

WORKING PAPER

A Literature Overview of Accountability and EdTech

Recommendations for Using Technology to Improve Accountability in Educational Systems from Ghana and Other LMICs

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Abbreviations and acronyms

DOAJ	Directory of Open Access Journals
EMIS	Education management information systems
ERIC	Education Resources Information Centre
IEPA	Institute for Educational Planning and Administration
JSTOR	Journal Storage
LCD	Link Community Development
LfL	Leadership for Learning
LMICs	Low- and middle-income countries
OLPC	One Laptop Per Child
SCIELO	Scientific Electronic Library Online
SPR	School Performance Review
SPuD	Searchable Publications Database

1. Introduction

Learning outcomes can improve significantly when local stakeholders are empowered to engage with their school's decision-making ([↑Atuhurra, 2016](#)). Decentralised, system-wide decision-making is thus integral and, in practice, this requires system-wide accountability: when stakeholders are truly involved with decision-making, then they will also be asked to take responsibility for their decision-making and be supported in this role. Feedback is data-driven and is given to all contributing stakeholders (teachers and parents as well as district officers and government ministers) in a nurturing and constructive way with a focus on supporting the future growth of each stakeholder group.

Holistic integration of education technology (EdTech) can increase stakeholders' participation in decentralised, system-wide accountability in low- and middle-income countries (LMICs). Technological tools enable practitioner monitoring and student tracking to be carried out in an efficient way. Thus, technology for accountability can address a widespread issue of teacher absence among other foundational issues around educational effectiveness ([↑Kremer, et al., 2013](#)).

Such data can additionally be harnessed to support our central concern, which asks how stakeholder involvement can be maximised via EdTech use during and after school transformation initiatives. Accordingly, the present document reports related research that collectively offers lessons on how EdTech can be used to support accountability within and across Ghana's educational system.

The overall aim of this report is to inform the Ghanaian government's new accountability programme in partnership with the World Bank (Ghana Accountability for Learning Outcomes Program) by bringing lessons and evidence from past relevant efforts. To do this, we seek to indicate where the gaps are in this research area as well as to identify some potential directions for upcoming research. In addressing this goal, we align our research interest with the EdTech Hub Problem Analysis ([↑Hennessy, et al., 2021](#)) by focusing on ways to address the global learning crisis and ultimately improve outcomes for the most marginalised students.

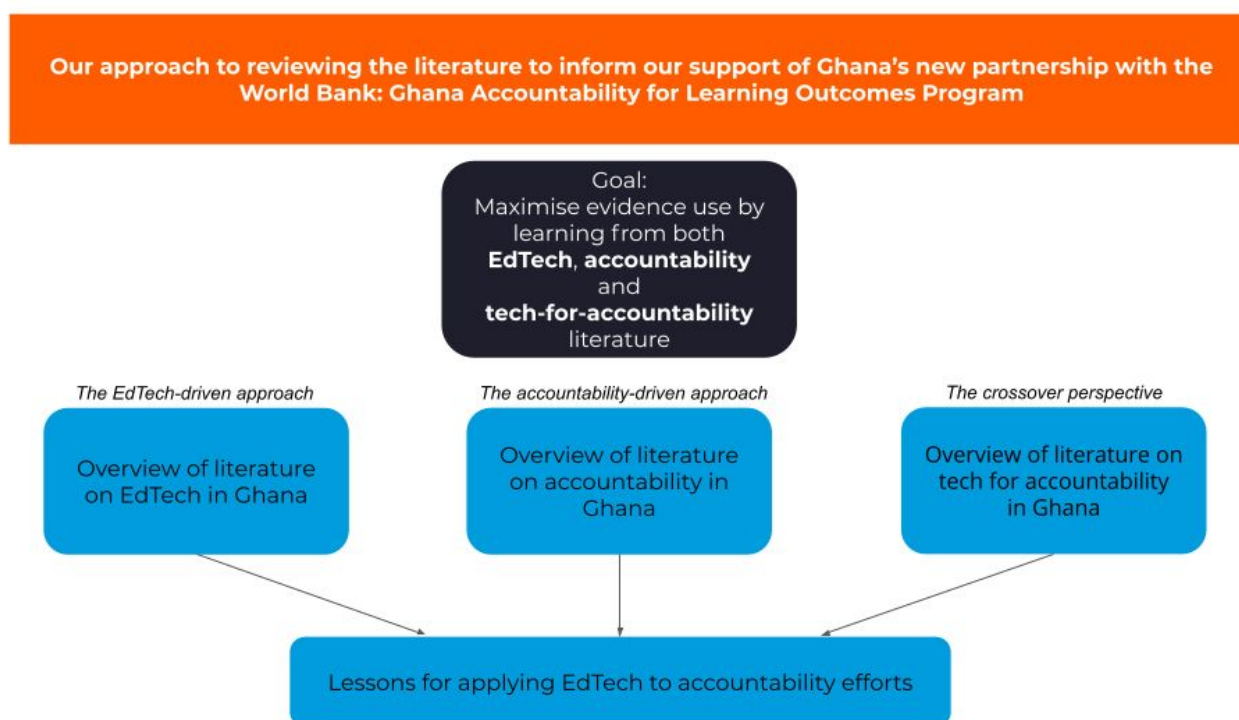
Practical suggestions are included regarding potentially fruitful connections to other individuals and organisations for such research (Appendix). We further anticipate our findings to inform others in the field who are interested in related research, and practitioners in other LMICs who are considering designing and implementing accountability efforts in the education sector.

1.1. Scope of the reviewed literature

We sought to discover existing research on how EdTech has been used for system-wide accountability in Ghana. We did not find any such research (in keeping with the challenges outlined in our Problem Analysis [↑Hennessy, et al., 2021](#))).

However, we did find research on *how EdTech has been used in Ghana* (Review Focus 1) as well as research on *accountability and management in Ghanaian education* (Review Focus 2), especially regarding the role of headteachers for accountability relationships. Therefore we have examined EdTech use and adoption in Ghana and synthesised this with the research on accountability to identify lessons on how EdTech can be used for system-wide accountability. We finally discovered a very small sample of research on *EdTech for accountability in LMICs* (Review Focus 3), which may have insights for Ghana. Lessons from [↑Abbas \(1987\)](#) have also been extracted and added to the wider report.

