

# EdTech Hub

Clear evidence, better decisions, more learning.

## Country-Level Research Review: EdTech in Ghana

**Date**

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## About this document

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### Notes

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## Abbreviations and acronyms

<b>CEA</b>	Complementary Education Agency
<b>CENDLOS</b>	Centre for National Distance Learning and Open Schooling
<b>CoEs</b>	Colleges of Education
<b>EdTech</b>	Educational technology
<b>EMIS</b>	Education management information systems
<b>ERIC</b>	Education Resources Information Center
<b>ESSA</b>	Education in Sub-Saharan Africa database
<b>FCDO</b>	Foreign, Commonwealth & Development Office
<b>GES</b>	Ghana Education Service
<b>GIFEC</b>	Ghana Investment Fund for Electronic Communications
<b>GoG</b>	Government of Ghana
<b>GTEC</b>	Ghana Tertiary Education Commission
<b>HE</b>	Higher education
<b>HPEG</b>	High-potential evidence gap
<b>ICT</b>	Information and communication technology
<b>ICT4D</b>	ICT for development
<b>ICT4AD</b>	Ghana ICT for Accelerated Development Policy
<b>IPA</b>	Innovations for Poverty Action
<b>IT</b>	Information technology
<b>JHS</b>	Junior high school
<b>LMICs</b>	Low- and middle-income countries
<b>MoC</b>	Ministry of Communications
<b>MoE</b>	Ministry of Education
<b>mSRC</b>	Mobile School Report Card
<b>NCTE</b>	The National Council for Tertiary Education

<b>OLE</b>	Open Learning Exchange Ghana
<b>OLPC</b>	One Laptop Per Child
<b>OOSC</b>	Out-of-school children
<b>PEA</b>	Political economy analysis
<b>pSRC</b>	Paper-based School Report Card
<b>RLI</b>	Research Landscape Index
<b>SEND</b>	Special educational needs and disabilities
<b>SITE</b>	Society for Information Technology and Teacher Education
<b>SIEF</b>	World Bank Strategic Impact Evaluation Fund
<b>SMS</b>	Short messaging service
<b>SPED</b>	Special Education Division
<b>STEAM</b>	Science, Technology, Engineering, Arts and Mathematics
<b>STEM</b>	Science, Technology, Engineering and Mathematics
<b>TESSA</b>	Teacher Education in Sub-Saharan Africa programme
<b>TPACK</b>	Technological pedagogical content knowledge
<b>TPD</b>	Teacher professional development
<b>T-TEL</b>	Transforming Teaching, Education & Learning
<b>UNICEF</b>	United Nations International Children's Emergency Fund

## Executive summary

This document presents a review of the research landscape in Ghana in relation to EdTech research focused at the level of school-based education (not including higher education). The search strategy identified research literature, policy documents, grey literature, and communications with key experts and stakeholders. A growing body of relevant EdTech research is identified to have been undertaken in Ghana. After undertaking searches for relevant literature since 2007, 132 research articles or papers were identified for inclusion. The review provides an overview of trends in this literature in addition to identifying key actors and projects. It also considers how existing research on EdTech in Ghana relates to five research topics that will be the focus of future EdTech Hub research. In combination with political economy analysis, the research identifies potential areas for new research which would be practical and likely to have high impact.

# 1. Introduction

This review provides an overview of EdTech research in and about Ghana in order to understand the opportunities for carrying out further research in the country and how the EdTech Hub can collaborate with researchers, practitioners, and policymakers most effectively. The report will be important for researchers in Ghana and the surrounding region, as well as for EdTech implementers seeking to understand what evidence exists and what is needed. Through analysis of existing literature, discussions with key stakeholders and experts, and analysis of the broader political economy, the gaps in evidence which have the highest potential for impact on education are identified to inform future research priorities. With regard to the use of EdTech in Ghana, these priorities will also serve more broadly to foster and sustain conversation within a community of practice and learning shared by education stakeholders.

## 1.1. Structure

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The review is made up of seven sections:

1. Introduction
2. Summary of the EdTech operating context
3. The texture of the EdTech research landscape
4. Key stakeholders within the EdTech research landscape
5. Summary of the academic evidence on EdTech
6. Summary of political economy analysis
7. Emerging priorities and opportunities for collaboration

## 1.2. Methodology

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To address the aims of the review, a combination of approaches were used in order to draw upon a range of sources.

Analysis of statistics and policy documents informed the context (Section 2), and political economy analysis (Section 6). Section 2 in particular drew upon previous work undertaken by the Engagement team within EdTech Hub ([↑Taddese, 2020](#)).

A review of the published academic research literature was undertaken to provide an overview of the existing research landscape around EdTech and



education for school-aged learners in Ghana (Section 3). This provides an overview of trends – and current gaps – in addition to identifying key actors and projects. It also considers how existing research on EdTech in Ghana relates to the five research topics that will be the focus of EdTech Hub’s research (Section 5). The research review also provided a way of exploring key academic stakeholders related to EdTech in Ghana (Section 4). The volume of EdTech-related research in Ghana has been increasing in recent years and 132 academic publications were identified for inclusion. The search process and its limitations are described in Section 3.

Lessons learnt from discussions with stakeholders informed several aspects of the report, in particular the political economy analysis (Section 6). Situating the priority research areas within the political economy analysis also brings a practical dimension. Potential directions for high impact research in Ghana, aligned with the priorities within the country and with those identified by the Hub, are outlined in Section 7. Each section starts with an overview of the data sources used.

## 2. Summary of the EdTech operating context

This section contextualises the EdTech space in Ghana. It presents selected data points to illustrate the state of EdTech in Ghana within the broader national context. The section also outlines the structures, policies and programmes, and recent developments which underpin Ghana's education system.

### 2.1. Country context

Located in West Africa, Ghana is divided into 16 administrative regions that are further subdivided into 216 districts. The Ashanti, Eastern, and Greater Accra regions are home to 50% of the population, while the Upper East and West regions are among the least populous ([Ministry of Education, Ghana, 2018a](#)). Ghana's rapid economic growth over the last ten years puts it in the company of lower-middle-income countries, but poverty and inequality are high in the rural northwest parts of the country.

**Table 1.** *Country overview.*

<b>Population</b>	Total population	In 2016, the population was 30 million. The growth rate is 2.2% per year
		38.8% of the population is below the age of 15
	Population location	Urban: 17 million (57%) Rural: 13 million (43%)
<b>Language</b>	English is the official language in Ghana but there are several other language groups, with at least 69 individual languages.	
<b>Literacy rate</b>	The overall literacy rate is 76.6%	
	The female literacy rate is 71.4%	
	The male literacy rate is 82%	

Source: Adapted from Ghana country scan ([Ministry of Education, Ghana, 2018a](#), [Ghana Statistical Survey & UNICEF, 2018](#), [Ministry of Education, Ghana, 2018b](#)).

## 2.2. Education in Ghana

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The 2008 Education Act<sup>1</sup> is the organising document for the education sector. It establishes the National Inspectorate Board (now known as the National Schools Inspectorate Authority), the National Teaching Council, and the National Council for Curriculum and Assessment and tasks each with a role in ensuring accountability in the education system.

### 2.2.1. Education system governance

The Ministry of Education (MoE) is responsible for planning, formulating, and monitoring the policies that give overall direction to the education sector. There are 22 agencies under the MoE leading the administration of subsectors. Key agencies include the following:

- **Ghana Education Service (GES)**, the largest of the 22 agencies, implements pre-tertiary policies and programmes.
- **Ghana Tertiary Education Commission (GTEC)** formally known as the **National Council for Tertiary Education (NCTE)** oversees policies and programmes at the tertiary level.
- **The Complementary Education Agency (CEA)**, formerly the Non-Formal Education Division, administers the delivery of non-formal education.
- **The Special Education Division (SPED)** within GES is responsible for administering inclusive and special education.

Ghana's education system has three levels: basic, second cycle (or secondary), and tertiary education:

1. Basic education consists of two years of kindergarten, six years of primary, and three years of junior high school (JHS).
2. Secondary education comprises three years of either academic programmes (senior high school), technical and vocational programmes, or apprenticeship.
3. The tertiary level includes Colleges of Education (CoEs), universities, technical universities (formally known as polytechnics), and other degree and diploma awarding institutions.

At the basic and secondary levels, schools are categorised into private (owned and managed by individuals, organisations or religious bodies) or public (owned and run by the government). Although private education in Ghana is

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<sup>1</sup> Parliament of the Republic of Ghana (2008), as available at <https://sapghana.com/data/documents/Education-Act-778.pdf>

growing, public primary, junior high, and secondary high schools make up the majority of schools in the country. Per-student spending varies across the different administrative regions and correlates with the regional distribution of poverty – the poorest regions of the country also have the most educationally deprived districts (↑[Ministry of Education, Ghana, 2018a](#)). Table 2 contains key education service delivery indicators at the basic and secondary levels.

**Table 2.** *Key education service delivery indicators at the basic and secondary levels.*

<b>Pre-primary</b>	Percentage of children aged 36–59 months attending an early childhood education programme	68%
	Institutions (kindergarten)	Total: 20,960 Public: 7,132 Private: 13,828
	Teachers (kindergarten)	Total Public: 37,147
<b>Primary</b>	Net attendance rate for children of primary school age	81% (2018)
	Institutions	Total: 21,309 Public: 14,405 Private: 6,904
	Teachers	Total Public: 96,715
<b>Junior high school</b>	Net attendance rate for children of junior high school age	41% (2018)
	Institutions	Total: 13,840 Public: 9,445 Private: 4,395
	Teachers	Total Public: 77,239

<b>Senior high school</b>	Net attendance rate for children of senior high school age	20% (2018)
	Institutions	Total: 863 Public: 562 Private: 301
	Teachers	Total Public: N/A
<b>Education infrastructure</b>	Electricity	<ul style="list-style-type: none"> <li>■ 25% of primary schools have electricity</li> <li>■ 49% of junior high schools have electricity</li> <li>■ 78.6% of senior high schools have electricity</li> </ul>
	Internet for teaching and learning	<ul style="list-style-type: none"> <li>■ 8.4% of primary schools have internet for teaching and learning</li> <li>■ 18.7% of junior high schools have internet for teaching and learning</li> <li>■ 39.4% of senior high schools have internet for teaching and learning</li> </ul>
	Computers for teaching and learning	<ul style="list-style-type: none"> <li>■ 3.5% of primary schools have computers for teaching and learning</li> <li>■ 13% of junior high schools have computers for teaching and learning</li> <li>■ 34.9% of senior high schools have computers for teaching and learning</li> </ul>
	Mobile phones	<ul style="list-style-type: none"> <li>■ 97% of urban households have access to a mobile phone</li> </ul>

- 88% of rural households have access to a mobile phone

### Education financing

Expenditure on education

In 2017, education expenditure as a percentage of total government expenditure was 28.9 per cent.

