Everything else should strengthen the teacher-learner interaction

7

Investments in school inputs, management, and governance often are not guided by how well they improve the teacher-learner relationship. To be effective, they should be.

Learners and teachers have a more productive learning relationship when supported by learning materials and other inputs. Most countries, from the lowest- to the highest-income, are seeking to incorporate technology into their classrooms and education systems. But technology is merely the most discussed of a range of inputs intended to improve the teacher-learner relationship, from pencils and textbooks in the hands of learners to the walls and roofs of school buildings. Good school management also focuses on supporting students learning from teachers. Yet technology—along with other physical inputs—often fails to support the work that teachers and students do, and the potential of school leaders and community members often goes unrealized.

This chapter lays out evidence for the most effective use of these complementary inputs in places where the gap between evidence and practice is largest. In many cases, the failures observed can be illuminated through models of human behavior, which also point the way to solutions (table 7.1). A synthesis of the evidence in these areas reveals three principles that are keys to success in achieving learning through school investments:

- Ensure that other inputs—including new technology—complement teachers, thereby making teaching more effective. Taking this approach, rather than seeking to circumvent teachers, can increase learning.

- Ensure that information and communication technology (ICT) can be implemented in current systems. Otherwise, it will be ineffective.
- Recognize that school management and governance reform, along with community monitoring, can achieve more learning only if they affect interaction between teachers and learners.

Technological interventions increase learning—but only if they enhance the teacher-learner relationship

Technology can strengthen learning.[1] Software can be highly effective if it allows students to learn at their own pace and, in the best cases, adapts dynamically to their knowledge.[2] A game-based computer-assisted learning program in Qinghai, China, intended to improve student language scores not only did that, but also improved students' knowledge of mathematics.[3]

Technology is about much more than giving computers to students. ICT interventions include a wide range of technological monitoring and information systems at all levels of education, from individual students to education systems. Computers and computer-assisted learning software, as well as online platforms such as Google Classroom, Blackboard, and Brazil's Education Connection, enable

Table 7.1 Models of human behavior can guide actions to improve the effectiveness of school inputs and governance: Some examples

| Synthesis principle	Where this fails	Models that identify a mechanism behind this failure	Approaches that address the modeled mechanism
Additional inputs should complement rather than substitute for teachers.	Inputs like laptops are sometimes used to circumvent the teacher-learner relationship but fail to deliver learning benefits.	*Information failure:* Policy makers seek to circumvent poorly functioning teacher-learner relationships without evidence on an alternative model of learning.	New books and materials have been ineffective in many places, but in Liberia they increased student learning when combined with teacher training.
Technologies must be implementable in the current education system to achieve more learning.	Education technology investments routinely fail because there is limited capacity to maintain them, or the infrastructure needed for them to work effectively does not exist.	*Behavioral (optimism bias):* Policy makers project unrealistic technological progress.	In India, computer-assisted learning has dramatically improved learning outcomes in dedicated technology centers.
School governance reform and community monitoring improve learning only if they affect the teacher-learner interaction.	School governance reforms and community monitoring often fail to take into account community capacity.	*Information failure:* Community members often do not observe the most important part of the learning process—what happens in the classroom.	In Mexico, community engagement over time, with decentralization of real decision-making power, has been effective.

Source: WDR 2018 team.

learners and parents to communicate with teachers about assignments and materials, and they offer free materials that educators and parents can use in designing age-appropriate development activities.[4] These platforms include interactive whiteboards, text messages to support teachers, and televised programs to improve instructional quality in areas with limited access to trained teachers.[5]

Though ICT offers potentially significant gains for education, the effects of tested interventions have varied greatly. Some programs have been extremely impressive, such as a dynamic computer-assisted learning program for secondary school students in India that increased math and language scores more than most other learning interventions tested there or elsewhere.[6] But others, such as the One Laptop Per Child programs in Peru and Uruguay, have shown no impact on student reading or math ability.[7] Indeed, the vast majority of ICT interventions have had either no impact or—as with certain hardware interventions—a negative impact on student learning (figure 7.1).[8]

