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# Teacher professional development and coaching in low-income countries: An evidence-informed conversation

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Helpdesk Request No. 008-20191216 and 009-20191216

## About this document

- Recommended citation.** Björn Haßler and Caitlin Moss (2020). *Teacher professional development and coaching in low-income countries: An evidence-informed conversation*. (EdTech Hub Helpdesk Response No. 1). Available at <http://docs.edtechhub.org/lib/SC5NHA65>. Available under Creative Commons Attribution 4.0 International, <https://creativecommons.org/licenses/by/4.0/>.
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Haßler, B. (2019). *Systems Leadership for Learning*. Open Development & Education. (Creative Commons Attribution 4.0, <https://doi.org/10.5281/zenodo.3595400>)  
Haßler, B., D'Angelo, S., Walker, H., & Marsden, M. (2019). *Synthesis of Reviews on Teacher Professional Development in Sub-Saharan Africa*. Open Development & Education. (Creative Commons Attribution 4.0, <https://doi.org/10.5281/zenodo.3497271>).
- Identifiers.** 2405685:SC5NHA65; 10.5281/zenodo.3631745
- Internal use.** [g/d/1Js4LKRgBJHEpBdxZiygXUxW-uZSWjvnpc6xwZk\\_Kwll](g/d/1Js4LKRgBJHEpBdxZiygXUxW-uZSWjvnpc6xwZk_Kwll)
- Note.** This working paper does not represent the consensus of the EdTech Hub, but rather the evidence-informed opinion of the authors.

## 1. Introduction

This document summarises the key findings of two briefs<sup>1</sup> prepared by the EdTech Hub. Below, we examine a conceptual theory of change of teacher professional development (TPD) and the potential roles of technology within it. This requires us to consider the existing evidence on these potential uses of technology, situated within considerations

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<sup>1</sup> The other briefs are listed in the references.

of the wider education system. We then examine specific questions as to how technology can or should be used:

- As a tool for teachers (or groups of teachers) to support their in-service professional development; and
- As a tool for coaches to support teachers' in-service professional development.

To obtain guidance in these areas, we synthesise evidence, knowledge, and recommendations on technology use for TPD and coaching most relevant to low- and middle-income countries, with a focus on sub-Saharan Africa. We attempt to make sense of the limited evidence available on these questions, and thus necessarily offer opinions and recommendations. The contents of the brief reflect the opinions of the authors, and not those of the EdTech Hub.

## **2. Teacher Professional Development and technology in the context of influences on student learning**

There are multiple influences on student learning across the education system and at varying levels, including national, community, school, teacher and student. Many of these influences can be seen in conjunction with technology.

### **2.1. Teachers and context matter**

Research shows that teachers matter; of any input to the education system, teachers have the most potential to impact student learning. Teacher salaries often constitute the dominant factor with the political economy of education systems; teachers are therefore not only able to have a significant impact on students but — especially given improvements over the last decade — teachers are also readily available to play that role.

We also know that context is critical, and that effective education practices are highly contextual. However, context should not necessarily be considered at the national level; rather, we should focus on important differences between meso-contexts within a country (such as urban versus rural environments). It is also important to acknowledge that the most disadvantaged and marginalised children are likely to be taught by teachers who are themselves relatively disadvantaged. These disadvantages not only impact children's opportunity to access education but also impact teachers' day-to-day work (including, for example, their access to electricity) in ways that potentially constrain (the impact of) technology use.

### **2.2. Technology use in the theory of change of teacher professional development**

We know that teachers matter in improving learning outcomes for children, and have evidence to indicate that the right kind of teacher professional development helps teachers become more effective. Thus, a simple theory of change for teacher professional development might look like:

1. Effective creation of TPD opportunities; ↘

2. More effective teacher education (pre-service and in-service); ↴
3. Effective teachers; ↴
4. Improved learning outcomes for children.

Technology could be used in conjunction with each of these four steps as follows:

- A. Effective creation of TPD opportunities, which inevitably draws on technology for the production and licensing of content and digital materials;
- B. Drawing on technology in the TPD process (or in other words, technologically-enabled TPD; ~e.g., video recording classroom activities to spark teacher reflection on classroom practice);
- C. Technology use in the classroom by teachers or by students to enable children's learning.

