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Teacher professional development and coaching in low-income countries: Overarching considerations for the use of technology

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Note.	This working paper does not represent the consensus of the EdTech Hub, but rather the evidence-informed opinion of the author.

Chapter 1. Introduction

This working paper forms part of a set of three working papers that consider teacher professional development and coaching in low-income countries. The first paper offers a broad overview:

> Björn Haßler & Caitlin Moss. (2020). *Teacher professional development and coaching in low-income countries: An evidence-informed conversation.* (2405685:SC5NHA65; EdTech Hub Helpdesk Response No. 1). EdTech Hub. https://doi.org/10.5281/zenodo.3631745

The present paper offers a wider perspective with some overarching considerations:

> 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

Finally, the third paper offers a range of practical considerations.

> 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

The papers do not need to be read in this order, but to the reader unfamiliar with the topics it may be advisable to initially read the first paper.

1.1. About this brief

In this brief, we consider two general questions. Although impossible to answer these questions in a general way that suits all contexts, this brief offers analysis and clarification in an attempt to provide insight into how these questions might be addressed in different contexts.

Guiding Questions
1. What impact do teacher professional development (TPD) interventions have on teaching practices and student outcomes? 2. How can technology enhance that impact?

We offer analysis and clarifications by developing and interrogating a stylised theory of change for technology use in teacher professional development, and by examining TPD interventions through a systems lens.

Chapter 2. Teacher professional development and technology in the context of influences on student learning

2.1. Determinants of student learning that can be modified through EdTech

When we ask about the role of technology within teacher professional development and the potential role of technology to improve student learning, we first have to ask the question, 'what are the influences on student learning'? This should be examined across the broader system, within which there are several determinants ultimately relevant to children's learning. The following table illustrates this.

Figure 1. Determinants (ultimately) relevant to children's learning (marginalised groups, gender-sensitive) that can be modified through 'EdTech' (in a broad sense), at various levels.

National	***Community***	***School***	***Teacher***	***Student***
Textbook availability, by local printing of open textbooks. Better pre-service teacher education. Improved curriculum, including more grass-roots teacher inputs. Better Education Monitoring and Evaluation systems.	Parental engagement (e.g., improved through adult literacy intervention; motivates parents to ensure children are in school; could utilise community-based telecentres). Community-engagement safeguards ICT installation (e.g., theft of copper wire).	Formative monitoring and evaluation (e.g., supported by coaches / district officials; might utilise technology). School management and EdTech-use for school management.	In-service TPD (may or may not involve EdTech). Peer-to-peer support (digital) as a motivating factor to engage with TPD. Opportunities for career development (through 'distributed and distance learning' and qualification) provides motivation.	Peer work relating to difficult to learn areas, supported by technology, leads to 21st-century learning gains. Individualised tech support for students with disabilities leads to better learning outcomes.

Having listed some of these influences, we can now start to disentangle the role that technology plays within education, at different levels.

2.2. What we know: Teachers and context matter

2.2.1. Teachers matter

Research indicates that teachers have the greatest potential to impact student learning (↑Hattie, 2012). A study of 15,000 teachers in Latin America and the Caribbean found that being taught by a good teacher is more important than being in a good school (↑Bruns & Luque, 2014). ↑Hattie (2015) argues,

> *"The greatest influence on student progression in learning is having highly expert, inspired and passionate teachers and school leaders working together to maximise the effect of their teaching on all students in their care"* (2).

Pre-service and in-service teacher training and education programmes should thus equip teachers with the soft and hard skills they need to create inclusive, quality learning environments for their students.

2.2.2. Context matters

We also know that context is critical. 'Universal best practice' simply does not exist, and 'effective practices' are highly contextual. The following two questions appear reasonable:

- What impact have EdTech interventions had on teaching practices and student outcomes?
- How do these interventions address issues of inclusion, adult learning, fragility, conflict and violence (FCV), gender and climate change?

However, while such questions can be posed broadly, they do not have global general answers; the answers instead depend on context. However, context here does not necessarily mean 'one nation' vs. 'another nation'. Instead, it might mean 'urban' vs. 'deep-rural'. Nevertheless, context-dependence is a fact: Any insights depend on context.