Figure 1. Our approach to reviewing the literature.



1.2. Methodology of the literature reviews

For the present literature reviews, we used EdTech Hub's bespoke literature database: [Searchable Publications Database \(SPuD\)](#). Here, users

can discover research focused on technology use in educational contexts in LMICs, totalling over 3 million records to date. The SPuD database brings in relevant records from major educational databases that we have identified to yield relevant literature: namely, Education Resources Information Centre (ERIC), Scopus, ProQuest Education, Journal Storage (JSTOR), ProQuest Arts and Humanities, Scientific Electronic Library Online (SCIELO) and Directory of Open Access Journals (DOAJ).

In accordance with the Hub's broad research focus and inclusion criteria available in Appendix 2, a search strategy¹ is used for bringing records into the SPuD database and to update the database on a regular basis. The SPuD search strategy is deliberately inclusive to maximise the database's usefulness to researchers who broadly share our interest in EdTech for LMICs, but false positives are dramatically reduced for such researchers when using SPuD as compared with source databases such as SCOPUS. As such, the SPuD database strikes a balance between inclusivity for addressing a wide range of research questions and selectivity via the pre-screening process lent by the database's search strategy.

Focused search strategies were employed using the SPuD database, for each of the review focuses. For Review Focus 1, literature spanning *EdTech*, *Ghana* and their synonyms was requested from the SPuD database. For Review Focus 2, literature concerning *accountability*, *management*, *Ghana* and their synonyms was requested. For Review Focus 3, *EdTech*, *accountability*, *LMICs* and their synonyms were requested. Each Review Focus involved deduplication, followed by Stage 1 screening for relevance of titles and abstracts, then Stage 2 screening of full texts relating to each Review Focus (e.g., *EdTech*, *Ghana* for Review Focus 1). Once the database of included records was finalised, literature was thematically coded in order to produce the written syntheses that are reported in this document. This coding system primarily involved classifying evidence by initiatives. Within each initiative, relevant principles were identified and grouped (for example, activities for student vs. teacher vs. school leader vs. district leader; or techniques, dialogic exercises and innovations vs. data-sharing approaches vs. individual feedback) and are described within each Review Focus' section.

¹ The full keyword inventory is available in [↑Haßler, et al. \(2020\)](#). Readers can also view a conceptual summary of the SPuD search strategy [↑Haßler, et al. \(2021\)](#).

2. Review Focus 1: Lessons from research on technology for learning in Ghana

Research literature on ‘EdTech in Ghana’ converged on six themes that spanned the education system: technology for learning, users’ technological readiness, distance learning, tech design efficacy, leadership development, and teacher professional development through EdTech. In order to focus the scope of this report, we refer only to studies sampling young students (0–18 years: pre-school to secondary education) to maintain the Hub’s focus on EdTech for children. Since most of the research pertained to higher education, this age-related focus reduced the reviewed studies from $n=129$ to $n=33$. Within this sub-sample of studies, we further opted to focus on technology for student learning as these studies access the heart of educational settings and offer the greatest insight into the challenges for adoption of system-wide EdTech for accountability.

Fourteen studies qualified for inclusion in our literature review on ‘technology for learning in Ghana’ (Table 1). Throughout these studies there is a recognition that EdTech does not in itself improve the process in question, such as learning or accountability ([↑Sarfo, 2007](#)). Although it does grab attention with potential to improve user engagement in the short term, EdTech itself has no intrinsic power or agency for sustained behavioural change or systemic improvement in the long term. Unless users become proficient at using the target EdTech ([↑Sarfo, 2007](#)), existing systems for accountability are likely to outperform the EdTech innovation ([↑Owusu, et al., 2010](#); see [↑Imhanlahimi & Imhanlahimi, 2008](#) for comparable findings in Nigeria). Yet, there is agreement that EdTech use has significant potential to make notable contributions and even fill important gaps in tech-free education (see, for example, [↑Yelkpiერი & Kweku, 2011](#)).

“Unless users become proficient at using the target EdTech (Sarfo, 2007), existing systems for accountability are likely to outperform the EdTech innovation.”

We now proceed to outlining major initiatives that have used technology for student learning in Ghana. We then collate findings and recommendations from lower-profile studies on this topic before finally providing a summary of implications from this body of research for accountability-related EdTech.

2.1. One Laptop Per Child

The One Laptop Per Child (OLPC, one.laptop.org) initiative provides each child with a durable laptop that has pre-loaded educational content for independent learning. A number of lessons for accountability could be drawn from OLPC. Perhaps well-known in the field is the failure of the OLPC programme to plan a sustainable implementation and adoption of the new technologies in school settings ([↑Ezumah, et al., 2012](#)). The programme in Ghana held a traditional view, often held by donors and implementing partners, that pro-innovation attitudes can simply be expected from stakeholders in low-income contexts. As a result, the programme was designed and implemented in a top-down manner with insufficient regard for the local context. Instead, careful needs-assessment is essential, alongside corresponding implementation planning as well as involvement of prospective EdTech users throughout the design and planning phases ([↑Ezumah, et al., 2012](#)). In addition, EdTech for accountability needs to be aligned with the expectations of the Ministry of Education (MOE) as well as ensuring compatibility of the innovation with the local content and context ([↑Ekekwe, et al., 2012](#), cf. [↑Ezumah, 2010](#)).

Another lesson from the OLPC initiative relates to the potential attempts at macro-level changes — that is, ‘disruptive’ educational technologies ([↑Denning, 2016](#)). OLPC was a proud proponent of constructivist (child-led) learning with which it sought to displace the didactic (teacher-led) instruction that dominated low-income, post-colonial settings. However, the wider in-school curriculum had not been redesigned in support of this change. As a result, students were unable to make a continuous journey of discovery; rather, their analogue learning was disconnected from their digitised learning and this disconnection interrupted their progress ([↑Ekekwe, et al., 2012](#)).