Moreover, current evidence likely overestimates the effectiveness of ICT interventions in education because many fail—or stumble badly—before being implemented. In Haiti, a program to use smartphones to monitor teacher attendance had no effect on teacher attendance or student outcomes because implementation proved untenable.[9] Brazil's One

Figure 7.1 Information and communication technology has had a mixed impact on learning

Distribution of the effects of education technology on student learning, by type
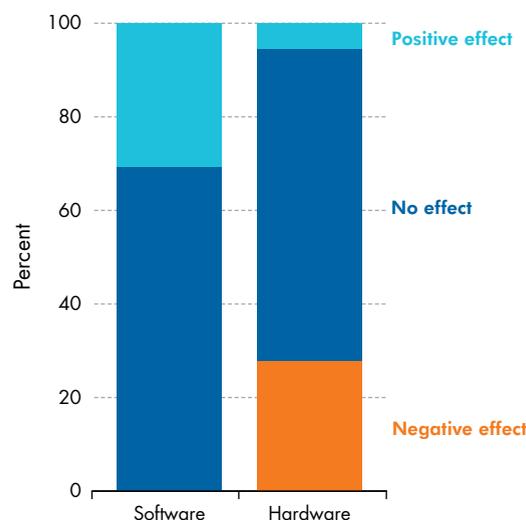
Source: WDR 2018 team, using data from Muralidharan, Singh, and Ganimian (2016, annex 2). Data at http://bit.do/WDR2018-Fig_7-1.

Laptop Per Child initiative faced years of delays in several states. And a year after the laptops made it to classrooms, more than 40 percent of teachers reported never or rarely using them in classroom

activities.[10] Rich countries face the same challenges: beyond education, almost a fifth of public sector ICT projects in the United Kingdom have had cost overruns of more than 25 percent, and the typical project takes 24 percent longer to implement than initially expected.[11] It is crucial to focus on technologies that are truly feasible in existing systems. In rural areas, technology may be more attractive because of weak education systems, but at the same time those weak systems—with their limited access to electricity or the internet—have the least capacity to support education technology interventions.

With such varied returns and so many challenges to implementation, why is there so much investment in education technology? Both principal-agent relationships and behavioral biases likely play a role. The principal-agent model is relevant because public officials may derive political returns from flashy technological interventions, independent of their usefulness for better learning. Thus their personal incentives (to make highly visible investments) may diverge from the goals of students (to learn). Cognitive bias may also be a factor, with individuals being unrealistically optimistic. In fact, there is a long history of overestimating the transformative nature of technology in schools, going back to Thomas Edison asserting in 1913 that "books will soon be obsolete in schools. . . . Our school system will be completely changed in the next ten years." Edison predicted that books would be entirely replaced by silent films.[12] Half a century later, as computers gained traction, some scholars wondered if they might replace teachers at some point.[13] Of course, schools in technology-rich environments do look different from those elsewhere: students might do their work on interactive displays rather than on paper. But technology has for the most part not been particularly disruptive in education. The buildings, the processes of the school day, and the interactions between teachers and students are very similar to those of a century ago.[14]

Technologies that complement teachers work better than technologies that substitute for them. Many students have poorly prepared teachers with limited training and motivation, and education systems have been tempted to use technology to circumvent these teachers. Most such attempts have failed. By contrast, using technology to complement teachers offers more promise.[15] Consider a computer-assisted learning program in Gujarat, India, that was implemented in two ways. One approach pulled students out of regular classes to use computer-based math programs—in other words, the program substituted for regular class time. Students under that model performed significantly worse than students left with their regular teachers. In the other approach, where students used the program after school, there were sizable gains, especially for the poorest performers.[16] Another example of technology that complements teachers is a series of prepared videos of high-quality lessons—such as Brazil's Telecurso—which can be used in a classroom.

Technology holds some promise in fragile settings, such as those afflicted by war or epidemic, to maintain a connection to formal education. During the 2014–15 Ebola epidemic in Sierra Leone, schools shut down for eight months, but the government launched an emergency education program with lessons five days a week. A 30-minute lesson over the radio is unlikely to have a deep learning impact, but this kind of program may help children stay connected to learning.[17] Sudan's Can't Wait to Learn program, which provides out-of-school children with computer tablets loaded with learning games, has shown positive learning impacts in mathematics and is now being tested on a large scale in areas receiving Syrian refugees.[18] In places where teachers are unavailable, such approaches may be the best option.

