of different contextual factors. Certain classes of programs that have been successful across several contexts—like structured pedagogy programs, school feeding programs, school fee elimination programs, or mother tongue instruction programs—may provide starting points for policy discussions in other areas.

The education impact evaluation evidence in Africa is shifting from simple tests of what works and what does not to what implementation design is most effective in a given context. As Duflo (2017) writes, "our models give us very little theoretical guidance on what (and how) details will matter." But the growing array of evidence can guide us in the path forward.

[19] Most immediately, evaluations can inform policy decisions in the same context, as demonstrated by the multifaceted use of evaluations by the Department of Basic Education in South Africa (Pophiwa et al., 2020). This is less relevant to the present synthesis of evidence from many countries.

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Table 1: Change in learning outcomes in African countries for two time periods between 2000 and 2017.

Country	Year of first data	Year of last data	Number of years between first and last data	Harmonized Learning Outcomes, earliest year	Harmonized Learning Outcomes, latest year	Difference
Average	**2004**	**2014**	**10**	**385**	**376**	**-9**
Burundi	2006	2014	8	425	423	-2
Benin	2006	2014	8	377	384	7
Burkina Faso	2006	2014	8	402	404	2
Botswana	2000	2015	15	397	391	-5
Côte d'Ivoire	2006	2014	8	377	373	-3
Cameroon	2006	2014	8	451	379	-72
Congo, Dem. Rep.	2006	2012	6	429	318	-112
Congo, Rep.	2006	2014	8	398	371	-28
Egypt, Arab Rep.	2003	2015	12	414	356	-58
Ghana	2003	2013	10	266	307	42
Gambia, The	2007	2011	4	356	338	-18
Kenya	2000	2013	13	426	455	29
Liberia	2011	2013	2	343	332	-12
Lesotho	2000	2013	13	345	393	48
Morocco	2003	2015	12	354	367	13
Madagascar	2006	2015	9	434	351	-83
Mali	2002	2015	13	387	307	-79
Mozambique	2000	2007	7	402	368	-33
Mauritius	2000	2013	13	430	473	43
Malawi	2000	2013	13	331	359	29
Namibia	2000	2013	13	337	407	69
Niger	2002	2014	12	370	305	-65
Rwanda	2015	2016	1	343	358	15
Senegal	2006	2014	8	415	412	-2

South Sudan	2016	2017	1	334	336	2
Eswatini	2000	2013	13	401	440	39
Seychelles	2000	2013	13	436	463	27
Chad	2006	2014	8	403	333	-70
Togo	2001	2014	13	423	384	-40
Tunisia	2003	2015	12	376	384	8
Tanzania	2000	2013	13	410	388	-21
Uganda	2000	2013	13	379	397	18
South Africa	2000	2015	15	375	343	-33
Zambia	2000	2013	13	336	358	22
Zimbabwe	2007	2013	6	394	396	2

Source: Authors' construction, using all African countries with at least two data points. For countries with more than two data points, we used the first and last data point. Data provided by the authors of Angrist et al. (2019).

Table 2: Studies according to the implementing partner. Private partners include for-profit schools, clinics and educational companies. Some studies have multiple implementing partner (e.g., public-private partnerships that are implemented by both government and private partners).

	Count of studies	%
Government	66	46%
Non-government organizations	58	40%
Private partners	17	12%
Researchers only	22	15%
National policies	27	19%
Total studies	145	100%

Source: Authors' calculations based on underlying studies.

Table 3: Distribution of cost analyses within studies.

	Count of studies	%
Studies with cost-effectiveness analysis	41	28%
Studies with quantitative discussion of costs (but not cost-effectiveness) - total program cost	11	8%
Studies with quantitative discussion of costs (but not cost-effectiveness) - costs of specific inputs but not the total program cost	31	21%
Studies with other claims regarding cost (low-cost, affordable, etc.) but no substantiating data	7	5%
Studies with no cost analysis or claims	55	38%
Total studies	145	100%

Source: Author calculations based on underlying studies.

Table 4: Studies reporting size of the treatment group. Other treatment units reported are households (2 studies) and classrooms (1 study).

Unit	Number of studies	Mean of treated units	Median of treated units
National scale	27		
Schools	88	96	66
Districts/clusters	7	39	19
Communities	8	105	114
Individuals	12	5,637	338
Others	3	845	1008
Total studies	145		

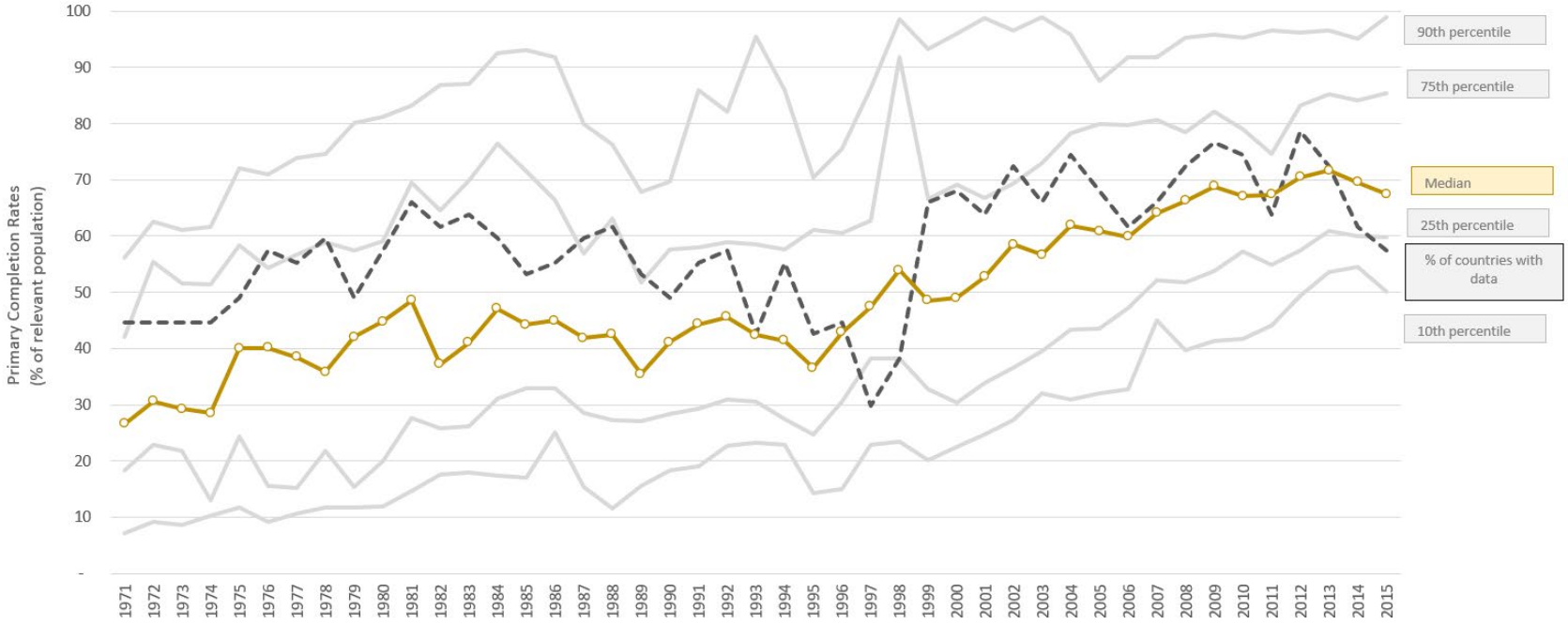
Source: Author calculations based on underlying studies.

Table 5: Studies reporting number of treatment arms.

Number of treatment arms	Count of studies	%
1	67	46%
2	28	19%
3	17	12%
4	4	3%
>= 5	2	1%
National policies	27	19%
Total studies	145	100%

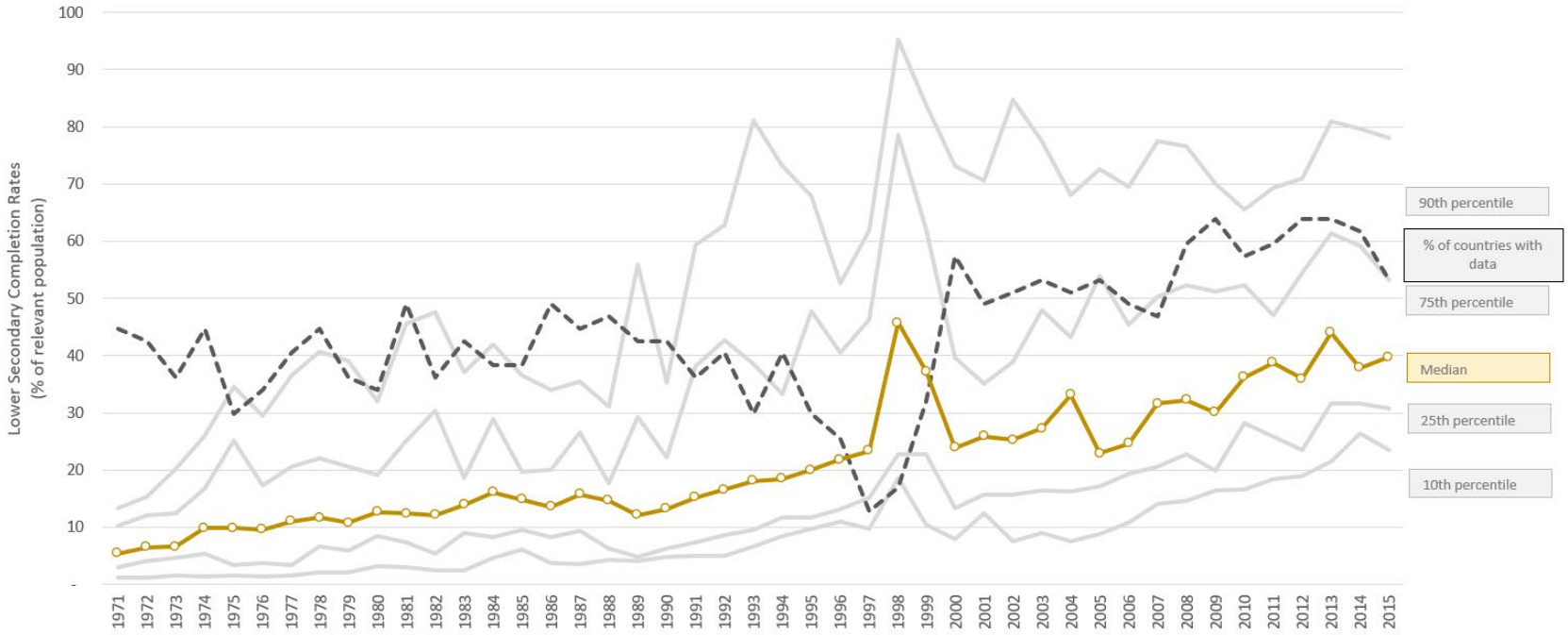
Source: Author calculations based on underlying studies.

Figure 1: Primary Completion Rates in Sub-Saharan Africa, 1971-2015.



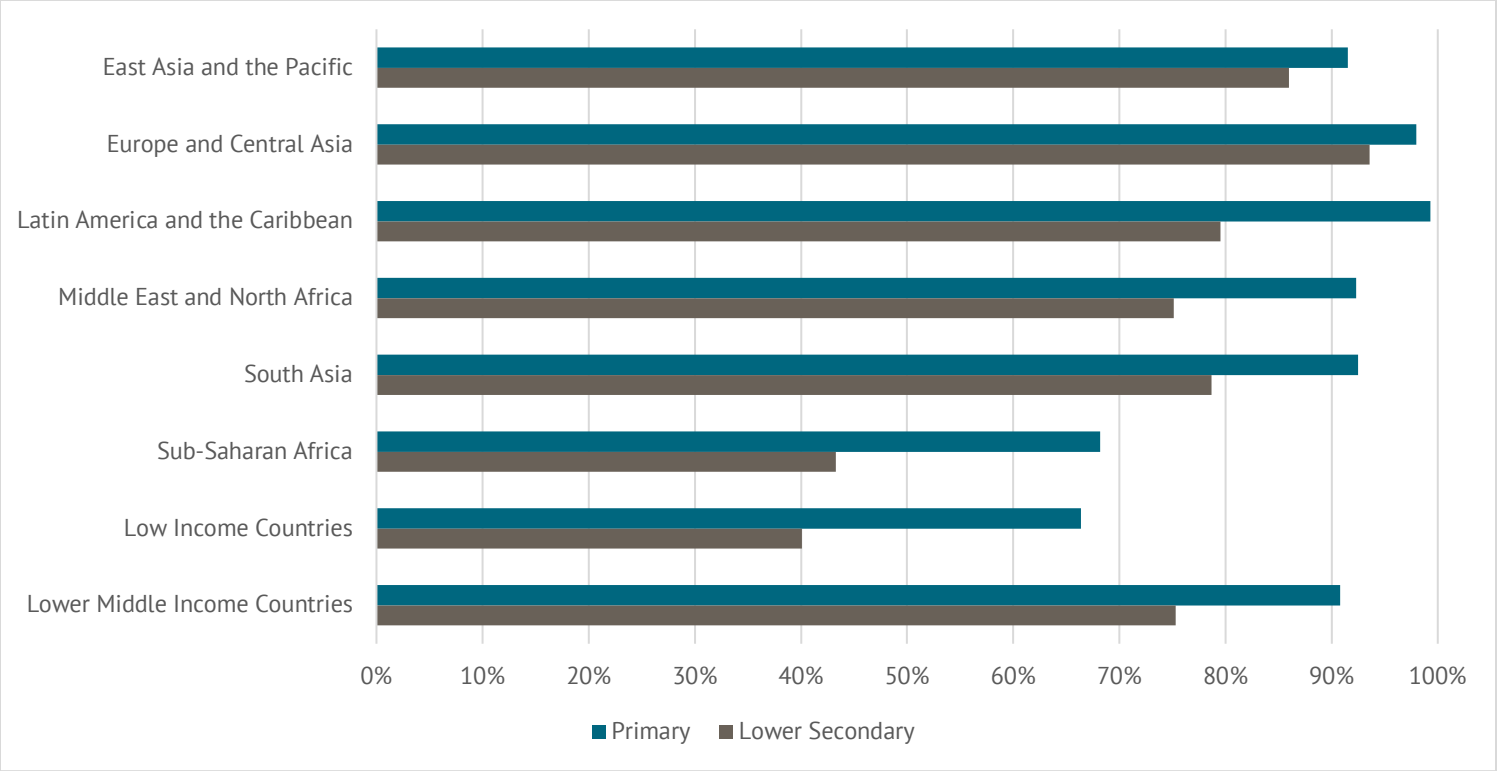
Source: Author tabulations using data from World Development Indicators (2020).

Figure 2: Lower Secondary Completion Rates in Sub-Saharan Africa, 1971-2015.



