

EDUCATION TECHNOLOGY MAP: GUIDANCE DOCUMENT

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Executive summary

This report serves as a user guide for a mapping exercise regarding the use of technology in low-resource environments. It should be read in conjunction with the map itself, which is an excel sheet titled '[Education technology evidence database](#)'¹. The map and user guide are intended to be resources for all those in the sector seeking to engage with the evidence regarding education technology. For the purpose of the exercise, education technology is understood to encompass all areas of education programmes and policy where technology may be used to help improve the effectiveness of interventions in achieving educational outputs and outcomes.

The conceptual framework for the map is organised around six input / intervention areas, five outputs, ten outcomes, six cross-cutting themes, and 12 types of technology. Each of these is included because of its relevance to the sector and link to DFID activities (section 4). In line with emerging DFID policy, there is particular emphasis on mapping the use of digital technologies to support teaching and learning.

The map allows users to search for evidence by filtering through one or more of these categories. In order to be included in the map, evidence had to be focused on low and middle income countries, be published in English and within the last 10 years, be based on primary research or secondary review, have direct relevance to the topic area, and be published in a journal or book chapter. In total the map includes 401 resources. Key trends include:-

- There is a major emphasis on observational studies (278), followed by quasi-experimental studies (81), experimental studies (23) and secondary studies (six).
- Of the studies with a stated geographical focus, 365 are located within one country and only 22 are multi-country studies.
- Overall, the evidence has a dispersed geographical base, with seven regions contributing more than 20 studies. However there is a complete absence of research from much of Central Africa.
- No one particular technology has particular prominence within the map: mobiles, laptops, desktops and tablets each have less than 50 studies.
- The most frequently occurring intervention / input areas are in relation to curriculum and pedagogy (263) and teacher training (139). The most frequently occurring outputs are teacher ICT literacy and use (262) and student ICT literacy and use (223).
- The most frequently occurring outcomes are related to teaching quality (194) and student educational achievement (135).
- The map does not assess the quality of evidence in the resources. However, more than half of all the studies self-reported a positive effect (219) and less than 10% reported a negative effect (35).

¹ <http://www.heart-resources.org/wp-content/uploads/2017/04/Education-technology-evidence-database.xlsm>

The annexes supplement the report providing definitions of all relevant terms, a list of all databases and journals included in the exercise, a list of all interviewees, and a selection of resources that provide further information regarding the effective use of technology in education.

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1 Introduction

1.1 Purpose of the report

The primary purpose of this report is as a user guide for a mapping exercise regarding the use of technology in education in low-resource environments. The report presents, explains and discusses the findings of the mapping exercise. As a user guide it should be utilised in conjunction with the map itself – an excel sheet titled ‘Education technology evidence database’.

The objective of the mapping exercise is to identify and organise the evidence regarding education technology interventions and the potential contributions, both positive and negative, that they make to improving educational outcomes at primary and secondary levels.

The mapping exercise builds on pre-existing methodological and substantive learning from DFID and across the sector. It is intended to be utilised by DFID staff and by other stakeholders that are seeking to make effective use of technology in education. It does this by:

- Presenting pre-existing research in an accessible format that enables the user to easily locate those studies most applicable to their needs
- Identifying the current extent of research in different areas, to provide an initial indication of potential evidence gaps

1.2 Definition of education technology

Education technology is an umbrella term that, for the purpose of the mapping exercise, encompasses all areas of education programmes and policy where technology may be used to help improve interventions, outputs and outcomes. It includes the use of technology in and around the classroom, use of technology in school management and leadership, and use of technology in the wider education environment beyond specific schools. In line with emerging DFID policy, there is particular emphasis on this work on the use of digital technologies to support teaching and learning. The detail of the definition is provided below within each element of the conceptual framework for the map. It should be recognised that whilst technology is intended to be used to improve classroom learning, it may also have other unintended consequences, not all of which may be positive.

1.3 Report structure

The report begins by briefly explaining the context for the map. It then outlines the parameters of the exercise, explaining how the evidence presented in the map should be viewed and interpreted. The conceptual framework for the map is then explained, listing the intervention / input areas, outputs, outcomes, cross cutting themes, and types of technology included. The next section of the report explains how the evidence map should be navigated, defining each of the tabs within the database. The report outlines the rationale for the inclusion and exclusion criteria, giving the detail for each element. It then documents the search approach and coding framework. Finally the report provides a brief analytical summary of the evidence map.

2 Context for the map

There is a long and contested history of technology use in education. In the early 2000s, various new initiatives were developed which were enthusiastic regarding the potential of technology to transform education in low-resource environments. However, many decisions were made based on transformational anecdotes rather than rigorous evidence of impact on learning outcomes. It is widely recognised that most attempts to introduce technology into education systems in low-resource environments have been less effective than initially anticipated. Indeed, there has been a lack of rigorous assessment of impact across the sector, with most focus being placed on inputs (such as number of computers deployed to a school) and outputs (such as number of teachers trained how to use technology) and relatively limited focus on outcomes (such as a change in student numeracy levels as a result of using technology). This has often been accompanied by an assumption that the introduction of technology into education will necessarily lead to improvement of some form.