Adapted from Ghana country scan, Ghana (GHA) — Demographics, Health & Infant Mortality, (↑[UNICEF, 2018](#)) & Education Sector Performance Report (↑[Ministry of Education, Ghana, 2015](#))

Despite government efforts to increase access to basic and secondary education, learning outcomes at the basic and secondary levels remain low for reasons that include inadequate teaching and learning materials and a shortage of classrooms. Low-quality teacher development and weak teacher management – absenteeism was as high as 14% in 2014 / 2015 – are additional contributing factors (↑[Ministry of Education, Ghana, 2018b](#)). Furthermore, the lack of quality and timely data on student learning outcomes in the education management information system (EMIS) makes it challenging to assess progress and correct what is not working (↑[World Bank, 2019a](#)).

Disparities in learning outcomes are high in poor and marginalised communities and among girls. The estimated population of out-of-school children at 450,000 is high, especially in the more impoverished northern regions of the country (↑[Ministry of Education, Ghana, 2018b](#)). In particular, a lack of quality and complete data about students with special educational needs and disabilities (SEND) hampers the MoE's ability to serve those students.

### 2.2.2. Reform priorities

Ghana's third Education Sector Strategy Plan 2018–2030 outlines an ambitious reform agenda for improving learning outcomes and ensuring equitable access to education for all learners. The MoE has prioritised accountability, management, and coordination across the sector to achieve these reform objectives (↑[World Bank, 2019a](#)). The newly created delivery unit known as the National Education Reform Secretariat is coordinating these priorities. The Reform Secretariat has also been charged with coordinating ICT in education reforms aimed at improving learner competencies, enhancing the use of technology in education management, and transforming teacher development and tertiary education (↑[Ministry of Education, Ghana, 2018b, p.117](#)).

## 2.3. Impact of COVID-19

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The Government of Ghana (GoG) announced the closure of all schools, colleges, and universities on March 16, 2020, affecting approximately 9,253,063 learners between pre-primary and secondary education levels ([UNICEF, 2020](#)). The MoE and GES introduced several measures to maintain learning for students, including developing radio and TV content for learners across all levels of the education system, a public awareness and health and safety communications campaigns targeting 21,000 out-of-school children, rollout of the iCampus and iBox learning portal for senior high school students, and a partnership with MTN Ghana and Vodafone to zero-rate digital online content. Radio-based education included Sabre Home Learning Radio (early childhood education for rural and peri-urban children).

Despite these measures, the Ghana RECOVR panel survey conducted in May 2020 found that only 64% of primary and 57% of secondary school children were spending time on education at home since schools were closed ([Innovations for Poverty Action, 2020](#)). Households reported that children were spending only an average of 5.9 hours per week on education for reasons that include a lack of adult supervision, lack of support from teachers and schools, and low motivation. And most households (60%) indicated that students were using their own learning materials at home rather than books provided by the school, Ghana Learning TV, or online educational content.

As of January 2021, schools in Ghana have reopened with health and safety protocols in place and guidelines distributed to all schools ([UNICEF, 2021](#)).

### 3. The texture of the EdTech research landscape

This section provides an overview of the existing research landscape in relation to EdTech in Ghana. Research into education in Ghana is a growing field. The country is one of the most prominent in the Education in Sub-Saharan Africa (ESSA) database of educational research, with over 460 results<sup>2</sup>. Furthermore, analysis of the ESSA database shows that Ghana (along with Ethiopia, Kenya, Tanzania, and Uganda) sits within the top countries in Sub-Saharan Africa that have produced scholarly outputs in collaboration with researchers based outside Sub-Saharan Africa (↑Asare, et al., 2020). The characteristics of this research are summarised below. This literature analysis also informs the discussion of some key authors and major projects in Section 4, and studies which align with the Hubs' immediate priorities for future research are considered in Section 5.

A strategic approach was adopted to search for published EdTech research. Given that 'EdTech' is an umbrella term which comprises a wide range of individual terms, approaches and technologies, and their synonyms, searches were conducted with a primary focus on 'Ghana'. The search strategy included four aspects:

1. Initial searching of key EdTech research documents for Ghana-focused studies. This included existing reviews of EdTech studies in low- and middle-income countries (LMICs) (for example, ↑Rodriguez-Segura, 2020), evidence reviews, and EdTech Hub publications. The Hub's bibliographic database containing over 21,000 items was also searched for research undertaken in Ghana.
2. Searching specialist education research databases (ESSA, Academia.edu, ResearchGate) for Ghana-focused work and selecting those which met the eligibility criteria (publication since 2007; English-language; focusing broadly on 'EdTech'; research conducted in and with a focus on Ghana [including by researchers based outside of Ghana]; focus on school-aged learners, teachers, or aspects of the educational system relevant to school-aged learners).
3. Automated searches of general academic databases (Google Scholar, ProQuest Education) for 'Ghana' and a range of EdTech-related terms (see Annex A).

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<sup>2</sup> <https://essa-africa.org/AERD> (search undertaken on 1st March 2021).



4. Snowballing searches for further articles from authors identified as prominent in the literature, in addition to generic search engine searches to identify further potentially relevant information or 'grey literature'.

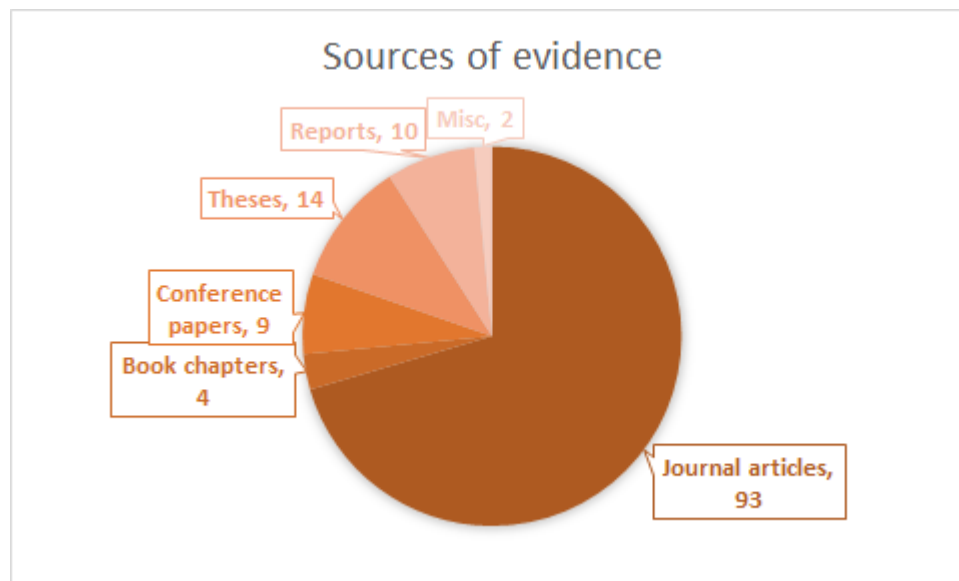
While it is not possible to guarantee that the search results are exhaustive given the wide range of technologies and approaches that can be considered 'EdTech', a level of saturation was considered to have been reached when implementing the search strategy as continued searches did not produce further results meeting the criteria. Thus, although this approach stops short of being a 'full' systematic review (not least because it was undertaken in a relatively short period of time), the sample is considered to offer an accurate representation of the EdTech research literature focused on school-aged learners, teachers, or aspects of the educational system relevant to school-aged learners in Ghana.

Articles identified through the search process were read in full, and information about those which met the search criteria were entered into a spreadsheet, mapping their characteristics to a pre-defined 'research landscape index' (RLI) framework. 132 articles were entered into the RLI. Categories within the RLI included: bibliographic information; authors; institutions; funders; research methods; sample size; study topic; and relevant Hub thematic area. Within each category, included literature was categorised in relation to some of the most promising 'high-potential evidence gaps' (HPEGs) identified by EdTech Hub (see Annex B for a description of these).

The bibliographic information for all included studies and the RLI spreadsheet can be found [here](#). Articles were characterised as representing country-led (that is, carried out by Ghana's academic institutions and research organisations; n=91) or internationally-led research (that is, carried out by international academic institutions and research organisations; n=41). Overall, 117 empirical studies were identified, consisting of 61 quantitative studies, 32 mixed-methods studies, and 24 qualitative studies. A further 15 theoretical pieces were included, mainly composed of book chapters, reports, and desk-based reviews.

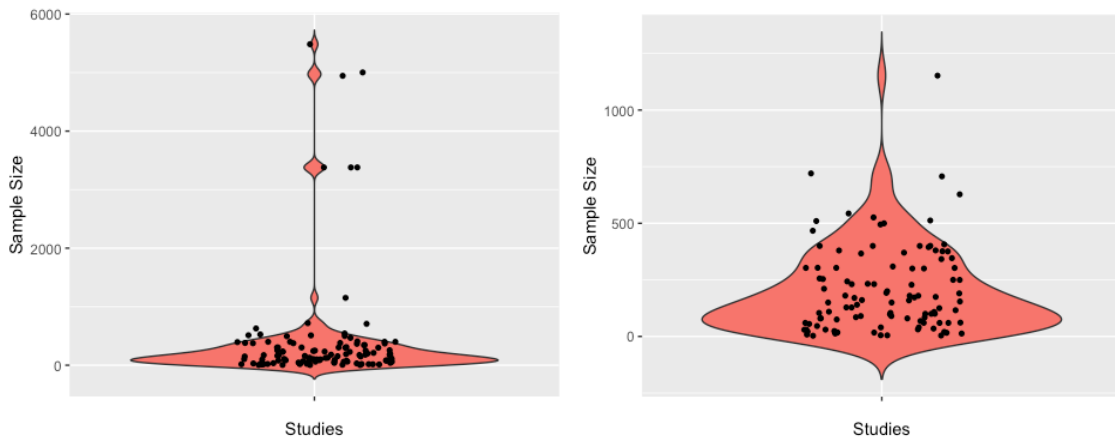
The searches revealed that a focus on EdTech has been an active area for academic research in Ghana. The 132 articles selected for inclusion in the review comprised mainly journal articles (n=93), book chapters (n=4), conference papers (n=9), reports (n=10), and Master's and PhD dissertations (n=14). Two miscellaneous items (one news article and one blog) were also included as they describe relevant educational technology projects. Figure 1

shows the relative proportions of each type of evidence identified through the search.