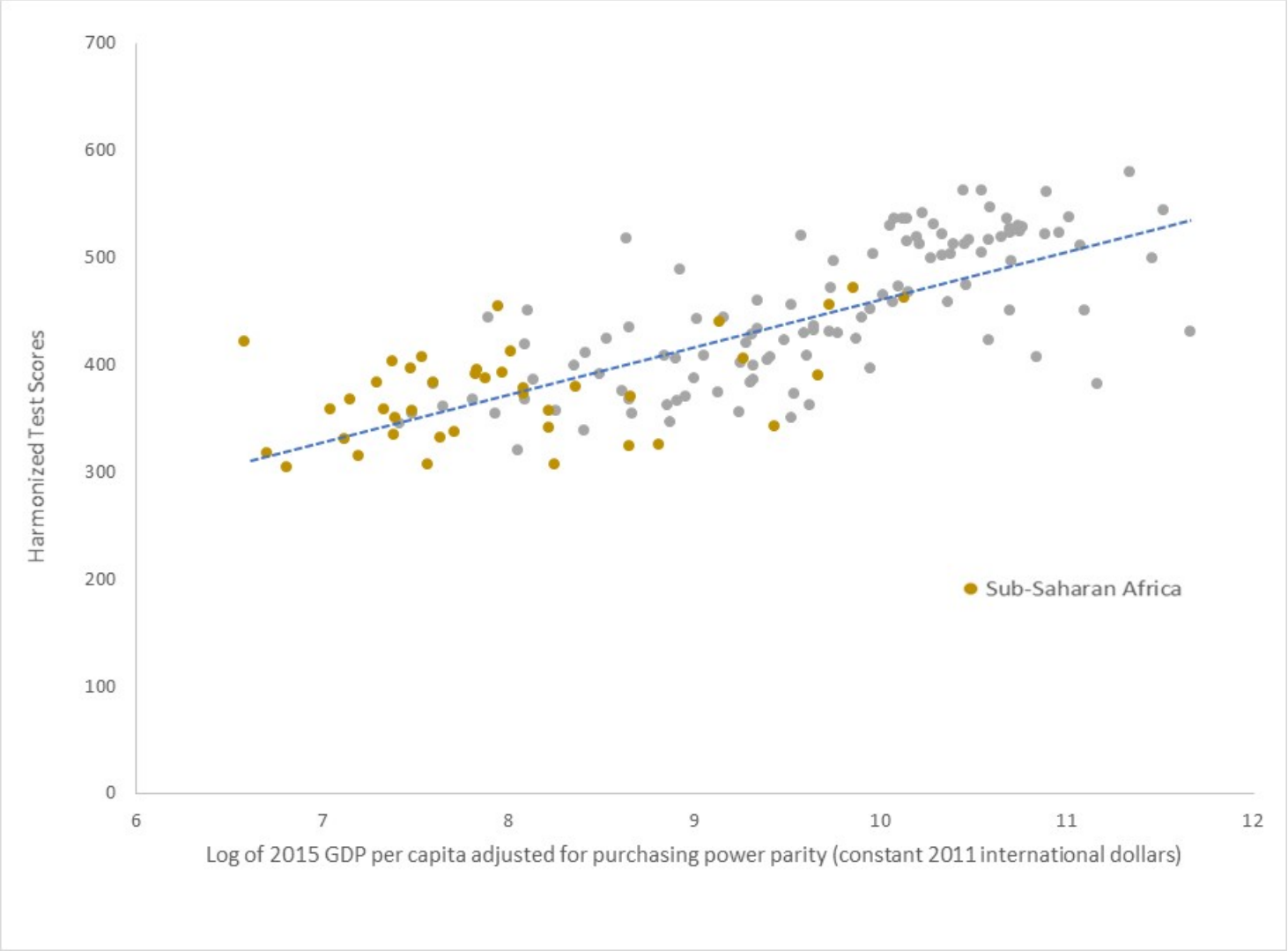
Source: Author tabulations using data from World Development Indicators (2020).

Figure 3: Primary and Lower Secondary Completion Rates across Regions in 2015.



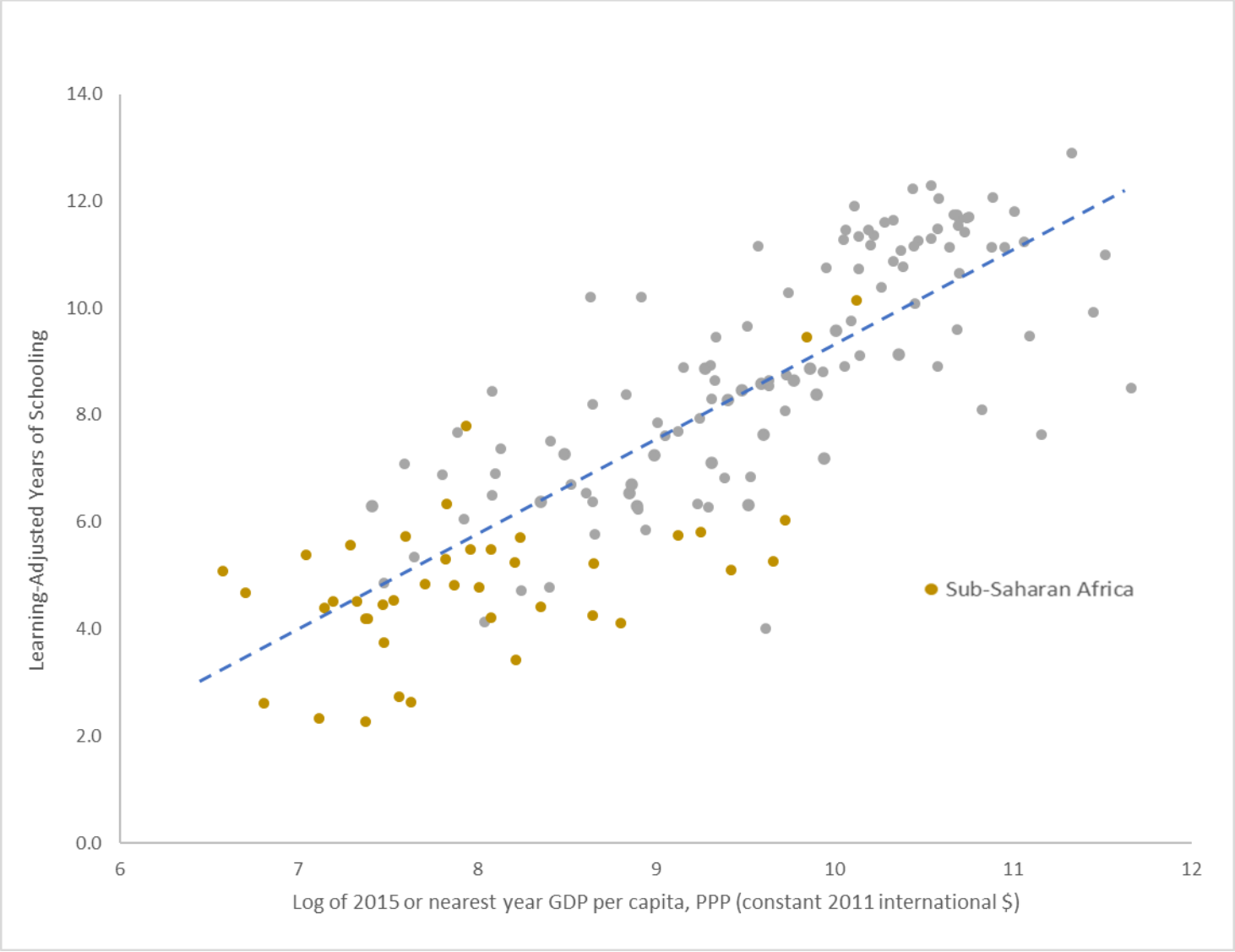
Source: Author tabulations using data from World Development Indicators (2020).

Figure 4: Test scores for countries at all income levels around the world relative to countries in Sub-Saharan Africa.



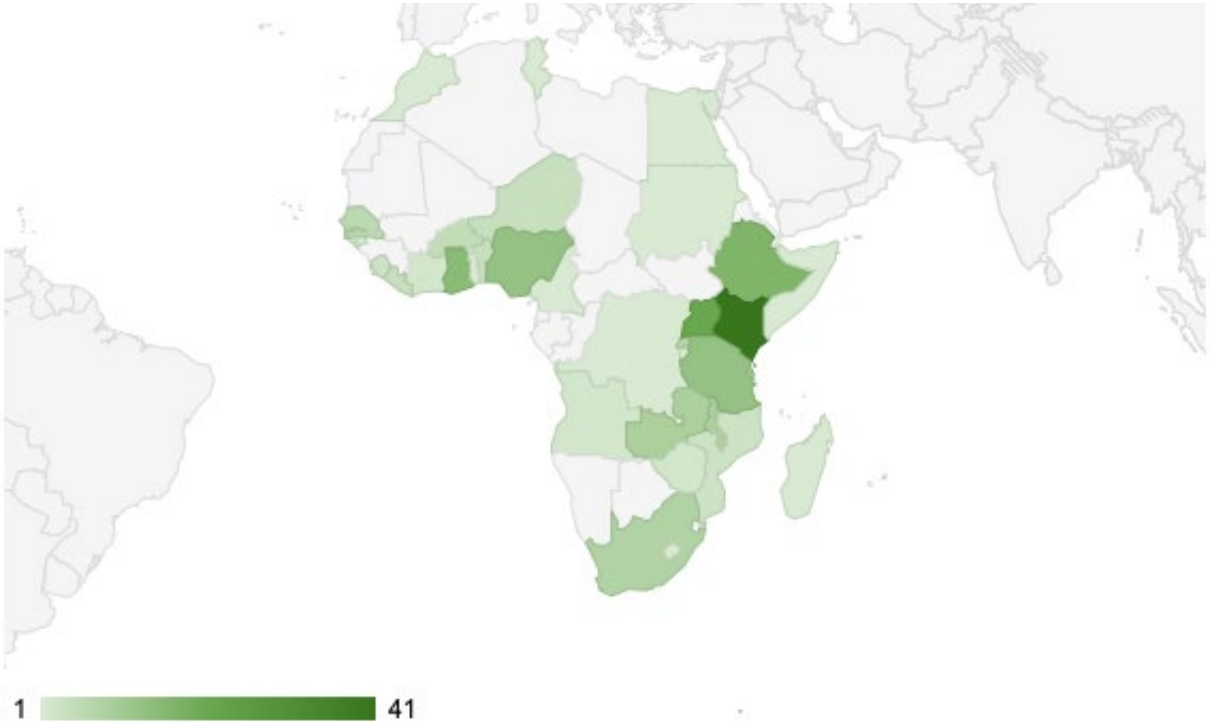
Source: Author construction using the harmonized test scores from the Human Capital Project (World Bank, 2018b, 2018c).

Figure 5: Learning-adjusted years of schooling for 158 countries around the world relative to countries in Sub-Saharan Africa.



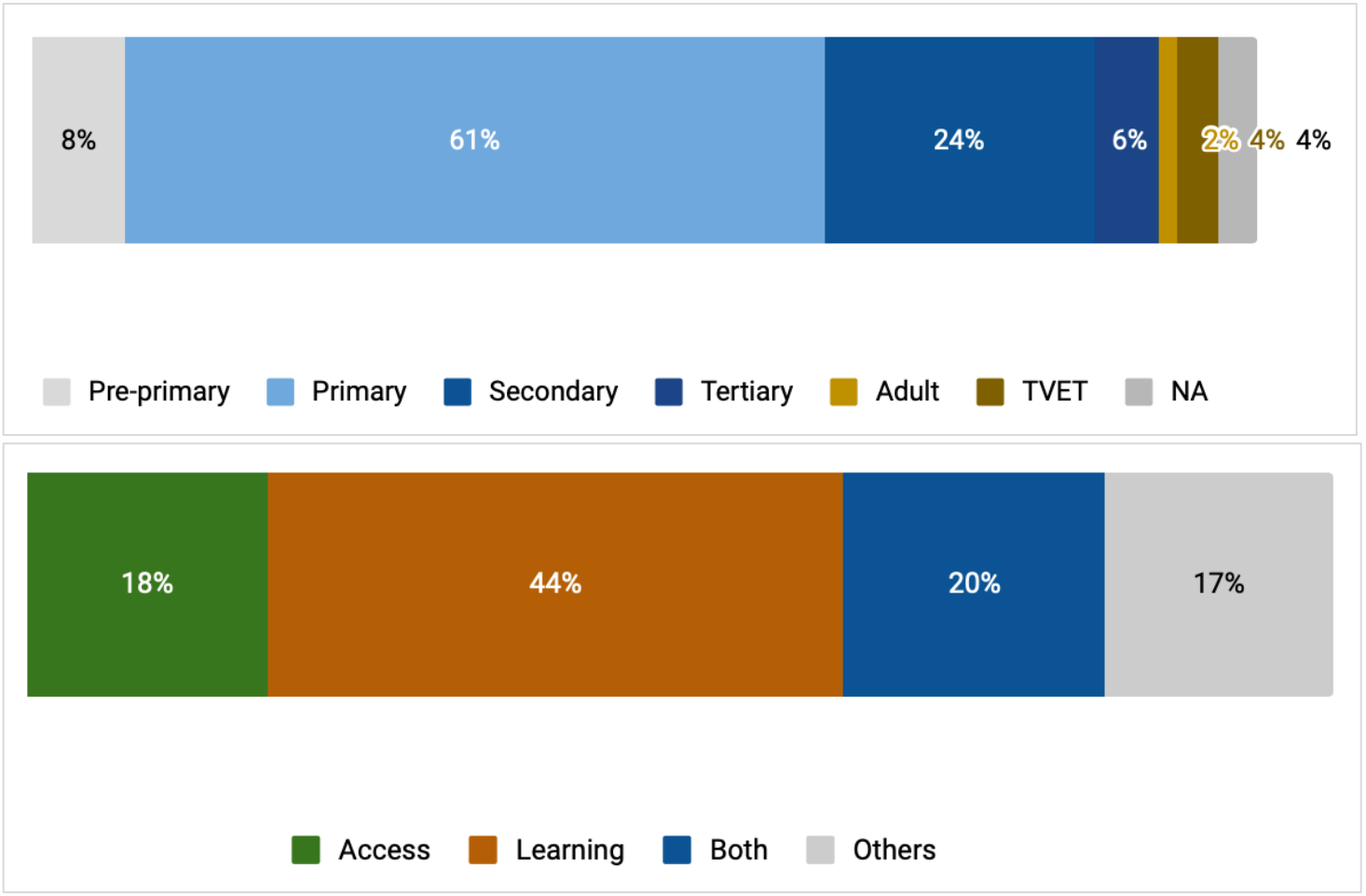
Source: Author construction using the data from the Human Capital Project (World Bank, 2018b, 2018c).

Figure 6: Distribution of identified education studies (2014-2020) across countries in Africa.