2.3. A reasonable assumption

Though less secure than the evidence that teachers and context matter, based on personal experience and insights working with both teachers and ministries, it seems reasonable to assume that the most disadvantaged and marginalised children are likely to be taught by teachers who themselves are relatively disadvantaged.

A reasonable assumption
The most disadvantaged and marginalised children are likely to be taught by teachers who themselves are relatively disadvantaged.

Teachers teaching in schools located in or near a village that have no electricity are not likely to not have access to electricity themselves. A decade ago in Zambia, a colleague mentioned to me that a survey of teachers had indicated that teachers' personal wish lists were led by electricity, running water and better communication.

This assumption is obviously not true in some peri-urban areas, where well-educated teachers might teach. However, in deep-rural areas, both children and teachers are co-located, and are subject to the same constraints, and — at least to an extent — subject to the lack of education opportunities.

Chapter 3. Technology use in the theory of change of teacher professional development

We know that teachers matter in improving learning outcomes for children. We also have some evidence to indicate that good teacher professional development helps teachers become more effective. The following diagram illustrates a simple 'theory of change' (Figure 2). That is, the chain of effects that you might expect to see after an intervention.

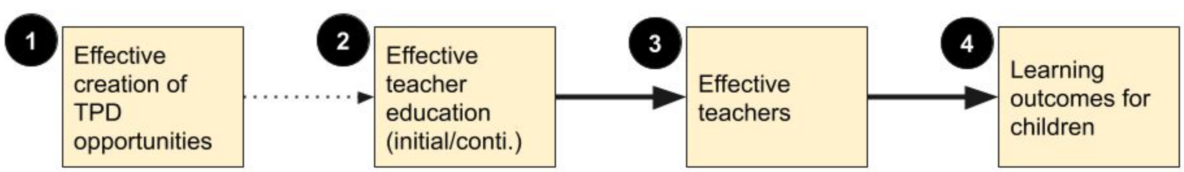
Box 1. Item 1 is the 'effective creation of TPD opportunities';

Box 2. This leads to item 2, which is 'more effective teacher education (in-service and pre-service)'.

Box 3. The outcome of this is item number 3, which is 'more effective teachers.'

Box 4. In turn, as a result, we reach item number 4, 'improved learning outcomes for children.'

Figure 2. Stylised theory of change for teacher professional development



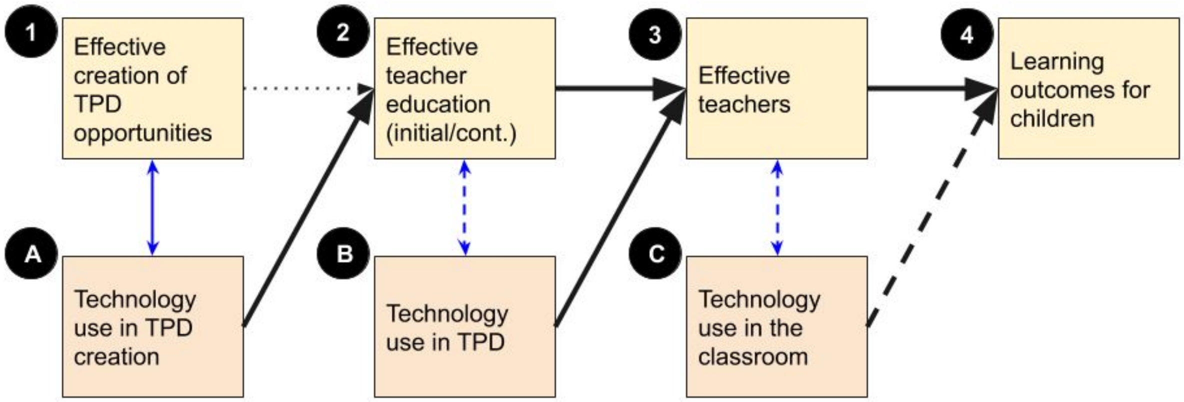
In this theory of change, there are several points at which technology could be used (illustrated in Figure 3):

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 their classroom practice).

C. Technology use in the classroom to enable children's learning.

Figure 3. Possible uses of technology in TPD stylized theory of change



The area we are considering here is TPD (*"effective teacher education"*, both initial and continuing; Box 2 in Figure 3) and specifically the *"the use of technology for TPD"* (Box B). Nevertheless, we return to boxes 1–4 above, to make several notes on the role of technology in those areas:

Box 1. 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.