Impacts on literacy and numeracy are not the only measures of success: technology can also promote digital skills. As more jobs require digital literacy, the opportunity to acquire those skills is an end in itself. Students with more access to computers at home have better computer skills.[19] And though Peru's One Laptop Per Child program had no effect on academic achievement or cognitive skills, students did significantly improve their knowledge of how to use laptops.[20] In such cases, clarity of purpose is key. Obviously, youth need computers to learn how to use them. But as tools for teaching reading and numeracy, evidence on their usefulness is mixed.

Other inputs bring learners to school—but promote learning only if they target teaching and learning

Building schools can increase enrollment in places with few schools, especially for girls. In Afghanistan, the provision of community-based schools in just over a dozen communities increased enrollment massively, effectively eliminating the gender gap in enrollment.[21] In Burkina Faso, a program to construct schools with modern amenities increased enrollment by a large margin, with the biggest impacts for

girls. Even beyond building entire schools, building latrines—particularly gender-specific ones—significantly increased enrollment of adolescent girls in India.[22] But in places where learners have relatively easy access to schools, additional schools will not be the most cost-effective way to raise access or to improve learning.

Even in places lacking infrastructure, providing it does not necessarily lead to more learning. The Afghanistan and Burkina Faso programs boosted learning, while India's did not. Why? Constructing a school where children previously had no access directly alters the learning process by creating a place to learn that did not exist before. Building latrines makes school a safe space, and so it makes children (especially girls) better able to be at school—but because it does not affect what happens in the classroom, it may not affect learning.

School feeding gets children to school, but it does not always improve learning. The most consistent impact of school-based meal programs has been more children in school, such as in Burkina Faso, Kenya, and Peru.[23] At school age, providing meals contributes less to brain development than earlier in the child's life, but it could still increase learning through improved attention and energy. However, if meals are offered during normal school hours, they reduce time on task. In Kenya and Peru, meals took significant time away from the classroom, and so they had an ambiguous net effect. Impacts on measured learning are mixed, with positive effects in Burkina Faso and Peru.

Similarly, simply increasing the materials available at schools does not improve learning if the materials do not improve teacher-learner interaction. Providing more textbooks in Sierra Leone in 2008 did not result in those books being used in the classroom because administrators put most of the books in storage—potentially to hedge against future textbook shortfalls.[24] Another textbook program, in Kenya, had no impact on learning, most likely because most students did not fully understand the language in which the books were written.[25] Simply providing desktop computers to classrooms in Colombia—where they were not well integrated in the curriculum—likewise had no impact on learning.[26] It seems obvious that resources have to be used to have an impact, but many interventions that provide inputs fail exactly because insufficient thought is given to how resources will be used. Infrastructure and other inputs are essential, but they work only when they serve the relationship between teaching and learning.[27]

School management and governance are crucial, and involving communities can help overcome incentive problems and information failures—but only if communities have capacity

Schools with better management have better test scores.[28] Schools vary significantly in management quality (figure 7.2), and school leadership plays a crucial role in school performance. Effective leadership means having school principals who are actively involved in helping teachers solve problems, including by providing instructional advice.[29] It also means having principals who set goals with teachers to prioritize and achieve high levels of learning. These factors are associated with the highest levels of student learning, and they confirm that effective school leadership improves the quality of teacher-learner interactions. A major school district in the United States improved student learning by training school