Below are a few notes on the role of technology along this theory of change.

**Regarding (1) and (A).** Technology in the creation of TPD opportunities (including TPD programming) is the only area where technology use is truly inevitable. Therefore, this area merits attention in order to ensure that TPD opportunities are created as effectively as possible.

**Regarding (2)-(4) without (B).** Teacher education may or may not use technology. One can still reach the goal of 'improved learning outcomes for children' via the route of effective creation of TPD opportunities → using technology to create content → more effective teacher education → more effective teachers → improved learning outcomes for children.

**Regarding (B) and (2)-(4).** It is possible that we might be able to improve learning outcomes by drawing on technology in the TPD process. The advantages and disadvantages of both technologically-enabled as well as non-technologically-enabled means of TPD, such as cost, reliability and more, should be carefully considered and weighed. There is of course a spectrum between 'TPD that fully relies on technology' to 'TPD that does not utilise technology at all'.

**Regarding (C) and (2)-(4).** TPD focuses on supporting teachers across a range of different aspects of their teaching practice; some of those practices might include how they use technology in the classroom (C). Technology in the classroom (C) also affects children's learning (4). However, this use compete both in terms of finance and effectiveness with the process outlined in the in the previous paragraphs.

When it comes to list item (C), technology use by teachers and children in the classroom, one starting point for guidance for decision-makers is the Education Endowment Foundation's (EEF) [toolkit](#), which presents classroom-level interventions — that is to say, "*proximate determinants*" ([↑Pritchett, 2015](#)) — listed against effectiveness, cost and security of the evidence. Regarding digital technology, the EEF toolkit provides a rating that indicates higher cost and lower learning gains than some interventions (such as feedback or metacognition). In many schools in low-income countries, such high-effectiveness-low-cost interventions identified by EEF (e.g., metacognition, feedback, and reading comprehension strategies) are not maximised.

There is a view, the view of “*low-teacher ability*”, that argues as follows. Let’s assume that teachers in low- to middle-income countries (LMICs) are simply unable to learn how to give effective feedback, or indeed unable to implement any of the high-impact, low-cost strategies identified above. Therefore, learning with technology is the only means of learning, or at least learning with technology would have a disproportionate impact. The flaw in this argument is clearly the assumption: evidence clearly indicates that teachers in low- and middle-income countries — just like teachers elsewhere — are clearly capable of professional development. However, it is also clear that effective teacher professional development at scale is not always successful. Below (and in the companion working papers) we offer insights into the ingredients of effective teacher professional development at scale. Clearly, this is not necessarily easy, but we argue that it is still possible.

Regarding cost, using technology is more expensive in LMICs than in higher-income countries, due to missing infrastructure. Proponents of technology as the main solution to improve learning outcomes would admit that the cost may be higher, but might make the case for value for money in that improvements in learning outcomes associated with the use of technology would justify the costs. Here, we make the argument of ‘convergence’. As nations move from low income to high income, it is likely that the effectiveness of digital technology in improving learning outcomes would eventually look similar to the effectiveness of digital technology in the UK. It seems highly counter-intuitive that low-income countries approach this curve from above, rather than from below.

Each of the possible uses of technology in the context of teacher professional development (as well as various combinations of these) should be monitored and measured in terms of impact on learning outcomes and other relevant factors, such as value for money. Monitoring and evaluation is only useful if it feeds back into decision-making. For each context, the most effective combination of these ingredients should be decided based on the evidence gathered.

### **3. Towards identifying top settings for learning with technology across education systems interventions**

In the UK, where wider factors within the education system — while important — are not debilitating, the EEF current sole focus on the classroom level appears reasonable. However, in LMICs, the lack of progress in education (and in some cases deterioration, despite decades of international aid), points towards the need for a holistic systems approach. Systems interventions may take place at the level of the classroom, the teacher, an education ministry, or concern other system factors.