Box 2. Teacher education may or may not use technology. One can still reach the goal of 'improved learning outcomes for children' via the route of 1→A→2→3→4 (i.e., effective creation of TPD opportunities → using technology to create content, to more effective teacher education → more effective teachers → improved learning outcomes for children).

Box 3. Boxes 1 and 2 (Figure 3) above are also distinct from technology use in the classroom. TPD (Box 2) 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 (Box C). Technology in the classroom (Box C) also affects children's learning (Box 4).

3.1. Technology in the creation of TPD (Boxes 1 and A)

Consideration of role and affordances of technology — and, more generally, 'digital' — in the creation of TPD is often overlooked. It is highly likely that the 'effective creation of TPD opportunities' (Figure #2.3, Box 1) will draw on technology in some way or other (Figure #2.3, Box A). Materials will be produced digitally, and other digital aspects (such as open licensing) are clearly relevant. Therefore the line from Box 1 to Box 2 is drawn as a dotted line, whereas the diversion via technology is drawn as a solid line.

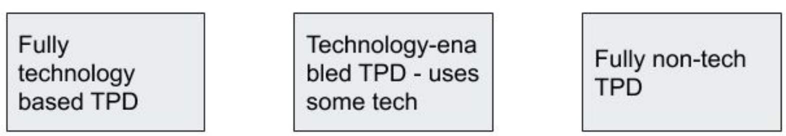
3.2. Technology use by teachers for TPD (Boxes 2 and B)

Let's now consider item 2 ('more effective teacher education'). The most direct path from item 2 to item 3 is a path in which technology is not used for TPD. One can still reach the goal of 'improved learning outcomes for children (4)' by going from 1 to A to 2 to 3 to 4. However, we might be able to improve learning outcomes by drawing on technology in the TPD process (box B). When we say, *"the use of technology for TPD,"* box B is what we mean. This is therefore different from box A, as discussed above, and box C, 'technology use in the classroom'.

The advantages and disadvantages of both technologically-enabled means of TPD, as well as non-technologically-enabled means of TPD, such as cost, reliability, etc., should be carefully considered and weighed. For example, a much-discussed use of technology in TPD is online learning for teachers. However, as we shall see below, this has several disadvantages and may not be the best use of technology for teachers' learning. By contrast, a use of technology that is widely recognised in more developed countries but hardly discussed in lower-income countries is the use of video for teachers to reflect on their own lessons as well as the use of previously prepared classroom video as a stimulus for reflection.

It is worth noting that there is, of course, a spectrum between 'TPD that fully relies on technology' to 'TPD that does not utilise technology at all.'

Figure 4. Spectrum of technology use in TPD



3.3. Technology use by teachers in the classroom (Boxes 3 and C) and technology use by children in the classroom (Boxes 4 and C): A reflection on the applicability of the Education Endowment Foundation[1] toolkit

In addition to box A, which focuses on the use of technology in creating TPD materials, and box B, the use of technology in the TPD process, technology can also be used in the

[1] See https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit.

classroom by both students and teachers. One starting point for clear guidance for decision makers (national governments, funders, NGOs etc) on technology use in the classroom (box C) is the Education Endowment Foundation's toolkit, which presents classroom-level interventions (*"proximate determinants"*, ↑Pritchett, 2015) listed against effectiveness, cost and security of the evidence.

For example, metacognition has high impact and low cost (with secure evidence). In other words, a Theory of Change that features *"increased metacognition leading to improved learning outcomes"* is backed by evidence. By comparison, 'early years interventions' have moderate impact and high cost (with secure evidence). Digital technology is ranked as moderate impact for moderate cost (with secure evidence). Thus, theories of Change that rely on early years and digital technology, but ignore metacognition, would be subject to criticism.

"Learning styles" (still used in the design of teacher programmes) has very low cost, but also low impact and limited evidence. A Theory of Change relying on this mechanism would have to argue carefully why such an approach is useful. Summer schools (out-of-school-time interventions, typically in breaks) have low impact for moderate costs, but this is based on extensive evidence. A Theory of Change suggesting summer schools as a cost-effective way to raise learning outcomes would run counter to UK-based evidence. Unless there are contextual factors that significantly change the UK-based analysis, such a Theory of Change would need to be discarded.

