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FROM ENROLLMENT TO LEARNING
THE WAY FORWARD

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CONTENTS

Introduction 1

The Early Years. 3

Enrollment, Learning, and Dropout. 5

Necessary Conditions for a Good Learning Environment 6

Context Specific Interventions that Promote Learning 10

Learning Outside of the Classroom 14

Health and Nutrition 16

Learning Assessments 18

Building an Education Sector. 20

Further Research 24

Conclusion. 25

Endnotes 27

References 34

LIST OF FIGURES

Table 1: ECD Programs and How They Impact Learning 4

Table 2: Creating the Necessary Conditions for an Effective School Environment 9

Table 3: Mother-tongue Learning and Multi-Grade Teaching 11

Table 4: Using Technology to Enhance Learning 12

Table 5: Learning Outside of the Home 15

Table 6: Health and Nutrition. 17

Table 7: Learning Assessments 18

Table 8: Tracking and Evaluating Efficiency of Education Expenditures 21

Table 9: School-Based Management and Governance 22

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INTRODUCTION

In an earlier policy brief, *Where is the Learning? Measuring Schooling Efforts in Developing Countries*,[1] we drew attention to what was labeled "the global learning crisis." While tremendous progress has been made over the past couple of decades to get tens of millions of additional children to enroll in school, progress in improving learning outcomes has been considerably less impressive. Although, shockingly, comprehensive learning outcome data are not available for most of the developing world, the many small scale, local or, in some cases, national studies that have been done show a dismal picture. For instance, Uwezo, an East African initiative, found that in Tanzania, only 44 percent of students in Grade 4 were able to read a basic story from Grade 2.[2] Similarly, the Annual Status of Education Report (ASER) facilitated by Pratham found that in rural India, less than half of Grade 4 students were able to do basic subtraction.[3] These examples demonstrate the gravity of "the global learning crisis" as students fail to master competencies appropriate for their grade level, hindering the development of life skills and success in further schooling, as well as performance in the labor market.

With about 61 million children[4] in the developing world still not yet in school, it is too early to declare victory on the "enrollment agenda". But we would do a disservice to the 250 million children around the world who fail to reach Grade 4 or attain minimum learning standards, if we don't step up efforts to improve learning outcomes.[5]

This policy brief is part of a larger effort to link resources in the education sector with outcome measures. As we have documented elsewhere[6], few countries systematically collect comprehensive financial data on education, although fortunately an increasing number of initiatives is trying to address this issue by producing, for instance, National Education Accounts (NEAs). When the focus of the sector changes from enrollment to enrollment plus learning, efforts to better grasp the size and use of financial resources should evolve accordingly. For instance, much learning takes place outside of the classroom, especially in the early years. For NEAs to be a useful tool for adjusting the allocation of scarce resources, the "learning" sector should be defined more broadly than the education or "schooling" sector. We will address this and related issues in a subsequent policy brief.

Once our focus becomes enrollment plus learning, we have to broaden our view and look at the entire environment in which a child develops skills, starting with the households in which children are born.[7] It has been

known for many decades and throughout the world, that among the best predictors of future school performance are some basic household characteristics, such as income and mother's education level.

Data from international assessments also show a relationship between income and educational performance, exemplified by intra and intercountry results. In Colombia, average Trends in International Mathematics and Science Study (TIMSS) math scores at Grade 8 for the richest quintile of students were close to 100 points higher than those from the poorest quintile. On the other hand, the difference in average scores between the poorest quintile in the United States and the richest quintile in Colombia was about 50 points.[8] Income is not the only predictor of success, as exemplified in Peru, where children whose mothers have completed primary school and whose maternal language is Spanish rather than an indigenous language, have a greater probability of reaching the appropriate school grade for their age.[9] In Kenya, Uwezo found that the higher their father's educational attainment, the more likely children were able to read a story at Grade 3 or attend extra tutoring sessions.[10]

In addition, the larger environment (such as the village or the urban neighborhood) in which the young child grows up also has a major and lasting impact. In Tanzania, urban students in Grade 3 are three times more likely than their rural counterparts to meet standards in literacy and numeracy.[11] Related to the impact of the larger environment, data from Nigeria suggest that girls are more disadvantaged in school attendance, as parents may be reluctant to send girls to school because of perceived fears for their safety while traveling and concerns about the physical strength required for walking the distance.[12]

Clearly, especially in the early years, most learning takes place outside of the classroom. Consequently, children who grow up in deprived circumstances will start life with a disadvantage leading to a lack of learning in the early grades, which will have lifetime effects.

In the next section, we will summarize the evidence that the early years (ages 0 to 5) are crucial for subsequent learning achievements. From this evidence we conclude that many of the problems with learning outcomes in the developing world (and in many developed countries) need to be addressed well before school age.

Before delving into what happens in schools, we explore the relationship between enrollment, learning and dropout. As the crux of this brief is to lay out the evidence on what contributes to learning, we must acknowledge the factors leading to low enrollment and dropout. Next, we turn our attention to what happens in schools and what can be done to improve these activities, as well as try to summarize the evidence about the relationship between specific school-based inputs and learning outcomes. As it turns out, this evidence is, in many cases, rather feeble. Therefore, we will first focus on school-level inputs that are necessary for a good learning environment, i.e. without which we cannot expect any learning to take place. Most of these inputs are rather obvious, but they are worth mentioning. Subsequently, we will discuss additional inputs that have proven to contribute to learning outcomes in some cases, but not in others. Clearly how these inputs are applied matters.

Next, we address factors that contribute to learning outside of a formal environment, after which we review issues in health and nutrition that are closely linked to learning outcomes. We then review the need for the collection and dissemination of learning assessments in order to impact further improvements in these areas and we try to answer the question: what are the building blocks for an education sector that promote learning? Finally we explore needs for future research in learning.

THE EARLY YEARS

The foundations for learning are laid before birth. Brain development occurring between 0 and 3 years is critical for child development, and is influenced by caregiver interaction, environmental factors, and the nutritional status of the mother and child.[13] As many children in developing countries face multiple risks, such as poverty, malnutrition, poor health and inadequate stimulation in home environments, cognitive and noncognitive development is effected, ultimately with a strong negative impact on learning outcomes.[14] Evidence that, among other factors, diarrhea, pneumonia, measles and neonatal conditions contribute to the premature deaths of 8 million children each year, shows the severity of environmental disadvantage faced by children in developing countries.[15]

Early Childhood Development (ECD) Programs Mitigate Risks Faced by Disadvantaged Children

As discussed above, there is substantial evidence demonstrating the presence of a socio-cultural gradient in learning; for example, in a study of language and mathematics scores in 13 Latin American countries, parental education was found to be a statistically significant determinant of student performance in all but three countries (Cuba, Honduras and Paraguay).[16] However, further evidence demonstrates that Early Childhood Development (ECD) programs, which address nutrition, health and education, mitigate those risks that disadvantaged children may face, increasing their future learning. While parents' education is a strong determinant of child language scores, in many low-income Latin American countries, where relatively high ECD program coverage exists, language scores in primary school are higher and less correlated with parental learning. Cuba provides such an example, as ECD programs seem to have lowered the association between children's language scores in primary school and parental educational achievement. A study found that among several Latin American countries (Costa Rice, Chile, Colombia, Peru, Paraguay, Dominican Republic, Uruguay and Argentina), Cuba had both the highest preschool enrollment and academic achievement in Grade 6, suggesting a strong possible influence of ECD on learning outcomes.[17]

If the Cuba example is less compelling because specific social, political and economic conditions make it less generalizable, Nuevo León, a state in Mexico, provides stronger evidence of the benefits accruing from ECD. In Nuevo León, the Centers of Childhood Development (CENDI), which provide ECD services to children of disadvantaged mothers,[18] have contributed to its out performance of the rest of the country in learning levels tested at the primary school level. While 24 percent of Grade 6 students in Mexico were able to read and comprehend paragraphs overall, 28 percent were at this level of achievement in the state of Nuevo León, compared to 19 percent in Argentina and 6 percent in Ecuador. [19]

How Do ECD Programs Effect Learning?