The increasing integration of technology into education has been propelled by enhanced technical capabilities that facilitate new opportunities (that is, it is now possible to do things that could not be done before), reduced costs and device proliferation (such as the personal ownership of mobile phones), alongside increased access to electricity and connectivity. Each of these factors means that technology is likely to gradually become increasingly integrated into mainstream education programming.

In the last couple of years there has been an increased focus on the importance of research, monitoring and evaluation within parts of the education technology sector. There are several examples of where programmes appear to be operating effectively at scale, and the learning from these is contributing to the on-going formation of good practice guidance. As part of this increasing focus on evidence, it has become clear that technology does not lead to improved outcomes when introduced in isolation: the chance of positive impact is significantly increased when technology is one component within a holistic, integrated investment in improving education.

Resources for further reading are provided in Annex F.

3 Parameters of the map

An evidence map is a useful tool for understanding the current evidence base within a given sector. However, in order to be used effectively it is necessary to understand the parameters of the map and also understand its limitations. Below are seven factors to consider when engaging with the map. Some of the limitations relate to what information is included in the map itself whilst others are potential limitations to studies identified within the map.

- Educational change is complex and most realistically presented as a cyclical process with multiple causal factors. An evidence map presents this change in a necessarily linear manner by allowing the reader to filter studies by particular intervention areas / inputs, outputs and outcomes. However a research study may include multiple intervention areas which in combination lead to multiple outcomes through a complex set of co-dependent elements. Or a research study may include multiple intervention areas, only once of which leads to an outcome. The linear nature of the map means that it is not necessarily possible to understand the complexity of the different pathways of change through a simple viewing of the map alone. To understand the detail of causal pathways of change between interventions / inputs, outputs and outcomes it is therefore necessary to engage in-depth with the detail of the individual research studies.
- An evidence map uses pre-agreed definitions for outputs and outcomes when categorising research studies. However outputs and outcomes are broad and not fixed categories, often operating over a period of several years. Within a programme there will often be interplay between them. Between programmes the categorisation may differ: what constitutes an output in one programme and research study could be considered an outcome in another, depending on the breadth of the theory of change in use. The map also does not disaggregate between short, medium and long term outcomes, each of which can be significantly different according to context. The map is intended to organise a disparate evidence base to enhance its accessibility. As above, it is therefore necessary to engage in-depth with the detail of the individual research studies to understand how outputs and outcomes function in different programmes.
- The effectiveness of an education technology programme is affected by non-technology-specific aspects of the education environment and also through non-education specific aspects of the political and infrastructural environment. Significant factors in determining the effect of an intervention may not be captured within the map though should be captured in the individual research studies themselves. The map should be used with an awareness that education technology research sits within, and is informed by, a much broader education sector.
- Within the mapping exercise there has been no substantive quality assessment of any individual study. The 'effects' code in the map is a reflection of how evidence has been recorded in the publication, and is not based on any assessment by the research team regarding the strength of the evidence presented. Similarly, it should also be noted that a high or low number of studies with a certain 'effect' code does not necessarily equate to a strong or weak body of evidence, or a high or low likelihood of this effect being found in other similar education technology programmes. A simple 'warning' column is included to demonstrate where the research team has identified a particular issue which may affect the study's overall quality. However, this should not be understood as in any way comprehensive: each piece of research requires the review of the individual reader for an assessment of its rigour.

- Studies have been included in the database and coded as being related to an outcome if they assessed the impact of an intervention that was intended to lead towards that outcome, regardless of whether the intervention was successful in its aims or not. For example, an intervention that intended to improve accountability is coded in the database as being related to accountability, regardless of whether the intervention actually strengthened accountability, weakened it, or had no significant effect. This links to the aforementioned point that the effect code was used to reflect the assessment of the author of the publication, not the assessment of the research team.
- As noted in the exclusion criteria, there is much related research that is not included in the review. Noteworthy areas which have been excluded include: research published in languages other than English, research regarding the role of radio in education, and research regarding the role of technology in higher education and life-long learning. Each of these areas of study would have been a valuable contribution but were excluded because of the need to maintain realistic parameters on the map.
- There is a significant volume of relevant research currently being undertaken regarding the role of technology in education. As the demand for rigorous evidence increases, so do the time requirements for conducting applicable research. There are multiple experimental and quasi-experimental studies of large-scale education technology programmes that are currently in progress and the findings will be published shortly. These studies are not included within the map. Their existence is noted here to demonstrate that the nature of the evidence map for education technology may alter in the near future because of current research in progress.

4 Framework for the map

4.1 Thematic approach

A thematic approach was designed to help address the question of how technology can be used in each of the intervention / input areas in order to bring about change in the output and outcome areas. The thematic approach was agreed following an initial review of the literature and in consultation with sector experts. Each of the intervention / inputs, outputs and outcomes were purposefully presented as value-neutral classifications. The mapping exercise is based on the OECD definitions of inputs, outputs and outcomes. It is recognised that there are additional ways that technology can be used in education that are not explicitly categorised in the framework.

4.2 Intervention / input areas

The mapping exercise focuses on six broad intervention / input areas that are of relevance to the sector and particularly linked to DFID activities. These are:

- Curriculum and pedagogy
- Teacher training, leadership and administration training
- School management, governance and culture
- Political and regulatory environment
- Educational advocacy and awareness raising
- Education monitoring, evaluation, research and learning.