Related research on the integration of EdTech into rural Ghanaian education has echoed the importance of involving stakeholders in the local community in the long term for continued integration and reproduction of EdTech in everyday learning. Students in particular need to be convinced that the EdTech space is one in which they can exercise creativity and make specific requests that are directly related to their learning needs ([↑Owoo, 2017](#)). In application to EdTech for accountability, comprehensive and system-wide changes can only be made if the intended philosophical shift towards an educational focus on learning and greater student agency are integrated throughout the system. For example, if EdTech is being brought in to increase community involvement and accountability (such as regular community forums to discuss recent school performance), then implementers must ensure that

the redefinition of community is shared by all stakeholders — both before and through the use of EdTech for accountability. Only then will EdTech use truly contribute to sustained, community-wide participation (↑[Nishimura, 2017](#)). These are the principles that are highlighted and demonstrated by the programmes reviewed in Sections 3 and 4.

“EdTech for accountability needs to be aligned with the expectations of the Ministry of Education as well as ensuring compatibility of the innovation with the local content and context.”

2.2. The Rumie Initiative

The Rumie Initiative (rumie.org) developed tablets with the aim of meeting local educational needs via synchrony with local curricula. This programme succeeded in some areas where OLPC failed. In particular, the Rumie Initiative had the deliberate goal of developing ‘authentic partnerships’ with stakeholders in target LMICs that are characterised by “long-term commitment, shared responsibility, reciprocal obligation, equality, mutuality and balance of power” (↑[Kiboro, et al., 2014](#), p.2). Partners included “corporate organizations, governments, philanthropists, non-profit organizations, local partners, schools and teachers who will use the Rumie tablets in educating children” (↑[Kiboro, et al., 2014](#), p. 2). This approach to partnership with the destination context was expected to significantly contribute to the tablets’ sustained implementation as well as students’ sense of ownership over the initiative.

Local users were additionally supported in establishing alternative and reliable routes to accessing the digital content without internet access, using strategies that include the offline availability of learning content. This enabled continued access to the tablet by integrating the device as a learning resource contextualised within structural and cultural forces such as children’s chores, school opening times and power structures in the community. In accordance with the principles of disruptive innovation, the Rumie Initiative did develop digital content that corresponded with the local curriculum, and relationships are being deliberately nurtured between the Rumie team and local stakeholders in the long term.

Across the recipient countries of this initiative, Rumie tablets have been reported to enhance students’ literacy and numeracy learning outcomes.

Through the introduction of EdTech at an early age, digital confidence is boosted among students as is interest in pursuing technology and engineering subjects in future (↑[Moon, et al., 2016](#)). Although these positive outcomes are specific to learning rather than accountability, it can be expected that the same conscious effort towards holistic integration of EdTech into local educational systems via dialogue with stakeholders may reap similar rewards in accountability.

2.3. The ‘Integrating ICT’ (IICD) initiative

‘Integrating ICT’ (IICD, iicd.org) is another group that has been exploring how EdTech innovations can be most effectively implemented in Ghana. ↑[Koopman \(2014\)](#) identified teachers to be key informants regarding integration of curriculum-appropriate content to technology-supported educational systems (see also ↑[Grimus & Ebner, 2015](#) for the same emphasis).

The IICD approach to integrating technology into educational systems is to train, create and equip. Professional development for teachers and managers needs to be conducted in order to increase teachers’ digital skills (train); content needs to be developed for the digital platform (create); and teachers need to be supplied with technologies, especially computers, in order to put digital resources to use in the classroom (equip).

Teacher recruitment and retention particularly benefit from increased availability of technology tools, since the more tedious work can be done much more quickly via technology (cf. ↑[Yelkperli & Kweku, 2011](#)). This latter principle relates directly to EdTech for accountability, since if the technological system is set up and coordinated adequately from the outset, data analysis and sharing can be carried out much more efficiently among the various stakeholders to focus more on the educational tasks. As Koopman wrote in her discussion, the ecosystem of the school can enjoy remarkable support from EdTech: “...school finances... students’ grades, attendance rates and more efficient administration saves valuable time that can be spent on teaching” (↑[Koopman, 2014](#), p. 3). Given such potential for school-wide impact, EdTech can be expected to have a strong role to play in accountability.

“The ecosystem of the school can enjoy remarkable support from EdTech: “...school finances... students’ grades, attendance rates and more efficient administration saves valuable time that can be spent on teaching” Koopman, 2014, p. 3).”

2.4. Lessons from other technology-for-learning initiatives

Previous interventions in Ghana have highlighted infrastructural constraints as a key obstacle for consideration, as is the case generally in LMICs. In a survey of headteachers across three regional classifications, inadequate technological infrastructure was unanimously identified as an obstacle to increased EdTech use in schools ([↑Quaicoe & Pata, 2015](#)).

Infrastructural issues have affected data collection for research (e.g., survey data collection), EdTech use, and workshops (or interventions) themselves. In another study emphasising teachers’ importance in the increased and sustained use of technology for learning, [↑Grimus and Ebner \(2015\)](#) conducted teacher-training workshops to increase use of mobile devices for learning. In the particular setting, connectivity was limited to one room in the entire school where bandwidth was low and incapable of supporting access from multiple devices. The Rumie Initiative offers one example of how connectivity issues in low-income contexts can be handled, by making offline access possible for stakeholders.

A concerning casual approach to access to and security on internet platforms was also noted. It seemed that everybody, including students, knew the school administrator’s login credentials and were able to download software (potentially malware) at will (cf. [↑Grimus, et al., 2013](#); [↑Grimus & Ebner, 2014](#)). Such gaps in security are especially relevant to accountability as data on individual students, teachers and school-wide management will all warrant adequate security to protect confidentiality.

Indeed, over 75 per cent of headteachers surveyed by [↑Quaicoe & Pata \(2015\)](#) acknowledged that a school-wide strategy was drastically needed, that the integration of technology into the wider school life was similarly urgent, and that the prospects for these outcomes would be significantly improved via increased financial support. Only when EdTech is synchronised with the whole rhythm of school and community life can it

be fully and consistently engaged with, without interruptions undermining its potential value. In the case of educational broadcasts, its timings can clash with children's community (e.g., home chores, church activities) and school (e.g., scheduled lessons, cleaning responsibilities, social gatherings) commitments, as well as wider events in these contexts that additionally undermine potential contribution from EdTech use. Once EdTech use has been synchronised and integrated into the local school system, specific arrangements (such as timetabling) need to be put in place that are designed to maximise users' benefits from it ([↑Yelkperli & Kweku, 2011](#)).