At the classroom level, there is little evidence, even from high-income countries, that commonly used 1:1 technology interventions support learning gains. As EEF points out, while the use of digital technology does have moderate impact, other interventions (e.g., metacognition) have higher impact and lower cost. A more promising option is therefore to sparingly use technology when there is a clear advantage over non-technology based scenarios. This could include, for example, using technology to

tackle common misconceptions in mathematics. This area requires close attention to questions that inform value for money, educational effectiveness, and equity, such as how often in a given week technology should be used, and for what subjects or topics. In these considerations, it is important to note that high levels of computer use can lead to lower learning gains than moderate use ([↑OECD, 2016](#)).

At the teacher level, again, it is important to consider the evidence on non-technology enabled interventions to shed light on claims that teacher professional development cannot work in practice. Clearly, the evidence indicates that professional development has to be of the right kind to be effective. Knowledge-transmission-based cascade models are still widely used even though there is limited evidence of their effectiveness and indeed evidence for their ineffectiveness. However, this Instead, school-based teacher professional development models provide better value for money and impact on children's learning gains. This model may include technology use at the teacher level. It is crucial to weigh the differential benefit of technology use in TPD in comparison with other relevant factors, such as facilitators' preparation, or the overall supply of facilitators.

At the ministry level, there are some indications from U.S. based experience that systems interventions — such as an open curriculum paired with open classroom materials — might lower costs significantly or provide substantial increases in access to high-quality education. It is as yet unclear whether similar models for marginalised children would lead to increased access to education. Such radically open approaches may also run up against vested interests at various levels.

In terms of wider system factors, it is possible that technology could help facilitate a stronger evidence base for systems change (for example, through the use of ICT in M&E). In addition, educational technology research must weigh additional factors such as the open and timely availability of outputs, compliance with open access requirements, sharing and utilising open data, and much more. However, there are many areas where the evidence base regarding education technology is limited, and thus, promising uses of technology in systems interventions in education are not clear.

## 4. Teacher Professional Development and Technology

In the discussion below, we focus on aspect (B) in the list above: the use of technology in the TPD process, rather than on using technology to create TPD content or teacher or student use of technology in the classroom.

In a 50-page synthesis, ([↑Haßler, et al., 2019](#)) characterise effective TPD as that which has high impact on student learning, good value for money, and seven design principles:

1. It explicitly and directly promotes and focuses on student learning and effective learning practices.
2. It promotes effective teaching and learning practices, such as metacognition and self-regulation, mastery learning, collaborative learning, oral language interventions, and peer tutoring.

3. It recognises teachers as professionals, and promotes teacher learning to become skilled problem-solvers and critical thinkers who can help students to become the same.
4. It is long-term, regular, carefully sequenced, and often school-based, rather than provided through one-off trainings. It is adapted and tailored to context, considering the self-sufficiency of the school, the cost of logistics, and the benefits of working as a whole school versus segmenting teachers into grade- or subject specific groups.
5. It motivates teachers to engage by paying attention to teacher career progression and salary structure.
6. It increases sustainability, scalability and equity by using teaching and learning materials that are Open Educational Resources.
7. It considers the use of EdTech very carefully, using it equitably for communication and to support peer facilitators in the facilitation of school-based TPD.

Because there is little secure evidence on teacher professional development in low- and middle-income country contexts, the above principles represent a reasonable set of guidelines that should be used in the absence of hard evidence to the contrary.

## 5. Specific uses of technology for TPD with teachers and coaches

### 5.1. Can technology be used to supplement teachers' lack of content knowledge?

Often, teachers cannot apply the content knowledge they do have because it was taught to them in theoretical ways. When teachers lack content knowledge, both pedagogical skills and content knowledge should be explored together. Whether it is technology-enabled or not, teacher professional development should provide teachers with content knowledge in a way that is practical and linked to pedagogical skills.

### 5.2. Can technology be used to supplement teachers' lack of pedagogical knowledge?

Yes, but it needs to be considered carefully. One of the most effective uses of technology in teacher professional development that we have seen is the use of video for teachers to: (1) watch recordings of others' teaching, and reflect and discuss pedagogical practice as a group; and (2) record their own teaching practice and look back at it as a starting point for dialogue between a teacher and his / her peers about pedagogy.

