#EdTechHub

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

Björn Haßler, EdTech Hub, https://edtechhub.org, January 2020
Helpdesk Request No. 008-20191216 and 009-20191216

About this document

Recommended citation. Björn Haßler (2020). *Teacher professional development and coaching in low-income countries: Practical considerations for the use of technology.* (EdTech Hub Helpdesk Response No. 3) Available under Creative Commons Attribution 4.0 International, https://creativecommons.org/licenses/by/4.0/.

Creative Commons Acknowledgement Some of the content in this document is based on:

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:VM6NXYF3; 10.5281/zenodo.3631749

Internal use. g/d/1_sZWhsh9w0G7vqMa1NcDYhSPAq7xDWhMFvac0njNXaM

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 second paper offers a wider perspective with some overarching conversations:

> 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 present 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

This brief is a discussion of considerations about the role of technology in (facilitating) in-service teacher professional development and coaching. In other words, how can technology 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.

This brief synthesises evidence, knowledge, and recommendations most relevant to the setting of low- and middle-income countries, with a focus on sub-Saharan Africa.

However, it should be noted that this is necessarily an opinion piece. These issues are under-researched and there is very little — if any — conclusive evidence available. At the same time, this is an area of active concern and investment by the EdTech Hub, and there is thus an imperative to make sense of the available evidence, however limited. The contents of the brief reflect the opinions of the author, and not those of the EdTech Hub.

1.2. What we know: Teachers and context matter

1.2.1. 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.

1.2.2. 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.

1.3. A reasonable assumption

This is less secure than than the statements in Section @1.2. However, based on personal experience and insights, both working with 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.

A teacher teaching in a school located in or near a village that has no electricity is not likely to not have access to electricity themselves. A decade ago in Zambia, a colleague mentioned 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.

1.4. What we mean by 'the use of technology for teacher professional development'

It is important to distinguish between three possible meanings of 'technology for teacher professional development.' This could refer to one of three things:

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 by teachers or by students

This brief focuses on item B, specifically the use of technology in the TPD process, in contrast to the generation of TPD content and / or teacher or student use of technology in classrooms. When people refer to 'technology and TPD,' they often mean item C, and more specifically, how teacher professional development can support teachers in using technology in their classroom practices, in teaching and learning activities with their students. This is not the focus of the brief. Rather, the area we are considering here is TPD (*"effective teacher education,"* both initial and continuing) and specifically the *"the use of technology for TPD"* (item B). For a discussion of items A and C, please see the EdTech Hub brief 'Teacher professional development and coaching in low-income countries: Overarching considerations for the use of technology' (↑EdTech Hub Helpdesk Brief No. 2).

Chapter 2. Teacher professional development and technology

2.1. What might good TPD look like? And what's the evidence?

2.1.1. Characteristics of good teacher professional development

This synthesis

> 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.

suggests that: Effective TPD is TPD that (1) has high impact on student learning; (2) has good value for money (VfM) and (3) has these 7 design principles:

Principle 1: Promote and focus on student learning
TPD must explicitly and directly promote and focus on student learning. TPD must, therefore, focus on effective learning practices.

Principle 2: Effective teaching and learning practices
Effective teaching practices to support student learning focus on feedback, metacognition and self-regulation, mastery learning, collaborative learning, oral language interventions and peer tutoring.

Principle 3: Teachers need to be recognised as professionals
Teachers must be recognised as professionals. TPD must promote teacher learning in appropriate ways. If students are to become skilled problem-solvers and critical thinkers, teachers must be skilled (pedagogical) problem-solvers and critical thinkers too.

Principle 4A: TPD sequencing and length

TPD needs to be carefully sequenced. It needs to be long-term and regular. In many contexts, this means that TPD needs to be school-based. One-off training (e.g., 'residential workshops') does not work.

Principle 4B: TPD adaptation for context

TPD needs to be tailored and adapted to the local context. There are certain 'meso' factors normally considered important for such adaptation (country, region, school level, subject, national languages). However, there is some evidence that there are other 'micro' factors, pertaining to the individual circumstances of the school that may be equally significant.