Figure 7.2 Schools vary significantly in management quality

Average school management score by country, relative to top-performing country, participating countries
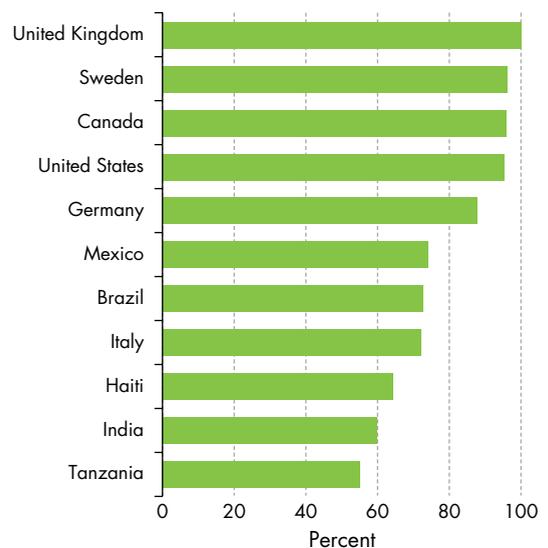
Source: Bloom and others (2015). Data at http://bit.do/WDR2018-Fig_7-2.

Note: The school management score is a combination of 14 basic management practices, each rated from 1 to 5. Schools with higher scores have more structured management practices.

principals in three sets of skills: how to give feedback to teachers on lesson plans; how to support teachers in regular learner assessments, as well as to provide feedback on action plans to improve student performance; and how to, through classroom observation, give feedback on teacher performance.[30] In Madagascar, clarifying the management roles of district officers, school principals, and teachers and providing them with coaching and supervision improved student outcomes, at least in schools where the heads had good performance incentives.[31] Likewise, in Jamaica training and mentoring principals improved school management (box 7.1).

Many countries have decentralized some elements of their education systems, often called school-based management. Providing schools and communities with decision-making power and resources can solve two problems. First, by giving local school leaders and parents more direct influence over teachers and other school representatives, it may make teachers more immediately responsive to student needs. Contrast this with supervision by a ministry of education representative based far away, who has little ability to bring shirking teachers to account. Second, schools and communities may have better information about the needs of local schools, which, along with access to discretionary resources, means they can more nimbly meet those needs.

School-based management programs improve learning when the community has the capacity to make and implement smarter decisions.[32] Data on 1 million students from 42 countries suggest that school autonomy is beneficial to student learning in high-income countries but detrimental in developing countries.[33] At the micro level, a school-based management intervention in The Gambia improved test scores only in communities with high literacy rates among parents.[34] A similar result was observed in the impacts of a school grant program in Niger.[35] Several of these programs did not last more than a year or two, in some cases because the programs were pilots and in others because of unstable education policies. Without time for communities to learn how to effectively engage in school management, impacts on learning are unlikely. Because communities are more readily able to monitor school enrollment than learning, school-based management may increase access even in low-capacity communities, as happened in Burkina Faso.[36]

Community monitoring will not help learning if it does not affect what happens in the classroom. A range of interventions seek to increase community monitoring of schools by sharing school information with parents. The structure of these programs varies, from the parents themselves collecting data on teacher attendance or school performance, to the education systems disseminating prepared data to parents, to supplementing information with facilitated meetings in which parents and teachers can discuss grievances and lay out courses of action.[37] But parents are rarely in the classroom, and even when they are, they cannot necessarily identify good classroom practice. This may explain why the growing evidence on these programs reveals mixed results.[38] For example, in Andhra

Pradesh, India, providing community members with report cards on school performance failed to increase either parental engagement or student learning.[39]

Successful community monitoring increases accountability through feedback loops between multiple stakeholders. Low-stakes accountability programs have improved student learning in Mexico, Pakistan, and Uganda.[40] Though some monitoring programs succeed and others fail for multiple reasons, successful programs, such as those in Mexico and Uganda, do not reach out to only one group, but rather share information explicitly with school leaders and teachers, as well as with communities and parents. (The Pakistan experiment is an exception, focusing only on parents.) Parents alone cannot enact accountability, and better information in the hands of school officials helps. To improve learning, parents and communities need to be able to harness increased information to hold teachers and schools more accountable.

School grant programs—in which schools receive regular influxes of resources and more autonomy over budget allocations—are one type of school-based management program. In Haiti, a program that provided schools with grants based on the number of students enrolled significantly increased enrollment.[41] From this perspective, school grants can effectively deliver money to schools, and schools need money to function. But most programs that simply deliver grants to schools do not increase learning. Just distributing grants to schools—as in The Gambia, Indonesia, and Tanzania—had no effect on student learning.[42] In Senegal, observed impacts on learning appeared only for a subset of children, then disappeared by the next year.[43] Some school grant programs increase learning outcomes only when the grants are unanticipated. When parents have known the grants were coming, they have reduced their own investments in education—not a recipe for long-term learning impacts.[44] By themselves, grants act in much the same way as other interventions that simply increase resources in schools. There is no guarantee that they will improve learning.