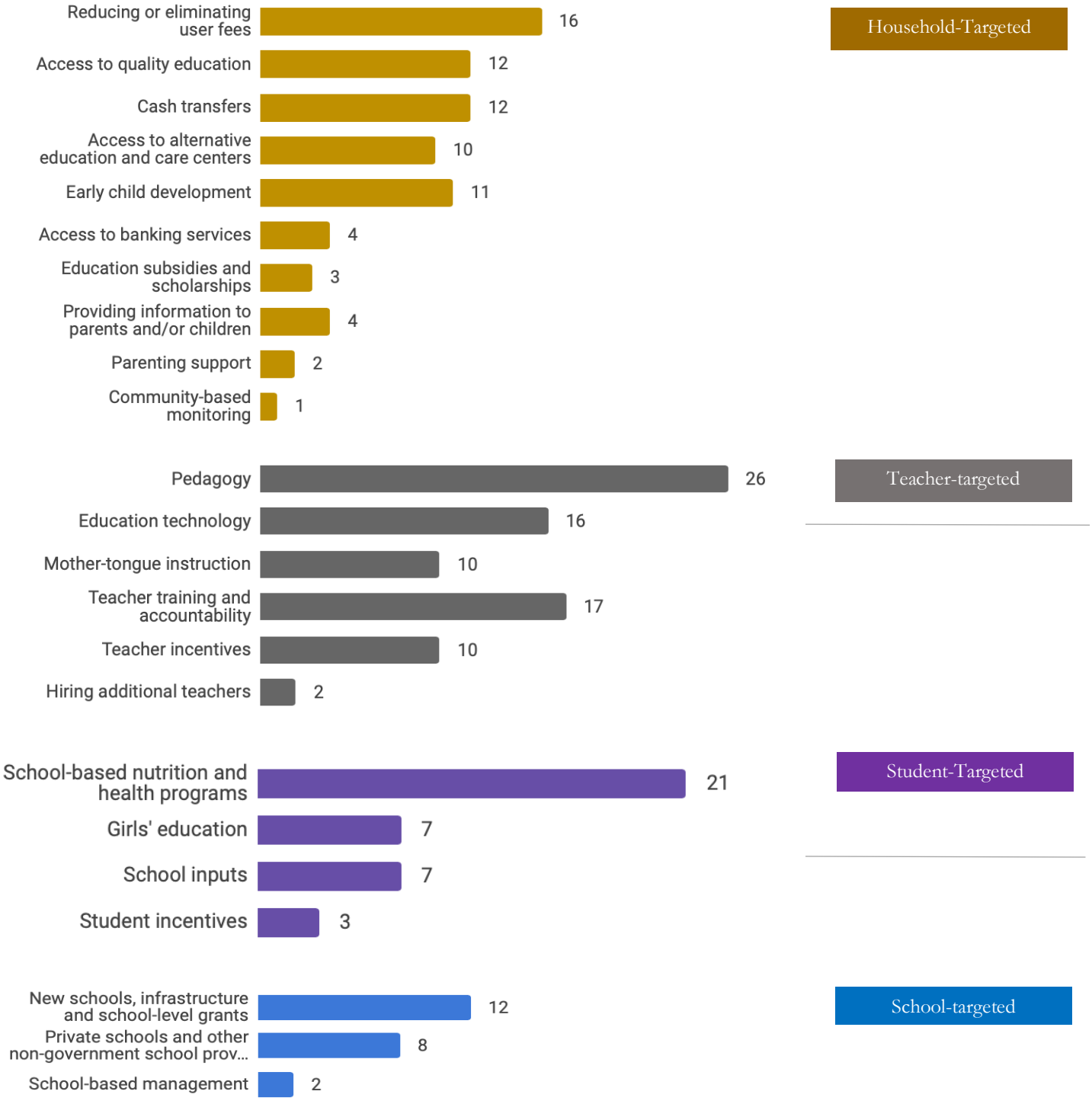
The countries with the most studies are Kenya (41 studies), Uganda (21), Ethiopia (17), Ghana (15), Nigeria (13), and Tanzania (13). This figure includes the 195 studies that passed the eligibility criteria of our search. In the results section, we restrict the sample to 145 studies on topics that are of current interest in education.

Figure 7: Distribution of identified education studies (2014-2020) across levels of education and classes of outcomes.



Note: Access includes all outcomes related to students staying in school such as rates of enrollment, attendance, and drop-out. Sum of values may exceed 100% since interventions can be implemented in more than one phase of education. Other outcomes include labor market outcomes and other life outcomes. This figure includes the 195 studies that passed the eligibility criteria of our search. In the results section, we restrict the sample to 145 studies on topics that are of current interest in education.

Figure 8: Distribution of the studies by targeting level and class of intervention.



Note: Our sample includes household-targeted interventions (75 studies, 38%), teacher-targeted (81 studies, 42%), student-targeted (38 studies, 19%), and school-targeted (22 studies, 11%). The sum of the percentages is more than 100 since each intervention may target more than one group. This figure includes the 195 studies that passed the eligibility criteria of our search. In the results section, we restrict the sample to 145 studies on topics that are of current interest in education.

Appendix for "Education in Africa: What Are We Learning?"

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Appendix Section 1: Returns to education in Africa – An overview

These two broad, cross-regional analyses—Psacharopoulos and Patrinos (2018) and Peet et al. (2015) – find estimates of returns to education in Africa between 9 and 11 percent. This type of estimate of the rate of return to schooling in Africa presents at least two challenges. First, Mincerian regressions typically do not account for the fact that characteristics that are often unobserved to the econometrician—such as innate ability, income level in childhood, social networks, parental motivation, or liquidity constraints—may affect both an individual's years of schooling and influence her adult earnings, limiting the causal interpretation of these estimates. Second, most estimates of the returns to education only include wage workers, which poses a particular problem in Sub-Saharan Africa, where fewer than 24 percent of workers receive wages or salaries.[20] In five countries across the region (Burundi, Central African Republic, Chad, Guinea, and Niger), that number is less than 10 percent (Appendix Figure 1).

Recent studies have sought to address each of these challenges in individual countries. In order to overcome self-selection issues, Samahiya (2020) used the compulsory education policy from South Africa in 1996 as a source of exogenous variation in schooling attainment and finds returns of 15.7 percent in monthly earnings, significantly higher than those from simple Mincerian estimates. In the north African country of Tunisia, Pellicer (2018) exploits education policy changes to estimate returns (specifically on the likelihood of public sector employment), showing that they have decreased over time but remain large, with the youngest cohorts seeing a 4 percentage point rise in public sector employment with an additional year of education.

To expand beyond wage earners, Lehmann-Uschner (2020) estimates the returns to education for self-employed market vendors in rural western Uganda, finding a return of 7 percent to formal education. Kavuma et al. (2015) impute wages for both the self-employed and the wage earners in Uganda, and estimate a return to schooling of 16 percent using a national household survey. Jones et al. (2018) use expenditures per contributing family member in the household rather than wages over three survey rounds in Mozambique and find a return of 10.5 percent points, remarkably similar to the Africa-wide estimate in Psacharopoulos and Patrinos (2018). As access to lower levels of education has risen, they find falling returns, so that "workers today must accumulate more years of schooling to achieve the same expected return as in the past." This is consistent with recent findings in the Democratic Republic of the Congo (Kuepié and Nordman, 2016) and. While there is some variation across estimates, that is to be expected across different countries, time periods, and samples. Furthermore, Serneels et al. (2016) show using Tanzanian data that estimates vary substantively and significantly (between 6 and 14 percentage points) depending on how the survey measuring wages and education is designed. A few recent papers have explored returns with respect to different outcomes. Woldehanna and Araya (2017) use longitudinal data in Ethiopia to show that access to early child education increases the odds of completing secondary school by a quarter. These estimates suggest significant returns to an additional year of education, including among informal sector workers.

Much recent research studies how to improve the quality of education (World Bank, 2018a). What are the returns to quality? There is much less evidence on this in the region, although evidence from high-income countries does show returns to higher quality education (Card and Krueger, 1992). Most studies on the quality

[20] The World Development Indicators report 24 percent for 2019 and 20 percent in 2000 (with intervening years between those two numbers). Sandefur (2019) highlighted this issue of low proportions of wage workers and the ensuing challenge of interpreting returns.

of education examine the impact of schooling interventions on cognitive outcomes (such as reading and math skills), and cross-country evidence suggests a strong role for cognitive skill in economic growth (Hanushek and Woessmann, 2008). In Ghana and Kenya, Valerio et al. (2016) find a positive association between reading ability and adult earnings, although the relationship remains statistically significant only in Ghana once they control for years of schooling. Using data from 53 countries, including many from Sub-Saharan Africa, Oye et al. (2016) find that schooling for women has positive returns on her children's survival, but that schooling together with learning yields significantly higher gains. An additional year of female schooling reduces under-5 mortality by 6 deaths per 1,000, whereas those reductions are two-thirds larger in the countries with the highest learning relative to those with the lowest learning. On net, this array of evidence suggests returns both to quantity and quality of schooling in Sub-Saharan Africa.

Appendix Table 1: Returns to education in Africa—recent studies

Study	Data	Identification strategy	Effect
Multi-country estimates			
Montenegro and Patrinos 2014 estimate returns to schooling around the world since the 1950s.	Constructed database of "data from 139 economies with a total of 819 harmonized household surveys."	"Basic Mincerian model" using data on earnings, years of schooling completed and potential experience.	"Private returns to schooling are generally positive and the cross-economy average rate of return to schooling is 10 percent a year."
Psacharopoulos and Patrinos 2018 estimate returns to education in 139 countries from 1950 to 2014.	Database of estimates on the rate of the return to education by the authors and other authors.	Averages rates of return (not just the Mincerian wage effect of education, but the "the value of lifetime earnings of the individual to the net present value of costs of education") to education from existing studies in different regions and time periods.	Private return to a year of schooling is 10.5 percent in Africa, second only to Latin America and the Caribbean (11 percent).
Peet, Fink, and Fawzi 2015 estimate returns to education in low and middle-income countries.	61 Living Standards and Measurement Surveys between 1985-2012 in 25 countries.	"Standard Mincerian wage equation" using data on earnings, years of schooling completed and potential experience.	Estimated return to education is 7.6 percent, with a return of 9.6 percent in Africa and 10.8 percent to urban workers in Africa and 10.9 percent to female works in Africa
Single country estimates			
Clifford, Xin, and Ilke 2017 estimate the impact of households' expected returns to education on post-primary school enrollment in Ghana.	Household data from the Ghana Living Standards Survey (GLSS-6) in 2012/2013.	Examines "composite and relative effect of opportunity cost, i.e., time and schooling expenditure, on children's post-primary school enrollments" and the effect of "of expectations on returns to education from the formal and informal economies on schooling decisions."	Expected returns from informal sector wages encourages secondary school enrollment while expected returns from the formal sector drives tertiary level enrollment.
Jones, Sohnesen and Trifkovic 2018 estimate private returns to education in post-conflict Mozambique.	Nationally-representative household surveys in Mozambique for 1996/97, 2002/03, 2008/09, and 2014/15.	Standard Mincerian regression - earnings ("expenditure outcome per contributing family member") against years of schooling with individual and household-specific controls.	Returns to education are non-linear and "have become more convex over time". "Returns to most levels of education have been falling over time."
Kavuma, Morrissey, and Upward 2015 estimate returns to education for wage-employees and self-employed in Uganda.	Household panel survey of 2005/06 and 2009/10 for Ugandan wage and self-employed workers.	"Mincerian human capital earnings framework," with a linear and quadratic specifications for monthly wage against years of schooling.	An "extra year of schooling is associated with an increase in earnings of 16 per cent" for both wage-employees and self-employed sectors.

Kuepié and Nordman 2015 estimate returns to education for two cities in Democratic Republic of the Congo (DRC) and across different sectors.	2009 Employment and Informal Sector Survey in the two cities in DRC.	"Mincer-type earnings model" using average hourly income from main work activity.	Study finds "convex returns to education" with higher returns for secondary and tertiary schooling.
Lehmann-Uschner 2020 estimates return to education for the self-employed non-agricultural workers in western Uganda.	Cross-sectional survey of market vendors in Western Uganda in 2015.	Mincerian regression of earnings ("average daily market earnings"), not profits on schooling, experience, experience2, a gender dummy, and a dummy for sector (food/nonfood).	"One additional year of schooling increases average daily income from market vending by 7 percent."
Pellicer 2017 looks at the change in returns to education in Tunisia over more than two decades.	Census and labor force surveys from 2004 to 2010.	"Exploits three comparable education policy change … to estimate the effect of education on public sector employment for different cohorts born from the 1950s to the 1970s."	"Returns have decreased across cohorts by around 1/3 although they remain large even for the later cohorts… One more year of education increases the chance of public sector employment by 4 percentage points."
Salisbury 2016 estimates returns to schooling in post-apartheid South Africa.			"Returns for Africans and coloreds were higher than in previous decades, but… remuneration outcomes for Africans and coloreds continuing to lag behind white South Africans by more than 20 percent"
Samahiya 2020 estimates returns to education in South Africa.	2018 South African General Household Survey	"Used the compulsory education policy of 1996 as a source of exogenous variation in schooling … and applied quantile regression analysis to trace the evolution of returns to education across the earnings distribution."	"An additional year of schooling increases the monthly earnings by 15.7%" using the basic Mincerian equation and 12.3% using the extended Mincerian equation.
Serneels, Beegle, and Dillon 2017 explore whether the survey design and choice of respondent affects estimates of return to education in Tanzania.	Survey experiment conducted in 2007-2008.	Returns are estimated first by OLS (log of daily wages), and then using non-parametric kernel regression to allow for non-linearity and endogeneity.	"The short questionnaire yields 6 percentage points higher returns to education for the highest (tertiary) educated men, and 14 percentage points higher returns for the lowest (primary) educated women."
Woldehanna and Araya 2017 estimate the returns of attendance in preschools in Ethiopia on completion of secondary education.	Longitudinal data from Young Lives Project in Ethiopia (2002 to 2016)	Uses Bellman equation of dynamic programming problem and logit, ordered logit and IV estimators to estimate the contribution of early	"Preschoolers are 25.7% more likely to complete secondary education than their non-preschool counterparts at the proper age."

		childhood investment on successful completion of secondary education"	

Appendix Table 2: Papers examined by source

Provenance	% of total
African Education Research Database	15%
Center for the Study of African Economies	20%
Evans and Popova (2016a)	7%
Evans and Yuan (2019)	14%
Journal Search	33%
North East Universities Development Consortium	2%
Added by authors	9%
Total	**100%**

Appendix Table 3: Studies on mother tongue instruction in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Brunette et al. 2019 estimate impact of a reading program in 12 different mother tongues in Uganda.	12 language communities included in the USAID-funded School Health and Reading Program Uganda.	"Within each district, schools are organized by coordinating centers that are staffed with coordinating center tutors. For the research design, [coordinating centers] were randomly assigned as either program (treatment) or control."	"Significant reading gains are possible in complex, large-scale mother tongue reading programs, but their magnitude may vary by language." The program "significantly positively affected literacy achievement in 9 of the 12 languages," and that "language characteristics, including complexity, were more predictive of impact than implementation fidelity or socioeconomic factors."
Kerwin and Thornton 2020 evaluate a mother-tongue literacy program in Uganda.	24 primary schools participating in the Northern Uganda Literacy Project.	Half of the schools were randomized to treatment (full-cost intervention) and the other half to control (reduced-cost intervention).	"A full-cost mother-tongue literacy program raised readings scores by 0.64SDs and writing scores by 0.45SDs while a reduced-cost version instead yields statistically-insignificant reading gains and some large negative effects (-0.33SDs) on advanced writing."
Laitin et al. 2019 estimate the "legacy of colonial language policies and their impact on student learning" in Cameroon.	24 primary schools in Cameroon.	Local education inspectors chose 12 schools considered to be "the low-performing schools in the region." Each school was matched to a control school by "three factors: (a) geographic proximity to the matched experimental school, (b) similar size, and (c) similar type of school [private or public]."	"Test results in examinations in both English and math reveal that treated students exhibit gains of 1.1–1.4 of a standard deviation in grades 1 and 3 compared with the control students. It also increases the probability of being present in grades 3 and 5 by 22 and 14 percentage points, respectively."
Piper et al. 2016c and 2018c evaluate the impact of the Primary Math and Reading (PRIMR) Initiative on learning outcomes in Kenya. Mother tongue instruction is one major component of the PRIMR initiative.	414 primary schools in Kenya	Schools were randomized to (i) base PRIMR, (ii) PRIMR and mother tongue instruction, (iii) control.	2016c: In general, the mother tongue literacy instruction led to positive learning outcomes with effect sizes between 0.3 and 0.6 SDs. The base program, teaching literacy in English and