A comprehensive definition for each of these interventions / input areas is provided in Annex C.

4.3 Outputs

The mapping exercise focuses on five outputs that are of relevance to the sector and particularly linked to DFID activities. These are:

- The role of technology in increasing access to education
- The role of technology in increasing student ICT literacy and use
- The role of technology in teacher massification
- Teacher technical literacy and use of technology
- Leadership and administration technical literacy and use of technology.

A comprehensive definition for each of these output areas is provided in Annex C.

4.4 Outcomes

The mapping exercise focuses on ten outcomes that are of relevance to the sector and particularly linked to DFID activities. These are:

- The role of technology in improving teaching quality
- The role of technology in improving student educational achievement
- The role of technology in non-mother tongue language acquisition
- The role of technology in improving student life chances
- The role of technology in forming holistic student worldview
- The role of technology in improving educational inclusivity
- The role of technology in improving the value of education in community and society
- The role of technology in improving educational accountability and governance
- The role of technology in improving income generation for education
- The role of technology in improving education security and reducing corruption.

A comprehensive definition for each of these outcome areas is provided in Annex C.

4.5 Cross cutting themes

The cross-cutting themes below were coded separately as they were important but did not fall within interventions, outputs or outcomes:

- Education level (primary, secondary, non-formal, no mention)
- Specific subject focus (mathematics, science, language, life-skills, social sciences and IT, general usage)
- Multi-sector partnerships
- Funding and financing
- Value for money and cost per beneficiary
- Sustainability.

A comprehensive definition for each of these cross cutting themes is provided in Annex C.

4.6 Types of technology

There is no universally agreed understanding of what technologies should be included within the umbrella term 'education technology'. For the purpose of the mapping exercise the term 'technology' encompasses hardware, software, provision of connectivity, and specific assistive technologies for

those with disabilities. The use of radio is also an important part of education technology but is excluded from DFID's current work on the topic for reasons explained in 6.2. The list below shows the different types of technology that are categorised for the mapping exercise:

- Laptops
- Tablets, including e-readers
- Mobiles, including MP3 players (mobile and recording technology exclusive of tablets and netbooks)
- Desktops
- Display technology
- Connectivity
- Electricity (including mains and solar or other alternative forms)
- EMIS (Education Management Information System, also including SIS - Student Information System)
- Assistive technology, for users with disabilities
- Educational software
- Generic ICT
- Open source.

4.7 Summary table

Relevant extended definitions are provided in section 6.2 and annex C.

Interventions / inputs <i>(‘ICT inputs and intervention areas relating to...’)</i>	Outputs <i>(‘ICT has the potential to have an impact on...’)</i>	Outcomes <i>(‘ICT has the potential to have an impact on...’)</i>
Non-intervention Curriculum and pedagogy Teacher training Leadership and admin training School management, governance, culture Political and regulatory environment Educational advocacy and awareness raising Education monitoring, evaluation, research and learning	Access to education Student ICT literacy and use Teacher massification Teacher ICT literacy and use Leadership and admin use of technology	Teaching quality Student educational achievement Non-mother tongue language acquisition Student life chances Student worldview Inclusivity Value of education in community / society Accountability and governance Income generation Security and corruption

5 Navigating the map

5.1 Overview

The database was created in order to identify and organise the empirical evidence for input and intervention areas, outputs and outcomes related to education technology interventions. There are multiple tabs within the database that allow the user easy functionality to navigate the literature, analyse the data, and search for specific publications. The different tabs are described below.

5.2 Database tab

The database tab contains the full list of the publications selected from the review that meet the defined inclusion criteria. The database is searchable by a series of classification types including: research design, publication form, publisher, geographic scope and focus, cross-cutting themes, inputs and intervention areas, outputs, outcomes and effect. To conduct a search there is a filter function at the top of each searchable column. Different classifications can be combined to display a list of publications that provide evidence on multiple criteria, allowing a user to refine their search and identify those that meet precise specifications.

5.3 Analysis tab

The analysis tab allows the user to analyse the data included in the database. Multiple criteria can be selected to generate bar charts for different combinations, which then illustrate the frequency of documents in each criterion. The counter at the top of the tab displays the total number of publications included for the combination of criteria selected. Selections made by the user in the analysis tab are then reflected in the filtered findings visible under the database tab.

5.4 Definitions tab

The definitions tab provides a detailed set of definitions for the different classifications used for coding. These coding classifications are also expanded on below in the chapter regarding search protocol.

6 Inclusion and exclusion criteria

6.1 Inclusion criteria

The following inclusion criteria were selected in conversation with DFID and refined by the research team.