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).

Figure 5. An excerpt of the EEF Teaching and Learning Toolkit on cost, security of evidence, and learning gains for classroom-level interventions

Teaching and Learning Toolkit **An accessible summary of the international evidence on teaching 5-16 year-olds** https://educationendowmentfoundation.org.uk/evidence-summaries/teaching-learning-toolkit		Cost	Security of evidence	Learning gain
Feedback	High impact for very low cost, based on moderate evidence.	1	3	8
Metacognition and self-regulation	High impact for very low cost, based on extensive evidence.	1	4	7
Reading comprehension strategies	High impact for very low cost, based on extensive evidence.	1	4	6
Mastery learning	Moderate impact for very low cost, based on moderate evidence.	1	3	5
Collaborative learning	Moderate impact for very low cost, based on extensive evidence.	1	4	5
Oral language interventions	Moderate impact for very low cost, based on extensive evidence.	1	4	5
Peer tutoring	Moderate impact for very low cost, based on extensive evidence.	1	4	5
One to one tuition	Moderate impact for high cost, based on extensive evidence.	4	4	5
Early years interventions	Moderate impact for very high cost, based on extensive evidence.	5	4	5
Phonics	Moderate impact for very low cost, based on very extensive evidence.	1	5	4
Digital technology	Moderate impact for moderate cost, based on extensive evidence.	3	4	4

In a school where feedback and metacognition are utilised as best as possible, one would look at other interventions as starting points to improve overall learning gains. However, in many schools in low-income countries, the high-effectiveness-low-cost interventions presented in Figure 5 above are not maximised.

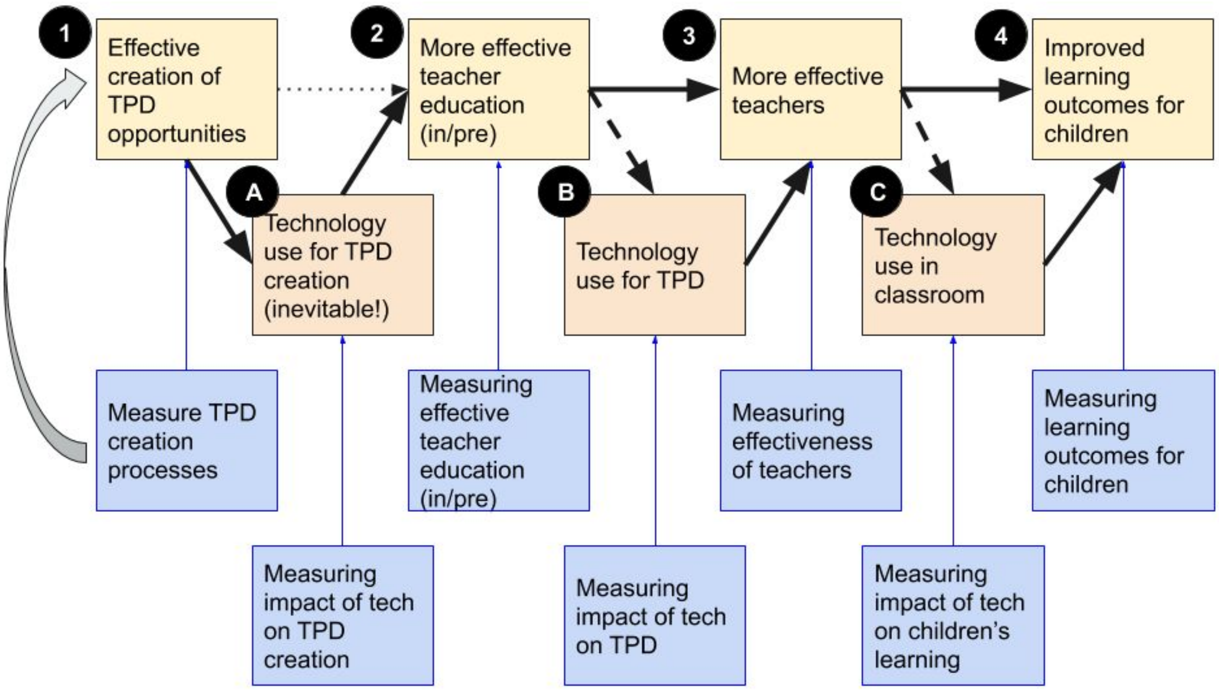
Some might suggest that, if teachers in LMICs are unable to learn how to give effective feedback, or implement any of the high-impact, low-cost strategies identified above, then learning with technology would be the only means of learning, or that technology could have a disproportionate impact. We would argue that teachers are clearly able to learn effective pedagogies, even in LMICs; instead, we should be asking how to orchestrate TPD at scale to give teachers the right opportunities to learn, which, based on our work, is not always easy but is still possible.