			Kiswahili, “also increased mother tongue learning outcomes in some measures, but had smaller effects than the [English + Kiswahili + mother tongue] program in oral reading fluency and comprehension.”
			2018c: “Assignment to the mother-tongue [instruction] group had no additional benefits for English or Kiswahili learning outcomes beyond the non-mother-tongue group, and that the mother-tongue group had somewhat lower mathematics outcomes.”
Ramachandran 2017 estimates the effect of mother tongue schooling on learning outcomes in Ethiopia.	2011 Demographic Health Survey for Ethiopia.	Differences in the implementation of the 1994 education reform across birth cohort, language groups and regions.	"Access to mother tongue schooling increases the ability to read by 40%...increases the completed years of schooling by more than half a year, and the probability of completing primary schooling by five percentage points... increases newspaper readership by around 25% and makes it 17% points more likely that individuals report using pamphlets, posters or leaflets as a source of information about family planning."
Seid 2016, 2017, and 2019 evaluates the impact of changing the medium of instruction on education outcomes in Ethiopia.	1994 and 2007 population census in Ethiopia.	The 1994 education reform allowed states “to choose the medium of instruction in primary schools located within their jurisdictions,” leading to some schools to change their medium of instruction while other schools did not. The study takes advantage of this exogenous variation in implementation.	2016: Mother-tongue instructions has "increased the probabilities of both enrollment in primary school and whether a child attends the 'right' grade for her/his age."
	2013 Ethiopian Labor Force Survey	Difference-in-differences estimation using state and birth cohort variations	2017:

		in implementing the 1994 educational reform.	Exposure to mother-tongue instruction in primary school led to higher probability of being employed as adults. For individuals in private sectors, mother-tongue instruction in primary school led to higher likelihood of having permanent positions, higher incomes, and higher job satisfaction.
	Young Lives' 2012-2013 Ethiopian school survey	Triple differences estimation using different levels of exposure to mother-tongue instruction across states and across different language groups.	2019: "Learning in mother tongue first (in grades 1 − 4) increases students' mathematics and literacy tests scores later after they transition to English instruction (in grade 5) by 0.269 and 0.089 standard deviations, respectively."
Taylor and von Fintel 2016 estimate the impact of mother tongue instruction in primary schools in South Africa.	Combined datasets (2007 to 2012) covering 827,745 individuals in 9,180 primary schools in South Africa.	"School fixed effects model to exploit within-school variation in the language of instruction in grades 1, 2 and 3 caused by historical changes in the language of instruction at specific schools."	"[MTI] in the early grades significantly improves English acquisition, as measured in grades 4, 5 and 6."

Appendix Table 4: Studies on structured pedagogy and other pedagogical interventions in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Multi-country estimates			
Lucas et al. 2014 evaluate the "Reading to Learn intervention, implemented by the Aga Khan Foundation" in Kenya and Uganda.	112 schools in from 28 clusters in Kenya and 109 schools from 10 clusters in Uganda.	Clusters were randomly assigned to treatment and control groups.	"We find that Ugandan literacy (in Lango) increased by 0.2 standard deviations. We find a smaller effect (0.08) on a Swahili literacy test in Kenya."
Ngware et al. 2014 evaluate a reading to learn intervention in a randomized controlled trial in Kenya and Uganda.	120 primary schools in Kenya and 109 primary schools in Uganda.	Random assignment to control and treatment groups.	The Reading to Learn program did not have an impact on numeracy and literacy in Kenya but raised oral and written literacy in Uganda.
Rosário et al. 2015 examine students' adoption of self-regulated learning in Mozambique, Chile, Portugal, and Spain.	First-year university students in four universities in the study countries.	Students were randomized to treatment group (263 students) and control group (247 students).	Use of letters from a fictional student describing experiences as a self-regulated learning (SRL) student was effective in "promoting the use of SRL strategies and in improving the motivational variables directly - related to the study process."
Single country estimates			
Agor 2014 evaluates the effect of a language-learner strategy instruction on English language achievement in Ghana.	Two classes of junior high school in Ghana.	One class was assigned to intervention and the other to control.	Incorporating "language-learner strategies both implicitly and explicitly" as part of English lessons improved language test results after one year.
Ali et al. 2015 test different approaches to improving English skills of students in Eastern Sudan.	85 secondary school students in Gadarif province, in Eastern Sudan.	Students were assigned to experimental and control groups. Pre-test and post-test were administered.	The Sudan Practical Integrated National English (SPINE) instruction led to higher test scores compared to using the traditional English literary text in teaching the past simple and past perfect tenses.
Argaw et al. 2017 look at the effect of problem-based learning on students' motivation in Ethiopia.	81 students in Wachemo Preparatory school in Ethiopia.	Students were assigned to four groups based on pre-test scores. Groups were randomly assigned to treatment and control, and were administered a post-test after intervention.	Problem-based learning strategy improved physics students' problem-solving skills but had no significant effect on motivation to learn the subject.

Gidena and Gebeyehu 2017 investigate the effect of advanced organiser model on students' achievement in Ethiopia.	139 students in three sections in Endabaguna preparatory school in Ethiopia.	Two sections with matching pre-test scores were randomly assigned to experiment and control. Post-tests were administered after treatment.	Use of advance organiser model in preparatory schools in Ethiopia led to better performance (effect size of 0.49) compared to conventional teaching method.
Inuwa et al. 2017 assess the effect of cooperative learning on student learning in Nigeria.	120 students randomly selected from six schools in Nigeria.	Random assignment to experiment and control, with pre-test and post-test.	Cooperative learning approach improved test scores compared to conventional instruction method for secondary students studying financial accounting.
Katreniak 2019 examines persistent overconfidence of students in Uganda.	5000 primary and secondary students in Uganda.	Students were randomized to intervention and control.	"Students are overly overconfident and group feedback only helps them to offset inflated beliefs which arose due to a task repetition. A decrease in confidence gap is accompanied with increase in performance but decrease in happiness."
Piper et al. 2014, 2015, 2016a, and 2018b evaluate the impact of the Primary Math and Reading (PRIMR) Initiative on learning outcomes in Kenya. The program includes the provision of structured teacher guides for teachers and feedback to teachers.	Grade 1 and Grade 2 students in 400 schools in three counties in Kenya.	Zones and clusters of schools were randomly assigned to treatment and control.	2014: The PRIMR Initiative "improved oral reading fluency and in grade 1 formal and nonformal schools and grade 2 non formal schools for both English and Kiswahili."
	Grade 1 and Grade 2 students in 547 schools in Kenya	Zones and clusters of schools were randomly assigned to treatment and control.	2015: Participation in the PRIMR Initiative improved oral reading fluency (effect size of 0.17 to 0.51) and reading comprehension (0.05 to .58 SDs) for poor students, with impact differentials across language, grade and school type. The impact of PRIMP outweighs existing negative socio-economic effects of poverty, although the gains for poor pupil were smaller than for the non-poor.
	Grade 1 and Grade 2 students in 411 schools in Kenya	Zones and clusters of schools were randomly assigned to treatment and control.	2016a: "The PRIMR Initiative provided pupil learning materials, teachers' guides and modest teacher professional

			development in mathematics. The mathematics intervention produced modest, statistically significant results: generally similar results for males and females, a larger impact in grade 2 than grade 1, a larger impact in non-government schools than public schools, and smaller outcomes in mathematics than for English or Kiswahili."
	171 randomly selected primary schools from 44 zones.	Random selection and assignment were utilized in assigning zones to treatments.	2018b: "[Teacher professional development], teacher instructional support and coaching, 1:1 student books, and structured teacher lesson plans was most effective" in increasing "literacy and numeracy outcome measures for grades 1 and 2."
Piper et al. 2018a evaluate the scale-up of Kenya's Tusome national literacy program.	23,000 public primary schools and 1500 low-cost private schools in Kenya	The paper relies on an external evaluation report that "compared the learning outcomes in a nationally representative sample of schools between 2015 and 2016… given that Tusome was implemented nationally and that there is no counterfactual."	"Tusome literacy program's external evaluation results showed program impacts of 0.6–1.0 standard deviations on English and Kiswahili learning outcomes."
Richter et al. 2015 evaluate an environmental education comic distributed in Madagascar.	542 students six primary schools at Lake Alaotra, Madagascar.	Researchers assigned a control class and intervention class in each school. Data were collected at the beginning, immediately at the end, and one year after the intervention.	Comic books and additional materials intended for environmental education program led significantly higher environmental knowledge and awareness of issues compared to controls. Results persist even after one year after education ended.
Roberts et al. 2016 test different approaches in improving skills related to writing standard orthography in Togo.	97 secondary school students in Togo.	Students were randomly assigned to treatment and control. After an "eleven-hour transition course," scores from pre-tests were compared to the scores from the post-test.	Secondary school students who underwent training on "representing the output of the lexical phonology" ... "outperforms the other groups in three of the error types associated with adding diacritics, although they performed less well on one of the error types associated with writing

			long vowels" against two other learning strategies.
Sarfo et al. 2017 compare two teaching methods in teaching mathematics in Ghana.	80 junior high school students in Ghana.	Students were randomly selected and randomly assigned to intervention and control.	"The designed concrete representational abstract intervention is more effective for improving students' general performance in geometry and algebra than the designed regular method of teaching intervention."
Sarkodie and Adu-Gyamfi 2015 look at the use of ball-and stick models to improve chemistry skills in Ghana.	One teacher and 60 high school students in Ghana.	Pre-test and post-test, with no control group.	Use of ball-and-stick models that can be physically manipulated improved student performance in "naming and writing of structural formulae of hydrocarbons" and student attitude towards learning.
Tetteh 2016 looks at effect of study time on learning outcomes in Ghana.	Three classes in an undergraduate business school in Ghana.	Classes were assigned to "strictly supervised study time," "not strictly supervised study time," and the control group.	Strict supervision of study time led to improved "learning process" for higher education students compared to non-strict supervision.
Tiruneh et al. 2017 examine different approaches to including critical-thinking skills in the curriculum for university students in Ethiopia.	Study of 147 first-year students in a university in Ethiopia.	Random assignment to control and treatment groups.	Immersion and infusion instructional conditions improved first-year university students' course achievement and domain-specific critical thinking proficiency, over the traditional instructional condition, but did not have significant impact on domain-general critical thinking skills.
Uba et al. 2017 evaluate the effect of graphic organizers in understanding prose fiction in English as a Second Language classroom in Nigeria.	Study of four secondary schools (100 senior students) in Nigeria.	Students assigned to different groups were evaluated with a pre-test and post-test.	Use of cognitive maps or concept maps in teaching prose literature in English in select secondary schools led to better performance in prose and comprehension assessments.
Yusuf 2014 evaluates the use of "think and search" questions in improving reading comprehension in Nigeria.	60 secondary school students from two government schools in Kaduna, Nigeria.	One school was assigned to treatment, and the other to control. Pre-test and post-test were administered.	Use of "think and search" questions enhanced reading comprehension in one school in Nigeria as compared to another school that did not have the same intervention.

Yusuf 2018 estimates the effectiveness of stop, think and talk activities on reading comprehension of students in Nigeria.	100 students from two secondary schools in Abuja, Nigeria.	Schools were assigned to treatment and control. Data was gathered through pre-test and post-test.	Secondary school students who underwent stop, think and talk activities performed better in reading comprehension compared to peers.

Appendix Table 5: Studies on teacher policies in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Aker and Ksoll 2019 evaluate "a simple monitoring system, implemented via the mobile phone [where] teachers, students, and the village chief were called on a weekly basis" in Niger.	160 villages in Niger	Villages were randomly assigned to adult training only, adult training + monitoring, or control.	After one year, the intervention improved reading and math test scores by .15-.30 s.d. higher, "with relatively stronger effects in the region where monitoring was weakest and for teachers for whom the outside option was lowest."
Attanasio et al. 2019 evaluate the Lively Minds program in Ghana that train "uneducated marginalised volunteer mothers" and kindergarten teachers.	80 kindergarten schools in Ghana	Schools are randomized by strata (cluster and school size) to control and treatment.	"The programme has significant positive impacts on children's cognitive and socioemotional development as well as health. The impacts on cognitive development are driven by improvements in numeracy, executive functioning and fine motor skills."
Beg et al. 2019 evaluate the Strengthening Teaching Accountability to Reach All Students in Ghana, a program that trains teachers on targeted instruction.	Teachers in P4 to P6 from 210 schools in Ghana	Clusters of schools were randomized to receive targeted instruction only (70 schools), targeted instructions and management training to heads (70 schools), or control (70 schools).	Both treatments led to "increased student learning on a combined English and Math test by about 0.11 standard deviations" In addition, "teachers in the treatment arms were no more likely to be present on school grounds but were about 11 percentage points more likely to be in the classroom."
Blimpo and Pugatch 2020 assess a comprehensive teacher training program in Rwanda. The program components are: "(i) six training sessions during school breaks, ii) exchange visits each term where teachers provided feedback to their peers, and (iii) outreach and support from NGO staff at least twice per year."	207 secondary schools in Rwanda	Schools are randomly assigned to treatment or control, stratified by district and public/non-pubic status.	"The program increased teachers' use of active instruction… increased (student) participation in businesses by 5 percentage points, or 17% of the control mean, with a commensurate decrease in wage employment, and no effect on overall income."
Bold et al. 2018 "report on a randomized trial embedded within a	"192 government primary schools spanning all eight Kenyan	"64 were randomly assigned to the control group, 64 to receive a contract	"New teachers offered a fixed term contract by an international NGO