Such factors include:

- The degree of expert input needed vs. self-sufficiency of the school;
- The cost of logistics (such as teachers travelling to a workshop venue or external experts or coaches travelling to schools);
- The benefits of working as a whole school (all teachers) vs. in segmented grade- or subject-specific groups of teachers.

Principle 5: Teacher motivation

TPD should appropriately motivate teachers (working in challenging settings) to engage, including attention to teacher career progression and salary structure (GITPD Characteristic #6).

Principle 6: Teaching and Learning Materials

Teaching and Learning Materials (TLMs), including materials for teachers and materials for children should be Open Educational Resources (GITPD Characteristic #8). This increases sustainability, scalability and equity, as well as resilience against unforeseen changes.

Principle 7: Information and Communication Technology

> The use of technology in education ('educational technology', EdTech) has to be considered very carefully, as such investments have often not led to improvements in student learning outcomes. In the first instance, technology should be used equitably for essential communication and to support peer-facilitators in their facilitation of school-based TPD (face-to-face, offline peer learning in schools; GITPD Characteristic #9). It is of the utmost importance to learn from the past and heed established principles for digital development.[1]

There are some 50 pages of reading in the report that go into these principles. In the remainder of this brief, we will examine the role of technology in this.

2.1.2. The underlying evidence for these characteristics

We may ask what the evidence underpinning these characteristics of good TPD. Here are three papers that discuss the evidence — or lack thereof — with references to further resources that discuss the issue of evidence in TPD:

- ↑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.
- ↑Björn Haßler, Sara Hennessy & Riikka Hofmann (2018) Sustaining and Scaling Pedagogic Innovation in Sub-Saharan Africa: Grounded Insights For Teacher Professional Development. *Journal of Learning for Development*, 5(1).

These two publications cite a number of publications that critically look at the evidence for TPD. A recent example is

- ↑Sims & Fletcher-Wood (2018). Characteristics of effective teacher professional development: what we know, what we don't, how we can find out. Working paper; https://improvingteaching.co.uk/characteristics-cpd/.

While there are some established concepts, and perhaps consensus, on the Principles cited above, the underlying evidence pertains predominantly to higher income countries, where evidence is secure, in contrast to lower income countries, where the evidence is less secure. There are also certain issues around how the existing evidence was collected that open up avenues for criticism.

In summary, hard evidence on teacher professional development is difficult to come by, particularly for low-income countries. However, the principles shared above are a reasonable set of guidance that should be used in the absence of hard evidence to the contrary.

[1] https://digitalprinciples.org/

Chapter 3. Teachers, coaching, and technology

3.1. Teachers

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

Should we remedy teachers' lack of content knowledge when it occurs? Yes, of course. But rather than prompting these teachers to use A-level textbooks and do exercises to improve their content knowledge, first we need to better understand the context for this apparent 'deficit'.

In many settings, teachers already have a degree of content knowledge. However, they may not be able to apply the content knowledge they have in the classroom because it was taught to them in very theoretical ways. While it may be helpful to give teachers some access to technology-enabled resources to better understand concepts that they will teach, ultimately this will only impact student learning if it is delivered to teachers within a suitable pedagogical framework. In situations where teachers lack content knowledge, then both pedagogical skills and content knowledge need to be provided together.

Whether technology-enabled or not, it is crucial that TPD provides teachers with content knowledge in a way that is practical instead of theoretical; it should be linked to pedagogical skills. Content knowledge should supplement pedagogical skills so that there is less cognitive work required by the teacher for the content knowledge to be implemented in the classroom.

Now understanding why teachers may not use their existing content knowledge, it becomes clear that whether technology-enabled or not, *how* content knowledge is taught to teachers, and whether it is linked to pedagogical skills, matters.

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

Technology can be used effectively to improve pedagogical knowledge. However, conventional means such as online learning are not the first solutions that we would recommend. Pedagogical knowledge can only be developed if a theoretical understanding of teaching is combined with the requisite practical skills, which need to be developed hand-in-hand.

