State of the Evidence

Description of the Evidence

Policymakers are often interested in adding technology to classrooms, yet technology is not a silver bullet and closely follows existing lessons about increasing learning outcomes from non-technology interventions.

For example, adding technology to a classroom by way of providing hardware (laptops, tablets, etc.) without changing other aspects of the classroom’s structure or pedagogy generally does not improve learning. Indeed, this is akin to “adding inputs only,” a category in this menu with low cost-effectiveness. In Peru (Beuermann et al. 2015) and Honduras (Bando et al. 2017), laptops did not increase learning. See more examples in J-PAL’s Education Technology Evidence Review here (Escueta et al. 2014) and Appendix C in Muralidharan et al. 2019.

However, pedagogy-focused CAL programs hold more promise for improving learning. Appendix C in Muralidharan et al. 2019 provides a review of impact evaluations that provide hardware and software to improve learning for children in primary and secondary school. This review finds: (1) Self-paced CAL programs with pedagogical software aimed at allowing children to review grade or curriculum-related content improve learning modestly; and (2) CAL programs with software that personalizes instruction to each student’s learning needs are particularly effective at improving learning.

In India (Muralidharan et al. 2019), students offered a voucher for a CAL program scored 0.37 standard deviations higher in math, and students who received the voucher also scored 0.23 standard deviations higher in Hindi. J-PAL’s Education Technology Evidence Review has more examples of computer-based adaptive learning programs with positive results here. This evidence is in line with the research that suggests tailored instruction that does not use technology is also effective at increasing learning outcomes (see the “Targeted instruction” section).

Technology can also be used to engage parents in learning by providing them with information either about their child’s performance or allowing them to engage directly with content and pedagogical support. This does not necessarily require high-tech technology; in Botswana (Angrist et al. 2020), a Covid-era educational intervention using only simple-feature phones, such as SMS messages and phone calls, had positive effects on learning, including a reduction in innumeracy of 31 percent. In addition, tailoring instruction in the messages and phone calls was more effective than standard SMSes/phone calls in improving higher-order competencies.

Finally, J-PAL’s evidence review notes that “combining online and in-person instruction can work as well as traditional in-person only classes, which suggests blended learning may be a cost-effective approach for delivering instruction. Students in online-only courses, however, tend to perform worse than students in in-person-only courses."

Notes on Context

Adding technology to classrooms may be particularly challenging in environments with low existing knowledge of how to use the technology. For example, teachers must be facile with the technology in order to assist students with using it. Additional challenges may include electricity and internet availability. It is important to do a contextual analysis to understand how introducing technology-based educational interventions will affect accessibility and equity concerns, as students from lower-income or more rural backgrounds may have less access to internet, electricity, laptops, or other forms of technology.
**Equity Considerations**

It is important to ensure that if technology is introduced to an educational setting, it is done in an equitable manner. This includes ensuring equal access for all students to any technology in the classroom. Teaching students to use technology in a classroom may be especially important for students who might not have this opportunity at home. Technology-assisted programs that occur outside the classroom may introduce discrepancies in access or outcomes if some students have access to computers, electricity, internet, etc. at home and others do not, meaning that some students would be able to take advantage of the program and others would not. Conducting an analysis to understand differential access to technology at home may be an important part of ensuring equity in programs that rely on technology at home.

**Operationalization**

**Generalizability**

Drawing on J-PAL’s Generalizability Framework, below are questions that will help you determine if a Computer-Assisted Learning (CAL) program in school might increase learning outcomes in your context. The below questions are not meant to be an exhaustive list of questions you will need to answer to determine if this type of program is appropriate for your context. They can, however, provide a starting point for applying the global evidence on this type of program to your specific context.

**Local Conditions**

- Are students currently struggling to master foundational literacy and numeracy skills?
- Is there a wide variety of student learning levels, suggesting that tailored or targeted instruction may help students starting at different levels catch up to the same place?

**Generalized Lessons on Behavior**

- Programs that use technology to provide tailored instruction have increased learning for students in some contexts.

**Local Implementation**

- Is there a location where students could attend CAL sessions, such as a computer lab at the school?
  
  If not, what would be required to create this resource? Are there low-cost computers that could be purchased? How will the space be procured? Will the computers be secure in that location?
  
- When is the best time for students to use CAL software? Can they be encouraged to take part in the program after school? Is there time during the school day to incorporate a CAL program?

**Successful Examples**

- Computer-assisted learning in India (Muralidharan et al. 2019)
- Low-tech phone calls and texts in Botswana (Angrist et al. 2020)

**Implementation Guide**

Guidance on Evidence-Based Computer-Assisted Learning Approaches

**Further Action Options**

For approaches with mixed evidence or high variation of effectiveness in the literature, more evidence generation is recommended to close evidence gaps. Based on the evidence for this category, potential next steps might include:

- Connecting with implementers to learn more about evidence-based programs in this category;
- Connecting with researchers to identify relevant open questions that would benefit from further research;
- Other activities to think through the policy implications and/or research needs of this evidence in your context

If you are interested in exploring these or other options, please contact the J-PAL Education team at, JPAL_Education@povertyactionlab.org, to set up an initial exploratory meeting. The team will be happy to brainstorm potential next steps.