nationwide reform of teacher hiring in Kenyan government primary schools."	Provinces" (Grades 2-3)	teacher as part of the government program, and 64 to receive a contract teacher under the coordination of the local affiliate of an international NGO, World Vision Kenya."	significantly raised student test scores, while teachers offered identical contracts by the Kenyan government produced zero impact. Observable differences in teacher characteristics explain little of this gap."
Chelwa et al. 2019 study the effect of the rural hardship allowance in Zambia. The allowance is a 20% increase in salary of teachers assigned to schools that are a certain distance from the district.	5,000 government-run schools with data from Annual School Census collected annually by the Ministry of General Education; payroll data from the Payroll Management Establishment Control of the Government of Zambia; and, telephone survey to validate the teacher-payroll mismatch in the database.	"The rural hardship allowance is allocated to schools outside a given radius from district centers, and this allows us to estimate the effects of salaries using a regression discontinuity approach."	The program had significant non-compliance: "crossing the threshold increases the share of teachers obtaining the allowance by 40%...Focusing on provinces with better compliance we find some, albeit weak, evidence that the allowance increases the stock of teachers," but no effects on teacher characteristics or student scores.
Cilliers et al. 2020c evaluate a "low-stakes accountability program that published both nationwide and within-district school rankings" in Tanzania called "Big Results Now in Education".	Tanzania Primary School Leaving Examination, administrative data from the Education Management Information System (EMIS), and micro-data from the World Bank Service Delivery Indicators (SDI) survey in Tanzania	Difference-in-difference model that exploits "the differential pressure exerted by BRN on schools at the extremes of their district ranking."	The program "improved learning outcomes for schools in the bottom two deciles of their districts. However, the program also led schools to strategically exclude students from the terminal year of primary school."
Cilliers et al. 2019 and follow-up in 2020 evaluate centralized training and in-classroom coaching for South African public primary school teachers.	180 public primary schools in South Africa.	"50 were randomly assigned to receive residential teacher training workshops (two days at a time, twice a year), 50 were assigned to receive on-site specialist coaching to teachers, and 80 schools were assigned to the control."	2019: "Students exposed to two years of the program improved their reading proficiency by 0.12 standard deviations if their teachers received centralized Training, compared to 0.24 if their teachers received in-class Coaching."
			2020: "One year after participating in the programs, teachers in both programs retain their knowledge and continue using the resources provided by the programs. These gains spill over to other teachers in the treated schools who did not participate in the programs. However, there is a sharp decline in teaching practices and only

			teachers who received Coaching maintain their improved teaching techniques"
Donfouet et al. 2018 evaluate the cost-effectiveness of different interventions aimed to improve quality of child development centers in Kenya.	300 child development centers in Nairobi, Kenya.	72 public zones, each containing several centers, were randomized to: 1) teacher training, 2) teacher training + instructional materials, 3) teacher training + instructional materials + hygiene education, or 4) no intervention.	Combining teacher training with instructional materials is cost-effective in preparing pre-primary children for primary school. After two years, the study finds that every additional US$ 1 spent on the intervention yields 0.16 additional percentage points in outcomes for public centres and 0.36 additional percentage points for private centers (US$ 14.83 and US$ 17.01 cost per child for the public and private interventions, respectively).
Duflo et al. 2015a evaluate a program allowing school committees to hire an additional teacher under a renewable contract and one-quarter of the normal compensation in Kenya.	210 primary schools in Western Province, Kenya.	Schools were randomized to control and treatment (one additional contractual teacher).	Hiring new teachers on an annual renewable contract conditional on performance led to increased student test scores, potentially because of lower teacher absenteeism. Despite class-size reduction from 82 to 44 for existing civil-service teachers, test scores did not increase significantly.
Duflo at al. 2020 evaluate the "Teacher Community Assistant Initiative (TCAI), a Ghana Ministry of Education program designed to test the relative efficacy of four alternative school based interventions."	500 primary school, with program implemented in Grades 1-3	Schools were randomly divided into "five treatment groups– assistant-led remedial instruction during school, assistant led remedial instruction after school, assistant split, teacher-led targeted instruction, and control."	"We find that all four interventions increased student achievement on tests that included content from all three grades of lower primary school. After being exposed to the program for 2 years, students who started the program in grade 1 increased their test scores by 0.08 to 0.15 standard deviations (SD), depending on the exact intervention, in all cases statistically significant."
Gilligan et al. 2019 evaluate a program in rural Uganda that provided bonus payments to teachers based on students' math performance relative to comparable students in other schools.	302 primary schools (Grade 6) in Uganda.	The schools were stratified according to presence of Grade 6 math books and class size. Within each strata, schools were ranked against previous performance. In three strata, treatment was assigned to schools with even	"This Pay for Percentile (PFP) incentive scheme did not improve overall P6 math performance, but it did reduce dropout rates. PFP treatment raised attendance rates a full year after treatment ended from .56 to

		ranks. In the remaining three strata, treatment was assigned to odd ranked schools.	.60." "PFP did not improve any measure of attendance, achievement, or attainment in schools without books."
Jukes et al. 2017 evaluate the Health and Literacy Intervention (HALI) literacy improvement program in Kenya that uses "training workshops, semi-scripted lesson plans, and weekly text-message support for teachers."	2,500 students in 101 rural government primary schools in Kwale and Msambweni Districts, Kenya.	Schools were randomly allocated to treatment and control, and stratified by Teacher Advisory Center tutor zones and average primary school leaving exam scores.	Kenya's HALI literacy intervention program led to increased focus on letters and sounds and more instruction with written text (effect sizes from 0.57 to 1.15). In addition, the intervention has a positive impact on children's literacy after two years (effect sizes of up to 0.64) and has reduced school dropout from 5.3% to 2.1%. A similar approach has been adopted nationally in Kenya.
Leaver et al. 2019 evaluate pay-for-performance (P4P) contracts in Rwanda.	1,963 qualified applicants and 164 primary schools (Grades 4-6) in Rwanda.	"In the first tier, we randomly assigned teacher labor markets to either P4P or equivalent fixed-wage contracts. In the second tier, we implemented a 'surprise', school-level re-randomization, allowing us to separately identify the compositional effects of advertised P4P contracts and the effort effects of experienced P4P contracts."	Pay-for-performance contracts attracted more money-oriented candidates, but those candidates were at least as effective as traditionally recruited candidates. Pay-for-performance boosted student learning by 0.21 standard deviations, with a quarter of the gain attributed to composition changes on the workforce, and the remaining three-quarters from increased effort.
Lichand and Wolf 2020 evaluate monitoring "nudges" provided to either parents, teachers or both in the Ivory Coast.	96 classrooms (2nd, 4th and 6th grades) in 100 Ivorian public primary schools	Schools were randomly assigned: 25 to control; 25 to only teachers nudged; 24 to only parents nudged; and 26 to have teachers and parents both receive nudges.	Providing twice-a-week text messages to either parents or teachers reduced dropout by nearly 50% but providing nudges to both parents and teachers at the same time had no effect on school dropout.
Mbiti et al. 2019a evaluate the "the impact of providing schools with (i) unconditional grants, (ii) teacher incentives based on student performance, and (iii) both of the above" in Tanzania.	350 public primary schools (Grades 1-3) across 10 districts in mainland Tanzania.	Schools were randomly assigned to the three treatment groups (7 schools each arm) and 14 schools to control.	"After two years, we find (i) no impact on student test scores from providing school grants, (ii) some evidence of positive effects from teacher incentives, and (iii) significant positive effects from providing both programs. Most important, we find strong evidence of complementarities

			between the programs, with the effect of joint provision being significantly greater than the sum of the individual effects. "
Mbiti et al. 2019b evaluate a pay for percentile system (rewards teachers based on their students rank against other students of the same baseline level in the school) and a pay for proficiency system (rewards teachers based on student proficiency levels) in public primary schools in Tanzania.	180 primary schools (Grades 1-3) from 10 districts in Tanzania.	Schools were randomized to the pay for percentile, pay for proficiency, or control group.	The simpler proficiency incentive system is at least as effective as the pay for percentile system in increasing Math and Swahili test scores. The pay for percentile system may encourage teachers to focus more on better-prepared students, especially in Kiswahili.
McDermott and Allen 2015 evaluate a teacher education project in rural Sierra Leone.	"Thirty school leaders representing five chiefdoms participated in three five-day workshops, which were held over the course of the 2013–2014 academic year. After completing each of the weeklong workshops, the school leaders were expected to provide similar workshops for teachers in their regions."	Before and after comparison.	After the training, "the school leaders improved significantly in their self-reported knowledge and use of literacy methods" and that they, in turn, "reported they successfully implemented local workshops, and their participants were receptive and eager to learn and use the teaching methods in their schools." Challenges reported include "insufficient classroom resources, difficult travel conditions to the school sites and a lack of formal education of many of the teachers."
Özler et al. 2016 evaluate a combined childcare teacher training program and parenting support program in Malawi.	2,120 children in 199 childcare centers in four districts in Malawi.	Centers were randomized to: 1) provision of play and learning materials, 2) teacher training and mentoring, 3) teacher training + monthly stipend, and 4) teacher training + parenting training.	At the 18-month follow-up, the combined program significantly improved children's scores in measures of language and socio-emotional development compared to children in centers receiving teacher training alone. Impact faded away at the 36-month follow-up.
Pugatch and Schroeder 2014 and 2018 evaluate the impact of the Gambian hardship allowance "which provides a salary premium of 30–40% to primary school teachers in remote locations, on student performance."	244 schools with 56,405 students. Student test scores come from the National Assessment Test, and payroll and school location information from the Education Management	The study uses the geographic discontinuity in the implementation of the policy as source of variation.	2014: "We find that the hardship allowance increased the share of qualified (certified) teachers by 10 percentage points. The policy also reduced the pupil–qualified teacher ratio by 27, or

	Information System, an annual census of schools.		61% of the mean, in recipient schools close to the distance threshold." 2018: The hardship allowance has no effect on the average test scores but improved performance of top students at the expense of bottom-ranking students.
Wolf et al. 2018 evaluate the impact of " 'Quality Preschool for Ghana' Interventions on Teacher Professional Well-being, Classroom Quality, and Children's School Readiness."	240 preschools (teachers N = 444; children N = 3,345) in Ghana.	Schools were randomly assigned to "one of three conditions: teacher training (TT), teacher training plus parental-awareness meetings (TTPA), and controls."	"Moderate impacts were found on some dimensions of professional well-being (reduced burnout in the TT and TTPA conditions, reduced turnover in the TT condition), classroom quality (increased emotional support/behavior management in the TT and TTPA conditions, support for student expression in the TT condition), and small impacts on multiple domains of children's school readiness (in the TT condition)."

Appendix Table 6: Studies on school feeding in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Aurino et al. 2019 evaluate Ghana's nationwide school feeding program.	4,269 children sampled in 93 communities	Priority districts with high poverty and food-insecurity were randomized to either the basic school feeding program or school feeding + sourcing of meals from local farmers. Two schools (and their surrounding communities) from each district were randomized to school feeding or control.	After two years of implementation, the nationwide school feeding program led to increases in test scores generally, and to "remarkable learning and cognitive gains for girls and children from poorest households and regions."
Azomahou et al. 2019 evaluate a program that provides canteens and deworming to schools in a field experiment setting in rural Senegal.	120 schools located in Diourbel, Fatick, Kolda and Sdhiou, Senegal.	The schools were randomized to: a canteen-only group, a canteen and deworming group, a deworming-only group, and a control group.	"Relying on the average treatment effect and the complier effects, we find that the programme has a positive and significant impact on pupils' scores and on the enrolment rate…For the aggregate and mathematics scores, the impact of the programme on girls is greater than on boys. By contrast, for the French score, the impact on boys is greater than on girls."
Diagne et al. 2014 examine the impact of school canteen programs in rural schools in Senegal.	120 schools with no existing canteens from the four poorest regions in Senegal.	Schools were randomized to treatment and control.	After a year, the school canteen has a positive impact on the overall score of students in grade 2, including in mathematics and French. Impact is not significant for older children. Girls are more likely to benefit than boys.
Hulett et al. 2014 test the effect of adding animal source in school feeding programs to correct for micro-nutrient deficiencies in Kenyan schoolchildren.	12 schools in the Embu subregion in Kenya	"Schools were randomized into one of the three feeding groups [corn and bean stew + meat, corn and bean stew + milk and, plain corn and bean stew] or the Control group via a slightly restricted randomisation process such	After over two years, "children in the Meat group showed significantly greater improvements in test scores than those in all the other groups, and the Milk group showed significantly greater improvements in

		that the three large schools with more than one standard I classroom could not be randomised to the same feeding condition."	test scores than the plain [corn and bean stew] and Control groups."
Mensah and Nsabimana 2020 "evaluate the impact of Rwanda's Home Grown School Feeding Program on the cognitive performance of students that benefited from the program."	"Administrative data on student test scores in … The Rwanda Primary School National Examinations - matched with information on school's enrollment into the [feeding] program." The data covers 104 beneficiary schools in Rwanda.	"Our identification strategy exploits the plausibly exogenous variations in exposure to the program induced by the staggered implementation of the program across schools and students grade at the time of program implementation."	"An additional month of exposure to school feeding increases student test scores on math, science and social studies by 0.015, 0.026 and 0.025 standard deviations respectively. We also find positive and statistically significant effect on test scores in English and Kinyarwanda [but] no gender differences in the impact of the program."
Nikiema 2019 evaluate "the impact of the Catholic Relief Services (CRS) school feeding programme on pupils' attendance and girls' enrolment rate within primary schools in northern Burkina Faso."	134,128 pupils from 684 schools primary schools in Burkina Faso.	All rural schools where girls' enrolment rate was below 40 percent were assigned for daily meals + take-home rations, while the rest received only daily meals.	"Take-home rations increased school attendance for both boys and girls. Moreover…girls' enrolment rate within schools increased by 3.2 per cent. This is driven by the increase in the number of newly enrolled girls compared with boys."
Parker et al. 2015 investigate a school feeding trial with fortified rice in Burundi.	904 children in 12 primary schools in rural Burundi.	The schools were randomized "to receive either fortified rice (intervention group) or milled rice (control group)."	The 7- month school feeding program did not have impact on hemoglobin concentration and prevalence of anemia among school children.