“Only when EdTech is synchronised with the whole rhythm of school and community life can it be fully and consistently engaged with, without interruptions undermining its potential value.”

Moreover, a clear understanding of the technology that is already available must be taken into account during any planned increase of EdTech for accountability ([↑Natia & Al-hassan, 2015](#)). It may be that the least technologically advanced EdTech is the most impactful and feasible way forward in the near future, since such platforms will be the most educationally advanced in the technology's life cycle. For example, teacher development might be conducted on optimising classroom use of nationally broadcast educational television programmes via television sets that are already distributed to every school in marginalised rural areas (cf. [↑Natia & Al-hassan, 2015](#)). Thus, existing EdTech, local infrastructural restraints (including poor connectivity) and foundational considerations, such as security and user proficiency, need to be taken into account when identifying the most relevant EdTech to be used in designing and implementing EdTech for accountability.

Adequate attention can be given to context- and culture-specific needs via design-based research. A cross-national study has successfully demonstrated the EdTech efficacy that can be attained through rigorous iteration cycles of informed exploration, enactment, refinement, and evaluation of digital designs for learning ([↑Palalas, et al., 2015](#)). EdTech systems for accountability can similarly optimise usefulness within the local context by taking socio-cultural dimensions (e.g. chores) into account in a dynamic manner. As Palalas demonstrated, outcomes of this design-based research can be made sustainable by training local

educators and instructional designers to adjust designs of EdTech tools as and when needs arise.

“A clear understanding of the technology that is already available must be taken into account during any planned increase of EdTech for accountability.”

2.5. Interim summary: Lessons for accountability via EdTech use

The above literature review on EdTech use in Ghana has focused on technology for student learning. From these studies, several lessons are relevant for future EdTech applications for system-wide accountability. There is already widespread recognition of the potential for EdTech use to support remarkable improvements in the quality of life throughout the educational ecosystem: its involvement can ease the burden of more tedious tasks and enable practitioners to focus more on the educational content and system.

Although the novelty of new technology does give rise to initial excitement, stakeholder involvement throughout needs-assessment, design and implementation is essential to sustain the adoption of technological innovation. EdTech innovations and underlying philosophical transitions must be fully integrated into comprehensive and systemic changes (for example, internet security) to ensure that the initiative is actually compatible with the local context. School-wide strategies are in the forefront of such reform. Infrastructural limitations need to be accounted for to empower continued engagement whilst digital tools expand their reach across the educational system. Stakeholders should also be offered sufficient training for accountability reforms involving EdTech. An example of such success is the Rumie Initiative, which taught users how to access the digital resources offline when connectivity is low.

Table 1. *Fourteen records from the EdTech Hub literature database that qualified for inclusion in our literature review on ‘technology for learning in Ghana’.*

Author	Year	Title	Journal
†Ezumah	2012	Planning and designing educational technology for low-income communities: A	Disruptive Technologies, Innovation and Global Redesign:

		participatory and proactive approach	Emerging Implications
↑Ezumah	2010	Toward a Successful Plan for Educational Technology for Low-income Communities: A Formative Evaluation of One Laptop Per Child (OLPC) Projects in Nigeria and Ghana	NA
↑Grimus and Ebner	2014	Learning and teaching with mobile devices: An approach in secondary education in Ghana	NA
↑Grimus and Ebner	2015	Learning and Teaching With Mobile Devices: An Approach in Higher Secondary Education in Ghana	International Journal of Mobile and Blended Learning
↑Grimus et al.	2013	Mobile Learning as a chance to enhance education in developing countries – on the example of Ghana	NA
↑Kiboro et al.	2014	Providing access to education in Sub-Saharan countries through Content-Oriented technology	2014 IEEE Canada International Humanitarian Technology Conference - (IHTC)
↑Koopman	2014	Step-by-step approach: The integration of ICT in the classroom in rural African schools	NA
↑Natia and Al-hassan	2015	Promoting teaching and learning in Ghanaian Basic Schools through ICT	International Journal of Education and Development using ICT
↑Owoo	2017	Bilingual Learning Spaces: Lessons From Using WhatsApp Videos in a Ghanaian Rural Context	Making a Difference: Prioritizing Equity and Access in CSCL

↑Owusu et al.	2010	Effects of computer-assisted instruction on performance of senior high school biology students in Ghana	Computers & Education
↑Palalas et al.	2015	A design based research framework for implementing a transnational mobile and blended learning solution	International Journal of Mobile and Blended Learning (IJMBL)
↑Quaicoe and Pata	2015	Factors determining digital divide in Ghana's basic schools	2015 IST-Africa Conference
↑Sarfo	2007	The Views of Educational Practitioners in Ghana on ICT Use and Instructional Design Practice for Promoting Quality Education	Seventh IEEE International Conference on Advanced Learning Technologies (ICALT 2007)
↑Yelkpiei and Kweku	2011	Patronage of Educational Broadcasts and its Effects on Academic Growth of Students of Winneba and Apam Senior High Schools in the Central Region of Ghana.	NA

3. Review Focus 2: Lessons from research on school leadership and accountability in Ghana

We are primarily interested in pursuing the role of EdTech for the broad purpose of accountability in educational systems. To that end, search terms focused on accountability-specific themes relating to the monitoring of school performance. However, we did not find sufficient studies in our literature database with such a focus in Ghana (pre-screening $n = 5$). We therefore requested studies on ‘accountability and school leadership’, which resulted in 35 initial records: search terms now also included themes relating to school leadership and management, as well as education management information systems (EMIS). Twenty-six records were included, following screening of titles and abstracts for relevance. One record was added by expert referral. Fourteen were finally included after full-text screening (see Table 2). Two particular initiatives warranted specific focus, after which we report more general lessons regarding EdTech for accountability from research on school leadership in Ghana. Indeed, school leaders’ historical influence makes them integral to building decentralised and system-wide educational accountability.