To serve this purpose, one of the most effective uses of technology in TPD that we have seen is the use of video. However, this does not mean conventional uses of video, such as showing teachers select examples of what good practice looks like, which has limited

effectiveness. Instead, there are two successful uses of video in TPD that are backed up by evidence in the education literature:

1. When embedded in a TPD programme, teachers watching video of another teacher's teaching can spark reflection and group dialogue about pedagogical practices. But typically, such video content does not show 'great practice'. Instead, the video shows common practice, which sparks discussion. For example, if teachers see ineffective practice, they might immediately criticise the teacher in the video for such ineffective practice; such discussion tends to quickly move on to encompass areas for improvement.
2. Another effective use of video involves a teacher using a video camera to record their own practice and then looking back at it. This enables the teacher to gain a more objective view of their own practice and facilitates discussion between the teacher and his / her peers about their own practice.

Video in TPD — The Digital Study Hall

In developing countries, where there is often a lack of qualified teachers, videos of expert teaching may be used to supplement coaches or mentors. One example is the Indian NGO, Digital Study Hall (DSH), which provides video lessons to rural school teachers through television, DVDs, mobile phones and the Internet. Master teachers create video content, which is then reviewed by expert teachers, before being disseminated to other educators. The DSH YouTube channel has more than 33,000 views and the view rate grew more than 170% during the last six months of 2012 (DSH, 2012). As of August 2013, DSH was working with more than 6,000 students in 70 District Institutes for Education and Training (Global Solutions Network, 2013). It currently offers 2,500 recordings of lessons in English, mathematics and science, in Hindi, Bengali, Kannada, Marathi, Nepali, Tamil, Urdu and English, and 1,500 additional videos of other materials such as stories, special science and history topics, and training sessions (DSH, n.d.). Moreover, a quantitative study found that children in classes using DSH videos scored almost 400% higher in English and almost 300% higher in maths than did children in a comparison school (Sahni, Gupta, Hull, Javid, Setia, Toyama & Wang, 2008). Two key elements of DSH is their dissemination of interactive, student-centered pedagogy and content that is culturally relevant and aligned to the national curriculum.

3.1.3. Can technology be used to track *teachers* to monitor progress over an academic year?

This is a complex question that I suggest approaching from a different perspective. Instead of the question above, I would ask, "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 that you have an effective TPD model in place, then participation of teachers in the programme would be the most important thing to monitor. If you want to monitor on a large scale, I would opt for a very simple way of doing so, keeping in mind that teachers may themselves not have access to technology to be used in monitoring, as the most marginalised children are most likely taught by some of the most disadvantaged teachers.

With this in mind, to monitor teachers' progress over the course of the academic year, we would suggest using school-based facilitators[2] who reports (digitally) on the progress of their school-based teacher group meetings as well as the degree of implementation happening at their school (which could be based on discussions in teacher group meetings). On the basis of these reports (say via WhatsApp), one can then allocate coaches to visit certain schools or not visit other schools depending on the support needed.

In international education, we often talk about the importance of context. Haßler et al. (2019) make the point that this context usually isn't at the macro level of differences between countries. Rather, it is much more likely to be the meso context, whereby differences between urban vs. rural areas are more pronounced than differences in urban areas between countries. This point is important to consider in proposing any large-scale solution for monitoring teacher progress across different meso contexts.

3.2. Coaches

3.2.1. What is the role of a coach?

There are different uses of the word 'coach' in teacher professional development. Common uses are:

1. **Workshop facilitator.** The coach as a trainer, who conducts a workshop away from the school.
2. **External facilitator for school-based workshops.** The coach as a trainer, who visits the school for the purposes of conducting or facilitating workshops (distinct from a *'school-based peer-facilitator'*).
3. **External 1:1 coach.** The coach as a trainer for individual teachers, where the interaction between the teacher and coach is one to one. This interaction may include activities in the classroom, such as direct teaching support.
4. **Peer coach.** The coach as a peer (*"peer coach"*), i.e., a teacher who undertakes coaching or mentoring activities with other teachers.