Included	Rationale
Geographical focus: Low- and middle-income countries	The map focused on low- and middle-income countries because the focus was on locating evidence regarding the interventions, outputs and outcomes of education technology in these environments. Studies including both high-income and low- or middle-income countries were included.
Language: English only	The map only engaged with evidence published in English. This is a recognised limitation that was necessary due to the volume of literature and time constraints.
Research type: primary, empirical research or evaluation (quantitative, qualitative, mixed methods) or secondary reviews	Evidence was required to be transparent regarding its methodology. Solely conceptual and theoretical papers were not included in the database.
Timeframe: evidence published within the last 10 years	The sector is rapidly evolving and it was decided that the most relevant evidence regarding education technology is from the last decade (published 2006 onwards).
Relevance: studies must explore the relationship between educational technology interventions and the determined set of outcomes, irrespective of the nature of the relationship	Evidence was included that identified links between education technology interventions / inputs, outputs or outcomes within the parameters of the map.
Publication form: academic journals, peer-reviewed materials, working papers, books, and book chapters	Evidence sources were from one of these formats to ensure consistency. All publications included are available online, a mixture of open access and paid access.

6.2 Exclusion criteria

The following exclusion criteria were selected in conversation with DFID and refined by the research team.

Excluded	Rationale
Studies that are focused on high-income or high-middle-income environments only	As above
Solely theoretical and conceptual papers	As above
Radio	The place of radio was excluded because there is a substantial and well-established body of evidence regarding radio for education and it was not possible to engage with this comprehensively without detracting from the other areas of evidence.
Higher education	The use of technology in higher education was excluded due to the volume of relevant literature and the desired focus of the map on primary and secondary levels. In addition, there is significant work already being undertaken elsewhere in DFID regarding higher education.
Duplicate studies	The research team avoided the inclusion of duplicate studies, such as the same content published as both grey literature and academic article. In such an instance, the academic article was prioritised. Any duplication concerns that were unresolved have been flagged in the database.
Sources that are unclear about their methodology	The map excludes any studies that are not transparent about the methodological approach employed and do not presented research-based evidence.

7 Search criteria

7.1 Study selection process

A search strategy was formed through an iterative process focused on a sample of publications within the evidence base. Annex D provides a full list of all the journals and databases included within the search process. Search strings were formed by identifying the key terms and phrases that reflect the central themes of the education technology sector. Once the base search terms and search specifiers were in place as a foundation the strategy was further enriched through the contribution of the interviewees and the additional exploratory work of the research team. The base terms and search specifiers are listed in the table below.

Base search terms	Search specifiers
Educational technology OR technology in education OR technology in schools Digital inclusion OR digital exclusion Digital divide Digital equality OR digital equity ICT and education OR ICT for education ICT AND [specific country]	Educational technology ICT OER Evaluation OR monitoring OR indicators OR review OR results OR outcome OR impact OR research OR effect Curriculum OR pedagogy OR curriculum and pedagogy Advocacy Accountability Community OR gender-based approaches OR women's groups OR empowerment Developing country Low-resource environments OR low-resource countries OR low-income environments OR low-income countries Middle-resource environments OR middle-resource countries OR middle-income environments OR middle- income countries Primary school OR secondary school OR teacher training OR teacher professional development OR pre-service training OR in-service training Technological pedagogical content knowledge Computerised OR digitised

7.2 Summary of search

The use of the base terms and search strings produced thousands of hits relating to education technology. The vast majority of evidence was excluded by screening titles and abstracts through the application of the inclusion and exclusion criteria. Many documents were easily excluded for reasons of date, country, education level, etc. Others required detailed review to better understand how the publication focused explicitly on interventions and output or outcome areas. Publications that were exploratory, descriptive or conceptual were also excluded.

To illustrate this process with one example, the search string ‘technology in schools’ used in the ERIC database produced 46,083 results. After applying the peer-reviewed, country, secondary education, and date inclusion criteria, this was reduced to 1,942 publications. Of these, 45 items were deemed suitable from their title and abstract and included in the database for full review and thorough application of inclusion criteria. The same process was repeated with ‘primary education’. This process was repeated with a similar pattern with other search strings. The following table provides an overview of the complete search and selection process and the number of publications excluded at each stage:

Description	Total
Total number of results from search strings used	704,473
After application of filters (e.g. education level, date)	12,014
After removal of duplicates	3,278
After exclusion on title and / or abstract review	2,701
Number fully reviewed with application of inclusion criteria	577
Additional exclusion on:	
Relevance	116
Country	29
Theoretical / conceptual	18
Methodology	13
Duplicate content	5
Education level	3
Sub-total included from search	393
Total number of additional publications from expert interviewees	41
Exclusion on:	
Publication date (before 2006)	10
Relevance	10
Country	8
Theoretical / conceptual	5
Sub-total included from interviewees	8
Total included in database (sub-total from search + sub-total from interviewees)	401

7.3 Search through interviews with sector experts

Experts from relevant organisations were consulted through informal interviews in order to ensure that the evidence base was as comprehensive as possible (annex E). A total of 11 interviews were conducted with individuals considered likely to be able to identify less accessible evidence sources. Each of the interviewees has a direct involvement in the use of technology in education through academia, research or implementation.

The interviews focused on identifying evidence for the map and did not engage with the personal assessment of the interviewee regarding the state of evidence in the sector or the efficacy and

appropriateness of conducting a mapping exercise. The interviewees were asked a series of questions that sought better to understand the evidence priorities of their organisation, how they engage in evidence building in their work, and for access to publications and details of ongoing and future research.