3.1. The School Performance Review initiative

As far as we are aware, [Prew and Quaigrain’s \(2010\)](#) research on the School Performance Review (SPR) is the only investigation with a primary focus on accountability in Ghana. It therefore has particular relevance to the present report. The SPR programme uses school-level data to ensure continual involvement of district offices, school leaders, teachers, and the community in the transformation of primary schools to improve access to data in accordance with the needs of local stakeholders. This data was collated onto an EMIS database which district officers synthesised and curated for community stakeholders.

The SPR framework adopts a systemic approach, which is achieved by four broad stages:

1. Collection of diverse data by trained district officers relating to literacy and numeracy outcomes, observed lesson quality, and ‘SPR indicators’ (including community involvement, teacher attendance, staff meetings, effective parent teacher association, pupil

satisfaction), which are measured via observations, interviews, documentary analysis and survey data.

2. Data synthesis into school-wide and district-wide reports by district officers.
3. Appraisal meetings for school-level, circuit-level then district-level discussions.
4. Improvement plan development, implementation and monitoring until the next round of data collection.

Thus, the SPR programme maximises schools' responsiveness to their current effectiveness and for district recommendations to keep schools accountable in a data-driven way (cf. [↑UNESCO & Education for All, 2005](#)). By establishing close collaboration and space for dialogue ([↑Wegerif, 2007](#)), the SPR fosters a supportive relationship between schools and district offices that nurtures confidence and motivation levels in individual school communities.

Diverse mixed methods data have been collected on the SPR programme: interviews, analyses, classroom observations, standardised testing (in maths and English) and existing EMIS data. Results from this programme suggest that local district staff have been empowered to perform the relevant data-handling, which optimised the likelihood of sustained application of the SPR's data-driven approach to local schools' accountability. The SPR model for accountability seems powerful, particularly regarding its success in improving the relationship between schools and their sources of support — the circuit, district, community, and NGOs — as well as identifying and meeting the individualised needs of each school ([↑Prew & Quaigrain, 2010](#)).

“Empowering local district staff to perform the relevant data-handling optimised the likelihood of sustained application of the SPR's data-driven approach to local schools' accountability.”

3.2. The Leadership for Learning programme

The Leadership for Learning (LfL) programme based at the University of Cambridge is particularly successful for increasing system-wide accountability via school leaders. In particular, one LfL dimension for effective school leadership emphasises 'mutual accountability' across

stakeholders. Until the LfL programme, systemic support had been insufficient for schools to enact the 1998 education decentralisation policy.

The programme was implemented at scale in Ghana a decade ago. As it progressed over the course of three years, 100 headteachers increased their ratings for the importance of the LfL principles of leadership ([↑Jull, et al., 2014](#)), demonstrating the importance of “locally contextualised practice [for accountability]; a parsimonious framework [that] aids learning and dialogue; modelling, critical friendship and moral purpose” ([↑Maclean & Swaffield, 2017](#), p. 277). In further support for system-wide accountability, the programme has been integrated into the Ghanaian Education System’s handbook for headteachers since 2010.

Scholars leading the LfL programme highlight the value of educational technology as the next step to the evolution and growing impact of this programme ([↑Swaffield, 2017](#)). The LfL programme has already reported the value of mobile phone text messaging for prompting school leaders to sustain professional reflection that relates to the programme’s principles (for example, “LfL Ghana supports Shared Accountability across the whole school: What are you doing this week to encourage a shared responsibility for learning?”, [↑Swaffield, et al., 2013](#), p. 1298). Indeed, the very reliance upon collective stakeholder effort and accountability for local school changes is considered to underlie the success of the programme ([↑Malakolunthu, et al., 2014](#)). Thus, it seems that the groundwork of an effective framework for significantly increasing community involvement, influence, ownership, and accountability in schools’ learning processes and outcomes has been found.

3.3. Decentralising accountability via school leaders

The remaining research included in this second literature review investigated the role of school leadership, offering key lessons on the importance of educational leadership in accountability.

Stakeholders generally agree that, among other traits, true leadership involves ensuring all processes and outcomes of a school are reflected and decided upon in a system-wide manner at the national level. School leaders should ensure that every stakeholder group is learning, sharing their learning, exercising their strengths, and being accountable for the school’s outcomes ([↑Zame, et al., 2008](#); [↑Jull, et al., 2014](#)). School leaders also play a central role in facilitating system-wide accountability because of their historical position of power and privilege under Ghana’s traditional, colonial model of educational management ([↑Essuman & Akyeampong, 2011](#)). Thus, adequate training ([↑Donkor, 2015](#); [↑Suaka & Kuranchie, 2018](#))

that includes this emphasis on system-wide educational accountability at the national level needs to be established. An effective way of fostering this mindset for shared (or system-wide) accountability is to involve stakeholders as critical friends during school leaders' training ([↑Malakolunthu, et al., 2014](#)). Given the importance of EdTech for system-wide accountability, we would additionally recommend enhancing school leaders' EdTech readiness within their professional development.

“True leadership involves ensuring all processes and outcomes of a school are reflected and decided upon in a system-wide manner at the national level.”

3.4. Interim summary: Lessons for accountability using EdTech

The above literature review focused on studies investigating educational leadership and one study on accountability specifically. From these studies, several lessons are relevant for future EdTech applications for system-wide accountability. Because of their historical influence and its importance in 'true leadership', school leaders are central to establishing accountability that is system-wide at a national level across schools under their management — especially during the early stages of such innovations. In addition to making such an emphasis on shared accountability, leadership training will substantially improve use of technology for EMIS (including literacy and numeracy data as well as regular lesson observations) for accountability purposes. Meanwhile, the sustainability of accountability transformation will be optimised when local stakeholders are empowered to collect, analyse, and report from school data proficiently. The School Performance Review (section 3.1) is an excellent starting point for how system-wide accountability can be carried out using EdTech to make EMIS data accessible to all stakeholders. This was possible only via continued communication with relevant stakeholders throughout the innovation as well as training for local implementers in the handling of EMIS data.