But grants can be leveraged in the context of broader school-based management programs to improve school outcomes. In Tanzania, grants alone had no impact on student learning, but grants combined with teacher incentives did improve learning. In Niger, grants alone had little impact, but grants with training improved both student learning and parent support for schools.[45] Likewise, grants alone had no impact on learning in Indonesia, but they did improve learning when the program also linked school management committees to village councils, seeking to resolve the principal-agent problem.[46] When grants are included in larger programs to encourage community school councils to engage in school management, the combination can improve learning.[47]

* * *

Whether an education input is a physical item, such as a tablet or textbook, or a process, such as school management and leadership, it will improve learning only if it directly improves the quality of teacher-learner interactions. Without that, more inputs will pile onto an ineffective process and fail to have the desired impact. But used strategically, inputs can work together with prepared learners and knowledgeable, motivated teachers to produce high levels of learning.

Notes

1. McEwan (2015).
2. Banerjee and others (2007); Carrillo, Onofa, and Ponce (2010); Muralidharan, Singh, and Ganimian (2016).
3. Lai and others (2012).
4. Esteves Pereira and Cabral (2016); "Planning Educational Activities for Children (PEACH)," Georgia Department of Early Care and Learning, Atlanta, http://www.peach.decal.ga.gov/app/.
5. Jukes and others (2017); Wolff and others (2002).
6. Muralidharan, Singh, and Ganimian (2016).
7. Cristia and others (2017); de Melo, Machado, and Miranda (2014). For Uruguay, the evaluation covers math and reading impacts in the early years of the program, when its main objective was to provide equipment and connectivity for schools; the program evolved since then to add ICT training for teachers and adaptive educational technology, and new evaluations are expected to be published in late 2017.
8. Bulman and Fairlie (2016); Muralidharan, Singh, and Ganimian (2016).
9. Adelman and others (2015).
10. Lavinas and Veiga (2013).
11. Budzier and Flyvbjerg (2012).
12. Smith (1913, 24).
13. Bellissant (1970); Goodlad (1969).
14. Pritchett (2013).
15. Snilstveit and others (2016).
16. Linden (2008).
17. Powers (2016).
18. War Child Holland (2016).
19. Kuhlemeier and Hemker (2007).
20. Beuermann and others (2015).

21. Burde and Linden (2013).
22. Adukia (2017).
23. Cueto and Chinen (2008); Kazianga, de Walque, and Alderman (2009); Vermeersch and Kremer (2005).
24. Sabarwal, Evans, and Marshak (2014).
25. Glewwe, Kremer, and Moulin (2009).
26. Barrera-Osorio and Linden (2009).
27. Ganimian and Murnane (2016).
28. Bloom and others (2015).
29. Robinson, Lloyd, and Rowe (2008); Waters, Marzano, and McNulty (2003).
30. Fryer (2017).
31. Lassibille (2016).
32. Carr-Hill and others (2015).
33. Hanushek, Link, and Woessmann (2013).
34. Blimpo, Evans, and Lahire (2015).
35. Beasley and Huillery (2017).
36. Sawada and others (2016).
37. Read and Atinc (2016).
38. Cheng and Moses (2016); Read and Atinc (2016).
39. Banerjee and others (2010).
40. Andrabi, Das, and Khwaja (2017); Barr and others (2012); de Hoyos, Garcia-Moreno, and Patrinos (2015).
41. Adelman and Holland (2015).
42. Blimpo, Evans, and Lahire (2015); Mbiti and others (2017); Pradhan and others (2014).
43. Carneiro and others (2015).
44. Das and others (2013).
45. Kozuka (2017); Mbiti and others (2017).
46. Pradhan and others (2014).
47. Gertler, Patrinos, and Rubio-Codina (2012); Santibañez, Abreu-Lastra, and O'Donoghue (2014).

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