### 5.3. Can technology be used to monitor teacher progress over an academic year?

We suggest framing the question differently, instead asking, *"how can monitoring of teacher progress contribute to improving learning outcomes for students? Are there other ways in which similar learning outcomes could be achieved?"* Assuming an effective TPD model is in place, then teacher participation in the programme would be important to

monitor. This can be done very simply via school-based facilitators who report on the progress of school-based teacher group meetings, with this information then used to inform the allocation of other resources (e.g., coaching visits, etc.).

#### **5.4. The role of coaches**

There are multiple meanings of the role of 'coach' in teacher professional development. We conceive of coaches as trainers for individual teachers, where the interaction between the teacher and coach is one to one.

#### **5.5. The effectiveness and costs of coaches**

Since coaches are external to schools, there are offer limited opportunities for visits. Coaching is therefore costly, and there is limited evidence on the most cost-efficient teacher-to-coach ratios. However, evidence from Kenya supports the need for lower teacher-to-coach ratios for coaching to be effective. This is turn means that unless you can afford such low ratios, coaching may be ineffective.

#### **5.6. Can technology replace coaches? Or, can face-to-face coaching be replaced by distance coaching mediated by technology?**

In theory, yes, this could be done in high-income country environments. However, teachers who teach marginalised children may themselves face disadvantages — such as access to electricity and internet connectivity. Such factors the impact of coaching done remotely via technology. We have not seen effective examples of coaching via WhatsApp or text chats. However, it may be possible to effectively support

#### **5.7. Can something else replace coaches?**

Are there viable alternatives? What is the right combination of factors? Based on evidence from Kenya, a combination of aspects are important in improving teaching, including teacher instructional support and coaching, one-to-one student books, and structured teacher lesson plans. However, different aspects of a TPD intervention need to be carefully balanced to achieve the best possible effect. One example from Ghana (the Transforming Teacher Education and Learning Programme) used a combination of peer-facilitated in-service teacher support, support from a limited number of coaches to the peer facilitators, and input monitoring to see how the programme was being implemented.

#### **5.8. Can technology be used to track coaches to monitor the fidelity of coaching? More specifically, can and should GPS technology be used to track coaches to monitor the fidelity of coaching?**

In response to the first question, yes, it can. However, monitoring should be fully transparent to those being monitored. A fairer and potentially more important use of GPS tracking may be to collect data to optimise school visits and update school databases. Any coaching programme should consider what geospatial data could be generated and safely shared, keeping in mind careful consideration of security, privacy and safety issues.

## 5.9. Can technology be used to enable online / digital communities of practice for teachers and coaches?

A community of practice of teachers naturally enables them to share examples of effective practice among themselves. However, such exchanges are more likely to take place and be fruitful when they happen face to face and help teachers build trust and relationships over time. Face-to-face communities of practice may also be more feasible and cost-effective. To serve the needs of the most marginalised children, we recommend first drawing on natural, face-to-face communities of practice that exist in schools, with facilitation coming from within the school itself rather than from experts.

For coaches, who likely have less face-to-face time with each other than teachers, and likely have access to technology hardware already, virtual communities of practice seem like an appropriate solution.

While some have suggested the idea of virtual communities of practice that include both teachers and coaches, this arguably seems less useful than face-to-face communities of practice serving only teachers.

If communities of practice use technology, then which technology should it be? If a community of practice (such as one for coaches) is going to be mediated through technology, then we recommend using WhatsApp or Telegram over other tools. The introduction of other tools (such as Edmodo, Moodle or Slack) needs to be informed by user testing.

## 6. Further reading

This working paper forms part of a set. This first paper is intentionally brief and mostly without academic references. The other two parts of this set offer references for the points made, as well as additional discussion:

Björn Haßler. (2020a). *Teacher professional development and coaching in low-income countries: Overarching considerations for the use of technology*. (2405685:H9W2X3KM; EdTech Hub Helpdesk Response No. 2). EdTech Hub. <https://doi.org/10.5281/zenodo.3631747>

Björn Haßler. (2020b). *Teacher professional development and coaching in low-income countries: Practical considerations for the use of technology*. (2405685:VM6NXYF3; EdTech Hub Helpdesk Request No. 3). EdTech Hub. <https://doi.org/10.5281/zenodo.3631749>

## 7. References

A full list of references for the set of three working papers is available here in the EdTech Hub Evidence library here:

[http://docs.edtechhub.org/lib/?ref=TZ9XL6PS&sort=author\\_asc](http://docs.edtechhub.org/lib/?ref=TZ9XL6PS&sort=author_asc).