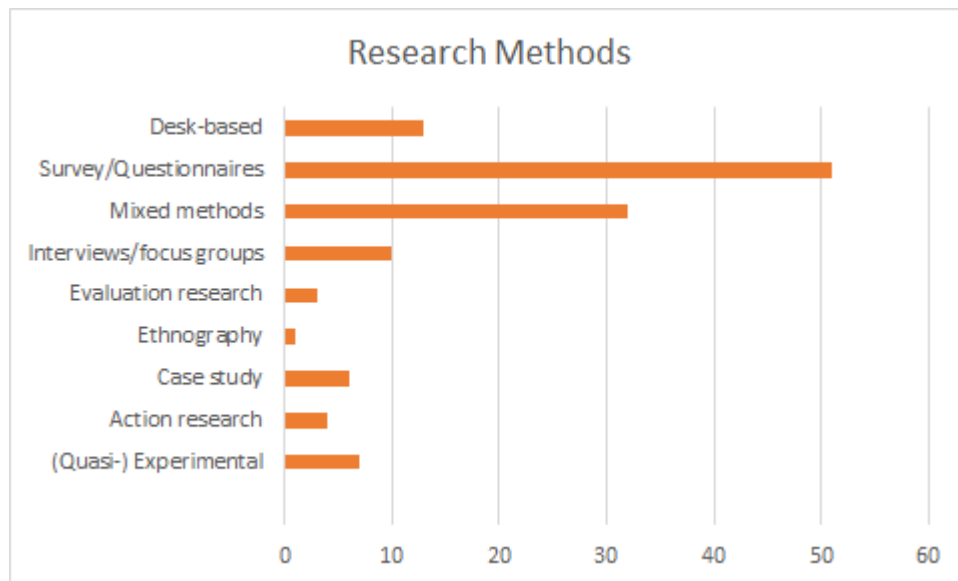
**Figure 1:** A pie-chart showing the relative proportions of the types of evidence sources included in the review.

The number of participants involved in research varied considerably. For instance, a minimum of five participants were involved in an ethnographic Master's study exploring the ways in which student teachers participate in digital literacy learning experiences to support their professional development ([Taner, 2018](#)). Meanwhile a study of 5,485 primary school learners examined the impact of a programme that broadcasts live instruction via satellite to 70 rural primary schools ([Abilimi & Adu-Manu, 2013](#)). Overall, given the high number of journal articles identified in the review, including many in journals recognised internationally, the quality of most identified research can be characterised as good. Note, however, a thorough critical appraisal of the quality of included studies has not been carried out (as would normally be the case during a full systematic review). Authors and projects are discussed in Section 4. The topics of research are considered in Section 5. In Figure 2, the distribution of sample sizes of studies included in the review are presented.



**Figure 2:** Violin plots with scatters depicting the full distribution of sample sizes of studies included in the scoping review. The right-hand plot represents the studies with 0 to 1500 participants for clearer visualisation.

In terms of research methods, most studies employed surveys and questionnaires (n=51) or mixed methods designs (for example, featuring questionnaires and interviews as the primary data collection tools; n=32). A small number of studies employed experimental designs (n=7). Figure 3 shows the frequency of the methods used in the articles included in the research review.



**Figure 3:** Frequency of research methods in the articles included in the literature review.

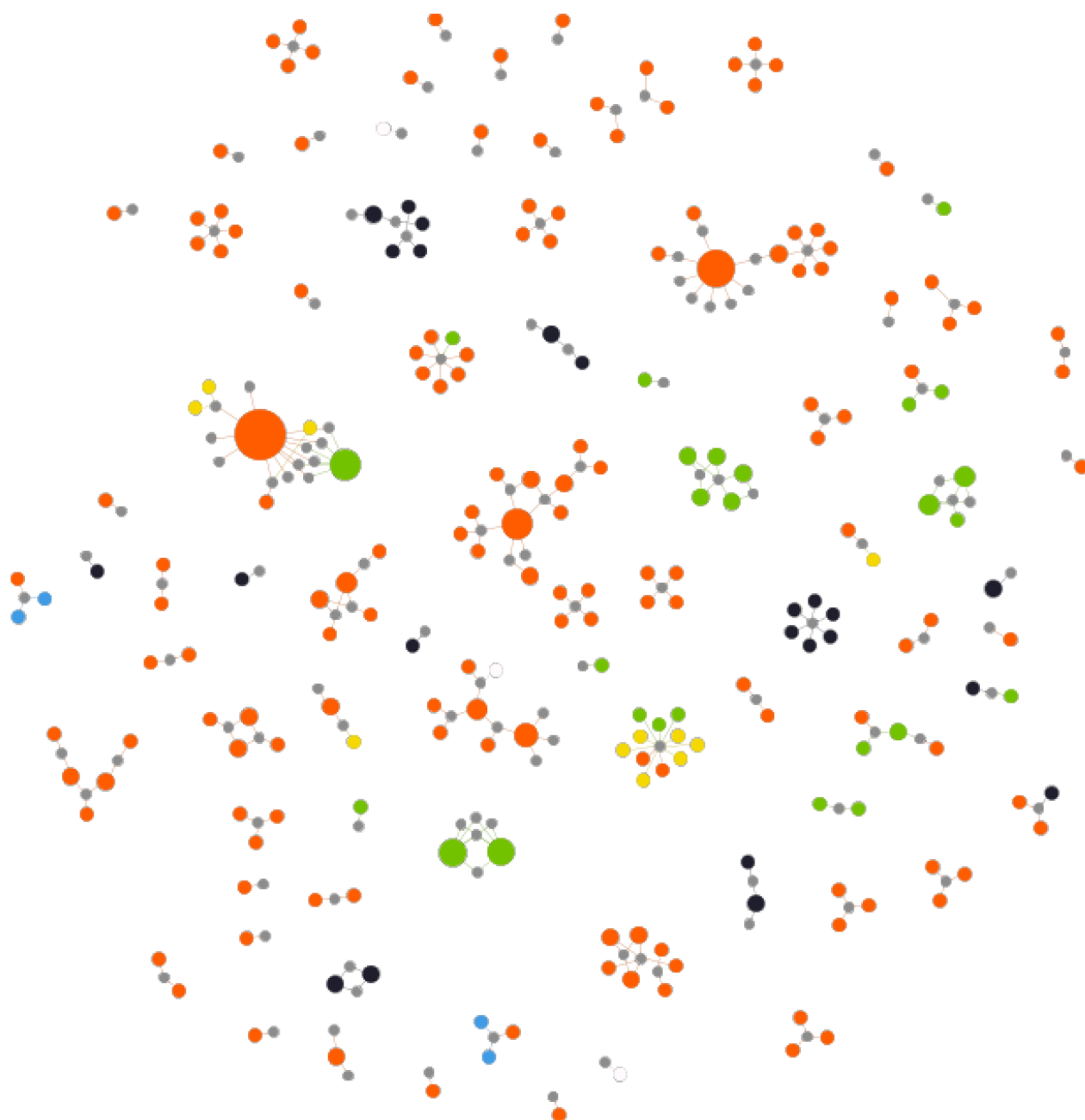
## 4. The key stakeholders within the EdTech research landscape

This section provides an overview of some of the individuals and organisations with interests in relation to EdTech research in Ghana. This information is not intended to be exhaustive. For instance, researchers who have not published in outlets indexed by the databases searched, or who are working on EdTech projects which have not yet reached the publication stage, may not be included. Furthermore, the inclusion criteria for the literature review limited the search to EdTech in the context of school-aged learners, teachers, or aspects of the educational system relevant to school-aged learners; this would also exclude Ghana-based academics with EdTech research interests in relation to higher education (HE), which, anecdotally, we observed as an active area for academic research<sup>3</sup>.

The literature search is subject to publication biases and although the search strategy was intended to be as inclusive as possible, searches may not be comprehensive. Nonetheless, the authorship of the articles included in the literature review is one way of exploring the academic research community with interests related to EdTech in the context of school-aged learners and teachers in Ghana. Figure 4 depicts a co-authorship network of links between papers and their authors, within the reviewed literature.

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<sup>3</sup> Searches for research on ICT in the Ghanaian context revealed how the volume of higher education-related research indexed on the African Education Research Database (<https://essa-africa.org/AERD>) was broadly comparable to, if not more substantial than, that focusing on school-aged learning and teaching only.



**Figure 4:** Co-authorship network of all papers included in the literature review. Links connect authors (coloured nodes) to articles (grey nodes). Node size is scaled according to the number of articles authored in the sample. Authors based in Ghana (148) are shown in orange; in Europe, green (26); in North America, dark blue (25); in Asia, light blue (4); and in other African countries, yellow (11). Authors who were not clearly associated with a particular location are shown in white.

The remainder of this section provides an overview of some of the key stakeholders that emerged primarily from the research literature review and communication with six experts and contacts associated with the EdTech Hub with an interest or an expertise in Ghana. The political economy analysis was

also informed by discussions with four experts. The section is arranged according to three sub-sections: first, academics undertaking research based in Ghana; second, major EdTech projects; and third, research organisations with interests related to EdTech research in Ghana.

## **4.1. Leading academics and independent researchers**

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The collection of research literature introduced in Section 3 included authors from across 27 HE institutions in Ghana (shown as orange nodes in Figure 4). The full list of institutions is shown in Annex C. The University of Cape Coast is the most frequent affiliation (22 of the 87 studies authored by Ghanaian-based authors) with University of Education (15 of the 87), University of Ghana (7 out of 87), and Pentecost University College (7 out of 87) featuring highly also.

### **4.1.1. Professor Douglas Darko Agyei (University of Cape Coast)**

<https://directory.ucc.edu.gh/p/douglas-darko-agyei>

Professor Agyei is an Associate Professor at the Department of Mathematics and ICT Education at the University of Cape Coast. He is also the Dean of the Faculty of Science and Technology Education. He specialises in ICT in Education especially within mathematics education. His expertise includes educational / instructional technology in addition to technological pedagogical content knowledge (TPACK) and technology in mathematics education. In 2014 he was awarded a Best Paper Award from the Society for Information Technology and Teacher Education (SITE). Prof. Agyei has also acted as a consultant on various national and international educational technology projects.

### **4.1.2. Dr Charles Buabeng Andoh (University of Education, Winneba, Ghana)**

<https://www.uew.edu.gh/>

Dr Charles Buabeng Andoh is currently a Senior Lecturer at the Department of ICT Education, University of Education, Winneba, Ghana. He holds PhD in IT, MSc in Computing, BSc in Physics and Diploma in Education. He has published at least 20 articles in Educational Technology in both local and international journals. His research interests are in the area of new technology and education. He is also interested in the application of Structural Equation Modeling and other statistical tools in connection with the above research areas.

#### **4.1.3. Dr Patrick Ohemeng Gyaase (Catholic University of Ghana)**

[http://www.cug.edu.gh/Staff\\_pro/gyaase.php](http://www.cug.edu.gh/Staff_pro/gyaase.php)

Dr Gyaase is Dean and Senior Lecturer in the Faculty of Information Communication Sciences and Technology at the Catholic University of Ghana. His research interests cover ICTs for Development, including e-learning. Along with colleagues such as Samuel Adu Gyamfi, examples of research undertaken include gauging e-readiness for the integration of ICT and the design of blended learning environments for pre-service teachers.