Among the several risk factors that children in developing countries face are inadequate stimulation and opportunities for learning, stunting, iodine deficiency, iron deficiency, intrauterine growth restriction, infectious diseases such as malaria, environmental toxins such as lead exposure, maternal depression, exposure to violence, HIV infection and institutionalization. These risk factors affect brain structure and function, and compromise children's development.[20] However, protective influences such as maternal education and breastfeeding,[21] along with interventions that address these risks can improve learning in the long term. For example, in Tanzania iodine supplementation in utero increased a child's school attainment by 0.36 years, with larger gains for girls (explained by the greater cognitive sensitivity of female fetuses).[22]

The most successful ECD programs integrate activities at the household and community level, providing high-quality preprimary learning opportunities, improving parent-child interaction, and providing nutritional and health assistance. Below, Table 1 describes different components of ECD programming and the pathway by which they impact learning.

A recent randomized control trial, commissioned by Save the Children, evaluated the impact of a center-based preschool program (with a parenting component) in rural Mozambique, finding that at a cost of $2.47 per month per child, the program was able to increase time spent on schooling activities and cognitive development. At follow-up two years after the start of the program, children who received the treatment were spending seven more hours per week on schooling activities and performed 87 percent better than the control group in the cognitive development and language domain, measured by the Early Development Instrument (the Early Development Instrument is discussed in the section on Learning Assessments).[23] The evidence from this study demonstrates the potential for preprimary education programs to impact learning; however, coverage remains low, with only 15 percent of children in low-income countries enrolled in preprimary education programs.[24]

Parenting programs are a critical component of ECD initiatives. The pathway from early cognitive development to learning is demonstrated in a study in Ethiopia, where a program for enhancing sensitive caregiving, which facilitated feedback on parenting through home visits, increased student performance (when compared to a control group) in four major academic subjects six years after receipt of the intervention.[25] While there have been few longitudinal studies in developing countries on the impact of ECD, evidence from the U.S. and Canada validate the translation of higher cognitive development in early years with greater school achievement, as demonstrated in results for example, from the Child Parent Centers in Chicago, which were found to increase kindergarten readiness and achievement at age 14.[26]

Early childhood is the most cost-effective time for intervention, with a cost-benefit ratio for preschool enrollment of up to 17.6:1.[27] High returns on early childhood investments result from their addressing multiple objectives of health, education and parenting.[28] The impact and cost-effectiveness of ECD on learning provide a strong case for increasing access to it and ensuring that it promotes holistic child development.

Table 1: ECD Programs and How They Impact Learning

Type of Intervention	Example of Intervention	What is the Learning Pathway?	Program Effect
Parenting programs (focused on parent and child)	A caregiving program in Ethiopia used home visits to provide feedback on parenting (Klein et al. 2004).	1. Increases language development. 2. Improves quality of parent-child interaction.	Increased student performance in academic subjects six years after receipt of the intervention.
Preschool programs	A program in Mozambique implemented center-based preschools and provided guidance on parenting (Martinez et al. 2012).	1. Increases cognitive development. 2. Increases language development. 3. Increases time spent on schooling activities.	Increased cognitive and language development by 87 percent in comparison to a control group.

ENROLLMENT, LEARNING AND DROPOUT

There is a dynamic relationship among enrollment, dropout and learning. Simply put, enrollment should facilitate learning, while dropout should hinder it. However, at the same time, low enrollment and high dropout are products of limited learning and often reflect student and family beliefs on the benefits of further investments in education. The relationship among these factors underscores the need for a specific focus on learning, while addressing perceptions of education and additional challenges related to school attendance and dropout.

Perceived returns to education contribute to overall attitudes toward schooling. In a study exploring the relationship between call center placement and school enrollment, researchers found that a rise in the perceived returns to schooling then increased school enrollment between 4 and 7 percent.[29] Another study in Madagascar went even further, demonstrating that providing statistics on actual returns to education, where they were underestimated, increased student test scores by 0.37 standard deviations, resulting from students' greater exertion of effort.[30] This emphasizes that efforts to improve parental and community awareness of the potential value of education are important for improving learning. Although not unrelated to perceived returns, poverty is a major factor contributing to household calculations of opportunity cost, forcing children to work instead of attend school. Worldwide, 215 million children are engaged in child labor,[31] which has an impact on education. In Zambia, there are 1.3 million child laborers (aged 5 to 14) who are expected to spend one less year in school by age 8.[32]

Banerjee and Duflo see low perceived returns as supportive of the "education-as-lottery" hypothesis wherein parents only see the value of education if children are able to pass certain gate-keeping exams and secure government jobs, encouraging investment in certain children.[33] This hypothesis suggests that families must have a sense that education can be beneficial regardless of their child's sex, physical handicaps or perceived ability. In turn, schools must provide an environment accessible to a wide variety of students, conveying the message that schooling is worthwhile. This could mean ensuring that there is an adequate focus on the basics, such that students do not get lost in advanced subjects, or could require that students with disabilities are physically accommodated. In addition to raising perceptions of education in order to sustain enrollment and facilitate learning, addressing these issues is critical for preventing inconsistent attendance and dropout. A paper commissioned by USAID reviewed studies conducted in developing countries in order to identify risk factors for dropout, which included low achievement, low commitment to school, gender, opportunity cost of education and disabilities.[34] These findings reinforce the need to simultaneously raise attitudes toward education and provide an environment that addresses the needs of all students.

NECESSARY CONDITIONS FOR A GOOD LEARNING ENVIRONMENT

Student Attendance

There are several basic features necessary for creating an educational environment conducive to learning. While much of the evidence here comes from study of formal schooling environments, many features are still applicable to nonformal ones. First of all, accessibility of primary schooling is critical. The farther schools are from children's homes, the less likely children will be to attend school regularly. While the impact of school distance is intuitive, evidence quantifies the effect, demonstrating that each additional kilometer a child lives from school causes attendance to drop by 20 percent or more.[35] Inconsistent attendance has a clear impact on learning. According to evidence from Honduras, a student's school attendance record is a major predictor of dropout and grade repetition.[36] Furthermore, distance from home to school can impact girls and boys differently, reinforcing the need to ensure reasonable access to schools in order to prevent gender-based learning disparities.