“Given the importance of EdTech for system-wide accountability, we would additionally recommend enhancing school leaders’ EdTech readiness within their professional development.”

Table 2. *Thirteen records from the EdTech Hub literature database that qualified for inclusion in our literature review on ‘educational leadership and accountability’ in Ghana.*

Author	Year	Title	Journal
↑Abreh	2017	Involvement of School Management Committees in School-Based Management: Experiences from Two Districts of Ghana.	Educational Planning
↑Akyeampong et al.	2012	Access, Transitions and Equity in Education in Ghana: Researching Practice, Problems and Policy	CREATE Pathways to Access
↑Alberta Teachers Association	2007	Access to Basic Education in Ghana: The Evidence and the Issues. Country Analytic Report.	NA
↑Donkor	2015	Basic school leaders in Ghana: how equipped are they?	International Journal of Leadership in Education
↑Jull et al.	2014	Changing perceptions is one thing... : barriers to transforming leadership and learning in Ghanaian basic schools	School Leadership & Management
↑Sherman and Kwadzo Agezo	2010	Female leadership and school effectiveness in junior high schools in Ghana	Journal of Educational Administration
↑Malakolunthu et al.	2014	Improving the quality of teaching and learning through leadership for learning: Changing scenarios in basic schools of Ghana	Educational management administration & leadership

↑Owusu-Bempah et al.	2014	Commonalities and specificities of authentic leadership in Ghana and New Zealand	Educational Management Administration & Leadership
↑Prew and Quaigrain	2010	Using School Performance Data to Drive School and Education District Office Accountability and Improvement: The Case of Ghana	Educational Management Administration & Leadership
↑Sofo and Abonyi	2018	Investigating the self-reported professional development activities of school leaders in Ghanaian rural basic schools	Professional Development in Education
↑Suaka and Kuranchie	2018	Head Teachers' Professional Management Needs and Concerns: Evidence from an Educational District in Ghana.	African Educational Research Journal
↑Swaffield, et al.	2013	Using Mobile Phone Texting to Support the Capacity of School Leaders in Ghana to Practise Leadership for Learning	Procedia - Social and Behavioral Sciences
↑Swaffield	2017	Supporting Headteachers in a Developing Country	Life in Schools and Classrooms
↑Zame et al.	2008	Educational reform in Ghana: the leadership challenge	International Journal of Educational Management

4. Review Focus 3: Lessons from research on accountability already supported by EdTech

In an effort to identify research that has investigated EdTech use in direct relation to accountability, we widened the scope to search for such investigations conducted beyond Ghana². The first round of geographical expansion requested literature relating to Sub-Saharan Africa (included n = 2). The next round requested such research in Africa but no relevant studies were discovered that were not already in our database. The final round requested such research in LMICs when one novel study was identified as relevant ([↑Al-Alawi, et al., 2019](#)). We then discovered one further relevant record via expert referral ([↑Piper, et al., 2018](#)). In all, we discovered only four studies that directly investigated ‘EdTech for accountability in LMICs’ (Table 3).

National school leadership innovation has been found to be impeded by a severe lack of basic technological support in Botswana. Although the innovation promoted system-wide accountability, the basic technological provisions for implementing the innovation were lacking. Schools reported the need for photocopiers to duplicate materials for workshops relating to the reform. Ownership of only one computer across a school was not an uncommon story either ([↑Bulawa, 2013](#)). It is for such reasons that accountability reforms in LMICs are often not constructive as far as teachers are concerned, and ultimately not successful. Related challenges have been reported in the Gulf Cooperation Council region, where the lack of training with technological support has also been identified as an obstacle to school transformation for system-wide accountability, alongside a widespread lack of internet access for staff to meet professional responsibilities at home ([↑Al-Alawi, et al., 2019](#)).

4.1. ‘Read to Succeed’ in Zambia

The ‘Zambia School Gateway’ is the technological tool at the heart of a national literacy innovation, Read to Succeed ([↑Rakusin & Bostock, 2018](#)). The innovation took a holistic approach by targeting five dimensions of school effectiveness, including leadership for accountability and community participation. School leaders are transformed from

² Other than the School Performance Review (Section 3.1), we have not found any accountability initiatives that make use of EdTech in Ghana.

administrators to being accountability champions for their schools. They contribute classroom observation and literacy progress reports to the Zambia School Gateway, which then provides a district-wide view of individual schools' literacy needs for district officers to offer support where it is most needed. The Gateway also enables community-wide discussions of Learner Performance Improvement Plans for next steps in each school's transformation towards improved literacy. ↑[Rakusin and Bostock \(2018\)](#) identified a correlation between the use of the Zambia School Gateway tool and integral steps towards system-wide accountability: increased use of data for target setting and the subjective importance given to data-driven planning for student performance improvement, as reported during interviews. Indeed, schools classified as high-performing (including via literacy outcomes) used the Zambia School Gateway twice as much as low-performing schools.

“The Zambia School Gateway enables community-wide discussions of Learner Performance Improvement Plans for next steps in each school’s transformation towards improved literacy. High-performing schools used this tool twice as much as low-performing schools.”

4.2. The Tusome Intervention

The Tusome intervention was a national literacy programme for primary schools in Kenya (↑[Piper, et al., 2018](#)). It is another demonstration of school transformation in an LMIC via system-wide accountability. The system-wide approach was achieved by setting clear goals in terms of educational outcomes, by holding schools accountable for meeting these goals via continued monitoring, and by providing timely and tailored support to individual schools (cf. ↑[DeStefano & Crouch, 2017](#)).

The Tusome dashboard contributed significantly to the monitoring and differentiated support components of school transformation. By making first-order analytic outcomes and visualisations available to relevant government officials, the current needs of county-, district- and school-level Tusome implementation could be identified and monitored efficiently and accurately.