On the question of cost, using technology is more expensive in LMICs than in the UK, due to missing infrastructure. Proponents of technology as the main solution to improve learning outcomes would admit that the cost may be higher, but would 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 argue 'convergence'. As nations move from low-income to high and very high income, it is likely that the effectiveness of digital technology in improving learning outcomes would look similar to the effectiveness of digital technology in the UK.

3.4. The importance of measuring the impact of possible uses of technology in the teaching and learning process

The blue boxes in the diagram below represent the evaluation of the effectiveness of each of these different aspects (1, 2, 3, 4; and A, B, C). Each of these aspects need to be measured in terms of impact on learning outcomes, as well as other relevant factors, such as value for money. Not only should each of these possible use of technology in the context of TPD be monitored and measured, but so would various combinations of these aspects.

Figure 6. Monitoring and evaluation of the use of technology in the TPD process



The grey arrow on the left indicates that monitoring and evaluation is only useful if it feeds back into decision-making. Each blue box has a small arrow pointing upwards, indicating both that this is a point of measurement, but also a point where learning needs to be taken into account to improve any TPD intervention.

On the basis of the evidence gathered, then, the most effective combination of these different ingredients should then be decided for a given context. It is crucial to measure the impact of each of the above three choices made about technology use, as well as to take learning about them into account to improve any TPD intervention.

3.5. Towards identifying the top settings for learning with technology across education systems interventions

The EEF focus on classroom interventions is appropriate in the UK, where the wider system factors — while important — are not debilitating.[2] However, in LMICs, the lack of progress in education (and in many cases deterioration, despite decades of international aid), points towards the need for a holistic systems approach (including *"system determinants"*,

[2] For a comparison of settings, see Björn Haßler, Sophia D'Angelo, Hannah Walker & Melissa Marsden (October, 2019). *"Synthesis of Reviews on Teacher Professional Development in Sub-Saharan Africa With a Focus on Mathematics."* Open Development and Education, Cambridge, UK. Version 2. DOI: 10.5281/zenodo.3497271. Creative Commons Attribution 4.0.

"contextual efficacy", *"political determinants"*, Pritchett, 2015). A table, similar to the EEF toolkit, but for systems interventions (in LMICs, including educational technology at different levels, focussing on marginalised groups) is shown below. This includes classroom interventions as part of wider systems interventions.

Level 1: Classroom. Route A shows a scenario that does not represent VfM impact on learning. Even in high-income countries, there is little clear evidence that 1:1 scenarios have particular learning gains. In fact, the opposite may be the case (c.f., Haßler, Major, Hennessy, 2015). Moreover, as EEF indicates, while the use of digital technology in the classroom does have moderate impact, there are other interventions (e.g., metacognition) that have higher impact and lower cost. While digital technology in the UK has a moderate cost, this cost is likely to be higher in LMICs. The promotion of metacognition, on the other hand, is likely to have similar cost to what it is in the UK. It is important to back this up through literature review and cost-analysis. However, the case is sufficiently clear to make primary research unnecessary.

Figure 7. Teacher professional development interventions as systems interventions

Systems interventions (LMICs, TFE)				
cost	***very low***	***low***	***medium***	***high***
Very high	B3	Open curriculum with open models of *tech-supported* school-based TPD incl. open classroom materials	Open curriculum ... tech support ... TPD plus topic-targeted classroom use of tech	high
High	Open curriculum with open models school-based TPD inc' open classroom materials	Open *tech-supported* school-based TPD (e.g. with video) Use of ICT for M&E with impact on interventions	Topic-targeted classroo n use of tech, in groups, with TPD	B1
Medium	Open models of school-based TPD B2	C	Cross-subject classroom use of tech, in groups, with TPD	A
Low			Use of tech for ICT lessons	1:1 computing, offline provision
None	Business as usual (direct instruction)	Use of ICT for M&E without impact on interventions	Use of tech without TPD Tech-supported cascade models	tech-supported examinations
negative			low	1:1 computing ,online provision