"Time on Task"

"Time on task" refers to the amount of time in which students are engaged in learning. In order to make the most gains in language, math and other subjects, time on task must be maximized. Time loss which ultimately lowers time on task may result from school closures, teacher absenteeism and failure to teach, tardiness, extended breaks and insufficient learning materials. In Ghana, a study found that students were engaged in learning only about 39 percent of the allotted instructional time due to time loss from these factors.[37]

In order to make use of instructional time, students and teachers must be present. Teacher absence is an enormous issue; a survey in six countries, Bangladesh, Ecuador, India, Indonesia, Uganda and Peru, found that on average, 19 percent of primary school teachers were absent on any given day.[38] Teacher absenteeism is a barrier to increasing time on task, underscoring the need to increase accountability and improve incentives for teachers to be actively engaged in their work. The following sections address possible interventions to improve teacher attendance and practice.

Additionally, in order to facilitate time on task, learning materials, such as textbooks and workbooks, are critical. Textbooks and workbooks can anchor a classroom, providing structure and visual material where few other resources exist, helping learners stay engaged and raising time on task. However, access to textbooks is not universal; in Tanzania, 23 percent of Grade 6 pupils had no access to reading textbooks in 2007.[39] Without textbooks or workbooks, for example, students and teachers may spend extra time copying assignments to and from a blackboard.[40] However, these materials cannot facilitate learning unless teachers are knowledgeable about the material contained within and are trained on how to integrate them into their lessons.[41] One study found that the introduction of textbooks in Kenyan government schools was effective only for students with higher test scores at baseline. One reason was that textbooks were too difficult for lower performing learners.[42] These findings reinforce the proposition that learning materials need to be not only locally relevant (in language of instruction) but also more accessible for all learners, specifically such that sufficient materials and copies are available to all students. Though there are challenges, adding high-quality and relevant textbooks and workbooks to classrooms can facilitate learning, and be cost-effective.[43] There is also recognition of the effectiveness of utilizing concrete materials in

order to enhance learners' understanding of mathematics.[44] Results from an intervention in preprimary schools in Bangladesh, which increased access to and regular use of materials (wooden blocks, foam shapes, puzzles, etc.) as well as teacher training on using such materials, showed that students' math test scores doubled, while students in control classroom conditions improved only slightly.[45]

Teacher Incentives and Support

In order to reduce teacher absence and increase time on task, teacher incentives must be aligned with learning objectives. As context dictates the success of specific measures for aligning teacher incentives to promote effectiveness, there are lessons to be learned from various environments. For example, evidence from Kenya and India suggests that contract-based teachers with less job security than civil service teachers, who are managed by local school committees, can increase student performance.[46] Given that the elimination of civil service teaching posts can foster discontent, introducing contract teachers in such environments may lead to limited success in raising learning outcomes, given that civil service teachers can respond with decreased effort where employed.[47] At the same time, a recent study in Kenya found that if civil service teachers respond to the introduction of contract teaching positions in a manner detrimental to student learning, robust community monitoring can help mitigate the problem.[48] These results highlight the role of school governance initiatives, which we will discuss further in the section on Building an Education Sector.

Additionally, performance-based pay has demonstrated some success in improving incentives for teachers to teach. For example, in a study conducted in Andhra Pradesh, India, the introduction of performance-based pay led to a 0.27 standard deviation increase in math test scores in treatment schools.[49] However, while success in raising test scores was noteworthy, the limited effect on teacher absence reflects entrenched problems that require more systemic reforms. At the same time, performance-based pay may encourage teachers to teach to a test and create a penalty for teachers with students less prepared from the outset.[50]

Beyond increasing teacher incentives to teach, in order to make instructional time more effective, teacher training is necessary. We know that support and training for teachers is important given substantial evidence that teacher quality is a significant predictor of student achievement cross-nationally.[51] However, many teachers have not had the opportunity to receive training, and if they have, programs are not effective. For example, according to the 2012 Education for All Global Monitoring Report, among 100 countries with data, there were 12 countries where less than 50 percent of teachers at the primary school-level were trained according to national standards. Included in this group were Benin, Honduras, Liberia, Mali, Ethiopia and Sierra Leone.[52] The low quality of many teacher education and training programs in developing countries is demonstrated in a meta-analysis, which found that a teaching degree fails to make a teacher more effective.[53] However, teacher training can be effective, particularly if it does not interfere with teaching time[54] and is practice oriented.[55] Training programs must also provide ongoing support and resources, which enable teachers to continuously improve their practice.[56] A school-based teacher development program in Kenya established a system for training one teacher, known as a Key Resource Teacher (KRT), in each school in science, math and English. Observation found that KRTs used a more problem-solving approach in their own practice, as they were more likely to use diverse teaching methods, such as mixed ability group work and active encouragement of the use of library books, in order to retain student

engagement. Although KRTs demonstrated effective practice themselves, they did not have much impact on colleagues whom they trained.[57]

Additionally, where teachers have insufficient skills, highly scripted lesson plans can provide direction and scaffolding. For example, a program in Kenya, which in addition to extensive teacher training, provided detailed lesson plans to Grade 2 teachers, doubled students' reading scores.[58] McKinsey, in their study of education systems, found that the introduction of highly scripted lessons was often a key reform for improving performance, giving teachers the ability to focus on executing lessons instead of devising them.[59]

A Focus on the Basics

A focus on basic numeracy and literacy skills at the primary school-level is critical for achieving learning success. This is necessary as students are often drastically behind the outlined curriculum. This is demonstrated in the case of Pakistan, where students are typically three to four grade levels below the curriculum. 'Overambitious curricula' make mastery of more advanced topics introduced in class difficult, as students fail to gain proficiency with necessary foundational skills.[60]

The success of remedial education programs reinforces the effectiveness in concentrating on basic skills. In India, a program focused on development of basic numeracy and literacy at Grades 3 and 4 improved average test scores of all students in schools where remediation was offered by 0.28 standard deviations, with students at the bottom of the distribution particularly affected.[61] We will revisit the issue of remedial programs later, as we analyze the role of extra tutoring programs. Table 2 highlights some of the necessary conditions for an effective school environment discussed in this section.

Table 2: Creating the Necessary Conditions for an Effective School Environment

Type of Resource, Input or Reform	Example of Evidence/ Intervention	Possible Learning Pathway	Program Effect
Learning Materials — Textbooks	Government textbook availability increased for students in Grades 1-8 in Kenya in math, science and English (Glewwe et al. 2009).	1. Students use textbooks in school. 2. Students complete more homework.	Textbooks increased average test scores for students in the highest quintile of initial test scores by 0.22 standard deviations, but did not have a statistically significant impact for those in the lowest quintile.
In- Service Teacher Training	A school-based program in Kenya trained Key Resource Teachers (KRT) in each school in English, math and science. (Akyeampong et al. 2011).	Raise teacher knowledge of different instructional approaches.	KRTs were found to use different instructional approaches, such as mixed ability groups, which resulted in their students being more actively engaged.
Teacher Effort—Contract Teaching Assignments	A program provided local communities funds to hire extra teachers on a short-term contract in schools in India (Muralidharan and Sundararaman 2010).	1. Increase accountability of staff to communities. 2. Increase teacher effort.	The program led to a 0.13 standard deviation increase in language test scores.
Teacher Effort—Performance-Based Pay	A performance-based pay initiative was implemented in India, where teachers received bonus payments dependent on student average performance (Muralidharan and Sundararaman 2009).	Increase teacher effort.	The program raised student math scores by 0.28 standard deviations.
Basic Numeracy and Literacy Focus	A remedial education program in India was implemented, which provided teaching aides to low-performing students, in order to focus on basic numeracy and literacy skills (Banerjee et al. 2004).	Increase support for low-performing students.	The program raised student test scores by 0.28 standard deviations.
Scripted Lesson Plans	A program in Kenya provided highly scripted lessons to teachers of Grade 2 students (Crouch et al. 2009).	Provide direction and support for teachers.	Students receiving scripted lessons doubled performance on tests.