- Arocena, R., & Sutz, J. (2016). Innovación y Sistemas Nacionales de Innovación en procesos de desarrollo. *Repensando El Desarrollo Latinoamericano. Una Discusión Desde Los Sistemas de Innovación*.
- Arocena, Rodrigo, & Sutz, J. (2000). Looking at National Systems of Innovation from the South. *Industry and Innovation*, 7(1), 55–75. <https://doi.org/10.1080/713670247>
- Björn Haßler, Sara Hennessy, David Hollow, Lea Simpson, Alice Carter, Kalifa Damani, Gill Francis, Katy Jordan, Nora McIntyre, & Joel Mitchell. (2019). *Systemic Mixed-Methods Research—A conceptual framework for EdTech research along the IDIA scale* (10.5281/zenodo.3377829;2339240:FJZA9NPX;2405685:RUSE8WYV;10.5281/zenodo.3377828; EdTech Hub Working Paper No. 1). EdTech Hub. <https://doi.org/10.5281/zenodo.3377828>
- Björn Haßler, Taskeen Adam, Meaghan Brugha, Kalifa Damani, Zoe Allier-Gagneur, Sara Hennessy, David Hollow, Katy Jordan, Kevin Martin, Mary Murphy, & Hannah Walker. (2019a). *Methodology for literature reviews undertaken by the EdTech Hub* (10.5281/zenodo.3352101;2405685:BMM3Z3CM;10.5281/zenodo.3352100; EdTech Hub Working Paper No. 3). EdTech Hub. <https://doi.org/10.5281/zenodo.3352100>
- Björn Haßler, Taskeen Adam, Meaghan Brugha, Kalifa Damani, Zoe Allier-Gagneur, Sara Hennessy, David Hollow, Katy Jordan, Kevin Martin, Mary Murphy, & Hannah Walker. (2019b). *Literature reviews of educational technology research in low and middle-income countries: An audit of the field* (10.5281/zenodo.3523943;2405685:NM6CPLE9;10.5281/zenodo.3523942; EdTech Hub Working Paper No. 2). EdTech Hub. <https://doi.org/10.5281/zenodo.3523942>
- Bruns, B., & Luque, J. (2014). *Great teachers: How to raise student learning in Latin America and the Caribbean*. World Bank Group. [https://www.worldbank.org/content/dam/Worldbank/document/LAC/Great\\_Teachers-How to Raise Student Learning-Barbara-Bruns-Advance%20Edition.pdf](https://www.worldbank.org/content/dam/Worldbank/document/LAC/Great_Teachers-How_to_Raise_Student_Learning-Barbara-Bruns-Advance%20Edition.pdf)
- Community of practice. (2020). In *Wikipedia*. [https://en.wikipedia.org/w/index.php?title=Community\\_of\\_practice&oldid=933903934](https://en.wikipedia.org/w/index.php?title=Community_of_practice&oldid=933903934)
- DFID. (2008). *DFID Education Policy 2018: Get Children Learning - GOV.UK*. <https://www.gov.uk/government/publications/dfid-education-policy-2018-get-children-learning>
- DHS. (2012). *Digital Study Hall Biannual report 2012*. Digital Study Hall. <http://digitalstudyhall.in/reports/dsh-biannual-report-2012.pdf>
- Dover, M. (2013). *Digital Study Hall: Lighthouse Case Study*. Global Solution Networks. <http://gsnetworks.org/wp-content/uploads/2013/11/Digital-Study-Hall.pdf>
- DSH. (2012). *The Digital StudyHall (DSH)*. Digital StudyHall. <http://dsh.jeejio.com/info/overview.html>
- Evans, D. (2008, October 10). *Can technology enable effective teacher coaching at scale?* <https://blogs.worldbank.org/impactevaluations/can-technology-enable-effective-teacher-coaching-scale>