Similarly, the word 'mentor' has a range of meanings, some of which align with the meanings above. We are using the word 'coach' here in the sense of (external) 1:1 coach.

[2] I.e., an existing teachers working at the school

3.2.2. The effectiveness and costs of coaches

In our definition, as somebody external to the school ('external 1:1 coach'), the coach has to invest time and money to get to the school and therefore will only be able to offer limited occasions for visits. The following publication discusses effectiveness of coaches in such scenarios as well as the cost implications.[3]

Teacher coaching in Kenya: Examining instructional support in public and non-formal schools	**Kenya**	**2015**
Instructional coaching has improved student outcomes in the United States, and may help to solve Kenya's literacy problems. Coaching is costly, however, and evidence is lacking regarding the most cost-efficient teacher-to-coach ratio. We used student literacy outcome data from more than 8,000 students participating in the Kenya Primary Math and Reading Initiative — a randomised controlled trial of instructional interventions in public and non-formal schools — to fill this gap. Coaches in larger public zones made fewer visits per teacher, and teacher-coach ratio and student performance were negatively associated. Using causal methods, we concluded that lower ratios might improve non-formal school outcomes.		
Piper, B. & Zuilkowski, S. S. (2015). Teacher coaching in Kenya: Examining instructional support in public and non-formal schools. *Teaching and Teacher Education*, *47*, 173–183. https://doi.org/10.1016/j.tate.2015.01.001		

3.2.3. Can technology replace coaches?

A typical question that arises from the above is: can coaching be replaced by technology? Or, as a variation of this, can face-to-face coaching be replaced by distance coaching mediated by technology? To answer this question, we need to ask: what is the purpose of coaching and what is the most effective means of delivering that coaching?

There are high-tech ways in which technology could facilitate distance coaching. However, as previously mentioned, since teachers who teach children in rural areas are themselves often located in rural areas, they may face at least partial disadvantages of limited or no access to electricity or fast connectivity. Theoretically, some coaching could be done remotely, and in a very high-income country this may be feasible. However, in a rural area in a low-income country, it is not.

Would it be possible to coach teachers via WhatsApp? In my experience this is near impossible to do it effectively. Rural teachers are not likely to have smartphones, and even

[3] The literature available on coaching is naturally sparser than the literature on TPD. Due to the multiple uses of the word 'coach' within and outside education, it is also difficult to discover. The new EdTech Hub database will significantly simplify this process, and we recommend revisiting this request once the database is available.

when they do, they tend to have insufficient connectivity or insufficient electricity to make regular conversations possible. Text chats are possible but do not constitute an effective way of coaching.

3.2.4. Can something else replace coaches? Are there viable alternatives? What is the right combination of factors?

The following publication looks at a combination of aspects that are important in improving teaching, concluding that a combination of teacher instructional support and coaching, 1:1 student books, and structured teacher lesson plans is likely to be most effective. Moreover, the results can be interpreted to say that 'interventions conducted at different times' do not combine 'linearly': Intervention A and Intervention B do not have the same impact as a combined intervention. While the combined intervention may be more expensive, it achieves greater impact and thus has greater value for money.

Identifying the essential ingredients to literacy and numeracy improvement: Teacher professional development and coaching, student textbooks, and structured teachers' guides	**Kenya**	**2018**
Several rigorously evaluated programmes have recently shown positive effects on early literacy and numeracy outcomes in developing countries. However, these programmes have not been designed to evaluate which ingredients of the interventions are most essential to improve literacy outcomes. Policymakers therefore lack evidence as to whether programme ingredients such as teacher professional development (PD), instructional coaching, learner materials, teachers' guides, community support, or technology are required for programme impact. A randomised controlled trial (RCT) was conducted on the Kenya Primary Math and Reading Initiative to compare three treatment groups with distinct components and a control group. Using literacy and numeracy outcome measures for Grades 1 and 2, the RCT evaluated the benefits of the following ingredients: (1) teacher PD and teacher instructional support and coaching; (2) revised student books in literacy and numeracy, at a 1:1 ratio, added to PD and instructional support; and (3) structured teacher lesson plans added to student books, PD, and instructional support. The research found that two of the three combinations of ingredients had statistically significant positive impacts on learning outcomes. The results showed that the third combination — PD, teacher instructional support and coaching, 1:1 student books and structured teacher lesson plans — was most effective. A cost-effectiveness analysis on the ingredients showed that the option of PD and instructional support, 1:1 revised books, and teachers' guides was the most expensive, but that the additional impact on learning made this the most cost-effective intervention. This study rigorously analyses which ingredients for literacy and numeracy improvement would be most effective for		