#### **4.1.4. Dr James S Quaicoe (Tallinn University)**

<https://www.tlu.ee/en/node/106726>

Dr Quaicoe is a Research Fellow at Tallinn University (Estonia). He served previously as the Assistant Director of Education in the GES and the British Council Digital Ambassador for the Sekondi-Takoradi Metro Education Office. His research interests include Teacher Education and ICT use in schools (Digital Divide, Social Technical Transitions and School Digital Learning Ecosystems).

#### **4.1.5. Rita Yeboah (University of Ghana)**

<https://www.ug.edu.gh/staff/yeboah-rita>

Dr Yeboah is a Lecturer at the Department of Teacher Education, School of Education and Leadership, University of Ghana. Her research focuses on the design of instructional resources, educational technology (game-based learning and flipped classrooms), teacher education and professional development, and education and sustainability.

### **4.2. EdTech research projects**

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#### **4.2.1. Making Ghanaian Girls Great! (MGCubed) Project**

<https://hundred.org/en/innovations/making-ghanaian-girls-great-mgcubed#82d3c967>

The MGCubed project aims to support marginalised girls and children with disabilities in two regions of Ghana. Using solar-powered and satellite-enabled distance learning infrastructure to deliver interactive learning sessions to students, teachers, communities, and government officials, it aims to sustainably improve literacy and numeracy learning outcomes and support the transition from primary to secondary school. An independent external evaluation indicated large and significant positive impact on students'

numeracy skills as well as improvement in girls' confidence and beliefs regarding gender norms<sup>4</sup>. MGCubed builds on the first phase of the project (GEC1), which ran from 2013–2016. The project was designed and delivered by the Varkey Foundation from its inception until October 2019, at which point the management of the project was transferred to Plan International UK.

#### **4.2.2. Mobile School Report Card (mSRC) research project <https://www.msrgghana.org/>**

The mSRC is an Android-based mobile phone application developed in 2014 with the aim to replace the paper-based School Report Card (pSRC) used since 2011 to collect information about the teaching and learning environment in basic schools in Ghana (↑Abdulai, et al., 2018). The mSRC provides a digitised end-to-end process for collecting real-time data concerning pupils, teachers, resources, and overall management at school level. A large-scale research project conducted in 2017 / 2018 – covering seven districts from across six regions – was commissioned by UNICEF to explore the functionality and use of mSRC in decision-making within the education management structure. The findings of the evaluation of mSRC are explored further in Section 5.

#### **4.2.3. STEM/STEAM project**

<https://ghanasteamedu.intelitek.com/login/index.php>

The STEM/STEAM project is an initiative through the MoE executed by Protogroup to provide Science, Technology, Engineering, Arts and Mathematics (STEAM) centers, Educational Kits, Training & Curriculum in STEAM education across all the regions in Ghana. Although major aspects of the project have to do with the construction of STEAM centers and the supply of educational kits, there is an EdTech aspect which introduces Basic school/second cycle students to the use of Learning Management System and Cyber Robotics Coding by the CoderZ: an innovative and fun learning platform for student's worldwide which uses 3D simulated robot to engage students. This project is still ongoing.

#### **4.2.4. Worldreader iREAD 2 Ghana**

<https://www.worldreader.org/where-we-are/ghana/>

iREAD was designed by Worldreader and aimed to address the lack of reading materials for and low literacy levels of early primary school students in Ghana. The intervention provided culturally and age appropriate reading materials via e-readers and delivered effective teaching practices and activity-based

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<sup>4</sup> <https://www.varkeyfoundation.org/what-we-do/programmes/making-ghanaian-girls-great> (Accessed 15th March 2021).



learning opportunities. Building on the iREAD pilot (2010–2011), launched in 2013, the study evaluation reported significant improvements in oral reading fluency, reading comprehension gains, significant impact among low-performing students, and the development of positive reading habits<sup>5</sup>.

### **4.3. Academic institutions, research centres, and independent organisations working in education and EdTech**

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The academic affiliation of Ghana-based authors included in the review are available in Annex C. In the remainder of this subsection, details of prominent research centres, hubs, and independent organisations working in education and EdTech are outlined.

#### **4.3.1. Transforming Teaching, Education & Learning (T-TEL) <https://www.t-tel.org>**

Transforming Teaching, Education & Learning (T-TEL) is a Ghanaian not-for-profit organisation established in 2020. It builds on a six-year FCDO-funded project to strengthen education in Ghana (2014–20) that sought to transform pre-service teacher education in Ghana by improving the quality of teaching and learning in relevant national bodies, institutions, and all 40 CoEs. Part of T-TEL's work featured developing insights into how EdTech (for example, mobile technology such as tablets<sup>6</sup>) can increase access to information on quality education, support effective teaching and learning, and enable communities of practice among tutors<sup>7</sup>. T-TEL was also involved in establishing a Virtual Learning Taskforce for Teacher Education to minimise educational disruption caused by Covid-19<sup>8</sup>.

#### **4.3.2. Participatory Development Associates <https://pdaghana.com/>**

Based in Ghana, Participatory Development Associates (PDA) aims to support processes of empowerment and self-determination in communities,

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<sup>5</sup> [https://reliefweb.int/sites/reliefweb.int/files/resources/iREAD-2\\_web.pdf](https://reliefweb.int/sites/reliefweb.int/files/resources/iREAD-2_web.pdf) (Accessed 15th March 2021).

<sup>6</sup>

<https://www.t-tel.org/files/docs/Learning%20Hub/Teacher%20education%20policy%20and%20institutional%20development/Policy%20Briefing%20007-%20TECHNOLOGY-SUPPORTED%20INNOVATION%20IN%20EDUCATION%20final.pdf> (Accessed 15th March 2021).

<sup>7</sup> <https://www.mottmac.com/en-US/article/13183/transforming-teacher-education-and-learning> (Accessed 15th March 2021).

<sup>8</sup>

<https://www.t-tel.org/news-view/ghanas-teacher-education-system-and-responding-to-covid-19> (Accessed 15th March 2021).

organisations, and individuals. Their approach is to work to enable people to reflect, to learn, and to act, thus bringing about a transformation in their present situation (for example, through their 'Phonics by Phone' programme). Recent publications include examining the role of EdTech as a response to Covid-19 in Ghana (↑[Agbe & Sefa-Nyarko, 2020](#)).

### **4.3.3. Innovations for Poverty Action (IPA) with Mowva Technologies and the University of Pennsylvania, Imperial College London and the Institute of Statistical, Social and Economic Research**

<https://www.socialscienceregistry.org/trials/6118>

Funded by the World Bank Strategic Impact Evaluation Fund (SIEF) as part of its Covid-19 emergency window, this randomised control trial will test the impact of SMS messages to suggest activities that (i) promote social-emotional development at home and (ii) encourage engagement with remote instruction. Outcomes will relate to parental engagement with schooling and learning at home, perceptions around girls' education, time use, and aspirations and expectations. The project (titled '*Nudges to improve learning and gender parity: Supporting parent engagement and Ghana's educational response to Covid-19 using mobile phones*') is a collaboration involving researchers who have partnered with IPA and Mowva Technologies. The Primary Investigators are Sharon Wolf, Isaac Osei-Akoto and Elisabetta Aurino.

### **4.3.4. OpenSTEM Africa: Ghana**

<http://www.open.ac.uk/about/international-development/projects-and-programmes/openstem-africa>

Launched in 2019, OpenSTEM Africa: Ghana supports the effective teaching and learning of practical science in senior high schools in Ghana by: creating a Virtual Lab of practical science apps, which helps provide more opportunities for learners to engage with practical science; professional development for teachers to develop effective ICT-based teaching and learning approaches; and professional support for heads of science to help improve the experiential teaching and learning of the practical science syllabus. Working with the Centre for Distance Learning and Open Schooling (CENDLOS), key practical science apps have been mapped to the Ghanaian curriculum and are being co-developed to provide up to 100 interactive online virtual experiments. The science apps will benefit up to 148 schools with the local iBox server and up to 1.2 million senior high school students and staff via the internet.

#### **4.3.5. Open Learning Exchange (OLE) Ghana**

<https://www.educationinnovations.org/p/open-learning-exchange-ole-ghana> & <https://www.ole.org/our-approach-learn-more/>

For over 10 years, OLE Ghana has sought to support existing in-country and global efforts at promoting quality education by employing ICTs to facilitate learning. These alternatives are based on low-cost yet robust technology, which has little dependency on the internet as well as having low power consumption. OLE Ghana uses methods to collect usage data for analytics via dashboards. Projects include the VSO / SNF-funded Teacher Empowerment through Technology and Support (TEST) Trials (2016 / 2017); Worldvision Ghana Technology in Reading project (see above); Ghana Reads, sponsored by the All Children Reading Partners (2012–2014); Ghana Learning Innovation Teams for Education (Ghana LITE) ‘Model Project’ (2010–2011); TeacherMate Trials (2011–2012).

#### **4.3.6. Impact(ed) International (formerly Discovery Learning Alliance) <http://www.impactd.org/>**

Launched by Discovery Communications in 1997, Impact(Ed) International has opened new doors to education in 16 countries, reaching millions through schools, broadcast television, and mass media initiatives in the developing world. This includes initiatives based in Ghana.

#### **4.3.7. Savana Signatures <https://savsign.org/>**

Savana Signatures are an impact organisation based in Ghana. Their mission is to initiate positive change among youth, women, and vulnerable populations of Ghana using innovative solutions to facilitate access to quality education and skills development.

#### **4.3.8. The Ghana Accountability for Learning Outcomes Project (GALOP)**

<https://projects.worldbank.org/en/projects-operations/project-detail/P165557>

Approved in October 2019, the purpose of the Ghana Accountability for Learning Outcomes Project (GALOP) is to improve the quality of education in low-performing basic education schools and strengthen education sector equity and accountability in Ghana. It is possible that EdTech may play a

potential role in helping to address some aims of this five-year initiative. See also: <https://righttoplay.com/en/countries/ghana/>

#### **4.3.9. One Laptop Per Child Project (OLPC)**

<https://www.onelaptopperchild.org/>

One Laptop Per Child (OLPC) is an initiative that seeks to improve the access to and use of technology in poor and rural areas of the world, mainly targeting underprivileged children. Ghana signed a first agreement with OLPC to purchase 10,000 XO laptops delivered in 2009 as the government aimed to enhance the usage of computers in schools. The project was overseen by the MoE.

#### **4.3.10. The School Connectivity Project**

<http://gifec.galebs.com/project-details/tech-drones-lansman/>

The School Connectivity Project involves the provision of high-speed computers, printers, scanners, projectors, and servers to educational institutions. These institutions are also connected to the internet for at least two years. It was one of several projects undertaken through the Ghana Investment Fund for Electronic Communications (GIFEC) agency to facilitate the spread of ICT and its use in (rural) Ghana.