The interviewed experts identified a total of 41 publications. Many of these had already been located or did not meet the inclusion criteria. A total of eight additional publications were added to the map through this process. The broader reflections from the interviewees have been incorporated into the brief summary recommendations at the end of the report.

8 Coding approach

The coding began with a dual review on a sample of the evidence to ensure standard interpretation and usage of the criteria. After this publications were selected and coded by individual researchers as described by the classifications listed below. Throughout the process the research team employed continuous quality-control mechanisms, cross-checking articles and co-reviewing any content that was particularly contentious or ambiguous.

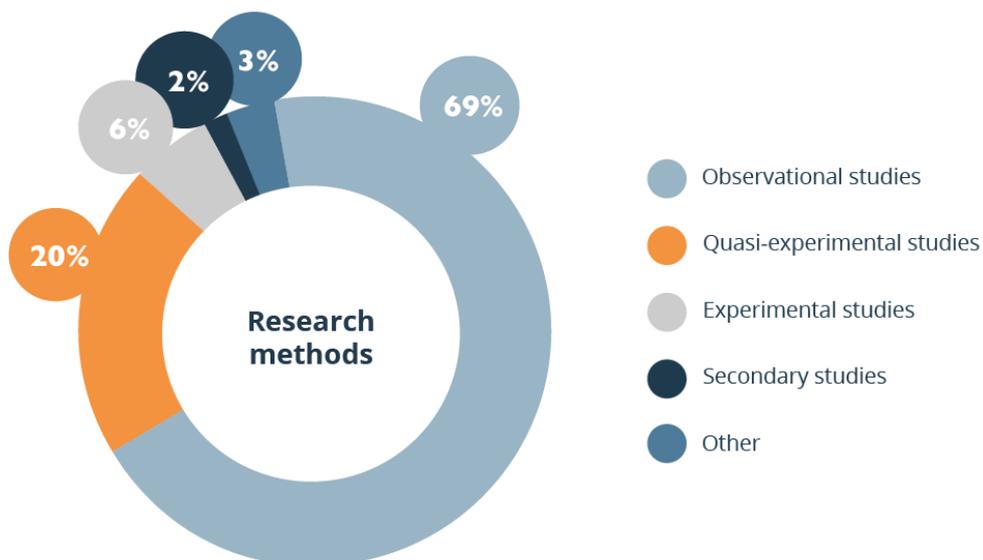
Code	Options / categories
Bibliographic information:	Author(s); year; title; book editors; journal/book name/series name; location published; publisher/institution; volume; issue; pages; abstract/summary; access [open source; proprietary]; URL/DOI
Research design:	Observational; quasi-experimental; experimental; secondary
Publication form:	Peer-reviewed journal; book or book chapter; evaluation; workshop or conference report; other report
Publisher:	Academic organisation/think-tank; international organisation; national government; NGO; private/commercial organisation
Geographic scope:	Multi-country; single country
Geographic focus:	Global; Eastern Africa; Middle Africa; Southern Africa; Northern Africa; Western Africa; Caribbean; Central America; South America; Central Asia; Eastern Asia; Southern Asia; South-Eastern Asia; Western Asia; Eastern Europe; Southern Europe; Oceania [The UN geo-scheme was used as guidance for tagging geographic focus for each country]
Country	List of countries and region within country [where applicable]
Cross-cutting themes:	Education level; specific subject focus; multi-sector partnerships; funding and financing; value for money; sustainability; conflict and displacement; type of technology introduced
Interventions:	[See intervention areas above]
Outputs:	[See outputs above]
Outcomes:	[See outcomes above]
Effects:	Positive; negative; mixed; no effect; unknown

9 Analysis of current evidence

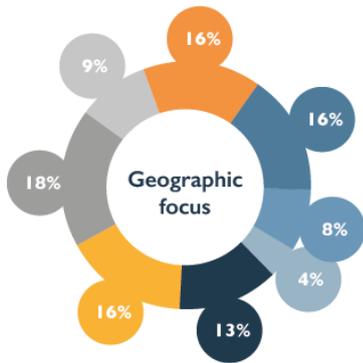
9.1 Types of study

Of the 401 publications in the evidence map there is a heavy emphasis on observational studies (278), followed by quasi-experimental studies (81), experimental studies (23) and secondary studies (6). The small number of secondary studies within the map is not because few exist but because the majority of those that do exist did not meet the inclusion criteria (such as the need to be explicit regarding methodological approach, and the exclusion of solely theoretical papers).

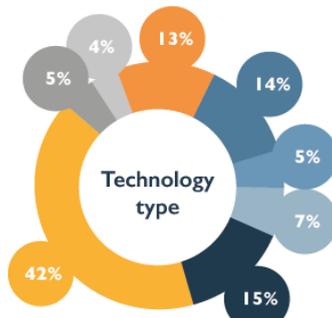
The charts below provide an overview of the data collected in the database for observational studies, quasi-experimental studies and experimental studies. It should be noted that the charts include studies that fulfil multiple categories. For example, both studies with multiple inputs and studies with a single input are included, so the total number of input types may not represent the total number of studies.