overall impact, and suggests to policy makers that careful decisions regarding programme components will lead to more effectively designed and implemented interventions to improve learning in developing countries.

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/gftrqf

To programme implementers, the results suggest that different aspects of an intervention need to be carefully balanced to get the best possible effect. For example, in the implementation of the Transforming Teacher Education and Learning (TTEL) programme (Ghana, DFID-funded, from 2015), the present author (B.H.) followed a similar approach. There were a limited number of coaches (15) that were to serve 40[4] Colleges of Education with 1,800 tutors.[5] Given the geographically dispersed nature[6] these numbers would have limited coaching sessions to one session per tutor per semester (in total 2–3 times a year). It is clear that this is completely insufficient to achieve any change in practice. Therefore, a number of steps were taken:

1. On the basis of the insights from OER4Schools (↑Haßler, et al., 2018 and references therein) a peer-facilitated in-service programme was developed. This programme has 12 two-hour sessions per term, creating 24 sessions (48 hours) of shared learning. The programme was envisaged to run for three years. Extensive materials were developed to scaffold each session, including materials for peer facilitators as well as materials for the tutors.
2. The role of the coaches was reshaped as support for peer-facilitators (rather than tutors directly). Given a fixed number of coaches, this provides proportionately more support to peer facilitators than to tutors directly.
3. Induction workshops were held for peer facilitators to provide detailed 'role plays' of the college-based sessions.
4. An 'input monitoring' system was set up for the in-service programme, enabling coaches to determine the 'health' of the programme within each college, and allocate their time strategically.

While few formal evaluations are available, the programme is regarded as successful and is also mentioned in the ↑DFID Education Policy 2018: Get Children Learning — GOV.UK.

[4] The number has increased since. The Colleges of Education offer programmes in primary school education, enabling students to teach in primary schools.
[5] The lecturers in the colleges are called 'tutors'.
[6] See ↑Haßler, et al. (2017). An Atlas of The Forty Colleges of Education in Ghana.

3.2.5. Can technology be used to track coaches to monitor the fidelity of coaching?

In the example above (Transforming Teacher Education and Learning, or TTEL), technology was used to support coaches via the 'input monitoring' system, which recorded session attendance, asked participants some basic multiple-choice questions, and allowed facilitators and tutors to ask questions and provide feedback. On the basis of this information, coaches were able to make strategic decisions as to where to place calls and which colleges to visit. However, in addition to college-based facilitators and college-based tutors providing feedback, coaches themselves would fill in brief reports on their various activities, such as college visits, support to the professional development sessions, support to facilitators and direct support to tutors. In summary, the three-fold technology-enabled aspects of the approach consist of:

1. Coaches reporting via digital forms
2. College-based facilitators reporting via digital form
3. College-based tutors reporting via digital forms

This reporting offered a fairly detailed picture of the programme (based on triangulated reported data).

The report ↑Haßler, et al. (2018) offers a similar example from Pakistan, where GPS data was used to monitor district officials visiting schools.

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

In using GPS to 'monitor' it is important to caution that of course this should happen fully transparently to the people being monitored, i.e., they should have access to their own GPS data. It does stand to reason that a fairer — and potentially much more important — use of GPS tracking may not be for (potentially top-down) monitoring, but as data for optimising school visits and updating school databases.