#### **4.3.11. Ashesi University Ghana**

<https://www.ashesi.edu.gh/>

Ashesi was established as an independent, public benefit education institution operating on a not-for-profit basis. It obtained accreditation from the National Accreditation Board in 2001 to operate under the mentorship of the University of Cape Coast. Ashesi received a Presidential Charter, effective 2018, making it an independent university. Offered courses increasingly focus on innovative education that is better suited to life and work in the 21st century (including relating to educational technology<sup>9</sup>).

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<sup>9</sup>

<https://www.ashesi.edu.gh/stories-and-events/2544-bridging-technology-gaps-for-the-visually-impaired.html> (Accessed 15th March 2021).

### 4.3.12. The Mastercard Foundation's Centre for Innovative Teaching and Learning in ICT

<https://mastercardfdn.org/all/centre-for-innovative-teaching-and-learning-in-ict/>

By working with EdTech entrepreneurs and governments, the Centre for Innovative Teaching and Learning in ICT aims to support entrepreneurs and scale up technology innovations to improve teaching and learning in secondary education. In 2020, three of the Centre's first cohort of EdTech Fellows were based in Ghana:

- **AkooBooks Audio, Ghana** (<http://www.akoobooks.com/>): AkooBooks Audio is a platform and experience provider that transforms African books into engaging audiobooks that are accessible on mobile phones.
- **Eneza Education, Ghana** (<https://enezaeducation.com/ghana/>): Eneza Education provides learning and revision materials via SMS/USSD on basic feature phones.
- **Chalkboard Education, Ghana** (<https://www.chalkboard.education/>): Chalkboard Education offers low-tech software and services for institutions to create and track training programs on mobile devices, without an internet connection.

### 4.3.13. Other organisations and EdTech start-ups

A growing number of EdTech-related companies are operating in Ghana, for instance, The Khalmax Robotics Project (<http://khalmaxsoftwaresystems.com/>), which was a finalist in the 2020 MEST Africa Challenge. Khalmax seeks to empower African students with engineering skills by training them to create and build robots from scratch to solve daily societal problems as well as learning to apply classroom lessons in solving problems around them.

There is also evidence that some EdTech initiatives initiated in higher-income countries are beginning to operate in the Ghanaian context (for example, Teacher Tapp: <https://teachertapp.co.uk/ghana/>).

Over time, this burgeoning field will likely lead to new opportunities for collaboration and the generation of new research insights. Details of some of the EdTech startup companies currently operating in Ghana are available online<sup>10</sup>.

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<sup>10</sup> <https://startupfacility.com/all-edtech-eduteh-startup-companies-in-ghana/> (Accessed 15th March 2021).

## 5. Summary of the academic evidence on EdTech

The purpose of this section is to provide an overview of existing evidence and to highlight potential opportunities for future research. Drawing on the RLI framework discussed in Section 3, the literature is thematically analysed and organised into five research topics of interest to EdTech Hub:

1. Technology to support personalised learning and teaching at the level of the student;
2. (In-service) teacher professional development, structured pedagogy, and technology;
3. Technology to advance data-use and decision-making in education;
4. Technology to promote access and participation in school;
5. Girls' education and technology.

Within each topic, where appropriate, existing research is broadly considered in relation to three thematic areas: learners, teachers, and systems. The reported synthesis is intentionally — and necessarily (given the constraints of the scoping review methodology) — 'high level'. It intends to provide an accessible summary of existing evidence to inform educators, policymakers, and donors. Annex D provides an overview of the assigned HPEGs and their frequencies. Bibliographic details of all included studies and detailed coding according to the HPEGs can be found [here](#).

### 5.1. Technology to support personalised learning and teaching at the level of the student

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Research suggests using technology to support personalised learning can be effective in increasing learner access to education, enabling targeted instruction by students' learning level, and reducing the negative effects of high teacher–learner ratios (↑[Major & Francis, 2020](#)). As with most LMIC settings, however, in Ghana there is currently a lack of rigorous evidence for how technology can be used most effectively to personalise learning to the right level in an effective, cost-effective, and contextually appropriate way.

Several studies (n=4) broadly consider the role of technology in supporting personalised learning or instruction in Ghana. This includes involving self-instructional software to enhance fundamental ICT usage skills of Basic School learners (↑[Asare & Leticia, 2020](#)) and measuring the effect of a culturally

responsive learning environment for high school computing education ([↑Anohah & Suhonen, 2016](#)). Research on the OLPC initiative is also reported ([↑Ezumah, 2012](#)).

In the context of research in LMICs, terms including *computer-assisted learning*, *computer-aided learning*, *computer-aided instruction*, and *intelligent / cognitive tutoring systems* have been used interchangeably to describe interventions that may personalise learning ([↑Major & Francis, 2020](#)). Such evidence is relatively limited in the Ghanaian context. However, [↑Korsah, et al. \(2010\)](#) report on a four-month controlled field pilot to investigate the viability and effectiveness of an automated reading tutor in enhancing the literacy skills of urban children. This study demonstrates how automated tutoring holds significant promise for helping children improve their reading. For such an approach to be sustainably implemented in low-resource contexts, however, it is identified that a range of challenges need to be addressed (for example, relating to resource constraints, lack of technical expertise, and infrastructure). While undertaken over a decade ago, similar messages continue to be espoused by recent research that examines the role technology-supported personalised learning in LMICs ([↑Kaye & Ehren, 2021](#)).

Again consistent with the wider body of EdTech research in LMICs, an examination of teachers' role in making technology-supported personalised learning effective as part of their everyday practice has also received limited attention in Ghana — although some studies do explore how participatory design approaches involving stakeholders may boost technology adoption ([↑Ezumah, 2012](#)). Exploring the role of technology in supporting personalised learning is an area of major technical interest and significant financial investment from the education community. There is currently, however, a lack of rigorous evidence for how technology can be used most effectively to personalise learning to the right level in an effective, cost-effective, and contextually appropriate way. The limited evidence base in Ghana suggests there is an important need to examine teachers' role in making technology-enabled personalised learning effective as part of their everyday practice given the paucity of existing research. This is in addition to there being significant potential to explore whether (and if so, how) personalised approaches that feature technology adapting or adjusting to learners lead to better learning outcomes.

Although ICT's potential to assist in closing digital divides has been examined in Ghana (for example, [↑Steeves & Kwami, 2012](#)), Section 5.4 discusses how little research has investigated SEND and educational access. People with disabilities are highly marginalised, both in terms of policy and practice, but

technology may help improve their (personalised) learning opportunities and school access and participation ([↑Nkansah & Unwin, 2010](#)).

## **5.2. (In-service) teacher professional development, structured pedagogy, and technology**

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Teacher quality is one of the most important determinants of learning outcomes at school level. For instance, many teachers are often either unqualified, or unsupported by good quality professional development. Research on teachers professional development (TPD), and integration of technology into their pedagogy, is mainly focused on the following areas in Ghana: Teachers technology adoption (n=75), teacher agency and needs (n=67), blended approaches to teacher development (n=15), teacher management and progression (n=10), and facilitators and coaches (n=5). Note, these categories are not mutually exclusive and in some cases included articles related to one or more of these areas (for instance, many examine both teachers' needs and technology adoption and are considered together).

A large number of studies (n=78) explored teachers' needs and adoption of technology in their classroom practice. Almost a third (n=27) focused on pre-service teachers' training, technology adoption and perceptions in universities and COEs (for example, [↑Osei Frimpong, et al., 2019](#); [↑Gyamfi, 2017a](#); [↑Gyamfi, 2017b](#)). The remainder focus on pre-school, primary school, basic schools, second cycle schools, and high schools. Lack of ICT knowledge, weakness of content development, and poor network infrastructure and resources feature as the most prominent teacher needs and barriers in adopting technology. The following paragraphs will highlight such studies from different educational levels (primary schools, basic schools, early years, and secondary schools).

Approximately 15 studies focused on ICT as a subject, including how ICT teachers integrate technology into their teaching. For instance, a survey reported by [↑Acquah \(2012\)](#) was randomly administered to 63 public primary schools in the Cape Coast metropolis. This revealed that although teachers had a broadly positive perception about the teaching of ICT in primary schools, ICT facilities in schools were identified to be largely inadequate for teaching an ICT curriculum. Teachers also expressed a preference for workshops as a means of in-service professional development in ICT teaching skills.

A recent study by [↑Amanor-Mfoafo, et al. \(2020\)](#) involving 108 basic school teachers examined their readiness to adopt e-learning practices as a response to the Covid-19 pandemic. This research highlighted that, while almost one fifth of teachers knew about e-learning, they did not feel prepared to integrate



this in their teaching practice. Moreover, almost half (45.1%) stated that internet access is a major problem and that IT infrastructure at their school cannot support e-learning (49.5%). Over 60% of teachers also stated that their school budget is not sufficient to support the use of e-learning. Authors recommend ongoing e-learning training sessions to help teachers become more familiar with online teaching methods and tools.

Despite the importance of having young children playfully explore technology and its uses ([↑Siraj-Blatchford & Siraj-Blatchford, 2006](#)) there is minimal research on technology adoption by Ghanaian early years educators. A study by [↑Asante \(2014\)](#), with 250 early years teachers, revealed a dispiriting picture of the technological resources available and early years teachers' background in ICT. Although teachers thought positively about the importance of ICT integration in the early years, 60% stated that they have no knowledge in ICT and 67% confirmed that they are not presently integrating ICT in their practice. Moreover, 19% stated that their school did not have any technological resources in their schools. These findings highlight the importance of upgrading the technological infrastructure of Ghanaian schools in addition to a need to invest in effective and up-to-date in-service TPD. The lack of research focusing on the education of early years learners suggests further studies are needed to identify teachers' needs and ways of integrating technology in the curriculum and practice.

Although the GoG recognises the importance and relevance of educational technology for improving learning and teaching, and finances ICT in secondary schools, teachers often seem unwilling to integrate it in their classroom practices ([↑Buabeng-Andoh, 2019](#); [↑Quaicoe, et al., 2015b](#)). [↑Buabeng-Andoh \(2019\)](#) surveyed 376 teachers from 24 public and private schools and reported that 34% of the teachers included in the study never use ICT and only 15% of the teachers use it daily, although the pedagogical use of it was low. Among the different reasons explored (for example, competence, access, self-efficacy, leadership support, perceived value, and expectation of success), training featured prominently, suggesting that teachers need more support and TPD courses on educational technology.

Pre-service and in-service ICT professional development is a growing area of research. Most of these studies focus on pre-service teachers. Professor Douglas Darko Agyei is a prominent figure in this area who has looked at how pre-service (and in-service) teachers adopt technology and whether training can improve their practice (for example, [↑Agyei, et al. \(2019\)](#)). Although most studies focused on technology adoption and technological needs, which could inform TPD interventions, few such efforts have been made.