The data on the Tusome dashboard was entered by the school's designated tutors (or teacher educators) sent in from the government. This data consisted of both teacher and student progress in the literacy

intervention. For teacher data, tutors would conduct classroom observations to assess the extent to which each teacher was successfully implementing the national literacy reform components and techniques. Tutors then obtained student data by selecting three students randomly from the observed class: the oral fluency of this student subsample would be entered into the Tusome dashboard. Using this data, tutors could offer district-level feedback to teachers on the basis of data from the Tusome dashboard. One-to-one sessions with each school's designated tutor served as opportunities for teachers to gain individual feedback as well as to give feedback to the designated tutor regarding reform-specific support. The Ministry of Education also used the Tusome dashboard data to inform national- and county-level officers of where support is especially needed.

Tutors themselves were also kept accountable via technology. Officials collected GPS data on the tablets used to enter teacher and student data onto the Tusome dashboard. Thus the official's location at the time of data entry was recorded to corroborate the authenticity of this data.

Thus, the Tusome dashboard provided a data interface for gathering and gauging progress in a national literacy reform at the student-, teacher-, tutor-, district- and county-level. It played a central role in enabling stakeholders (especially the Ministry of Education and teacher educators) to monitor reform-specific needs at the school level and to respond in a differentiated manner. It also made regular, individualised feedback possible for teachers, whilst keeping learning outcomes at the forefront of Tusome's intervention progress tracking.

“The Tusome dashboard made analytic outcomes and visualisations available to relevant government officials so that county-, district- and school-level needs could be identified and monitored efficiently and accurately.”

4.3. Interim summary: Lessons for accountability via EdTech

The above literature review focused on studies investigating EdTech for system-wide accountability in LMICs. From these studies, it is clear that the shortage of technological provisions and connectivity significantly hinders the adoption of technology-based systems for system-wide

accountability across LMICs. Only when such infrastructure is adequately put in place can stakeholder-led school transformation be successful. The Zambia School Gateway initiative demonstrated this, as well as the value of community-wide conversations and training for headteachers in using the associated EdTech innovation. In Kenya, the Tusome intervention showcased a scalable approach to system-wide accountability that was only possible via its EdTech platform, the Tusome dashboard, which enabled government officials and teacher educators to monitor current implementation progress from the national-level perspective and to support classroom teachers' individualised professional development.

Table 3. Four records from the EdTech Hub literature database that qualified for inclusion in our literature review on 'EdTech for accountability in LMICs'.

Author	Year	Title	Journal
↑Al-Alawi, et al.	2019	Investigating the barriers to change management in public sector educational institutions	International Journal of Educational Management
↑Bulawa	2013	Constraints to Senior Management's Capacity to Implement the Performance Management System in Senior Secondary Schools in Botswana	International Education Studies
↑Piper, et al.	2018	Scaling up successfully: Lessons from Kenya's Tusome national literacy program	Journal of Educational Change
↑Rakusin and Bostock	2018	School leadership and early grade reading: Examining the evidence in Zambia	Cultivating Dynamic Educators: Case Studies in Teacher Behavior Change in Africa and Asia (Book)

5. Conclusion: Implications from the literature for how EdTech use might improve accountability in Ghana and other LMICs

Use of EdTech has the potential to improve accountability systems dramatically in LMICs providing that key considerations are addressed. An effective technological innovation for accountability would be shaped by continual stakeholder consultation during planning and reflection (cf. EdTech Hub's Problem Analysis, 4.2.1 ([↑Hennessy, et al., 2021](#))). It would then be data-driven during implementation (cf. Problem Analysis, 3.3.1 ([↑Hennessy, et al., 2021](#))). EdTech for accountability would be system-wide: that is, embedded throughout the educational structure. Stakeholders would thus be empowered to deliver these cycles of accountability for themselves by active involvement throughout and from the very beginning. Such involvement would consist of continued communication with and training for the EdTech innovations for accountability.

In Ghana, EdTech innovations for system-wide accountability must integrate infrastructural limitations into implementation plans. EdTech users would be equipped with a toolkit of options to overcome evolving infrastructural obstacles such as connectivity issues, which, given the low-income context, are likely to persist for some time after the initiation of the new innovation. Overarching these accountability and technology considerations is the critical importance of contextualising the EdTech system within the culture of the local school and community. It is in this way that EdTech for accountability will enable data engagement by all, shared ownership of local educational improvements, and digital programmes that are adapted to the contextual realities of the country. These lessons find echoes across the LMICs and may be globally relevant to all international development programmes relating to accountability innovations via EdTech.

Furthermore, future research on EdTech for system-wide accountability can go beyond studies that have hitherto focused primarily on technology for EMIS data and making this data available to stakeholders. One next step might be to explore how EdTech can be used to support the process of stakeholder involvement itself. The relevance of social media and remote meeting tools might be examined, for example, in terms of how

such platforms increase stakeholder access to decision-making for decentralised educational systems.

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7. Appendix 1: In-country researchers related to EdTech for accountability

7.1. University research groups

The [Institute for Educational Planning and Administration \(IEPA\)](#) is a research centre in the University of Cape Coast Ghana that co-led the LfL programme (see, for example, ↑Jull, et al., 2014). The IEPA has particular relevance to EdTech Hub for its explicit mention of education technology as the next step in progressing the benefits of EMIS data for school transformation (↑Maclean & Swaffield, 2017).

The [University of Education at Winneba](#), Ghana, collaborated on the CREATE (Consortium for Research on Educational Access, Transitions and Equity, e.g., ↑Akyeampong, et al., 2007; ↑Akyeampong, et al., 2012) programme, which examined drop-out and EMIS data as part of its 12-point plan for improving access in low-income contexts, including [Ghana](#). The institution's work with CREATE focuses particularly on Northern Ghana.

The [Institute of Education and Entrepreneurship](#) in the Methodist University College Ghana hosts researchers who are affiliated with the CREATE programme and who take particular interest in educational delivery and partnerships for effective stakeholder involvement (for example, Ato Essuman, see below).

7.2. Independent research groups

The [Badiliko Digital Hub Ghana](#) promotes ICT as a new mode of learning and has clusters of schools or community centres for whom they provide infrastructure, curricula, and relevant training. It collaborated on the study reviewed above by ↑Quaicoe & Pata (2015) and was initiated by the British Council.