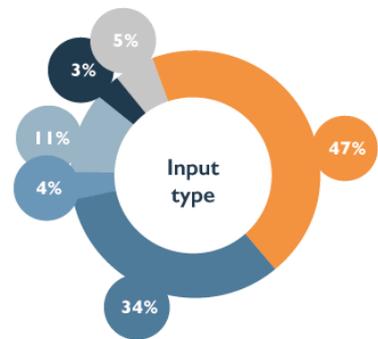
Analysis of 278 observational research studies



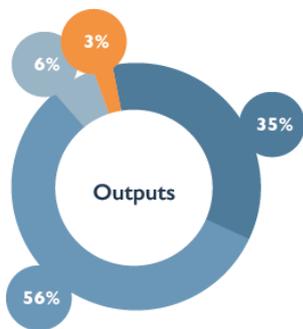
- East Africa
- Southern Africa
- Western Africa
- East Asia
- South Asia
- South East Asia
- West Asia
- Other



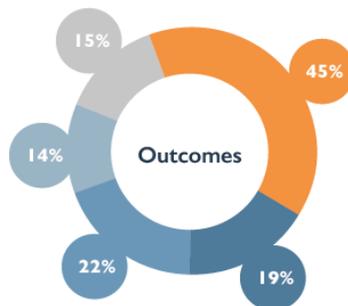
- Tablets and/or mobiles
- Desktops and/or laptops
- Display technology
- Connectivity
- Educational software
- Generic ICT (no detail)
- Open source
- Other



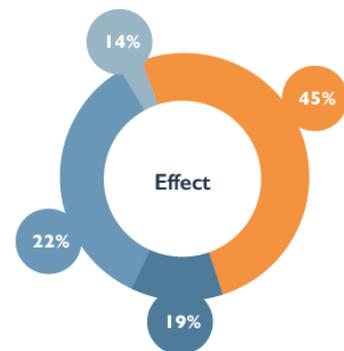
- Curriculum and pedagogy
- Teacher training
- Leadership & administration training
- School management, governance, culture
- Educational advocacy and awareness raising
- Other



- Access to education
- Student ICT literacy and use
- Teacher ICT literacy and use
- Leadership and administration

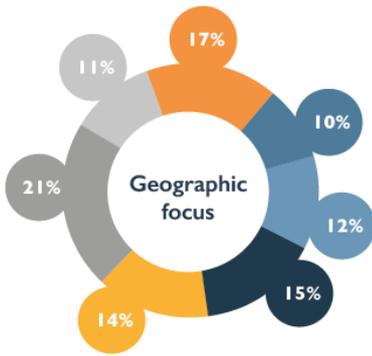


- Teaching quality
- Student educational achievement
- Student life changes
- Inclusivity
- Other

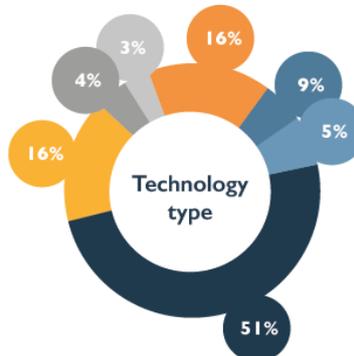


- Positive effect
- Negative effect
- Both positive and negative effects
- No or unknown effect

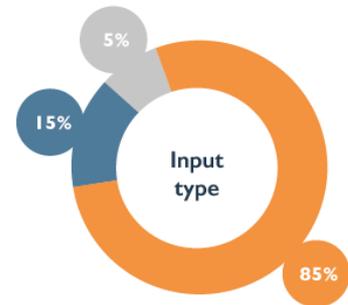
Analysis of 81 quasi-experimental research studies



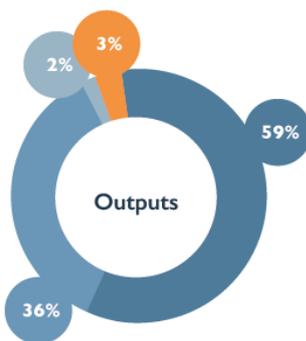
- East Africa
- Southern Africa
- Western Africa
- South Asia
- South East Asia
- West Asia
- Other



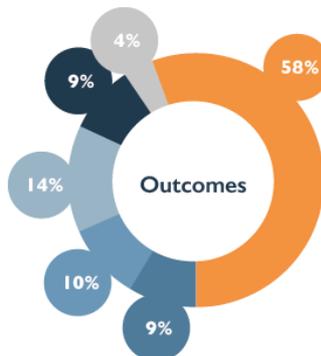
- Tablets and/or mobiles
- Laptops
- Display technology
- Educational software
- Generic ICT (no detail)
- Open source
- Other



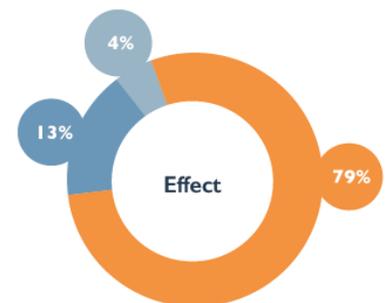
- Curriculum and pedagogy
- Teacher training
- Other



- Access to education
- Student ICT literacy and use
- Teacher ICT literacy and use
- Leadership and administration