Technology that can support new forms of teacher professional development has been highlighted as a way to improve access and quality in Ghana ([↑Taner, 2018](#)). However, most of the literature in the area of TPD focused on teacher training courses delivered by colleges of teaching (for example, [↑Wiafe, et al., 2020](#)) or universities (for example, [↑Wilson, et al., 2011](#)) that offer training in incorporating technology into classroom practice ([↑Wiafe & Akaadom, 2019](#)). Limited research has examined the role of educational technology in in-service TPD, which highlights the need for further research ([↑Agyei, 2015](#); [↑2021](#); [↑Tachie-Donkor & Dadzie, 2017](#)). Notably, [↑Agyei \(2015\)](#) evaluated the impact of an ICT instructional design element within a TPD programme and found that, although teachers' ICT skills were improved, this improvement did not transfer to their classroom practice. This finding is supported by a subsequent study ([↑Agyei, 2021](#)) that involved 4,945 in-service teachers from six Sub-Saharan African countries. The author suggests greater effort is needed at the school as well as TPD programmes to ensure a smoother transition from training to classroom practice. [↑Tachie-Donkor & Dadzie \(2017\)](#) also note that there is no in-service professional development in information literacy skills for teachers, recommending the Ghana Education Service introduce in-service teacher training in this skill. In-service TPD of ICT skills appears to be among the least explored topics in the EdTech literature in Ghana. Technology could provide the infrastructure to deliver these courses in an accessible and flexible way, but more research needs to examine this.

Students' learning and ICT skills can benefit from quality EdTech TPD and effective tutoring. [↑Asante & Owusu-Ansah \(2015\)](#) evaluated the impact of OLPC policy on teaching and learning in Ghana schools, recruiting 500 students and 10 ICT instructors. Findings suggest that the use of the laptops and qualified instructors has improved students' knowledge in ICT. However, lack of infrastructure, power supply, and trained teachers featured among the main challenges for the implementation of the programme, reinforcing the message throughout this section that resources should be allocated for technology infrastructure and TPD.

Teachers' digital empowerment is a necessary condition for a school's digital innovation ([↑European Commission, 2013](#)). Digital cultures of Ghanaian schools are influenced by teachers, school factors, external factors, and the digital services available to schools ([↑Quaicoe, et al., 2015b](#)). One author in this area is Dr James S Quaicoe, who has published a number of papers on the digital divide, namely the lack of opportunities for access to and use of digital resources ([↑Quaicoe & Pata, 2015a](#); [↑2015b](#); [↑2020](#)). This body of research highlights digital disparities among the basic schools in the areas of ICT tools

and resources, internet access, lack of change management measures for ICT integration and teachers' digital literacy ([↑Quaicoe & Pata, 2020](#)).

From a 'systems' perspective the conclusion is the same: teachers need more professional support to utilise technology as a professional tool and make meaningful changes in their teaching practices ([↑Quaicoe & Pata, 2020](#)). ICT stakeholders need to pay attention to digital infrastructures, allocating more resources to schools. This is an area that requires more attention from policy but also from research.

### **5.3. Technology to advance data-use and decision-making in education**

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Technology can be utilised to promote data collection, analysis, and planning to inform effective teaching and learning. However, educational systems in LMICs often lack mechanisms to collect data or struggle to apply the lessons learnt from them when making decisions about educational policy. In Ghana, research related to the technology for data-use has centred around: data for education (n=3); accountability between schools and parents (n=2); child protection, and safeguarding and privacy (n=2). While a large number of studies also consider policy planning and systems strengthening (n=42), most of this research overlaps with TPD, structured pedagogy, and technology and hence has been considered already (see Section 2).

At a systems level, modern educational institutions face increasing pressure from stakeholders (for example, employers, government agencies, and parents) to be accountable and share information about the learning and teaching culture and outcomes within the institution ([↑Ohemeng, et al., 2015](#)).

The goal of the ICT in Education Policy (2015) is to utilise ICT to facilitate education and learning in the Ghanaian education system. One of the key priorities is "to ensure an Educational Management system that recognises the relevance of ICTs in Education" ([↑Ministry of Education, Ghana, 2015, p. 29](#)). More specifically, some of the indicative activities suggested to achieve this goal include the evaluation, development, and implementation of different types of EMIS that can be used in education administration. This is in addition to providing appropriate training to users in the use of the systems.

One of the major efforts that has been made since 2015 to advance the capture and use of teaching and learning data in Ghana is the Mobile School Report Card (mSRC) initiative supported by the Ghana Education Service and UNICEF ([↑Abdulai, et al., 2018](#)). The mSRC is an Android-based mobile phone application developed in 2014 with the aim to replace the paper-based School Report Card (pSRC) used since 2011 to collect information about the teaching

and learning environment in basic schools in Ghana. A large-scale research project conducted in 2017 / 2018 — covering seven districts from across six regions — explored the functionality and use of mSRC in decision-making within the education management structure. Findings suggest that the mSRC is functional and stable with no reports of bugs, but its analytic capacity was identified to have potential to improve. Furthermore, over 92% of more than 400 users reported that they had mastered its use. However, some issues still remain with newly appointed headteachers struggling to use the app and most headteachers still finding it difficult to handle the registration of new teaching staff in their schools. Also, there was a lack of understanding of the mSRC among teachers and community members, including about the goals of the app. The mSRC programme has been rolled out in 20 districts in Ghana to date, with ongoing stakeholder operations aimed at nationwide coverage.

In terms of how data collected through the mSRC app is informing decision-making in education, limited use of the mSRC data in official policy-making and planning has been reported both at regional and national levels ([Abdulai, et al., 2018](#)). Instead, data were mainly used for school monitoring purposes, resources management (for example, school textbooks and furniture), and preparing annual district reports. In sum, the mSRC app represents a substantial effort to upgrade the collection and use of data in educational decision-making and has been found to be functional and user friendly. More may be done, however, in training new headteachers in using the app, informing the educational community about the purpose and use of data, and in terms of leveraging its features for evidence-based decision-making and educational policy-making.

There is limited research at the school level that examines how teachers, headteachers and administrators use technology to collect, store, and share data. However, one study surveying 60 teachers and 30 administrators from 20 second cycle institutions reports that most teachers and administrators rely on printed forms for sharing and communicating information; unavailability of equipment, lack of capacity for effective use, and the longer time needed are stated as the most prominent reasons for this ([Ohemeng, et al. \(2015\)](#)). Regarding access to computers and the internet, which is a prerequisite for teachers to engage with electronic means of knowledge management and storage, 52% of teachers indicated they could not access a computer and 35% had no internet access. These findings corroborate those in Section 5.2, specifically the necessity of efforts to upgrade the network and internet infrastructures in educational institutions in Ghana, and of effectively training teachers and stakeholders in using technology for information management purposes.

## 5.4. Technology to promote access and participation in school

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The already significant number of children out of school worldwide is likely to be exacerbated by the impact of Covid-19. Technology offers the potential to play an important role in supporting learners returning to school after the pandemic through providing positive messaging about education and promoting participation in school activities. In Ghana, research related to the uses of technology for promoting participation in school has focused on: girls and access (n=6), positive messaging and participation (n=4), SEND and access (n=3), and technology that adapts to marginalised learners' needs (n=3). Overall, this section is based on a relatively small number of studies, compared to previous sections. Girls and access is covered in the subsequent section, so this section will focus on positive messaging, and SEND and access.

Two studies by Kolog and colleagues ([↑\(2014\)](#); [↑\(2015\)](#)) examined the use of technology to deliver e-counselling to Ghanaian students, who often face challenging situations in their lives that may impact their academic work (for example, low financial status, drug addiction and abuse, rape). E-counselling can be defined as a counselling method that aims to enhance students' self-management and development. It is typically delivered through technologies such as telephone, the internet, and teleconferencing. [↑Kolog, et al. \(2014\)](#) first explored the main challenges students face (n=30) and to what extent technology is used to provide counselling services to students. The findings identified financial problems, academic issues, career obstacles, and psycho-social health problems as the main challenges. Moreover, while students were typically unaware of the use of e-counselling, they were often enthusiastic about the idea of engaging remotely with a counsellor (mainly because this offered an opportunity to discuss issues that could not easily be discussed face-to-face). In a subsequent study, [↑Kolog, et al. \(2015\)](#) investigated the factors that could drive high school students (n=250) to adopt and use e-counselling in Ghana. The results highlighted performance expectancy (that is, the belief that using e-counselling would improve their academic work) and social influence (namely, the degree to which students believe that others think he or she should use e-counselling) as the factors that could influence students' behavioural intention to adopt and use e-counselling. This is a potentially interesting area of research worth pursuit as effective e-counselling could increase school participation and engagement.

There is very limited research done on SEND and educational access. People with disabilities are highly marginalised, both in terms of policy and practice, but technology can help improve their learning opportunities and school

access and participation ([↑Nkansah & Unwin, 2010](#)). For instance, a study by [↑Ampratwum, et al. \(2016\)](#) explored the use of computer assistive technology by students (n=35) with visual impairment at the Akropong School for the Blind, which was established in 1945 and is made up of different departments from kindergarten to JHS level. The findings indicated that students struggle with training and are unfamiliar with using computer assistive technology. The recommendations stemming from this research include the purchase of additional computers, more practice time for the students to maximise computer use and licensed Job Access With Speech (JAWS) programs — computer screen reader programs that allows blind and visually impaired users to read the screen either with a text-to-speech output or by a refreshable Braille display — to be acquired by the school to advance students' competence in using computer assistive technology. See also the section above on supporting personalised learning with technology.

Overall, there is limited research on the role of educational technology in promoting access and participation in school. This is an important area to explore, especially in the aftermath of the Covid-19 pandemic, during which thousands of the most marginalised learners have lost access to schooling.

## 5.5. Girls education and technology

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Girls are educationally marginalised in many countries, and the issue is often exacerbated with the introduction of EdTech. Yet, the evidence is that educating girls is among the most effective ways to reduce inequality. Equitable provision of technology and support in its use can also result in more positive learning outcomes for girls. In the context of Ghana, particular support for girls' education has received attention in the policy and planning spheres. However, it is not clear that this has resulted in programming changes or has been integrated into the research concerns of those investigating EdTech in Ghana more broadly.

The research in this area demonstrates active engagement at a policy level, but insufficient commitment to practical implementation. Researcher interest in the topic demonstrates some focused attention in the subject of gender and girls education in EdTech, with seven relevant papers included; however, none of these included significant primary data collection.

Attention on girls' education and policy in the context of ICT is addressed specifically in [↑Steeves & Kwami \(2012\)](#), which points to the inadequacies of ICT policies alone in reducing gender inequalities.

Ghana's ICT for Accelerated Development policy (ICT4AD) mentions using EdTech to address issues of gender equality, but there is no clearly articulated

strategy for implementation. The policy overlooks the impact of social dimensions of gender (such as economic class and geographic location). The gendered construction of ICTs privileges males in terms of ICT access, use, and decision-making in the classroom and at system levels ([↑Steeves & Kwami, 2012](#)).