- Evans, D. (2017, July 5). Teacher Coaching: What We Know. *World Bank Blogs - Development Impact*.  
<https://blogs.worldbank.org/impac evaluations/teacher-coaching-what-we-know>
- Gove, A., Poole, M. K., & Piper, B. (2017). Designing for Scale: Reflections on Rolling Out Reading Improvement in Kenya and Liberia. *New Directions for Child and Adolescent Development*, 2017(155), 77–95. <https://doi.org/10.1002/cad.20195>
- Harvey, S. (1999). The impact of coaching in South African primary science InSET. *International Journal of Educational Development*, 19(3), 191–205.  
[https://doi.org/10.1016/s0738-0593\(99\)00012-7](https://doi.org/10.1016/s0738-0593(99)00012-7)
- Haßler, B. (2019). *Systems Leadership for Learning* (10.5281/zenodo.2626704;10.5281/zenodo.3595400;2339240:EXPQPHYQ;2405685:F7MH9IWP). Open Development & Education.  
<https://doi.org/10.5281/zenodo.3595400>
- Haßler, B., Akunor, J. T., & Nyamador, E. S. (2017). *An Atlas of The Forty Colleges of Education in Ghana* (1867969:6DT2K28R;2405685:SKFNBK29).  
<http://bjohas.de/atlas2017>
- Haßler, B., Broadbent, E., Cunningham, A., Chimombo, J., Jamil, B. R., Kauthria, R., Lake, L., Rose, P., Sarfraz, S., & Szekely, M. (2018). *Synergies Between the Principles for Digital Development and Four Case Studies* (10.5281/zenodo.1196830;1867969:MS4YEFUV;2339240:6UEQFTXM). Research for Equitable Access and Learning (REAL) Centre, Faculty of Education, University of Cambridge. <https://doi.org/10.5281/zenodo.1196830>
- Haßler, B., Hennessy, S., & Cross, A. (2014). School-based professional development in a developing context: Lessons learnt from a case study in Zambia. *Professional Development in Education*, 41(5), 1–20. <https://doi.org/10/gfv5xw>
- Haßler, Bjoern, Hennessy, S., & Hofmann, R. (2018). *Sustaining and Scaling Pedagogic Innovation in Sub-Saharan Africa: Grounded Insights For Teacher Professional Development* (2339240:HR2YGWX3;2339240:2BCABLG6;2339240:HGHAYJ5G;2339240:4N3G4XDJ;2405685:ZFJ79LQS;2405685:NZ3GKZCR). 5(1).
- Haßler, Björn, D'Angelo, S., Walker, H., & Marsden, M. (2019). *Synthesis of Reviews on Teacher Professional Development in Sub-Saharan Africa* (10.5281/zenodo.3497271;2339240:GJ83JMQA). Open Development & Education.  
<https://doi.org/10.5281/zenodo.3497271>
- Hattie, J. (2012). *Visible learning for teachers: Maximizing impact on learning* (2405685:24JDEIRH). Routledge.
- Hattie, J. (2015). *What works best in education: The politics of collaborative expertise* (2405685:J6IMU5KZ). British Columbia Teachers' Federation.
- Johnson, S. R., Finlon, K. J., Kobak, R., & Izard, C. E. (2017). Promoting Student–Teacher Interactions: Exploring a Peer Coaching Model for Teachers in a Preschool Setting. *Early Childhood Education Journal*, 45(4), 461–470.  
<https://doi.org/10.1007/s10643-016-0790-1>