CONTEXT SPECIFIC INTERVENTIONS THAT PROMOTE LEARNING

Pupil-Teacher Ratio

Reducing the pupil-teacher ratio (PTR) has gained high visibility in Western and developing countries as a necessary reform. However, its high cost and the mixed evidence on its effectiveness in different school systems[62] suggest its context specificity. For example, reducing PTR might be a greater priority for younger children, as they may benefit from increased teacher contact and differentiated instruction.[63] On the other hand, if teachers are capable, there are potential pedagogical strategies for dealing with larger class sizes in the case where hiring additional teachers is prohibitively expensive; for example, using small groups, or utilizing peer-to-peer support.[64] For any of these strategies to be effective, they must be executed well. For instance, small groups can alleviate challenges related to large class sizes; however, students still need guidance and support for learning in them.[65]

Multi-Grade Teaching

Multi-grade teaching, where students from different grade levels are taught jointly, is often a pragmatic solution to the low-resource capacity of rural schools, although it has also been explored as an explicit method for improving learning. While multi-grade classrooms are often born of necessity, programs pioneered by *Escuela Nueva* in Colombia demonstrate how their deliberate use can foster effective learning environments in rural areas. In the *Escuela Nueva* model, teachers were given training on strategies for utilizing a multi-grade learning environment (for example, through encouraging collaborative learning among students of different ages), as well as opportunities for interaction and collaboration with other teachers. Additionally, students were provided with learning materials, which they could use to guide independent work, and were encouraged to work both independently and in small groups.[66] An evaluation of *Escuela Nueva* schools in Colombia found that Grade 3 students performed 0.45 standard deviations higher in math than their counterparts in control schools.[67] Because the success of this intervention is dependent on the quality of training provided to teachers on using the multi-grade environment, student materials and overall program implementation, it is important to note its context specificity.

Mother-Tongue Learning

Where there is a drive for students to learn in English or languages that appear to have greater applicability for labor market needs, students in households from linguistic minorities are disadvantaged. The barriers to learning posed by a language mismatch between mother tongue and language of instruction are obvious; additionally, when students learn in a language different from what is spoken at home, there are limited opportunities for reinforcing what is learned in the classroom. Despite the potentially obvious gains that could be made with the implementation of mother-tongue learning, in many areas, teachers lack proficiency in local languages. A mother-tongue education program in Cameroon found that children who were taught in their mother-tongue, Kom, in Grades 1-3 performed on average, 125 percent better in math and English compared to peers where English was the language of instruction.[68] When students learning in mother-tongue in Grades 1-3 transitioned to English-based instruction after Grade 3, their performance dropped, although they still performed better than students who learned in English in Grades 1-3. Because students learn-

ing in their mother-tongue must be supported once they have transitioned to a second language as the medium of instruction, the impact of mother-tongue learning depends on a variety of factors, including the development of teachers' skill in the second language of instruction.[69]

Technology

Many programs and policies have focused on providing technological capacity to poor classrooms in the developing world through, for example, harnessing mobile applications and providing laptops and computer labs to schools. As access to technology increases and its associated costs lowered, demonstrated best in the proliferation of mobile phones, there has been increased experimentation in this space, with new ideas being identified and implemented.

While computers receive more attention, interactive radio instruction (IRI) is one of the earliest examples of using technology to enhance learning, enriching environments with limited resources and teacher training. An IRI program in Zanzibar, consisting of 30 minute radio programs linking songs, games, and stories with the standard curriculum (along with training for instructors) was found to increase Grade 1 students' scores in Kiswahili, math and English, by approximately 10 percent, when compared to a control group.[70]

Another area where there has been much experimentation is in the introduction of computers and laptops. A study in India found that computer assisted learning programs raised Grade 4 math scores by 0.35 standard deviations in the first year of program implementation.[71] However, other evidence finds that when

Table 3: Mother-Tongue Learning & Multi-Grade Teaching

Type of Resource, Input, or Reform	Example of Evidence/ Intervention	Possible Learning Pathway	Program Effect
Mother-Tongue Learning	An experimental project introduced instruction in Kom, the mother-tongue of students in the Boyo district of Cameroon, and compared performance to students learning in English (Chuo and Walter 2011).	1. Raises "time on task." 2. Improve opportunities for reinforcement of learning at home.	Students learning in their mother-tongue in Grades 1-3 performed 125 percent better than their peers learning in English.
Multi-Grade Teaching	Multi-grade teaching arrangements were introduced In Colombia, along with teacher training for supporting such an environment and learning materials for students (*Escuela Nueva)*, (McEwan 1998).	1. Increase teacher knowledge and support. 2. Improve learning materials available to students. 3. Allow students opportunities to learn both independently and collaboratively.	Grade 3 students receiving the intervention performed 0.45 standard deviations higher on math tests their counterparts in control schools.

computers are not integrated within a curriculum, they are ineffective at raising learning outcomes.[72] If computers or other interactive programming are introduced, they can only be effective when they are used regularly, which underscores the fact that many such resources are underutilized, as teachers are inadequately trained on how to use them and integrate the new technology into their teaching. For example, results from an evaluation of the One Laptop per Child program in Peru reveal no significant impact of increased laptop access on literacy and numeracy skills due to limited coordination with teachers' pedagogical practices.[73]

Recent innovations and experiments with mobile-based technologies show enormous potential, particularly given high mobile penetration rates in low-income countries. In rural India, games developed for mobile phones were found to increase students' word reading in English, as they enabled practice vocalizing words facilitated by speech recognition technologies.[74] An evaluation of an adult literacy program in Niger, supplemented by instruction on using simple mobile phones, also suggests the impact of such technologies, as adults in the program made greater gains in numeracy in comparison to adults without the phones. Additionally, this evalu-

Table 4: Using Technology to Enhance Learning

Type of Resource, Input, or Reform	Example of Evidence/ Intervention	Possible Learning Pathway	Program Effect
Computer Assisted Learning	A computer assisted learning program was implemented in India, providing Grade 4 students with two hours of shared computer time each week for playing educational games related to math skills (Banerjee et al. 2004).	1. Challenge students' comprehension with games. 2. Teachers provide students encouragement and support on an individualized basis.	The program raised Grade 4 math test scores by 0.35 standard deviations.
Interactive Radio Instruction	An interactive radio instruction program was implemented in Zanzibar, providing 30-minute broadcasts, which integrated games, songs, and stories with the curriculum (Education Development Center 2009).	Engage students with high-quality and interactive learning activities.	The program increased Grade 1 students' scores in math, English and Kiswahili by 10 percent, when compared to a control group.
Mobile games	A program in India used mobile games with speech recognition technologies in order to help students practice vocalizing words (Kumar et al. 2012).	Provide opportunity for practice vocalizing words.	The program increased students' word reading in English.

ation found the effect of mobile phones to be greater for younger adults, indicating the role that mobile-based technologies can play for children learning both in and outside of the classroom.[75] (Since many technological resources can be used both inside and outside of a classroom environment, we will revisit technological innovations for learning in the next section on Learning Outside of the Classroom).