Appendix Table 7: Studies on education technology in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Abrami et al. 2016 evaluate "the impact of interactive, multimedia literacy software (ABRA) on the reading skills of early elementary students in Kenya." In-school intervention.	254 grade two English students under 12 teachers from 6 schools in Kenya.	The teachers were randomly assigned to treatment or control.	Use of a multimedia literacy software that included 90-min lessons, weekly web conferences with the trainer and technical support improved students' reading comprehension as measured by a standardized literacy test. "In addition, ABRA students outperformed their peers in control classes on the core end-of-year subject exams including English, Mathematics, Science and Social Studies."
Cardim et al. 2020 test the impact of "ProFuturo, a program providing the technological/ pedagogical package Aula Digital (Digital Mobile Classroom), to primary schools in Luanda, Angola." In-school intervention.	42 primary schools in Luanda, Angola.	Schools were randomized to treatment or control.	One year after start of implementation, the study finds "positive treatment effects on students' and teachers' familiarity with technology… positive treatment effects on measures of students' motivation and interaction with their peers" and less teacher absenteeism.
Cilliers et al. 2020b compare on-site and virtual coaching of teachers in South Africa. In-school intervention.	180 schools in two districts in the Mpumalanga province in South Africa,	Schools were stratified according to size, performance, and socio-economic status and then randomly assigned to on-site or virtual coaching, or to control.	"After three years, on-site coaching improved students' English oral language and reading proficiency by 0.31 and 0.13 SD, respectively. Virtual coaching improved English oral language proficiency (0.12 SD), had no impact on English reading proficiency, and an unintended negative effect on home language literacy."
Derksen et al. 2020 evaluate the impact of providing access to Wikipedia to students in Malawi. In-school intervention.	1,508 in four urban secondary schools in Malawi.	"We randomized at the student level, and stratified on four key variables: school, form, exam scores and internet experience. "	Access to Wikipedia "had a small positive impact on Biology and English exam scores, and no impact on other subjects."
Lehrer et al. 2019 evaluate the impact of Project Sankoré which "creates a digital classroom" through installation	11,289 students from 173 primary schools in Senegal.	Eligible schools were ranked according to government priority and the top schools in the list received the kits.	Providing interactive smartboards in grades 1 and 2 classrooms had a

of an interactive whiteboard, a computer, a data projector, and digital resources in primary schools in Senegal. In-school intervention.		The researchers employed regression discontinuity analysis to compare schools around the cut-off.	positive impact on student scores of urban students.
Habyarimana and Sabarwal 2018 evaluate the effect of providing e-readers to students in Lagos, Nigeria through both the 'gadget effect' (reciprocity in response to the gift of a valuable gadget) or the 'content effect' (increasing exposure to relevant materials). eReaders were distributed in the school, but almost half of the students used the eReaders exclusively at home.	500 Grade 8 students	Students were randomly assigned "to a control group that received nothing and three treatment groups that each received eReaders with either: a) only non-curriculum reading material; b) non-curriculum reading material and curriculum textbooks; and c) non-curriculum material, curriculum textbooks and supplementary curriculum relevant material."	Six to eight months of exposure to eReaders with curriculum textbooks and supplementary content led to positive impacts on learning and improved student retention. Providing eReaders (with non-curriculum recreational material) reduced student learning outcomes.
Croke et al. 2017 examine the "impacts of an information and communications technology training intervention that targeted university graduates in five major cities" in Nigeria. Trainings were conducted in classrooms.	3,018 applicants from Lagos, Abuja, Kano, Kaduna, and Enugu in Nigeria.	Applicants were randomized to attend the program or control.	After two years, the intervention led to a 26 percent increase in likelihood of working in the ICT sector, but "no average impact on the overall likelihood of being employed." For women who at baseline were "implicitly biased against associating women with professional attributes", the intervention led to three times higher likelihood of the program inducing a switch to ICT than for women with no such bias.
de Hoop et al. 2020 study the impact of e-learning technology and activity-based learning on learning outcomes in Zambia. In-school intervention.	63 schools (33 treatment and 30 control) in three poor districts in rural Zambia	Schools were randomly assigned to treatment or control. "We compared all children who were eligible to enroll in first grade living near the 30 treatment schools with eligible children who lived near the 34 control schools 14 months after the program start."	The program "increased early grade reading scores…early grade math scores… achievement test scores… and oral vocabulary scores… for all children who were eligible to enroll in first grade during the baseline survey."

Jere-Folotiya et al. 2014 examine "the effect of using a mobile literacy game to improve literacy levels of grade one students in Zambian schools." In-school intervention.	573 first grade students from 42 government schools in Lusaka, Zambia.	"Within each school, two grade one classes were randomly selected and randomly assigned to either a control or intervention class."	The mobile phone-based literacy game GraphoGame improved students' scores on the spelling test especially for the intervention that includes exposure of both teachers and students to the game.
John et al. 2016 evaluate "an electronic career guidance package for secondary schools" in Nigeria. In-school intervention.	60 senior secondary students.	Students were randomized to treatment or control.	The e-Career Guidance System led to increased "vocational self-awareness and career awareness".
Johnston and Ksoll 2017 "estimate the impact of a program that broadcasts live instruction via satellite to rural primary school students" in Ghana. "The model is interactive, and students in satellite classes could communicate in real time with their remote teachers." In-school intervention.	147 primary schools in Ghana.	Schools were randomly assigned to treatment to control.	The technology-enabled distance instruction improved rural students' numeracy and foundational literacy skills but had "no impact on attendance and classroom time-on-task… suggesting that these gains may result from improved instructional quality rather than from increased instruction time."
Kotze et al. 2019 evaluate a virtual coaching model that provides tablets to teachers in South Africa. In-school intervention.	180 primary schools in South Africa	Schools were randomly assigned to: (i) training + printed lesson plans, (ii) training + electronic lesson plans, method videos, and sound clips stored in tablets, or (iii) control.	"After one year of intervention, virtual coaching with the tablets was no less effective than on-site coaching at improving both the instructional practice of teachers and the targeted literacy outcomes."
Lysenko et al. 2019 investigate "the impacts of the interactive early literacy software and the library of digital books and stories on primary students' reading abilities and reading instruction in Kenyan schools." In-school intervention.	54 teachers and their 2,264 students from 19 primary, preparatory schools in Mombasa and Nairobi, Kenya.	"The study was designed as a two-group, non-equivalent, pre-test-post-test quasi-experiment."	Access to interactive early literacy software led to significantly higher reading scores for primary students. Including a system of training and support led to some small but positive gains in reading instruction.
Piper et al. 2016b evaluate "a randomized controlled trial comparing the effects and cost of three interventions – e-readers for students,	80 primary schools in Kisumu County, Kenya.	8 zones were randomly selected from 34 zones in Kisumu County. "These 8 zones were then randomly assigned to one of the three treatment conditions	"ICT investments do not improve literacy outcomes significantly more than the base non-ICT instructional program."

tablets for teachers, and the base [Kenya] PRIMR program with tablets for instructional supervisors." Students can bring the eReaders home. Other interventions are in-school.		or the control group, stratified by rural and peri-urban location. Within each zone, 10 primary schools were randomly selected to implement a particular treatment" resulting to 60 intervention schools and 20 control schools.	
Riley 2020 evaluate the impact of the movie *Queen of Katwe* on educational attainment in Uganda. Movie was shown to students in the cinema.	1,500 secondary school students in Kampala, Uganda	Students were randomized to treatment or control.	"Treatment with the role-model movie leads to lower secondary school students being less likely to fail their maths exam a week later: 85% of those who watched Queen of Katwe passed the exam, whereas only 73% of those who didn't [watch] passed. This effect is strongest for female and lower ability students."

Appendix Table 8: Studies on school construction in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Ashraf et al. 2020b examine "how the effects of school construction on girls' education vary with a widely-practiced marriage custom called bride price" in Indonesia and Zambia.	1995 Indonesia Intercensal Data, 2000 and 2007 Indonesia Family Life Surveys, and 1996, 2001, 2007, and 2013 Zambia Demographic and Health Surveys.	The study takes advantage of variations in access to schooling due to a national large-scale school construction initiative in the 1970s and a similar initiative in Zambia in the late 1990s and early 2000s.	"For groups that practice the custom of bride price, the value of bride price payments that the parents receive tend to increase with their daughter's education. As a consequence, the probability of a girl being educated is higher among bride price groups."
Bagby et al. 2016 evaluate the IMAGINE (IMprove the educAtion of Girls In NigEr) project three years after the end the program. The program constructed "`girl-friendly' primary schools, with amenities such as separate latrines for boys and girls, a water source, and housing for female teachers in rural Niger, along with complementary interventions."	204 villages selected "based on certain eligibility criteria, such as the number of school-aged girls in the village, access to water within the village, and distance to a major road."	Villages were randomly assigned to treatment or control.	The project improved primary school enrollment by 8.3 percentage points, reduced absences of more than two consecutive weeks by 7.9 percentage points, had a 0.13 SD impact on math test scores and had no impact on overall French test scores. Impact on girls' enrollment, attendance, and test scores were larger.
De Hoop and Rosati 2014 evaluate the Burkinabé Response to Improve Girls' Chances to Succeed (BRIGHT) program in Burkina Faso. The program consist of "the construction of a primary school and the provision of direct incentives for school participation in the form of school meals for all pupils and take-home rations for female pupils."	293 villages nominated by provincial governments in Burkina Faso.	Villages were ranked according to need, and a cut-off score was determined (132 villages in the treatment group, and the rest in control). Estimates were calculated through regression discontinuity analysis.	The program improved school enrollment (15 percentage points "for girls and boys with female siblings", and 10 percentage points "for boys without female siblings"), but simultaneously led to an increase in children's participation in work within the household.
Deschênes and Hotte 2019 report on the effect of 1990s school constructions in Benin.	Demographic and Health Surveys for Benin 2011, and an administrative	Difference-in-difference estimation that takes advantage of the variation in	The school constructions led to increased probability to attend primary school in rural areas and decreased the

	database of school constructions in Benin.	exposure to schools due to the school construction campaign in the 1990s.	probability of finding wife beating tolerable.
Ingwersen et al. 2019 evaluates the second phase of Burkina Faso's BRIGHT program, a "girl-friendly" primary school intervention.	293 villages nominated by provincial governments in Burkina Faso.	Villages were ranked according to need, and a cut-off score was determined (127 villages in the treatment group, and the rest in control). Estimates were calculated through regression discontinuity analysis.	Ten years after the construction of "girl-friendly" primary schools, "primary school-age children in villages selected for the program attend school more often and score significantly higher on standardized tests". "We also find long-term effects on academic and social outcomes for children exposed earlier in the program. Secondary-school–age youths and young adults (those old enough to have finished secondary school) complete primary and secondary school at higher rates and perform significantly better on standardized tests. Women old enough to have completed secondary school delay both marriage and childbearing."
Kazianga et al. 2019 report a follow-up on Burkina Faso's BRIGHT program seven years after its implementation.	293 villages nominated by provincial governments in Burkina Faso.	Villages were ranked according to need, and a cut-off score was determined (127 villages in the treatment group, and the rest in control). Estimates were calculated through regression discontinuity analysis.	Seven years after construction of "girl-friendly" primary schools, the program increased enrollment by 15.5 percentage points and increased test scores by 0.29 SDs. "These upgraded schools are effective at getting children into school, getting children to start school on time, and keeping children in school longer. Overall, we find that the schools sustain the large impacts observed about three years earlier, with enrollment declining slightly from 18.5 to 14.9 for the cohorts of children who were exposed to both the first and second phases of the intervention."

Appendix Table 9: Studies on other inputs in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Duflo et al. 2015b conduct a seven-year randomization study on Kenya's education subsidies and the government's HIV curriculum.	328 schools in Kenya's Western Province (sixth grade students followed for seven years).	"Schools were stratified and assigned to one of four arms using a random number generator: (i) Control (82 schools); (ii) Stand-alone education subsidy program (83 schools); (iii) Stand-alone HIV education program (83 schools); (iv) Joint program (80 schools)."	Education subsidies reduce adolescent girls' dropout, pregnancy, and marriage but not sexually transmitted infection (STI). Subsidies combined with the government's HIV curriculum reduces STI more, but cuts dropout and pregnancy less, than education subsidies alone.
Evans and Ngatia 2020 evaluate a program in Western Kenya that provides sponsorship for school uniforms.	1,152 primary school students from Busia, Kenya.	Students were randomly chosen for sponsorship through lottery.	Providing school uniforms reduced absenteeism by 37 percent (7 percentage points) for the average student and by 55 percent (15 percentage points) for children who initially had no uniform. However, there is no evidence of sustained impact on highest grade completed or primary school completion rates eight years after the program began.
Falisse et al. 2019 "test whether a new self-study routine, designed to encourage the use of textbooks at home, can improve student achievement" in Democratic Republic of the Congo.	90 primary schools in the districts of Shabunda and Walungu, in South Kivu in Democratic Republic of the Congo.	"We stratified the sample by district, and then randomly assigned schools in each stratum to treatment or control group."	"French language test scores improved in the treatment schools by 0.319σ relative to the control group, but no impact on math test scores was found. The intervention also raised the average likelihood of a student taking the high-stake end of the year national exam by 10 percentage points, without a negative impact on average exam results."
Fazzio et al. 2020 test an intervention that provided "simple schools offering four years of education to primary-	49 villages in rural Guinea Bissau	The villages were clustered according to several socio-economic variables and then randomized by stratum to treatment (16) and control (33).	"At endline, children receiving the intervention scored 58.1 percentage points better than controls on early grade reading and math tests,

school aged children in lieu of the government" in Guinea Bissau			demonstrating that the intervention taught children to read and perform basic arithmetic, from a counterfactual condition of very high illiteracy."
Hassan and Lucchino 2017 report on the impact of distributing solar lamps to 7th grade students in Kenya.	286 students "across 13 classes in the Loitokitok and Nzaui districts" covered by baseline interview and matched with transcript records.	Students were assigned to treatment and control. Students in the control group will receive solar lamps at the end of the experiment.	"We find a positive and significant intention-to-treat effect [in math grades] as well as a positive and significant spillover effect on control students."
Sabarwal et al. 2014 evaluate a public program in Sierra Leone that provides textbooks to primary schools.	341 primary schools in Sierra Leone	Schools were randomized to either receive textbooks or not.	Provision of textbooks to primary schools had no impact either on student access to books or student performance primarily because most books were stored. Book storage was positively correlated with proxies for head teacher uncertainty regarding government transfers of books.