High-level concerns with prioritising girls' education, directed from a policy perspective, are also apparent in the way gender-responsive pedagogy is included in TPD through the T-TEL evaluation ([↑2017](#)). As with the broader policies mentioned in [↑Steeves & Kwami \(2012\)](#), the commitment on paper to girls' education is not accompanied with concrete steps to improving pedagogical practices. Indeed, one of the few specific findings — that continuous training for mentors is critical for increased uptake of gender-sensitive mentoring strategies — is a general reflection on the universal need for continuous inputs to sustain gender-sensitive approaches. The technology-specific element of this is left unstated in the T-TEL evaluation, but the implication is that follow-up through digital communications can facilitate this at a broader scale.

With regard to reflections on the specifics of EdTech in Ghana and girls' education, one study ([↑Richter & Zelenkauskaite, 2014](#)) did have a comparative approach. Two notable findings suggest future growth areas in integrating technology in girls' education:

- **Positive reinforcement for resilience:** the highest divergence in male / female answers was regarding the treatment of boys / girls after failing a task, suggesting this is a key teachable moment.
- **Gender-streamed support:** students recognised the value of using EdTech in gender-separated education and workgroups ([↑Richter & Zelenkauskaite, 2014](#)).

Further studies repeated analyses of older data previously published in government reports and internal evaluations, describing well-documented education inequality for girls in EdTech access and usage in urban and rural contexts ([↑Roberts-Lewis, et al., 2015](#), [↑Steeves & Kwami, 2017](#)). One notable finding particular to the context of Ghana was that inequality of ICT access in urban areas was more pronounced between girls and boys than it was in rural areas, resulting in slower uptake of EdTech by urban girls than urban boys ([↑Roberts-Lewis, et al., 2015](#)).

As a whole, the presence of this emerging body of literature on girls' education and technology in Ghana suggests the potential for future work. However, the lack of primary data collection means this will still be in nascent stages. Clearer frameworks and implementation pathways for putting into practice the values

set out in policy will ensure better integration of future research into the priorities of stakeholders outlined in Sections 4 and 6.



## 6. Summary of political economy analysis

The purpose of this political economy analysis (PEA) section is to present an overview of the drivers of EdTech research in Ghana, and its use in policy and programming decisions.

This includes analysis of:

- The organisations and people who determine EdTech evidence uptake;
- Reasons those organisations and people are important;
- EdTech decision-making priorities vis-à-vis EdTech Hub's focus areas;
- The most significant drivers of research uptake in Ghana to ensure impact on policy and practice.

The analysis has combined literature search and analysis of policy documents with informal interviews in the Ghanaian education system, including donors, the government, researchers and think tanks. The analysis specifically looks at:

- The government education system (as opposed to private alternatives);
- Primary and secondary levels;
- The role of evidence in relation to EdTech;
- The political context, climate, and receptivity vis-à-vis EdTech.

A stakeholder-mapping exercise was undertaken looking at the different stakeholders across the system.

### 6.1. National EdTech policy

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In 2003, the GoG introduced ICT4AD. The policy describes the government's vision for using ICT to achieve development objectives across 14 thematic priorities that include education, health, agriculture, e-governance, and research and development capacity. Although the policy is now outdated, it helps to position EdTech in the broader ICT context in Ghana and emphasises the cross-cutting nature of ICT efforts. While the ICT4AD plan identifies critical implementing partners for each priority, it does not set expectations for coordination across thematic areas to achieve development objectives.

The MoE's current ICT in Education Policy was drafted in 2003 and reviewed and updated in 2006 and 2009, before being finalised in 2015. The strategy guides seven priority areas:

- Education management
- Capacity building
- Infrastructure / e-readiness
- Incorporating ICTs into the curriculum
- Content development
- Technical support, maintenance, and sustainability
- Monitoring and evaluation

The policy aims to address challenges that include the absence of a clear process for consulting with the MoE / GES on EdTech, which slows progress in achieving scale and leads to MoE / GES dependency on unsustainable external funding sources. It also highlights the limited skill and knowledge of MoE staff to implement ICT interventions and of teachers to integrate ICT into learning effectively, as well as the lack of curriculum-aligned content and the weak infrastructure of schools, all issues identified through the research review of (in-service) TPD, structured pedagogy, and technology literature (See Section 5.2).

The ICT in Education policy is designed to serve as a roadmap for implementing education sector priorities outlined in the ICT4AD policy. In practice, the policy is rarely consulted both within the MoE (Interview 1, 2020) or by partners outside of government (Interview 4, 2020). And it lacks guidance on how best to address new developments in educational technology, such as the recent increase in mobile phone ownership and questions surrounding its use in schools. Other issues to note about the policy are that:

- It lacks a detailed operational or implementation plan, and the roles and responsibilities of implementing government agencies are not specific enough;
- While it highlights the significance of public–private partnerships, it falls short of providing guidance for planning and structuring partnerships to ensure transparency and alignment with overall education sector priorities;
- It does not offer a plan for addressing resource constraints.

The policy document notes that the MoE had created an ICT in Education Coordination Office to oversee the policy's implementation, but high staff turnover prevented the office from taking hold. It also mentions setting up a research unit to evaluate digital content for teaching and learning. It is unclear

if this unit was ever established as the MoE still has a critical gap in research capacity (Interview 3, 2020).

The MoE recognises the potential of technology to enhance education and has taken steps to integrate EdTech into schools and management processes. However, this had not happened at scale or in a coordinated way until the Covid-19 pandemic and unexpected closure of all schools. As a result of this, the MoE has been rapidly mobilising and coordinating partnerships and resources to develop a strategy that ensures learning for all students continues. The Education Sector Strategic Plan 2018–2030 lays out the MoE’s overarching objective for EdTech as “improved mainstreaming of ICT use in education at all levels” ([↑Ministry of Education, Ghana, 2018b, p.129](#)). At the basic education level, strategies appear to be focused on improving infrastructure and supporting skills development for teachers and learners. At the secondary level, the focus appears to be on improving the integration of EdTech in teaching and learning materials, with particular attention to STEM subjects. At the systems level, the MoE identifies three strategic priorities:

- Strengthening the EdTech policy to make it more comprehensive.
- Improving EdTech infrastructure in schools.
- Strengthening the Centre for National Distance Learning and Open Schooling (CENDLOS).

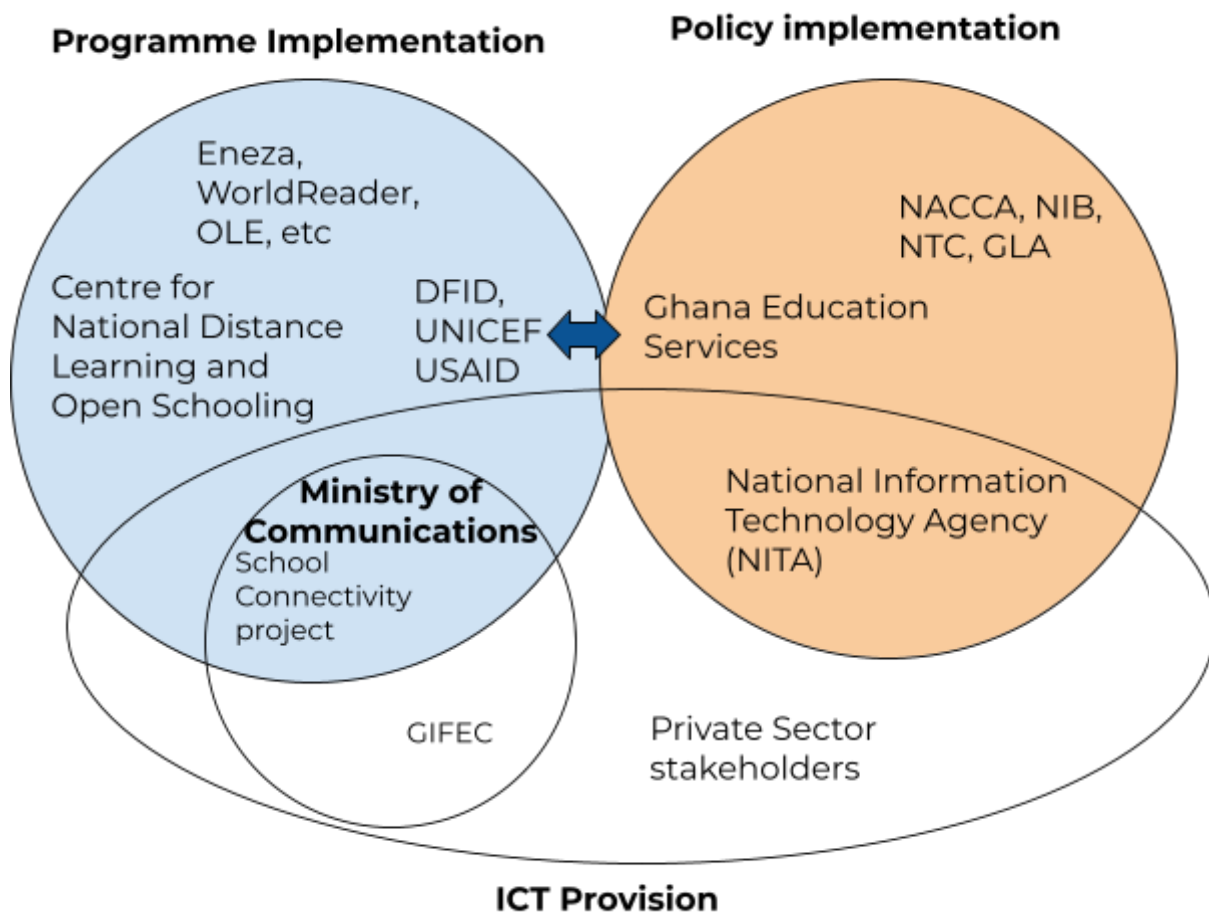
## 6.2. Government agencies

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The primary government agencies involved in EdTech are the MoE and the Ministry of Communications (MoC), which have 22 and 7 sub-agencies respectively. Broadly speaking, the MoE agencies are concerned with policy implementation, while the MoC agencies are focused on ICT provision (including infrastructure). The MoE is also named as a partner institution in most programmatic implementation; however, the extent of this role is unclear. The creation of CENDLOS as one of the MoE’s 22 agencies represents an effort to address implementation directly with an explicit mandate to integrate technology in teaching and learning. The initial vision for CENDLOS was a hub-like function — coordinating, advising, monitoring, and tracking e-learning initiatives across the sector. However, for what it is expected to accomplish, CENDLOS is severely under-resourced and, with a staff of three people, potentially limited in what it can achieve.