Although there is potential for technologies to enhance learning, programs may not be effective without careful planning. Winthrop and Smith identify a need for planners to address how sustainable technologies are, which requires consideration of the total cost of ownership, factoring maintenance and training, for example, into the cost of a program. They also recommend consideration for the reliability of any technology, making sure that, for instance, irregular access to electricity will not hinder its use. At the same time, they argue that if a technology is not easily used or requires extensive training before use, there will be substantial limitations to any impact on learning.[76]

The lack of access to technologies can perpetuate inequality given the increasing need for proficiency with computers and other resources for success in the workplace. Bridging the digital divide is important; therefore, if appropriately implemented, there is great potential for reducing inequalities by improving access to and proficiency with technologies.[77]

LEARNING OUTSIDE OF THE CLASSROOM

As discussed earlier, much of learning occurs outside of formal schooling environments. Children may learn unconsciously through observation of others and their environments (for example, children may observe signs marking streets), and through interactions with family members and peers.[78] While it's difficult to recognize and address the innumerable contexts in which students learn, the following discussion focuses on more structured activities that may improve learning outside of formal schooling.

Learning at Home

As evidenced by the relationship between various household-level characteristics and student achievement, increasing opportunities for enrichment outside of school is critical for improving literacy and numeracy skills. For instance, in many low-income households, reading materials might not be available for children at home to reinforce learning from classroom activities. In response to this lack of access, Save the Children, as one part of their multipronged Literacy Boost program, worked with communities in Malawi to create book banks, which are collections of local language books that students are encouraged to borrow and read at home. In Malawi, Grade 2 students who reported using book banks had reading gains that were on average 16.98 percentage points larger than those who did not.[79]

In addition to reading materials, educational media programs have also been successful in promoting learning outside of the classroom. After watching 52 episodes of *Jalan Sesama*, an adaptation of the popular *Sesame Street*, in which Indonesian children aged 3 to 6 were exposed to educational messages regarding literacy and numeracy, health and safety, social development, and environmental and cultural awareness, children improved letter and number recognition when compared to a control group watching children's media without a specific educational focus.[80] Another program demonstrating impact involved applying same language subtitles to a popular television program in India. In a sample of children who could not read a syllable in Hindi at baseline, 56 percent of those who were exposed to the television program with the same language subtitles were able to become good readers five years later, compared to only 24 percent of those without exposure.[81] Considering the impact of these programs and the relationship between household characteristics and learning levels, identifying innovative ways to support learning outside of the classroom is clearly an important priority.

Extra Tutoring

The number of students receiving extra tutoring has mushroomed in the past several years, leading to the coinage of the term 'shadow education' to refer to these activities outside of the mainstream schooling system.[82] For example, of Bangladeshi children attending public primary school, 43 percent from the poorest quintile of students received extra tutoring in 2010, while 67 percent in the richest did.[83] While some tutoring programs explicitly assist students studying for public exams and higher education entrance exams, others provide support in particular subjects.

Tutoring programs can improve learning outcomes and can be a useful resource for struggling students needing remediation. For example, a program in India, which provided remedial tutoring during school hours led to impressive gains in students' literacy and numeracy, reflected in an impact of 0.28 standard deviations on scores in the second year of the pro-

Table 5: Learning Outside of the Home

Type of Resource, Input, or Reform	Example of Evidence/ Intervention	Possible Learning Pathway	Program Effect
Learning Materials in the Home	A program encouraging and allowing children to borrow reading materials to read in their homes was implemented in Malawi (Dowd et al. 2010).	Increase time spent practicing reading.	Children using book banks improved their vocabulary 17 percent more than those not using them.
Educational Media	*Jalan Sesama*, an adaptation of the popular *Sesame Street*, allowed Indonesian children aged 3 to 6 exposure to educational messages regarding literacy and numeracy, health and safety, social development, and environmental and cultural awareness, (Borzekowski et al 2011).	Increase exposure to letters and numbers.	Children watching these episodes improved letter and number recognition.
Same Language Subtitling	Same language subtitles were applied to a popular television program in India (Kothari et al. 2008).	Increase exposure to words and reading.	Students watching programs with same language subtitles improved reading skills.
Extra Tutoring	A 20,000 VND (approximately $.0.95) increase in expenditure on paid tutoring in Vietnam at the lower secondary level was analyzed (Dang 2007).	Increase time spent on learning activities.	Increased the probability of a student's good or excellent performance by 8 percentage points.

gram.[84] While tutors were paid by an NGO and worked during school hours, a lot of the tutoring happening in developing countries is fee based. In Vietnam, analysis of data from household expenditure surveys found that increasing spending on private tutoring by 20,000 VND (approximately $0.95) at the lower secondary level increases the probability of a child's good or excellent performance by 8 percentage points.[85] Though this example demonstrates the benefits of private tutoring, there are several consequences related to its growth. First of all, the cost of tutoring raises inequalities; for example, girls and students in rural schools have lower access compared to boys and students in urban schools. Additionally, many teachers tutor their own students. A study in Nepal found that teachers in government schools tutoring their own secondary school students reduced effort in their mainstream classes, ultimately covering less material.[86] While extra tutoring can promote learning, its unintended consequences suggest reasons to better track and control the practice where it perpetuates inequalities, while identifying ways to provide tutoring more equitably, for example, through NGO or government financing.

HEALTH AND NUTRITION

Interventions in health and nutrition are critical in fostering gains in learning. Attention to these areas of child development must begin early in life.

As demonstrated in a previous section, micronutrient supplementation in women of childbearing age shows potential for improving the educational attainment of their children. De-worming, another cross-cutting issue in health and education, has been demonstrated to be an extremely cost-effective method for increasing school attendance by improving children's health. While a clear relationship with learning has not been observed, if de-worming improves attendance where it is erratic and is coupled with other reforms, it could go a long way in improving learning outcomes.[87] However, given that intestinal parasites are more likely in coastal areas, the necessity of this intervention is based on context.