Learning gains

A more promising mode is route B1: technology is used in the classroom, but only where it has the highest impact on learning gains. This means sparing use of technology, where there is a clear advantage over non-technology-based scenarios. This could include, for example, tackling common misconceptions in mathematics. This area needs careful consideration to identify the exact payoff of technology-use, how to make technology robust so it can serve the most marginalised, etc. A central question is the balance of VFM versus educational effectiveness for uses of tech in the classroom; one such example is consideration of how often in a given week technology should be used, and for what subjects/topics. How technology use at the classroom level compares to technology use at the teacher level, and use of 'digital' at the systemic level, is explored below.

Level 2: Teachers. Routes B1 and B2 start from the 'low point' of little impact on learning and medium cost. Route B2 starts at cascade models, which are still widely used, despite widespread evidence that they are not effective. Along route B2, the TPD model is changed towards the more effective open model of school-based TPD, which has a better VfM and impact on children's learning gains, and may include technology use at the teacher level (↑Haßler, et al., 2018).

As before, the differential benefit of technology (at various system levels), in comparison with other relevant wider factors (such as facilitator preparation overall facilitator supply) is paramount. Further, systemic capacity for making TPD decisions (including local research capacity), and how it can be built, needs to be considered.

Level 3: Ministry. Route B3 considers wider systemic interventions, such as an open curriculum together with open classroom materials. In the USA there are indications that this might lower costs by 80%, or, equivalently, provide a 5-fold increase in access to high quality education. This option needs to be considered from the perspective of the most marginalised, to determine whether similar models can lead to similarly increased access to education. Moreover, to implement such new, radically open approaches may conflict with vested interests at various levels (including national governments, funders, implementers, NGOs). Creating space for innovation and professional development are possible paths, that can be validated through design experiments.[3]

Wider system factors. Routes B1–B3 only represent part of the system, and other aspects need to be considered (c.f. Figure #3 above). For example, systems change needs to be evidence-based and thus supported by M&E outcomes (using ICT, possibly in near-real time) leading to improvements in interventions, policy change, etc. (Route C). However, the table clearly does not capture the whole system, which includes educational technology research. Regarding educational technology research, we need to weigh additional factors, such as the open and timely availability of outputs, compliance with open access requirements, research processes complying with best practices,[4] sharing and utilising open data (now associated with increases of GDP), professional learning for researchers, as well as how funding is allocated to research.

Returning to the above table, we stipulate that at the end of routes B1–B3 and C we have a point (labeled 'high') with high impact on learning and good VfM. However, this remains speculative.

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[3] The writing of Lundvall (↑Lundvall, 2016; ↑Lundvall & Lema, 2014; ↑Lundvall, et al., 2011; ↑Lundvall, 2010) as well as Arocena and Sutz (↑Arocena & Sutz, 2000; ↑Arocena & Sutz, 2016) is recommended in this regard.

[4] Such as registration of experiments: This is accepted practice in health, where, e.g., RCTs without registration are unthinkable. By contrast, education RCTs are rarely registered, casting doubt on validity.

Chapter 4. Conclusion

An important goal for the near future is to shore up the evidence in this area, in order to better advise implementers. This means both developing a better understanding of the problem (↑EdTech Hub, 2020), as well as understanding current evidence as best as possible (↑Muyoya, et al., 2016; ↑Haßler, et al., 2019; ↑Haßler, et al., 2019; ↑EdTech Hub, 2020). However, overall it appears that the evidence base for the sector is not sufficiently mature. Sustained and systematic research will be needed in the future (↑Haßler, et al., 2019).

Chapter 5. Further reading

This working paper forms part of a set. The three parts of this set are:

Björn Haßler & Caitlin Moss. (2020). *Teacher professional development and coaching in low-income countries: A evidence-informed conversation.* (2405685:SC5NHA65; EdTech Hub Helpdesk Response No. 1). EdTech Hub. https://doi.org/10.5281/zenodo.3631745

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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

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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.

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