[Mobiles for Development](#) has a branch in Ghana that has been part of a design-based study focused on culturally appropriate EdTech (↑Palalas, et al., 2015).

[Link Community Development \(LCD\)](#) is an NGO and partner on the SPR programme (cf. ↑Prew & Quaigrain, 2010). LCD already collaborates with one of the EdTech Hub partners (Results for Development) and has potential interest in accountability transformation through leadership, as suggested by the focus on educational leadership across its core

programmes. According to published SPR research, LCD takes particular interest in Northern Ghana.

The [Associates for Change](#) network brings international development professionals together with a special focus on education and social development, women's empowerment, small enterprise development, and children's rights. It has contributed to major policies with an emphasis on increasing educational access for the most marginalised in Ghana.

The [Ghana Developing Communities Association](#) has partnered on a number of relevant programmes including [Ghana's Strengthening Accountability Mechanisms](#) and School For Life (↑DeStefano, et al., 2006). It is an NGO that takes special interest in Northern Ghana and focuses on the delivery of complementary basic education across all of Ghana, improved access to high quality education and increased public knowledge of priority national areas for development.

The [Ghana National Education Campaign Coalition](#) brings research groups together with others interested in realising the 'Education for All' programme in Ghana.

[Creative Associates International](#) implemented the Zambia School Gateway project and is currently active in a non-educational programme in Ghana.

Other relevant groups and networks include the [Complementary Basic Education Alliance](#) and the [Northern Network for Education Development](#).

7.3. Individual researchers

Individuals involved with research relating to accountability and EdTech in Ghana are listed below.

- [Kennedy Quaigrain](#) is the Ghana Executive Director of Link Community Development which co-led the School Performance Review research on shared accountability.
- [Dr Seidu Al-hassan](#) is Associate Professor at the University for Development Studies in Ghana and co-author of an EdTech study on the promotion of teaching and learning in Ghanaian Basic Schools through ICT (↑Natia & Al-hassan, 2015).
- [Dr Frederick Kwaku Sarfo](#) is an independent researcher who has published widely on EdTech, with particular focus on the use of technology by teachers for student learning.

- [Dr Kofi Acheaw Owusu](#) is a lecturer with published interest in EdTech. He works in the Department of Science & Mathematics Education, University of Cape Coast, Cape Coast, Ghana.
- [Dr Leslie Casely-Hayford](#) is the director of Associates for Change and has researched for numerous funders including the UK Foreign, Commonwealth & Development Office. Her research interests in special educational needs and girls are particularly relevant to the Hub's focus on the marginalised.
- [Dr Eric Ananga](#) is a Senior Lecturer at the University of Winneba. His research focuses especially on school dropout and can be invaluable for considerations of how out-of-school children can be integrated into EdTech innovations for system-wide accountability.
- [Professor George Oduro](#) at the Institute of Education in the University of Cape Coast co-led the Leadership for Learning research.
- [Dr Alfred Ampah-Mensah](#) is Senior Research Fellow at the Institute of Education in the University of Cape Coast and co-authored the Leadership for Learning research.
- [Justice Owusu-Bempah](#) is a Lecturer in the Department of Family and Consumer Sciences in the University of Ghana who conducted a country comparison study on EMIS from the 'authentic leadership' perspective.
- [Professor Joseph Gharthey Ampiah](#) partnered on the CREATE programme and is based at the University of Cape Coast Ghana as Vice Chancellor. He also supported the Ministry of Education's Whole School Development programme. For other Ghana academic contacts from the CREATE programme, click [here](#).

8. Appendix 2: Inclusion criteria

Criteria	Details
Publication date	1 Jan 2008 to 31 Oct 2019 Given the fast pace at which technology advances, it is necessary to explore research that is relatively recent (i.e. approximately the last 10 years).
Publication type	Peer reviewed academic journal articles Books and book chapters PhD theses Peer reviewed conference papers Peer reviewed literature reviews Grey literature (inc. Groups for innovation and public engagement, e.g. UK's Department for International Development's [DFID] Devtracker) The above documents that exceed abstracts or extended summaries in length
Research design	All relevant research papers (see publication type) will be included, namely... 'Empirical' research. That is, qualitative and quantitative analyses of both primary and secondary data--and 'Non-empirical' papers that are narrative, theoretical and conceptual in nature
Publication language	English French Portuguese Spanish
Context: Geographical location	Our research questions focus on Educational Technology within Low and Middle Income Countries.

Accordingly, countries were included if they qualified via one or more of the following criteria:

- Have the United Nations' (UN) Human Development Index ranking of 'low' or 'medium', according to the World Bank in 2017;
- Have an Inequality-adjusted Human Development Index score of less than .69, according to the World Bank in 2017;
- Have a Global Multidimensional Poverty Index of greater than .31;
- Have a Gini coefficient index that is greater than 40 (in either 2015 or 2016);
- Are listed as a DFID priority country for project funding (i.e. they are one of the lowest 50 of the UN's Human Development Index ranking);
- Are listed as 'high or moderate fragility' by DFID as listed on the [UK AID web page](#);
- Are disputed territories and recognised by the UN;
- Have a border with a disputed territory or country that qualifies for inclusion in this review.

Sample population

- Students who are:
 - In formal education
 - Early childhood education
 - Basic education (primary and secondary education)
 - Informal education (i.e. established within national system; e.g. community education)
 - Marginalised, including
 - With Special Educational Needs
 - Ethnic minorities
 - In education for refugees and displaced people
 - Girls
 - Street children

- Non-formal education (i.e. not established within national system; e.g. temporary education for refugee outreach)
- Educators of students in the above categories, who are:
 - Undertaking initial teacher training
 - In-service teachers
 - Teaching assistants

**Intervention:
Educational
technology**

Any form of technology that is used for educational purposes will be included. All hardware, software, content (digital and non-digital) and tech-related regulations (e.g. licences) will be included if they are used for educational purposes.

Comparators

No eligibility decisions are being made on the basis of comparators. Rather, these will form the basis for how we at the EdTech Hub will improve on the research practice in the sector (see Research Question 2).

Outcomes

No eligibility decisions are being made on the basis of outcome measures.