Water, sanitation and health interventions (WASH) can also be effective for increasing child well-being and school attendance. Fit for School, implemented in public elementary schools in the Philippines, encourages daily hand washing with soap and tooth brushing with fluoride toothpaste, along with de-worming twice a year. In addition to encouraging these activities at the school level, the program is conducted alongside efforts within communities to construct washing facilities and improve access to clean water in schools.[88] Evaluation found that children in schools with the program benefited from reduced oral and worm infection, in addition to increased school attendance.[89] The lack of separate toilet facilities for girls has gained attention as a barrier to learning, although a recent systematic review of the evidence concluded that there was insufficient research on their educational impacts.[90] Further research could clarify the impact of separate toilets for girls though this question is complicated by cultural and environmental factors, as well as on how schools manage facilities. Fundamentally, it may be important to focus instead on providing enough toilets of good quality in schools, which continue to remain lacking in developing countries.[91] Access to sanitary products for managing menstruation has also been identified as a barrier facing girls' enrollment and attendance in school. Again, little research exists on this topic, although one study in Nepal found a limited impact of increased access to sanitary products on girls' attendance.[92]

School feeding has been attempted in almost every country,[93] with programs providing breakfast, lunch, snacks or take-home rations. A study in Jamaica found that arithmetic scores for students in Grade 2 improved by 0.11 standard deviations as a result of a school feeding program because of more regularized school attendance and increased student effectiveness while in school.[94] However, the effect was not strong for students in higher grades, underscoring the importance of early intervention in health and nutrition.

Table 6: Health and Nutrition

Type of Resource, Input, or Reform	Example of Evidence/ Intervention	Possible Learning Pathway	Program Effect
Micronutrient Supplementation	A program providing iodine supplementation in utero was introduced in Tanzania (Field et. al. 2009).	1. Increase cognitive development. 2. Reduce child mortality.	The program raised schooling attainment by 0.36 years 10-14 years later among children of mothers receiving supplements.
De-Worming	A school-based program providing de-worming drugs to students was implemented in Kenya (Miguel and Kremer 2004).	Regularize school attendance.	The program led to a reduction in school absenteeism by 25 percent.
Water, Sanitation, and Health	A program encouraging hand washing, tooth brushing and de-worming, along with improving access to clean water, was introduced in schools in the Philippines (ODI 2012).	Regularize school attendance.	The program reduced oral and worm infections in children and increased school attendance.
School Feeding	A school feeding program was implemented in Jamaica (Jukes et al. 2008).	Regularize school attendance.	The program improved reading scores by 0.11 standard deviations.

LEARNING ASSESSMENTS

Assessment of cognitive and noncognitive skill development must begin early in a child's life in order to ascertain gaps and intervene where learning may be impacted. In addition to measuring learning of students in schools, it is critical to capture data on enrollment, dropout and retention, and where possible, learning levels of those not enrolled. For example, Uwezo and ASER measure learning by cohort, as they assess learning among children aged 5-16 and 6-16 respectively, including both children in and out of school.[95] Including children who are not enrolled in school prevents a biased interpretation of learning levels. Data gleaned from assessments can be particularly useful for increasing accountability to communities, improving teacher practice and helping policymakers make informed decisions.

Additionally, assessment surveys may be carried out at a local, national, regional or international level. An earlier policy brief, *Where is the Learning? Measuring Schooling Efforts in Developing Countries*, recommended that in order to improve learning, countries develop national assessment systems.[96] The case of Brazil furthers support for this recommendation.[97] Since the development of a strong national assessment system might be difficult for countries with insufficient capacity, implementing assessments that provide information early on in a child's life, and inform teachers, parents and students of learning levels, are of greatest need in low-income countries. The Early Development Instrument (EDI) and the Early Grade Reading Assessment (EGRA) address some of these needs. Though large scale international assessments have received much attention, they might not be appropriate for developing countries. Despite participation in large scale international assessments like the Program for International Student Assessment (PISA), learning outcomes have not improved, signaling a need for greater focus on how data collected through these methods is being used to improve learning. However, participation in regional assessments, such as measurement by the Southern and Eastern African Consortium for Measuring Education Quality (SACMEQ) as well as international assessments, like the Progress in International Reading Literacy Study (prePIRLS/PIRLS), may be useful for increasing country capacity for the development of a national assessment system. Overall, specific

Table 7: Learning Assessments

Assessment	Who is Assessed?	What is Assessed?
Early Development Instrument (EDI)	4 and 5-years-olds	School readiness to learn (physical health and well-being, social competence, emotional maturity, language and cognitive development, communication skills and general knowledge).
Early Grade Reading Assessment (EGRA)	Grades 1–4	Foundational skills required for reading.
Southern and Eastern Africa Consortium for Monitoring Education Quality (SACMEQ)	Grade 6	Reading and mathematics skills.
Progress in International Reading and Literacy Study (PIRLS/pre-PIRLS)	Grade 4-6	Reading comprehension.

assessment needs should inform choice; we describe below some assessments, while elaborating their uses and contributions.

Early Years

At a regional or national level, assessments can provide decision-makers with relevant data needed for determining how to improve learning environments for specific students, whether through specific policies or resources. The Early Development Instrument, a population-based measure assessing a child's readiness to learn, is one such critical tool.[98] The EDI measures physical health and well-being, social competence, emotional maturity, language and cognitive development, and communication skills and general knowledge. It has been implemented in 14 countries, where there is tremendous potential for using aggregated data by ethnic group or district to provide vital information for determining the direction of policy.

Primary Level

The Early Grade Reading Assessment, developed by RTI International with support from USAID and the World Bank, is a rapid reading assessment that can be conducted with regularity in order to track the progression of student performance.[99] EGRA addresses the foundational skills required for success in reading, which is important given that poor reading performance is indicative of future school success and predictive of dropout. By assessing foundational skills required for reading, it provides evidence early in a child's life, so that there is more time to remedy low learning. Given that there is limited comparability in assessment results across different groups of students, its primary purpose is in guiding teachers, students and community members in identifying learning gaps.[100] Information on an individual child's abilities can be particularly informative to parents, who may subsequently be able to advocate for their child in school and improve support at the household level. Results of learning assessments must be made available and used by parents and teachers, or nationally by ministers of education. For example, given that it's a rapid assessment, EGRA has made it conducive to sharing results with parents and students immediately, so that they can identify problems in learning and take active steps to remedy them.[101]

The Southern and Eastern Africa Consortium for Monitoring Educational Quality is a consortium of national governments in 14 countries, which administers an assessment to measure proficiency in reading and mathematics at Grade 6. So far, assessments have been conducted three times—in 1995, 2000 and 2007.[102] There is some evidence that SACMEQ has influenced policymakers at the national level about regulatory activities around curriculum content and performance standards, behavioral activities around classroom instruction and teacher professional development.[103]

The Progress in International Reading Literacy Study is a multi-country assessment measuring reading comprehension in Grade 4. Recognizing the challenges arising when comparing performance in reading between low- and high-income countries, PIRLS and prePIRLS offer certain alternatives. For countries where reading skills might not be developed until after Grade 4, PIRLS can be used to assess Grade 5 and 6 instead. Additionally, a different assessment, prePIRLS, offers another alternative as it is designed to test the same basic reading skills as PIRLS in Grades 4 to 6, except with less difficulty.[104] Allowing developing countries more options for participation in multicountry assessments can strengthen the technical capacity needed for a national assessment system; however, given the problems associated with previous participation in large scale multicountry assessments, this remains a major challenge. Table 7 catalogues the assessments discussed in this section.[105]

BUILDING AN EDUCATION SECTOR

Earlier we noted that textbooks, like computers and other inputs, might not facilitate learning unless accompanied by other simultaneous reforms. In order to improve the effectiveness of such inputs, accountability within the system must be enhanced. For example, the World Bank's Education Strategy 2020 underscores systems-level reform, defining it as "aligning... governance, management of schools and teachers, financing rules, and incentive mechanisms with the goal of learning for all."[106] Given the high rates of teacher absenteeism described earlier, measures to increase accountability are key to improving learning outcomes. Teachers and school administrators are accountable to students and their families when communities have information about their performance and have some power to exert pressure on them when they are performing poorly. More specifically, accountability may be improved by generating and disseminating systems-level indicators, which more clearly link finance with outcomes, transforming school management and enhancing opportunities for community participation. We begin this section by continuing our discussion of collecting data and then turn to the prospects for success of different types of school management and community participation efforts.