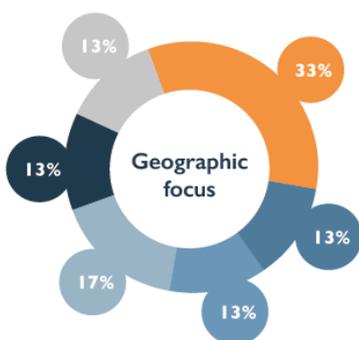


- Teaching quality
- Student educational achievement
- Student life chances
- Inclusivity
- Non-mother tongue language acquisition
- Other

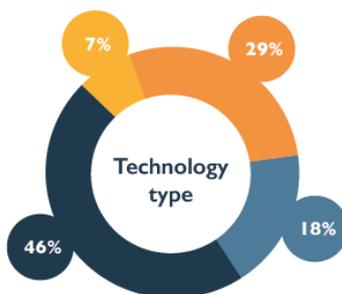


- Positive effect
- Both positive and negative effects
- No effect

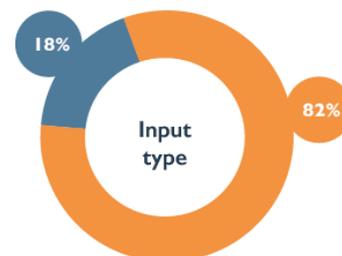
Analysis of 23 experimental research studies



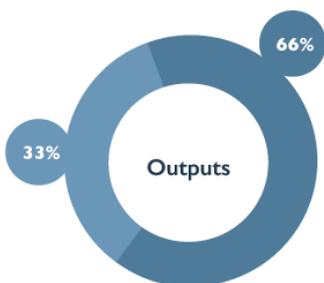
- East Africa
- Central America
- South America
- East Asia
- South Asia
- Other



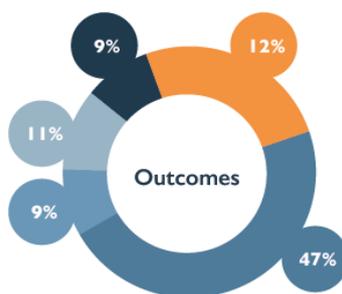
- Tablets and/or mobiles
- Desktops and/or laptops
- Educational software
- Generic ICT (no detail)



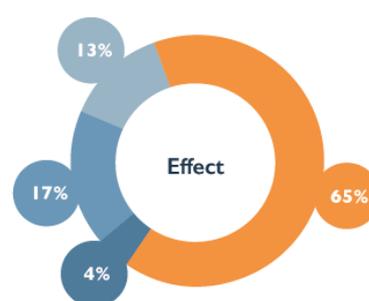
- Curriculum and pedagogy
- Teacher training



- Student ICT literacy and use
- Teacher ICT literacy and use



- Teaching quality
- Student educational achievement
- Student life chances
- Inclusivity
- Non-mother tongue language acquisition



- Positive effect
- Negative effect
- Both positive and negative effects
- No effect

9.2 Geographical focus of study

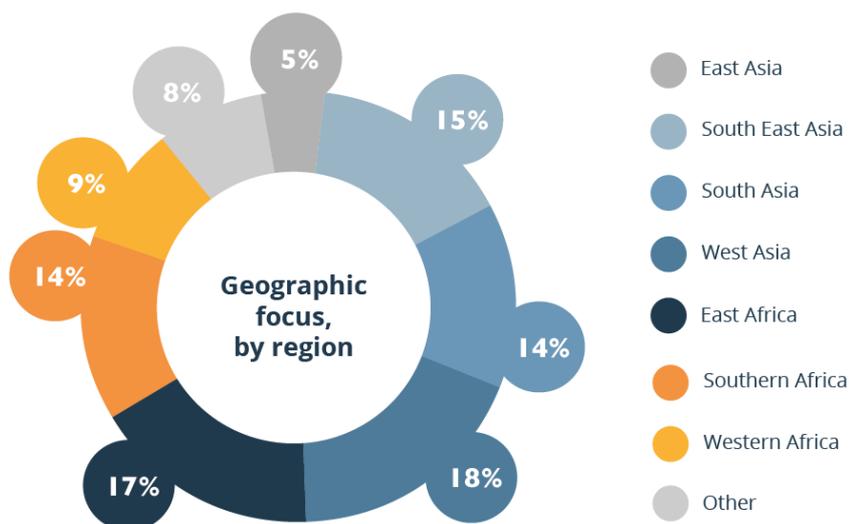
Of the studies with a stated geographical focus, 365 are located within one country and 22 are multi-country studies. The majority of resources are focused on countries in Asia (211) or Africa (167), though this is perhaps influenced by the inclusion of only English language research.

The evidence has a relatively dispersed geographical base, with seven regions contributing more than 20 studies: West Asia (74), East Africa (68), South East Asia (61), Southern Africa (56), South Asia (55), Western Africa (35), and East Asia (20). As demonstrated in the map below, there is a complete absence of research from much of Central Africa.

When only considering experimental studies there is a clear emphasis on research conducted in East Africa (eight of the 23 studies).

Certain areas of research are focused within specific geographical regions. For example, there are 32 studies which engage with non-mother tongue language acquisition at outcome level. Of these, 28 focus on a country within Asia, five focus on a country within Africa, and three focus on a country within Central America (the total is greater than 32 because of the presence of multi-country studies).