Appendix Table 10: Studies on cash transfer in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Akresh et al. 2016 evaluate the welfare impacts of a two-year cash transfer program in Burkina Faso.	75 villages in Nahouri province, Burkina Faso.	Villages were randomly assigned to: conditional cash transfers given to the father, conditional cash transfers given to the mother, unconditional cash transfers given to the father, unconditional cash transfers given to the mother, and a control group	In general, cash transfers are shown to improve children's education and health outcomes. Gains such as school attendance for older children and use of preventive health care for younger children are higher for those receiving conditional cash transfer than for those receiving unconditional transfers.
Baird et al. 2016a summarize "short-term impacts of a cash transfer program on the empowerment of adolescent girls in Malawi."	3,796 women from 176 areas in the Zomba district in Malawi.	Areas were randomized to treatment (conditional and unconditional transfer) and control.	For girls already in school, the conditional cash transfer improved the average number of terms enrolled by 0.54 (baseline is 4.79 terms) and led to significant improvements in math, English and cognitive test scores. For girls not in school at the start of the program, the transfer led to an increase of 2.35 terms enrolled (compared to 1.02 in the control).
Baird et al. 2019 examine the "medium-term effects of a two year cash transfer program targeted to adolescent girls and young women" in Malawi.	A follow-up to Baird et al. 2016	Areas were randomized to treatment (conditional and unconditional transfer) and control.	"Significant declines in HIV prevalence, teen pregnancy, and early marriage among recipients of unconditional cash transfers (UCTs) during the program evaporated quickly two years after the cessation of transfers. However, children born to UCT beneficiaries during the program had significantly higher height-for-age z-scores at follow-up."
Benhassine et al. 2015 evaluate the effect of cash transfer labeled as education support on school participation in Morocco.	44,000 children in 4,000 households from over 320 school sectors in Morocco.	"School sectors (with at least two communities each) were randomly assigned to either a control group or one of four variants of the program: [labeled cash transfer] to fathers, [labeled cash transfer] to mothers, [conditional cash transfer] to fathers,	Unconditional cash transfers explicitly labeled as education support program made to fathers of school-aged children improved school participation and "increased parents' belief that education was a worthwhile investment." "Adding conditionality

		and [conditional cash transfer] to mothers."	and targeting mothers made almost no difference."
Evans et al. 2014 report on the results of a trial of a community-based conditional cash transfer in Tanzania.	80 villages in three districts in Tanzania.	Villages were randomly allocated to treatment (40) and control (40).	The community-targeted conditional cash transfer led to higher likelihood of school attendance and higher rates of primary school completion.
Eyal and Woolard 2014 "examine…the effects of the expansion of the South African Child Support Grant on the educational outcomes of older Teenagers."	15,490 children in the national representative panel data from the National Income Dynamics Survey in South Africa.	Variation in exposure to treatment because of the gradual roll-out of the program between 1998 and 2000.	The grant led to at least ten percent higher enrolment rates but no impact on educational attainment. The program increased enrolment rate by 15 percent for "coloured learners, and those in Gauteng and the Western Cape."
de Walque and Valente 2019 test the effect of cash transfer and an "information only" intervention where parents are informed of their children's school attendance without the cash transfer.	173 schools in Manica province, Mozambique.	Schools were assigned to: cash transfer conditional on > 90% school attendance, vouchers as prize for girls attaining target attendance, "information only" where parents receive attendance information but neither cash transfer nor vouchers, and control.	"Information only treatment accounts for as much as 75% of the attendance effect of a conditional cash transfer program incentivizing parents…Directly incentivizing children to attain an attendance target is at least as effective as incentivizing parents." In addition, both the information only treatment and the conditional transfers program improved math test scores by 8.5% to 9.4%.
Haushofer and Shapiro 2016 "study the response of poor households in rural Kenya to unconditional cash transfers from the NGO GiveDirectly."	120 villages with the highest proportion of thatched roofs within Rarieda, Kenya.	Randomized at both household and village level to treatment and control. Transfers were randomized by recipient gender, transfer magnitude and transfer timing (lump sum vs. monthly installment).	Nine months after the start of the program, study finds a positive impact on consumption, but no significant effects on educational and health outcomes.
Kilburn et al. 2017 report on the short-term impacts of Malawi's Social Cash Transfer Program on child schooling.	3,365 households in Salima and Mangochi districts in Malawi.	"Households in village clusters were randomly assigned to treatment and control arms with treatment villages receiving transfers immediately and control villages assigned a later entry."	After a year's worth of transfer, the program improved enrollment rates and decreased dropouts.
Pellerano et al. 2014 evaluate the Lesotho Child Grants Programme, an	3,000 households from 96 electoral divisions in five districts in Lesotho.	Electoral divisions were randomly assigned to treatment and control through a public lottery.	Child grants programme had positive effect on children's enrolment but "no noticeable impact on other important

unconditional cash transfer for poor households.			dimensions of school progression (early enrolment, repetition, primary completion and enrolment in secondary)."
Sabates et al. 2019 review the effect of Concern Worldwide Graduation Programme, an unconditional cash transfer program combined with livelihood training, on schooling outcomes in Rwanda.	Data is from a sample of 1,000 beneficiary households from 31 villages in Rwanda.	Households identified as very poor by their communities were validated for eligibility by Concern Worldwide staff. Villages with eligible households were considered beneficiary villages (800 villages) and were matched with other villages "based on socio-economic characteristics and belonging to the same districts" as control (200 villages).	The program enabled households to make educational investments and increased share of children with school uniforms by 42 percentage points but did not have an impact on school attendance.

Appendix Table 11: Studies on school grants in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Beasley and Huillery 2017 evaluate grants given to school committees in Niger to encourage parent participation in the process.	1,000 schools in Tahoua and Zinder districts in Niger.	Schools were randomized to treatment and control, stratified according to urban/rural classification and existing support for school committees.	Grants to school committees increased parent participation and responsibility, increased enrollment at the lowest grades and improved school resources in general, but had no measurable impact on test scores, and teacher absenteeism increased.
Blimpo et al. 2015 evaluate a four-year, large-scale experiment on Gambia that provided grant and training to schools.	273 Gambian primary schools	Schools were randomized to the three arms: grant and comprehensive school management training, grant but no training, and neither intervention.	"Three to four years into the program, the full intervention [grant + training] led to a 21 percent reduction in student absenteeism and a 23 percent reduction," in teacher absenteeism, but produced no impact on student test scores.
Carneiro et al. 2015 "analyze the impact of a school grants program in Senegal, which decentralized a portion of the country's education budget."	633 schools submitted project proposals eligible for grant financing.	The schools were randomized to when they will receive their grant (first cohort: June 2009, second cohort and third cohorts: mid- 2011), creating comparable cohorts during mid-2009 to mid-2011.	Targeted school grants improved test scores of younger grade students which persisted for at least two years. Effects are concentrated among schools that focused funds on HR improvements rather than school materials.
Mbiti and Schipper 2020 evaluate a program in Tanzania that provides: a school grant, teacher performance pay, and both.	350 public primary schools in Tanzania	Schools were randomly assigned to the three treatment groups (7 schools each arm) and 14 schools to control.	"Approximately 96 percent of teachers support the idea of teacher performance pay, while 61 percent favor at least some performance linked element in a future salary increase. Further, 80 percent of head teachers support performance pay."

Appendix Table 12: Studies on eliminating school fees in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Multi-country estimates			
İşcan et al. 2015 "examine the relationship between primary school fees and education quality and access over the past forty years in seven sub-Saharan African countries."	World Bank data on primary enrollment rate, pupil-teacher ratio and primary completion rate for Ethiopia, Ghana, Kenya (Education Policy and Data Centre 2011 for pupil-teacher ratios), Malawi, Tanzania, Uganda, and Zambia.	"Our analysis uses a parsimonious model to examine the relation between school fees and our education indicators. We estimate the coefficients of the pooled regression model by [ordinary least squares regression]."	"Primary school fees were associated with a 17-percentage point reduction in enrolment rates in primary schools, and a 5-percentage point drop in primary completion rates. At the same time, we note a decline in the pupil–teacher ratios (a reduction of about seven pupils per teacher) when school fees are present in our sample countries."
Omoeva and Moussa 2020 examine the long-term effects of free primary education in Ethiopia, Malawi, and Uganda.	Living Standards Measurement Survey (LSMS) and Demographic and Health Surveys (DHS)	Fuzzy regression discontinuity design using the roll-out of free primary education as an exogenous shock.	Free primary education increased "educational attainment across all three countries between 0.6 and 1.5 years of completed schooling," which translated to lower "sexual activity, child birth, and marriage rates during adolescence," but did not improve labor force participation or employment.
Single country estimates			
Ajayi and Ross forthcoming evaluate the effect of Kenya's free primary education program rolled out in 2003.	2015 Kenya FinAccess household survey.	Different intensity of exposure to program due to regional and birth-cohort variation.	Kenya's free primary education program is associated with "increases in educational attainment and increased use of formal financial services, particularly through mobile banking" and "increases in employment rates and incomes but limited improvements in effective numeracy, retirement planning, and subjective financial well-being."
Atuhurra 2016 assesses the learning impacts of Kenya's free primary education program.	"Unique repeated cross-sections dataset obtained from the Southern and East	"By assuming a common trend and relying on the conditional independence assumption, we utilize private schools as a comparison group	The policy led to "large achievement declines" (specifically reading test score is reduced by 0.415 SDs while

	African Consortium for Monitoring Education Quality (SACMEQ)."	since these were not directly treated by the… intervention."	math test score declines by 0.510 SDs." Statistically significant learning declines were experienced by boys in urban public schools, but no difference in learning achievements between girls in public and private schools. In addition, "the declines are associated with decreased teacher efforts and local community disengagement" with teacher efforts declining by over 12 hours for reading and 13.8 hours for math.
Blimpo et al. 2019b evaluate the evidence from school fee elimination in the Gambia rolled out between 2001 and 2004.	Student exam records from the West African Examinations Council (1998 to 2012), 1998 wave of the Integrated Household Survey, and the annual school census conducted by the Ministry of Education (1998 to 2012).	"The gradual rollout of the program across geographic regions provides identifying variation in the policy."	Eliminating school fees for secondary school girls led to an increase in the number of girls taking the high school exit exam by 55 percent, an increase in the share of older test takers in poorer district (suggestive of "expanding access for students who began school late, repeated grades, or whose studies had been interrupted"), and "robustly positive point estimates of the program on test scores."
Boahen and Yamauchi 2018 evaluate the effect of Ghana's Free Compulsory Universal Basic Education in 1996 on girls' adolescent fertility and early marriage.	No open source available.	No open source available.	"Girls who were exposed to the reform had more education, higher age at first marriage, and low fertility than girls who were not exposed to the reform." Effect decreases with age and disappears after age 19.
Brudevold-Newman 2019 investigates the impacts of "the Kenyan government's 2008 abolition of tuition for public secondary schools."	The 2014 Kenya Demographic and Health Survey, and an administrative dataset of secondary school completion examination results.	"Identification of causal impacts exploits region and cohort-specific variation in the treatment intensity of individuals exposed to the program."	Kenya's free secondary education program improved access to post-primary education and consequently led to delayed childbirth and related behaviors and shifted employment away from agriculture towards skilled work. There is little evidence that secondary school completion examination grades deteriorated as a result of the program.

Chicoine 2016 the effect of school's fees removal to women's education and fertility in Ethiopia.	The 1994 Ethiopian Census, and the 2005 and 2011 rounds of the Ethiopian Demographic and Health Survey.	Different intensity of exposure to reform given year and region of birth.	Removal of school fees for primary education "led to an increase of over 1.5 years of schooling for women." An additional year of schooling "led to a reduction of 0.2 births, a delay in sexual activity, marriage, and the timing of both the first, second and third births, improved labor market outcomes and decreased desired number of children.
Chicoine 2019 examines "the impact of both removing school fees and introducing mother tongue instruction in the early 1990s" in Ethiopia.	The 2007 round of the Ethiopian census, the 2005, 2011 and 2016 rounds of the Demographic and Health Survey, and the 2016 Living Standards and Measurement Study.	The study "exploits geographic variation in pre-reform levels of schooling and the timing of the policy changes in Ethiopia."	Ethiopia's free primary education combined with mother tongue instructions led to a net increase of 0.7 years of schooling, which, in turn, translated to "an increase in literacy, knowledge of family planning material from newspapers and magazines, knowledge of HIV, and the likelihood of knowing a location for HIV testing."
Delesalle 2016 reviews the impact of universal primary education program in Tanzania implemented from 1974 to1978.	10 percent IPUMS sample from the 2002 Tanzanian Census and the Living Standards Measurement Study - Integrated Surveys on Agriculture panel data collected in 2008-2009, 2010-2011 and 2012-2013.	Exogenous variations in exposure to the program according to year and region of birth.	Program improved access in education from previously less-educated regions. The increase in education resulted to increased household consumption aggregates with heterogeneous effects: returns to education are lower in rural areas compared to urban areas, and returns are "lower for the agricultural sector than for the non-agricultural self-employment sector and for the wage-earner sector."
Duflo et al. 2019 evaluate the impact of free secondary education in Ghana ten years after implementation.	2,064 youths in Ghana	"Full scholarships were awarded to 682 adolescents, randomly selected among a study sample of 2,064 rural youth who had gained admission to a public high school but did not immediately enroll."	"Ten years after receipt of the scholarship, winners show private labor market gains, primarily in the form of better access to jobs with rents."
Gajigo 2016 evaluate a nation-wide scholarship program for secondary school girls in the Gambia.	Two cross-sectional, nationally-representative household surveys	"This gradual expansion of the program in the initial implementation phases provides a unique opportunity	"The program increased enrollment for secondary school female students by 5 percentage points. The effects for

	conducted in 1998 and in 2002/03 in the Gambia.	to rigorously assess the causal impact of the scholarship program on educational outcomes."	female primary school students were similarly significant."
Masuda and Yamauchi 2018 assess the effect of universal free secondary education program in Uganda.	District-level data of Uganda Certificate of Education exam from the year of 2006 to 2012 merged with the Annual School Census for the same years.	Regional and birth-cohort induced variation in exposure to the program.	The universal fee-free secondary education program "increased the number of the students taking the secondary school exit exam by 16% and raised their test score, in math and English, by 0.05-0.2 standard deviation in the median intensity district."
Moshoeshoe at al. 2019 "examine the impact of Lesotho's Free Primary Education (FPE) programme on enrolment and relative grade attainment."	2000 Multiple Indicator Cluster Survey and 2002 Core Welfare Indicators Questionnaire survey.	The study uses a difference-in-differences strategy to exploit the variation in exposure to the policy across age groups.	"We find that the FPE policy increased enrolment of primary school-age children by 19.1 percentage points between 1999 and 2002. We also find that the policy had a negative effect on relative grade attainment: post-FPE, children had 0.15 fewer grades per year of age compared to pre-FPE. We do not find evidence of sibling effects."
Omoeva and Gale 2016 evaluate the effects of Uganda's universal secondary education policy launched in 2007 on household schooling costs and equity.	Uganda National Panel Survey rounds in 2005 and 2009–11, which are included as part of the World Bank's Living Standards Measurement Study.	The study uses a basic regression equation to estimate effects of the policy.	Receipt of policy grant "has increased substantially for most pupils, and is associated with a reduction in household spending on education per child, at the lower secondary level." There is no evidence that the policy improved school attendance or retention.
Sakaue 2018 evaluates Uganda's free primary education policy.	"Nationally representative panel household survey data based on the UNHS 2005/2006 and the Uganda National Panel Survey (UNPS) collected by the Uganda Bureau of Statistics (UBOS)."	Difference-in-difference, combined with propensity score matching using baseline data.	"This study [finds] that there is a strong negative effect of high fees on public school attendance of children from poor households… The study also finds a limited role of private schools absorbing the children from poor households who left public school due to high fee charges."
Valente 2019 estimates "the effect of enrollment growth following the	2000 and 2007 SACMEQ surveys	Difference-in-differences using "variation in the subsequent rate of enrollment growth across regions"	The enrollment growth following the removal of primary school fees in led to " a sizeable increase in pupil-teacher

removal of primary school fees in Tanzania" announced in 2001.		despite simultaneous removal of primary school fees.	ratios and a reduction in observable teacher quality, but rule out a substantial effect on test scores overall."