Tracking Resource Expenditures

Collecting data on resources within an education system can lead to greater efficiencies. The potential for Education Management and Information Systems (EMIS) to impact learning exists through tracking and more efficiently distributing resources, such as teaching posts.[107] While many countries have established and strengthened EMIS, there are still many gaps in the data currently available. Though strong EMIS would go a long way in furthering evidence-based policymaking, experiences in implementation in Ghana, for example, suggest that data collection must be simplified such that it does not overburden teachers and principals, who are responsible for collecting and reporting information at the local level. Additionally, a robust and reliable ICT infrastructure is necessary to support EMIS.[108] Furthermore, the efficacy of EMIS is circumscribed by its coverage; for example, given that the private sector plays a major role as a provider of education, it along with nonformal education providers should be included so that a full picture of an education system is achieved.

Other system-wide data sources, which have been useful to disseminate, include Country Status Reports (CSRs), which explore enrollment patterns, internal and external efficiency (dropout and repetition rates, and education's connection to the labor market) and educational equity.[109] In addition, CSRs report information on finances, particularly related to public and household expenditures, as well as donor financing. By simultaneously collecting and analyzing data on expenditures and outcomes, it is possible to make policy recommendations based on cost-effectiveness. For example, in the Gambia's Education CSR, the high cost-effectiveness of remedial education programs and their high impact on reducing repetition make it an attractive recommendation.[110]

BOOST is a World Bank data tool that analyzes the efficiency of public spending and promotes greater access among citizens to information on where public resources have been allocated.[111] By understanding how education spending is being allocated, there is greater accountability for expenditures. For example, in Moldova, the BOOST tool was used to map the relative efficiency of public education spending in different districts.[112] Districts were categorized according to level of spending and efficiency, based on calculations of inputs and service delivery outputs. The availability of such data analysis enables citizens and policymakers to reflect on education strategies.

Table 8: Tracking and Evaluating Efficiency of Education Expenditures

Tool	What Does it Track?
Education Management and Information Systems (EMIS)	Resource allocation, for example teaching posts.
Country Status Reports (CSRs)	Relates expenditures on education to outcomes, such as repetition and dropout.
BOOST	Calculates efficiency of spending on public resources by analyzing inputs and outputs.
National Education Accounts (NEAs)	Tracks flow of finance in education from source to subsector and beneficiaries.

National Education Accounts (NEAs), much like National Health Accounts (NHAs), can track the flow of financial resources in the education sector, disaggregating expenditure by education subsector and characteristics of beneficiaries.[113] If implemented and utilized, NEAs can allow for evidence-based policy-making. In El Salvador, data from NEAs about the costs that families bore in sending their children to secondary school spurred the Ministry of Education to invest in a free secondary education initiative.[114] Table 8 describes the tools discussed in this section. Clearly, these are different tools used by various stakeholders for the pursuit of different objectives; however, they all essentially attempt to relate resource allocation in the education sector to educational outcomes.

School-Based Management

Transformation of school management may help in addressing system-wide challenges. For example, school-based management (SBM) can change who has the power to make certain decisions and to what degree they can exert this authority.[115] On the one hand, school-based management can mean that principals and teachers have greater power in determining curricula or other school-level policies, such as school hours. As decision-makers are increasingly at the local level, the logic follows that they should be more responsive to community needs. SBM may mean that school staff is accountable to local (parents and community members) instead of central authorities, presenting an incentive for stronger effort and effectiveness.

Evidence demonstrates that SBM can influence intermediate indicators such as failure, repetition, and dropout rates, which have an impact on learning.[116] A program begun in Mexico in 1996 has provided parent associations with money to spend on specific education related resources, along with training on how to manage funds and participate in school activities. Schools participating in the program saw large declines in dropout and repetition rates, which parents attributed to stronger teacher effort.[117] However, the poorest communities involved did not experience this same impact, reflecting that SBM may not be effective for the most disadvantaged due to a lack of monitoring capacity. Other studies only find a small statistically significant impact of SBM on test scores. For example, in the Philippines an SBM program was designed to involve an entire community in identifying school spending priorities for the purpose of budget planning and to increase transparency by facilitating schools to share annual plans and report cards on student performance. Students

in participating schools performed 1.5 percentage points higher on tests that measured English, math and science aptitude.[118]

Given that teacher and community capacity must be strong for it to work, SBM may require a long-term outlook, with results visible only after a period of five years.[119] While the evidence base on SBM is still small and somewhat inconclusive, its attempt at fostering dialogue among teachers, parents and administrators is important for improving a learning environment; although the most effective policy iteration for increasing community dialogue and involvement in schools may not be known or the same for every context, some mechanism for community participation is necessary.

Community Participation

A major aspect of SBM is the greater involvement of parents and community members in monitoring school staff and providing input on general functions. In addition to SBM programs, community participation can be facilitated in a variety of ways. Information campaigns about public funds allocated for school expenditure or school performance are examples of increasing community knowledge for accountability purposes. In an evaluation of a mass information campaign in Uganda aimed at stemming the siphoning of public funds meant for nonwage school expenditures, researchers found that test scores were 0.4 standard deviations higher where communities were more highly exposed to newspapers with information on the allocation of the funds.[120] Due to the awareness campaign, fewer resources were leaked and there was greater spending on teaching material and nonwage resources, which subsequently had an impact on learning.

Private Schools

In recent years, there has been tremendous attention to the growth of private schooling in low-income countries. Despite some calls for increased privatization,

Table 9: School-Based Management and Governance

Type of Resource, Input, or Reform	Example of Evidence/ Intervention	Possible Learning Pathway	Program Effect
School-Based Management	A school-based management program in the Philippines increased community involvement in school spending and decision-making (Khattri et al. 2010).	1. Increase parental and community involvement. 2. Increase accountability of staff to communities. 3.Increase effectiveness of money spent on school resources.	The program increased student test scores by 1.5 percentage points.
Community Monitoring	Communities in Uganda were exposed to information about the allocation of public funds for nonwage school resources (Bjorkman 2006).	1. Decrease leakage of funds. 2. Increase nonwage teaching resources.	Students in communities exposed to such information performed 0.4 standard deviations higher on Primary School Leaving Exams (PLE).

it's unclear whether an expansion of private schools can foster effective and sustainable change for learning. A recent study in Kenya found that students in private schools performed one standard deviation better than peers in government schools.[121] While another study of private and government schools in India also found that students in private schools performed better than government school counterparts after controlling for certain student and parent characteristics, the researchers concluded that there was no robust advantage to private schools.[122] Additionally, they found that there was wide variation in performance of students in private schools.