As a spin-off, conceived during the TTEL programme, a member of the National Council for Tertiary Education and a member of the Ghanaian OpenStreetMap group worked together with the present author (B.H.) to create an atlas of the forty Colleges of Education in Ghana (↑Haßler, Akunor, Nyamador, 2017). At the beginning of the Transforming Teacher Education and Learning programme, the locations of some of the colleges were only known to the nearest town. While drivers have 'local' knowledge, they clearly do not have knowledge of all localities in Ghana. A careful understanding of the college locations led to reconsidering some of the travel routes for coaches. Previously, these had been aligned with administrative divisions; in these divisions, there are occasionally nearby colleges that are in different districts. Taking into consideration the distance between colleges led to a restructuring of the workload per coach once travel was factored in. As a result, this also changed coaching time available to colleges.

Another use of map data is to plan not just travel between colleges, but also arrangements within colleges. For example, the Colleges of Education aspire to college-wide wifi. However, there are no maps of the college grounds available. Given that the colleges are very diverse in their arrangements — ranging from small colleges cramped into city centres to extensive semi-rural campuses — planning for infrastructure has to be highly customised. College maps were obtained using the Humanitarian Open Street Map (https://www.hotosm.org/) approach in just a few sessions with volunteers (↑Haßler, Akunor, Nyamador, 2017).

In the public sharing of data, security and privacy are paramount.[7] However, in many circumstances, the benefits of mapping public buildings (including educational institutions as well as other public institutions, such as hospitals) may well outweigh the possible threats to security or privacy. For example, the humanitarian sector has a robust model for sharing data (https://data.humdata.org/) while the education sector has so far not achieved this. In the light of the successes of data sharing in the humanitarian sector, it seems negligent in the extreme that school supporters, NGO workers, and coaches are travelling day-to-day between educational institutions without considering what useful geospatial data could be generated and safely shared.

Recommendation: Consider how GPS data can be shared
Any coaching programme should consider what geospatial data could be generated and safely shared. Security, privacy and safety issues must be carefully considered.

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

Although the topic of communities of practice is wide-ranging and impossible to cover adequately here, I raise several key points that seem particularly relevant for consideration.

3.2.7.1. Face-to-face vs. virtual communities of practice

The idea of communities of practice was initially articulated as face-to-face communities of "a group of people who share a craft or a profession" within the concept of "situated learning" (↑Wikipedia (2020). Community of practice).[8] There is nothing specifically virtual

[7] For example, newly discovered archaeological sites are usually kept secret for the very real threat of looting.

[8] For those who are concerned about referencing Wikipedia, we note that Wikipedia articles are referenced including the specific identifier for a unique version of that page. This means that this specific version of the Wikipedia page has been judged to be an adequate reference for the present context by the author, as with any other reference. We note that — however likely or unlikely — this may or may not be true for past or future versions of that Wikipedia page.

about communities of practice, and in light of our assumption about the likelihood that marginalised children are taught by disadvantaged teachers, it would seem prudent to initially explore non-virtual communities of practice before introducing technology.

3.2.7.2. Composition and characteristics of communities of practice

It is now reasonable to ask which different communities of practice might exist and how they might be mediated.

Teachers. Non virtual communities of practice among teachers may take the form of weekly teacher group meetings that are school-based and facilitated. Required inputs include teacher time and teacher motivation. ↑Haßler, et al. (2018) Experience suggests that time for teacher group meetings should be explicitly scheduled within the school timetable. Especially in countries where teachers teach in morning or afternoon shifts, it is possible to schedule teacher group meetings by borrowing time from the shift when teachers are not teaching.

Some would argue that a virtual community of practice can alleviate some of the time constraints on teachers by allowing for meeting times to be shifted into teachers' personal time; however, it is far from obvious that this is successful. Many of the constraints on teachers' time equally affect individual online activities as physical group activities. In addition, virtual communities require other inputs and thus have several disadvantages. These include the need for connectivity, which for the most marginalised teachers, may not be available. To serve the needs of the most marginalised children, ↑Björn Haßler, et al. (2019) recommends drawing on the natural face-to-face community of practice that exists in each school. Rather than looking to an expert to facilitate, one might think about how the school itself can be empowered to strengthen its own community of practice.