- Lundvall, B.-A. (2016). *The Learning Economy and the Economics of Hope* (2405685:UXLKGYEP). Anthem Pr.
- Lundvall, B.-Å., & Lema, R. (2014). Growth and structural change in Africa: Development strategies for the learning economy. *African Journal of Science, Technology, Innovation and Development*, 6(5), 455–466.  
<https://doi.org/10.1080/20421338.2014.979660>
- Lundvall, B.-AAke. (2010). *National systems of innovation: Toward a theory of innovation and interactive learning* (261495:T38AFXER;2405685:M8W9JU49; Vol. 2). Anthem Press.
- Lundvall, B.-AAke, Joseph, K. J., Chaminade, C., & Vang, J. (2011). *Handbook of innovation systems and developing countries: Building domestic capabilities in a global setting* (2405685:7T39BA9P). Edward Elgar Publishing.
- Muyoya, C., Brugha, M., & Hollow, D. (2016). *Education Technology Map: Guidance Document* (2339240:TE5NDYPK;2405685:PLYXAFQY;2339240:I8BVRXMI;2405685:AYEMCFEZ). Jigsaw Consult.  
[https://assets.publishing.service.gov.uk/media/58ff5610ed915d06ac00023b/A1541\\_HEART\\_report-Education\\_technology\\_evidence\\_FINAL.pdf](https://assets.publishing.service.gov.uk/media/58ff5610ed915d06ac00023b/A1541_HEART_report-Education_technology_evidence_FINAL.pdf)
- OECD. (2016). *Innovating education and educating for innovation: The power of digital technologies and skills* (2339240:MUZ4UCRL;2405685:QG76K2FC). OECD Publishing.  
<http://www.oecd.org/education/ceri/GEIS2016-Background-document.pdf>
- Piper, B., Simmons Zuilkowski, S., Dubeck, M., Jepkemei, E., & King, S. J. (2018). Identifying the essential ingredients to literacy and numeracy improvement: Teacher professional development and coaching, student textbooks, and structured teachers' guides. *World Development*, 106, 324–336.  
<https://doi.org/10.1016/j.worlddev.2018.01.018>
- Piper, B., & Zuilkowski, S. S. (2015). Teacher coaching in Kenya: Examining instructional support in public and nonformal schools. *Teaching and Teacher Education*, 47, 173–183. <https://doi.org/10.1016/j.tate.2015.01.001>
- Piper, B., Zuilkowski, S. S., Kwayumba, D., & Strigel, C. (2016). Does technology improve reading outcomes? Comparing the effectiveness and cost-effectiveness of ICT interventions for early grade reading in Kenya. *International Journal of Educational Development*, 49, 204–214. <https://doi.org/10.1016/j.ijedudev.2016.03.006>
- Pritchett, L. (2015). *Research on Improving Systems of Education (RISE): Creating Education Systems Coherent for Learning Outcomes: Making the Transition from Schooling to Learning* (261495:XF7ZTBDH;2339240:MYBSZSWU; Working Paper RISE-WP-15/005).  
[https://www.riseprogramme.org/sites/www.riseprogramme.org/files/inline-files/RISE\\_WP-005\\_Pritchett\\_1.pdf](https://www.riseprogramme.org/sites/www.riseprogramme.org/files/inline-files/RISE_WP-005_Pritchett_1.pdf)
- Sahni, U., Gupta, R., Hull, G., Javid, P., Setia, T., Toyama, K., & Wang, R. (2008). *Using Digital Video in Rural Indian Schools: A Study of Teacher Development and Student Achievement*. 30.  
<https://static1.squarespace.com/static/593ef400d2b85780fbc82544/t/5d700b1522>

[833b0001a0181d/1567623958011/Using+Digital+Video+in+Rural+Indian+Schools+-+A+Study+of+Teacher+Development+and+Student+Achievement.pdf](https://doi.org/10.5281/zenodo.3631588)

*Scoping review* (10.5281/zenodo.3631588;2405685:CMRISZHV; EdTech Hub Working Paper No. 6). (2020). EdTech Hub. <https://doi.org/10.5281/zenodo.3631588>

Sims, S., & Fletcher-Wood, H. (2018). *Characteristics of effective teacher professional development: What we know, what we don't, how we can find out* (2339240:2VB6UKTN; p. 25) [Working paper]. <https://improvingteaching.co.uk/characteristics-cpd/>.

*Technology in education in low-income countries: Problem analysis and focus of the Hub's work* (10.5281/zenodo.3352007;2339240:65KP6SVQ;2339240:2387P995;2405685:R88UVQZ7;2339240:8RA9UD7W;2405685:BBQI3VSA; EdTech Hub Working Paper No. 5). (2020). EdTech Hub. <https://doi.org/10.5281/zenodo.3352007>