The proliferation of private schools raises equity issues, as fees are unaffordable for the poor. The 2012 Education for All Global Monitoring Report estimated that the cost of private school in an urban slum in Nigeria was equivalent to $217 per year, which could feed a family of six for 70 days.[123] In addition to issues of affordability, Andrabi and Das point out the limits of private school expansion, noting that growth is constrained by the availability of educated teachers, particularly a problem in rural areas.[124] Although private schools can contribute to learning, the variation in quality and their unaffordability for the poorest, show that there are many limitations for further expansion.

FURTHER RESEARCH

One rather obvious conclusion from this review on "*what contributes to learning?"* is that more research is necessary. But what kind of research is most likely to contribute, and contribute fast, to a better understanding of the link between resource use in education and learning outcomes? In recent years, one particular brand of research has been pushed hard by various groups of excellent researchers: Randomized Controlled Trials (RCTs). This is not the place to extensively discuss the pros and cons of RCTs[125], but a few comments will be useful.

In particular, the call for RCTs at the exclusion of all other forms of investigation is unfortunate. First, research on "education production functions" has been conducted for decades and to ignore everything that has been learned over those decades would be a mistake. A typical example of meta-surveys that ignore most of the older literature is Glewwe et al.[126] The survey focuses on studies in both the education and economics literature, published between 1990 and 2010. It finds 9,000 such studies, but quickly narrows this down to 79 studies that are "of sufficient quality". Then, using stricter criteria, the reviewers end up with 43 studies, and, with a singular focus on RCTs, with just 13. While weighting the results of research by the quality of the study is certainly desirable, it is hard to believe that nothing can be learned from the 8,921 studies that have been given a weight of zero in the first selection.

Second, the singular focus on RCTs limits the research agenda mostly to "small issues." RCTs are excellent to determine the casual relationship of input A on outcome B, but they are mostly restricted to one-dimensional inputs and outcomes. The education system is much more complex than that. Furthermore, if something works in one context, there is no guarantee that it will work in another context (unless that context has explicitly been made a topic of that study, which is hard to do with RCTs).

RCTs are not suitable for dealing with larger systemic issues and with complex factors that include, for instance, political economy considerations. For those larger questions, approaches that use mixed methods, both qualitative and quantitative, with inputs from different disciplines, are necessary. RCTs mostly approach a research question as if nothing is known about it. Data are collected and the researchers "let the data speak." Increasingly there is a call for a more Bayesian approach, in which the results of prior knowledge (acquired through other forms of research, or through experience) are combined with whatever new data have been collected, to get a more complete picture.[127] Given how much we still need to know about how learning takes place in complex education systems, within a large variety of different environments, future research should set priorities based on the importance of the questions for which we seek answers, and then pick a suitable (set of) methods, rather than the other way around.

We need more evidence on how dynamic factors interact within education systems. The dearth of information on school organization and how education systems can be reformed to generate changes in learning suggest that future research tackle these issues in particular. The enormity of the problem of accountability in school systems further demonstrates this need. Though RCTs cannot fully answer these questions, we know that there is a lot to learn from other research. For example, McKinsey & Co.'s study of education reform is a great example of generating useful lessons on how, from various starting points, education systems can improve performance.[128]

CONCLUSION

In this policy brief, we once again drew attention to the dismal learning outcomes that accompany the impressive increase in enrollment rates in the developing world. We do not want to imply that one is the result of the other. Rather, we ask the question: *what can be done to address the learning deficit?* In order to answer this question we reviewed the literature on the link between resource use and learning outcomes. We are, of course, not the first to do this. Ever since the Coleman report[129] was published, the education world has seen a steadily growing number of studies searching for the so-called "education production function." In turn, these individual studies have been summarized in numerous meta-studies.

To mention just two of them: in 1998, Verstegen and King[130] published a review and analysis of 35 years of production function research, titled "The Relationship Between School Spending and Student Achievement", in the *Journal of Education Finance*. The authors are relatively positive about the available evidence. Recognizing the limitations of the production function approach, and the context specificity of many of the results, they still conclude that "Policy makers and administrators should take note of the positive relationships among teacher's verbal ability, experience, salary, and student achievement" and "Studies of administrative arrangements suggest that efficiency may be enhanced by reductions in pupil-teacher ratios…and by heterogeneous grouping, thus permitting lower achieving pupils to learn from higher achieving peers…"[131].

Other authors are much less positive. Hanushek (2007), for instance, states bluntly "The accumulated research surrounding estimation of education production functions simply says there currently is no clear, systematic relationship between resources and student outcomes".[132]In an earlier study titled "The Failure of Input-based Schooling Policies" Hanushek comes to the same conclusion but adds that a stronger focus on *incentive-based* policies may present a way forward. We addressed that issue earlier and indeed found some positive results of providing teacher incentives under certain conditions.

This policy brief tries to update the evidence, with a special focus on the developing world. It is based on a workshop organized by the Center for Universal Education[133] and subsequent literature review. The update is timely, given the rapidly growing number of high-quality studies from developing countries. While a lot more needs to be learned, we believe that the collective evidence is more positive than Hanushek's bleak assessment.

We first find that much can be achieved if more resources are devoted to the early years. A lot of learning (including the ability to learn) takes place before age 5, in the household and in the community. There is ample evidence that improving the environment in which young children grow up will greatly enhance their chances to perform well in a formal schooling environment.

We subsequently look at the impact of resource use at the school level. Some results are obvious, but still worth mentioning. A good school infrastructure, with schools at easy to reach locations, is critical. Textbooks (in the local language and about the appropriate curriculum) are necessary inputs. Well-trained and motivated teachers are a must. However, the impact of technology is much more context specific.

Other context specific inputs include a reduction in the pupil/teacher ratio (although it is amazing how controversial this issue still is, after decades of research), multi-grade learning and the language of teaching.

Investments from outside the education sector, such as health (e.g. de-worming) and nutrition (e.g. micro-

nutrients) have also been shown to be effective in improving learning outcomes.

We have stressed the need for building a much stronger information base for the education sector, both on the input side (how much is being spent at what education level on which inputs?[134]), and on the achievement side. The biggest information gap is probably about child development during the early years, although good and cheap data collection systems (such as the EDI) do exist, and, fortunately, are increasingly used. Assessment data at the primary and higher levels of formal schooling are becoming more and more available, but there is still a long way to go. In order for evidence to guide education policies, it needs to be collected on a regular basis, in a systematic and transparent way, and be relevant to the context in which it is being used. Some progress is being made in this respect, but in general, data collection in the education sector is still ad hoc and incomplete. As this policy brief is part of a larger effort to link resources in the education sector with outcome measures, we believe that further attention on initiatives like National Education Accounts (NEAs) will go a long way in allowing for evidence-based policymaking.

Finally, we recognize that an education system is more than the sum of its parts. System-level reforms should include school-based management efforts and empower local communities and parents to influence policy decisions and actions that impact the quality of education for their children. These activities show promise in improving learning outcomes, though they appear to be less effective in poorer communities.

Given the large learning deficit, and our relatively limited level of solid knowledge about what can be done to improve learning outcomes, there is a continued need for monitoring and rigorous impact evaluation of new policy initiatives and local education experiments.

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