A community of practice of teachers naturally enables teachers to share examples of effective practice among themselves. However, given the difficult circumstances teachers are often in, such exchanges seem much more probable and fruitful when undertaken face to face. ↑Haßler, et al. (2018) and references therein describe how at the start of the programme, teachers were quite unfamiliar with each other and only used "their family names to address each other." Through the programme, teachers build trust and gain much more insight into other teachers' practices, growing into a community of practice and "addressing each other with their first names." I recommend that such opportunities for creating non technology-mediated communities of practice are not overlooked when their creation is more than feasible and cost-effective.

One might also argue that virtual communities of practice enable better subject specific communication, given that any one school may only have a limited number of subject specialists. ↑Haßler, et al. (2019) discuss this point and conclude that in the low-income country settings we are interested in, much can be gained by breaking down (often artificial) subject barriers. For example, the TTEL programme in Ghana originally envisaged learning activities specific to tutors from English, mathematics, and science. However when the in-service programme was initiated, we made the conscious choice to invite all tutors

across subjects. This enables, for example, the English tutor to learn from interesting practices of an art tutor, while the art tutor may understand where it is useful to refer to curriculum content from English. We note that this does happen in the context of subject specific pedagogy rather than general pedagogy. It is just that the art tutor is invited to think about subject specific pedagogy for English while the English tutor is invited to think about subject specific pedagogy for art. We have found this approach very useful in primary, secondary and tertiary education. There are very specific aspects of subject pedagogy, for example, in mathematics, that may not be relevant to someone teaching English. However, in our experience educators are patient and flexible to explore questions outside their own subjects.

Coaches. It is clearly beneficial for coaches to share their experiences among themselves. As coaches do not necessarily operate in a team and may have little physical contact time. This, combined with the likelihood that coaches have some kind of technology equipment already, makes a virtual community of practice seem like an appropriate way forward.

Coaches and teachers. It is sometimes argued that an all-encompassing community of practice that includes both teachers and coaches could be helpful. I would argue that because such a community of practice would have to be virtual, it would likely be less useful then a face-to-face community of practice that includes only teachers from one school. While such virtual groups may enable coaches to share lesson plans and other innovative practices, one would have to ask why such examples cannot be shared in advance of the meeting or programme. First, many of the issues that occur in day-to-day teaching are easily pre-empted and should be included as part of a well-designed teacher professional development programme. Second, one of the principles of working in low connectivity settings is to share all fixed materials in advance — for instance, to print books or offline materials — and preserve precious connectivity for essential communications (↑Haßler, et al., 2018).

3.2.7.3. Communities of practice: mediated by technology

If you are going to mediate a community of practice, such as one for coaches, through technology, then the question of *which* technology immediately arises.

From our experience we find that tools like WhatsApp are frequently used. We also note the Whatsapp-like app called Telegram has a large group of users globally, including in sub-Saharan Africa. Telegram also has other features, such as ‘supergroups’. We would be happy to provide a detailed comparison between WhatsApp and Telegram. Either one would be my technology of choice to mediate a community of practice.

While other tools, such as Edmodo, Moodle or Slack have a range of theoretical advantages, there are very few (or perhaps even no) examples of these tools being truly successfully used with teachers in low income countries. The principle of iterative improvement would strongly suggest starting with WhatsApp or Telegram first, and once this is working, to consider bringing in other tools if absolutely necessary. The introduction of further tools should always follow extensive user testing.

Chapter 4. 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

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

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.

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

Community of practice. (2020). In *Wikipedia*. 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/impactevaluations/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

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

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

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/5d700b1522833b0001a0181d/1567623958011/Using+Digital+Video+in+Rural+Indian+Schools+-+A+Study+of+Teacher+Development+and+Student+Achievement.pdf

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