A mapping exercise was undertaken looking at the overall structure of relationships between the key stakeholders identified through the research and the partnerships and overlapping functions of different key bodies

(particularly agencies of the Ministries of Education and Communication). This mapping exercise identified the key spheres of policy implementation, programme implementation, and ICT provision, showing how different organisations and government bodies work across different spheres, both autonomously and through partnerships (see Figure 5).



**Figure 5:** Venn diagram showing the relationship between key government, private, and third sector stakeholders, and their different spheres of influence.

Despite the number of active stakeholders in the EdTech ecosystem, the extent to which research informs policy and practice remains limited, and the avenues to do so are mediated by the MoE and major donors involved on the programme implementation side.

## 7. Emerging priorities and opportunities for collaboration

In this review, we have drawn upon a range of sources — including contextual statistics, policies, PEA, and the existing research literature — to present an overview of the landscape of EdTech research in relation to school-level education in Ghana. Although progress has been made in improving access to education, inequalities exist along socio-economic lines, in relation to urban and rural contexts and gender, for example (Section 2). Ghana has a burgeoning EdTech community (Section 4); there is potential for EdTech Hub to work in partnership with this community and promote further collaboration and knowledge sharing. Searches of the academic literature also revealed how a focus on EdTech has been an active area for academic research in Ghana (Section 3). While this provides insights which will be helpful moving forwards, there remain multiple potential avenues for future research (see below). Finally, we explored the influential actors and dynamics in relation to education and technology within the Ghanaian education system through PEA (Section 6). As observed, despite the number of active stakeholders in the EdTech ecosystem, the extent to which research informs policy and practice remains limited in Ghana, and the avenues in which to do so are predominantly mediated by the MoE and major donors involved on the programme implementation side. Additionally, the autonomy at the school level for decision-making is limited, which means that the loop between research and implementation at that level is not joined up.

### 7.1. Opportunities for future research

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While the body of EdTech research in Ghana is relatively well established when compared to that undertaken in other LMICs, rigorous and critical additional research would make a strong contribution to advancing understanding of all five of the research areas previously identified. Three main future research directions are suggested:

1. There is currently a lack of evidence for how technology can be used most effectively to personalise learning in an effective, cost-effective, and contextually appropriate way in Ghana. Consistent with the wider body of EdTech research in LMICs, teachers' role in making technology-supported personalised learning effective as part of their everyday practice has received limited attention. This includes whether (and if so, how) personalised approaches that feature technology adapting or adjusting to learners lead to better learning outcomes.

Related technical, classroom, and system factors also need to be explored.

2. Despite a large body of research focusing on (in-service) TPD and technology in Ghana, this mainly identifies teachers' technological needs and the way they currently adopt technology. While such work provides a good foundation for further research (and may inform effective TPD planning), more needs to be done to move the field beyond its current exploratory stage. Few studies report on how technology might be used to support teacher development (for example, new forms of training that may help to improve TPD access and quality in Ghana). The importance of upgrading the technological infrastructure of Ghanaian schools, in addition to upskilling teachers' digital literacy, is also highlighted.
3. While there is some evidence that technology can promote data collection, analysis, and planning to inform effective teaching and learning in Ghana, this is limited at the school level and at scale. There is also limited research on the role of educational technology in promoting access and participation in school. This is an important area to explore, especially in the aftermath of the Covid-19 pandemic, during which thousands of the most marginalised learners have lost access to schooling. This is especially true for girls, who are more likely to leave school at an earlier age, and less likely to return after an interruption to their schooling. While access to EdTech offers an alternative means of continued engagement with learning, evidence suggests that girls have less access to EdTech than their male counterparts, especially in urban areas.

This review has identified a number of emerging priorities, opportunities, and challenges that could be further explored through collaborative and critical EdTech research. Drawing on the existing EdTech evidence base in Ghana, there appears to be potential for technology to play an important role in education reform in the country. However, there also remains significant potential to investigate other avenues too. The priorities identified will serve more broadly to foster and sustain conversation with a community of practice and learning among education stakeholders about the use of EdTech in Ghana.

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## 9. Annexes

### 9.1. Annex A: Search terms

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Two sets of search terms facilitated searches.

#### **Set 1 (title, abstract, and keyword searches only):**

Ghana AND

EdTech OR “Education technology” OR “technology enhanced” OR “e-learning” OR “computer-assisted” OR “computer-supported” OR “computer-aided” OR “blended learning” OR “distance learning” OR “digital learning” OR ICT4D OR “Intelligent tutoring system” OR “adaptive learning” OR “mobile learning”

#### **Set 2:**

“Ghana” AND

Education OR Learning OR Teaching OR Classroom AND

EdTech OR technolog\* OR Digital OR Remote OR Internet OR “Social Media” OR “Distance learning” OR Online OR Mobile OR Phone OR Virtual OR Laptop OR Tablet OR comput\* OR televis\* OR Device OR Software OR MOOC OR ICT OR Video OR radio OR “blended learning” OR e-learning OR “management system” OR “LMS” OR VLE OR SMS

### 9.2. Annex B: List of HPEGs categorised by their relevance to learners, teachers, and systems

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#### 9.2.1. *Learners*

**L1. Use of technology to help improve access to education and increased learning for girls:** How can technology be used most effectively to improve girls’ access to and learning quality in education and beyond?

**L2. Use of technology to support personalised learning:** What are the most effective (impact on learning and cost) ways that technology-supported personalised learning can be used to increase student learning outcomes?

**L3. Use of positive messaging to increase participation in school:** What are the most effective (impact on learning and cost) ways that technology can be used to share information on the benefits of schooling to local communities —

to increase participation in school and reduce the number of out-of-school children?

**L4. Use of technology for learning in appropriate languages:** How does the choice of language impact children's learning and teachers' instruction in multilingual contexts?

**L5. Use of technology to improve the assessment of student learning:** How can EdTech be used better to capture data that can be used for adapting and improving learning outcomes?

**L6. Use of technology to help children with SEND to have improved access to education and increased learning:** What kinds of EdTech may be appropriate to support learning of children and young people with disabilities in low-resource contexts?

**L7. Use of technology to help improve access to education and increased learning for refugee and forcibly displaced children:** How can technology be used most effectively to improve access to and quality of education for children on the move?

### **9.2.2. Teachers**

**T1. Technology modalities and blended approaches to teacher development:** How can modalities of technology use be optimally combined to form the basis for effective, sustainable teacher development at scale?

**T2. Teacher agency and needs — accounting for contextual variation in tech-supported TPD:** How can teachers be encouraged to be creative in the classroom whilst also following effective pedagogical approaches?

**T3: Using technology to support teachers to implement personalised learning:** Can (technology-mediated) TPD support teachers to undertake formative assessment and learn to differentiate instruction? Where personalised learning software is available, what role do teachers play and how can TPD support them?

**T4. Using technology in teaching that adapts to marginalised learners' needs:** How can technology be used to help teachers adapt their teaching practices to address the needs of key groups of marginalised learners?

**T5. Using technology to develop and support facilitators and coaches:** How can technology facilitate a more experienced peer or expert in providing support for teacher development?

**T6. Using technology to support non-formal educators:** How can technology support non-formal educators through the use of structured lesson plans or text message-based nudges to help build capacity at home and in school?

**T7. Supporting teachers' technology adoption:** How can processes and learning habits be embedded for teachers needing to frequently adopt — and adapt to — new technologies?

### 9.2.3. Systems

**S1. Use of technology in data for education:** In what ways can EdTech expand the availability, analysis, and use of accurate educational data, for both existing administrative datasets — such as EMIS and student assessments — and new datasets (including big data and real-time data)?

**S2. Use of technology in support of mutual accountability between schools and parents:** In what ways can EdTech strengthen mutual accountability between schools and parents, ensuring that existing data is being effectively analysed, publicised and used and enhancing communication to support learners?

**S3. Use of technology for child protection, safeguarding, and privacy:** What are the potential privacy and child protection risks of EdTech and what legal, technological, and social safeguards are necessary to ensure it is safe?

**S4. Use of technology for learning futures, such as 21st-century skills, school-work transition:** Are current education policies and systems in LMICs fit for purpose to support and guide schools in providing the skills and competencies learners need in the 21st century?

**S5. Use of technology in policy planning and systems strengthening:** How can taking a systems approach to education inform understanding of where and how best to invest in EdTech for education system diagnosis and strengthening?

**S6. Use of technology in teacher management and progression:** How can teachers be incentivised to improve their teaching?

### 9.3. Annex C: Institutional affiliation of Ghana-based authors

**Table 3.** *Frequency of institutional affiliation of Ghana-based authors within the collection of articles included in the literature review (ordered alphabetically).*

Type	Frequency
Accra Institute of Technology, Ghana	1
Akrokerri College of Education, Ghana	2
Cape Coast Technical University, Ghana	1
Catholic University of Ghana	5
Central University College, Ghana	1
Christian Service University College, Ghana	1
College of Distance Education, University of Cape Coast, Ghana	2
Enchi College of Education, Ghana	1
Ghana Education Service	1
Kibi Presbyterian College of Education, Ghana	1
Koforidua Technical University, Ghana	2
Komenda College Of Education, Ghana	1
Kwame Nkrumah University of Science and Technology, Ghana	5
Lancaster University, Ghana	1
Ministry of Education, Ghana	1



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National Council for Tertiary Education, Ghana	1
Offinso College of Education, Ghana	1
Pentecost University College, Ghana	7
Presbyterian University College, Ghana	1
St. Monica's College of Education, Ghana	2
University for Development Studies, Ghana	2
University of Cape Coast, Ghana	22
University of Education, Ghana	15
University of Ghana	7
University of Twente, Ghana	1
Wiawso College of Education, Ghana	1

## 9.4. Annex D: Mapping the HPEGs to the study areas

**Table 4.** *Categorisation of research literature articles according to the 'study area' typology in the RLI.*

HPEG	Frequency
<b>Technology to support personalised learning and teaching at the level of the student</b>	
Personalised learning	4
Appropriate Language	3
Support in personalised learning	1
Technology that adapts to marginalised learners' needs	1

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### **(In-service) TPD, structured pedagogy, and technology**

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Teachers' technology adoption	75
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Teacher agency and needs	67
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Blended approaches to teacher development	15
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Teacher management and progression	10
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Facilitators and coaches	5
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### **Technology to advance data-use and decision-making in education**

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Policy planning and systems strengthening	42
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Data for Education	3
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Accountability between schools and parents	2
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Child protection, safeguarding, and privacy	2
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### **Technology to promote access and participation in school**

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Girls and access	6
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Positive messaging and participation	4
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SEND and access	3
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Technology that adapts to marginalised learners' needs	3
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Refugee and access	0
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### **Girls' education and technology**

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Girls and access	6
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Technology that adapts to marginalised	3
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learners' needs

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### Unassigned HPEGs

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Assessment of learning	25
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21st-century skills and school-work transition	3
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Non-formal educators	2
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