Appendix Table 13: Studies on early childhood development and education in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Multi-country studies			
Bietenbeck et al. 2019 report on the effect of preschool attendance on subsequent learning outcomes in Kenya and Tanzania. Intervention is on access.	More than 500,000 children covered by the Uwezo surveys, "large-scale household surveys of children's literacy and numeracy skills, which also collect retrospective information on preschool attendance" in Kenya (2013 and 2014) and Tanzania (2011 to 2014).	Using expansion of pre-primary education in the two countries, the study uses regressions to "identify the impacts from within-household differences, controlling for a variety of child-specific covariates."	Attending preschool is associated with attending primary school later, but progressing through grades faster, than peers who did not attend pre-school. At ages 13-16, pre-school attendees "have completed about one and a half more months of schooling than their same-aged peers who did not attend preschool" and "score around 0.10 standard deviations higher on standardized cognitive tests."
Single country studies			
Aunio et al. 2019 estimate the impact of kindergarten attendance on early numeracy skills in South Africa. Intervention is on access.	Cross-sectional sample of South African children (N = 442) upon enrollment in first grade.	Regression estimation.	"Kindergarten attendance predicted children's early numeracy performance even when controlling for executive function and language skills."
Blimpo et al. 2019a estimate the effect of two ECD interventions (introduction of new community centers to areas with no existing centers, and training of providers in areas with existing centers) in The Gambia. Intervention is on both access and quality.	Survey data from 144 treatment and control sites.	Randomized assignment of communities to treatment and control groups.	Setting up new community-based ECD centers in villages without previous access "led to declines in child development among children from less disadvantaged households." Qualitative evidence suggests that "these households may have been steered away from better quality early childhood settings in their homes." Providing intensive training to pre-existing ECD centers failed to improve levels of child development. But overall, "comparisons of observationally similar children across experiments reveal that existing early childhood development centers increased language skills by 0.4

			standard deviation relative to the community-based alternative, reflecting differences in program quality."
Knauer et al. 2019 evaluate a reading training program for parents and young children in Kenya.	357 caregivers and their children in rural Kenya	Caregivers were clustered geographically and randomly assigned to one of the four interventions or the control.	"Parent training paired with the provision of culturally appropriate children's books increased reading frequency and improved the quality of caregiver-child reading interactions among preschool-age children."
Krafft 2015 estimates the impact of early childhood care on subsequent educational attainment in Egypt. Intervention is on access.	Household fixed effects, comparing children in the household who received early child education to those who did not.	"Comparisons between siblings are used to control for selection and duration analysis methods are used to account for the presence of current students in the data."	Early childhood care and education leads to "one additional year of schooling. Key pathways for this effect include improved school performance, such as increases in test scores and decreases in repetition, during basic education."
Martinez et al. 2017 report the outcomes of a community-based preschool program in Mozambique. Intervention is on access.	Panel survey of 2,000 households from 76 communities in "high-poverty areas of rural Mozambique."	"Preschools were randomly assigned to 30 of 76 eligible communities."	"Preschoolers were 21 percentage points more likely to be enrolled in primary school, 14.9 percentage points more likely to enroll at the appropriate age, and had higher cognitive and communication scores in first grade. Treatment effects were generally larger for children from vulnerable households, those with higher initial development levels, and those with longer exposure to treatment."
Morabito et al. 2018 report on the effect of high quality versus low-quality pre-school on subsequent learning outcomes. Intervention is on quality.	100 children randomly selected and then paired with another child (matched on sex, ethnicity and "electrodermal activity at age 3") from the pool of 1,795 children in the longitudinal data from the Joint Child Health Project in Mauritius.	Each pair is randomly assigned to treatment and control.	"Quality of preschool education had no significant effect on children's overall educational attainment. However, academic performance of children in the experimental group was higher for children with poorly educated fathers, but lower for children with poorly educated mothers."

Woldehanna and Araya 2017 estimate the impact of preschool on children in Ethiopia. Intervention is on access.	908 children from the 2002 Young Lives longitudinal data in Ethiopia.	Regression estimation.	"Urban preschool children are 25.7 per cent more likely to complete secondary education than their non-preschool counterparts at the proper age. The marginal returns are higher for those who attended preschool for two and three years than those who only attended for one year."

Appendix Table 14: Studies on girls' education in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Ashraf et al. 2020a "study whether a negotiation skills training can improve girls' educational outcomes" in Zambia.	8th grade girls at 41 primary schools throughout Lusaka, Zambia	Girls in 29 schools were randomized to three groups: control, safe group, or negotiation group. "An additional 12 schools were assigned to be "pure control" schools, to assist in measuring spillovers, using a matched-pair randomization strategy."	Negotiation training "negotiation training significantly improved educational outcomes over the next three years."
Bandiera et al. 2019 evaluate an empowerment and livelihood for adolescents (ELA) protective space intervention by BRAC where girls in Sierra Leone "can find support, receive information on health and reproductive issues, and vocational training."	4,700 young women in 150 villages.	"Our analysis is based on a 2 × 2 factorial design, where one dimension is the quasi-random assignment of the severity of Ebola-related disruption to villages, and the other dimension is the random assignment of villages to ELA treatment or control."	Girls in control villages highly disrupted by the 2014 Ebola crisis experienced a "persistent 16 percentage points drop in school enrolment post-crisis," partly due to more out-of-wedlock pregnancies. The safe space program "entirely reversed" these adverse effects. Even for older girls engaging in transactional sex, the program increased use of contraceptives.
Bandiera et al. 2020 evaluate an intervention in Uganda that provides "vocational training and information on sex, reproduction, and marriage" to adolescent women.	150 communities in Uganda.	Communities were assigned to treatment (100) or control (50), stratified by BRAC branch office.	"Four years postintervention, adolescent girls in treated communities are more likely to be self-employed. Teen pregnancy, early entry into marriage/cohabitation, and the share of girls reporting sex against their will fall sharply."
Benshaul-Tolonen et al. 2019 "conduct a three-arm pilot cluster randomized controlled trial that provided sanitary products to schoolgirls to reduce absenteeism" in Kenya.	644 students in 30 primary schools in western Kenya	Girls were randomized to receive: (i) an insertable menstrual cup, or (ii) 16 sanitary pads monthly, or (iii) control (usual practice).	"Using the spot-check data, we confirm that providing sanitary pads reduces absenteeism by 5.4 percentage points."
Buehren et al. 2017 evaluate the effects of an empowerment program for girls in Tanzania. The program Empowerment and Livelihood for Adolescents (ELA) by BRAC included a safe-space club, life skills training, livelihood training, community	5,454 adolescent girls from 150 villages in Tanzania.	The villages were randomized to treatment (100) and control (50).	Although the program had great success in Uganda, the Tanzanian program did not have "notable effects" on economic, health, and social outcomes. "The addition of microcredit improves the take-up of the program and

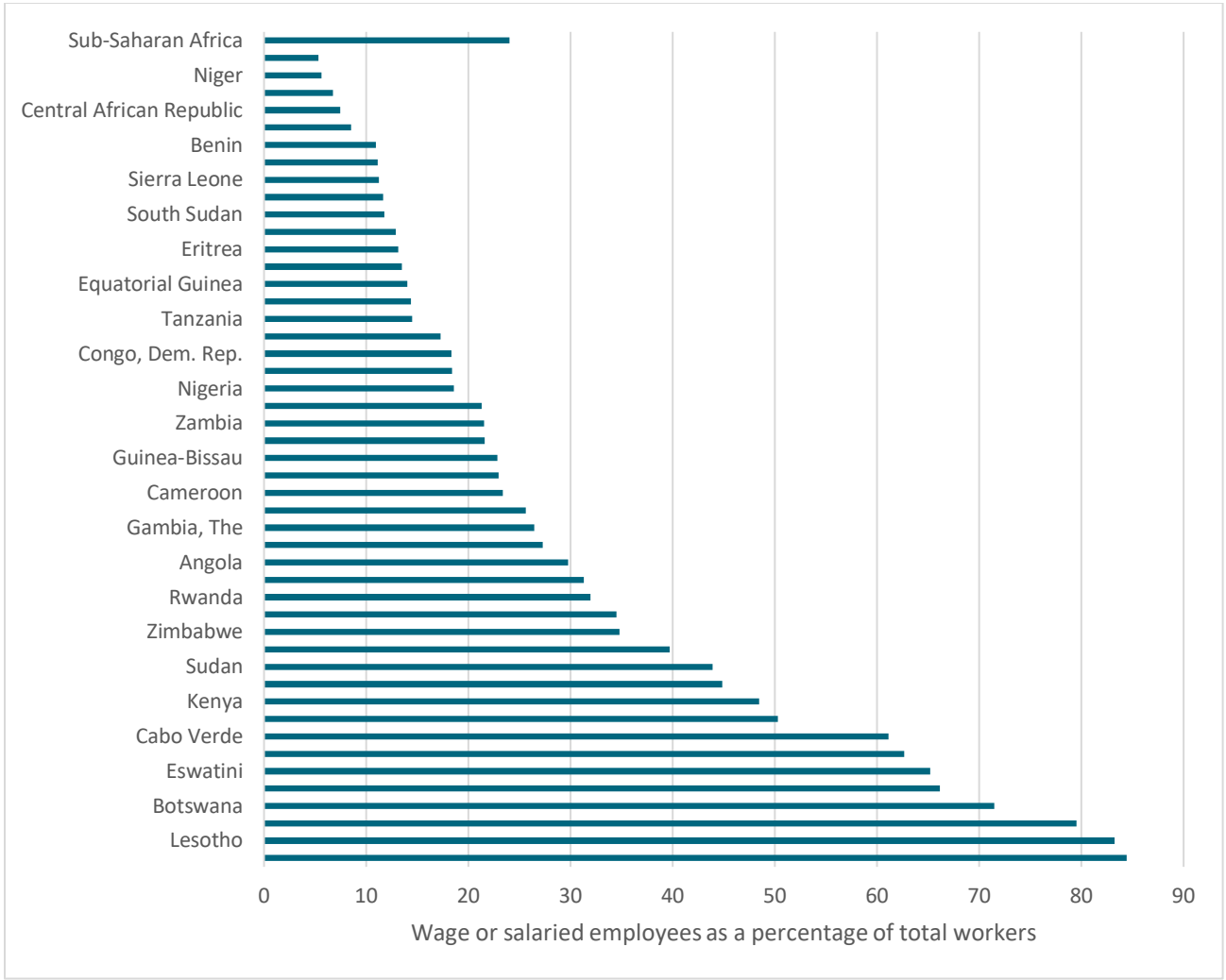
participation program, and access to microfinance for older girls.			savings of the participants."
Fiala et al. 2020 evaluate a program that provides bicycles to girls	2,471 girls in 100 schools	Schools were randomly assigned to: (i) free bicycles, (ii) free bicycles with upfront payment for maintenance and spare parts kits, and (iii) control.	"The intervention reduced overall absenteeism, commute time, and late arrival to school and had modest (but non-trivial) impact on Math scores."
Koroknay-Palicz and Montalvao 2019 report on the effects of a Sisters of Success program in Liberia. The intervention included a mentoring program to develop social and emotional life skills.	2,884 girls in Monrovia, Liberia.	The girls were randomized to treatment and control groups, stratified by age, schooling status and geography. "Girls who were close friends, sisters, or living in the same household were randomized jointly to either treatment or control."	Mentoring program for adolescent girls increased likelihood of primary school completion and enrollment to secondary school, and a "significant improvement in the quality of girls' relationships with their peers and parents."
Medhin and Erulkar 2017 report on the impact of safe spaces in program in Ethiopia where out-of-school girls received training in literacy and life skills, and vouchers for medical services.	Longitudinal data of 2,000 girls from 12 treatment areas and 10 control areas in Ethiopia.	Districts with high poverty rates and low school attendance were prioritized for treatment. Areas with similar socio-economic characteristics and other comparable data were selected as control.	Out-of-school girls living in the project sites had higher literacy scores and were 1.6 times more likely to have used a health services in the past six months than their counterpart in control areas.

Appendix Table 15: Studies on private and other non-government provision of schooling in Africa, 2014-2020 (experimental and quasi-experimental)

Study	Data	Identification strategy	Effect
Multi-country estimates			
Crawfurd 2017 estimates school management quality in Sub-Saharan Africa and its association with student test scores.	"2016 management survey, with school characteristics taken from the 2015 Ark School Survey, official test score data for 2015 from the Uganda Examinations Board (UNEB), and further contextual data on schools from the 2013 Education Management Information System (EMIS), and the national population census in 2014 and 2002."	School management data was matched to individual student panel test scores to estimate the impact of school type and school management quality on test scores.	School management quality matters for student learning: " a standard deviation difference in management is associated with a 0.06 standard deviation difference in test scores". Additionally, "contrary to common perception, I find no difference between the quality of school management in government, private or public–private partnership (PPP) schools (despite the higher level of autonomy available to them)."
Single country estimates			
Barrera-Osorio et al. 2019 "estimate short-term, partial equilibrium impacts of a public-private partnership program on low-cost private secondary schools in Uganda." Participating schools receive a per-student voucher from the government.	100 secondary schools	Schools were randomized to starting the program the first year (treatment) or getting the program the following year (control).	"The PPP program led to both large enrollment increases and significantly higher student performance. Improved performance is potentially linked to increased input availability and positive household-driven selection of voucher recipients."
Lipcan et al. 2018 examine student achievement in Bridge schools in Lagos	37 Bridge schools	"All 37 Bridge schools in Lagos were matched with low- and medium-fee private schools… Matching was conducted using a composite score index based on three variables: nominal school fees, total number of pupils, and GPS coordinates (longitude and latitude)."	Students at Bridge schools have higher literacy and numeracy scores than students in public schools, and higher literacy (but not numeracy) scores than students in other low-cost private schools. "Teachers in Bridge schools report higher motivation than teachers in other schools, and Bridge schools are better managed than other schools. However, observed teaching practice does not differ substantially between school types for literacy."
Romero et al. 2020 evaluate the Partnership Schools for Liberia (PSL) program where the government	3,499 students in 185 government schools in Liberia.	93 schools were randomly assigned to the PSL program.	"After one academic year, students in outsourced schools scored 0.18σ higher in English and mathematics. We do not

outsourced management of public schools to private providers. "Providers received US$50 per pupil, on top of US$50 per pupil annual expenditure in control schools."			find heterogeneity in learning gains or enrollment by student characteristics, but there is significant heterogeneity across providers While outsourcing appears to be a cost-effective way to use new resources to improve test scores, some providers engaged in unforeseen and potentially harmful behavior, complicating any assessment of welfare gains."
Romero and Sandefur 2019 follow-up on the Partnership Schools for Liberia program three years after its implementation.	3,499 students in 185 government schools in Liberia.	93 schools were randomly assigned to the PSL program.	"After the first year, treatment effects on learning gains plateaued (e.g., the intention-to-treat effect on English was .18σ after one year, and .16σ after three years, equivalent to 4 words per minute additional reading fluency for the cohort that started in first grade). Looking beyond learning gains, the program reduced corporal punishment (by 4.6 percentage points from a base of 51%), but increased dropout (by 3.3 percentage points from a base of 15%) and failed to reduce sexual abuse." Results varied across contractors.
Wamalwa and Burns 2018 examined the effect of private schools on literacy and numeracy.	Third round of Uwezo survey for Kenya (2012).	"We use the household fixed effects model to control for unobservables at the household level."	"Our results show that private school attendance is associated, on average, with an increase in maths and language scores of 0.12 and 0.13 score standard deviations, respectively."
Zuilkowski et al. 2020 evaluate low-cost-private schools in Kenya.	326 students in 47 private and public schools in Nairobi, Kenya	"We used residual gain scores (from a randomly selected sample)—as opposed to cross-sectional measures—in English and Kiswahili literacy and mathematics, to compare the outcomes of students" across two academic years.	Low-cost private schools in general "do not produce higher student growth over time than public schools." If both private and public schools were provided with instructional improvement intervention, private schools "increased student performance more than public schools, particularly in English."

Appendix Figure 1: Wage and salaried workers as a percentage of total employment, 2019



Notes: Data were not available for the Seychelles.

Source: World Development Indicators, World Bank, drawn from the International Labour Organization, ILOSTAT database. Data retrieved on March 1, 2020.