9.3 Types of technology

There is no one particular technology that has prominence within the map: mobiles, laptops, desktops and tablets each have less than 50 studies. A total of 109 studies focused on educational software, and the largest category, with 165 studies, was classified as “generic technology interventions” as no specific technology details were provided.

It is noteworthy that:-

- Of the 23 experimental studies, 13 focused on educational software and 5 focused on the use of tablets.
- Of the 26 studies regarding tablets, there is a geographical focus on Eastern Africa (11) and 23 of the 26 focus on curriculum and pedagogy. There is only one study that focuses on electricity provision.
- Of the 23 studies that focus on connectivity, all but one are observational.
- There are only eight studies that focus on EMIS, and all of these are observational studies.

Technology type



9.4 Types of intervention

The most frequently occurring intervention / input areas are in relation to curriculum and pedagogy (263) and teacher training (139). All 23 of the experimental studies engage with curriculum and pedagogy. The most frequently occurring outputs are related to teacher ICT literacy and use (262) and student ICT literacy and use (223). The most frequently occurring outcomes are in relation to teaching quality (194) and student educational achievement (135).

Inputs



Outputs



Outcomes



9.5 Self-reported effects

More than half of all the studies reported a positive effect (219), with just over a quarter of studies reporting a positive and negative effect (114) and less than 10% reported a negative effect (35). Of the 23 experimental studies, most reported a positive effect (15), followed by both positive and negative effects (4), no effect (3), and a negative effect (1). To note, all these effects were self-reported by the studies and not verified during the mapping process.

Annex A Conceptual framework and definitions

1. Research design	
Observational	Publications where investigators observe subjects without assigning treatments to them
Quasi-experimental	Publications where investigators use an experimental design without random assignment
Experimental	Publications where investigators apply treatments to subjects who have been randomly selected, before observing their effect
Secondary	Publications where investigators base their analysis on the primary research of others. These can also include reviews and meta-analyses
2. Cross-cutting themes	
Education level	Primary
	Secondary
	Non-formal
	No mention
Specific subject focus	Mathematics: education technology within the mathematics subject area, or outcomes described as numeracy
	Science: education technology within the core science subjects such as biology, physics, chemistry and environmental science
	Language: education technology within vernacular language learning as well as non-vernacular language learning, or outcomes described as literacy
	Life-skills: education technology within topics such as physical and mental health education, civics, careers, and counselling
	Social sciences and IT: education technology within social science and arts subjects including geography, history, religious education, and Information Technology
	General usage: subject area was not specified
Multi-sector partnerships	Education technology implemented in some form of multi-sector partnerships that is explicitly mentioned in the publication
Funding and financing	The funding and financing of the education technology intervention is an explicit theme mentioned in the publication
Value for money/cost per beneficiary	Value for money or cost per beneficiary of the education technology intervention is an explicit theme mentioned in the publication
Sustainability	The sustainability of the education technology is an explicit theme mentioned in the publication

Conflict and displaced people	Educational technology implementation directly relating to conflict and displaced people is an explicit theme mentioned in the publication
Type of technology introduced	Laptops
	Tablets, including e-readers
	Mobiles, including MP3 players (mobile and recording technology exclusive of tablets and netbooks)
	Desktops
	Display technology
	Connectivity
	Electricity (including mains and solar or other alternative forms)
	EMIS (Education Management Information System, also including SIS - Student Information System)
	Assistive technology, for users with disabilities
	Educational software
	Generic ICT - no details given
Open source	
3. Intervention areas	
Non-intervention	Evidence that identifies outputs or outcomes of interest, but where it is not clear that there was any direct education technology intervention, or what it entailed
Curriculum and pedagogy	Teaching and learning resources (content); Learning Management Systems, networks for both students and teachers, mLearning, open educational resources, assessment, and ICT integration
Teacher training	Pre-service and in-service training for teachers, including mentoring and support, in-school, centralised and distance-based
Leadership and admin training	Training for head teachers, principals, technical staff and for education officials operating externally to the school setting
School management, governance, culture	EMIS (including financial management), feedback mechanisms, technology planning and strategy and openness to and support of technology integration
Political and regulatory environment	Technology standards, policies and legislation, funds and integration of decision-making bodies
Educational advocacy and awareness raising	Social media, television, SMS, and online games - often taking place outside the parameters of formal schooling
Education monitoring, evaluation, research and learning	Use of technology to enhance monitoring, evaluation, research and learning regarding education - through things such as real time data, big data, iterative or participatory programme design
4. Outputs	

Access to education	Student access to education including enrolment, participation, retention, and completion
Student ICT literacy and use	Student ICT literacy, interest, confidence and use
Teacher massification	Use of education technology to enable one teacher to engage with a large number of students, often in multiple sites using video-based learning
Teacher ICT literacy and use	Teacher ICT literacy, confidence, interest, use, participation in forums and networks and collaboration with colleagues
Leadership and admin use of technology	Head teacher ICT literacy, interest, confidence and use, including of education data through use of EMIS
5. Outcomes	
Teaching quality	Relating to teacher recruitment, motivation, incentives, retention, attendance, approach, and self-efficacy
Student educational achievement	Student literacy, numeracy, specific subject performance, exam performance, citizenship, worldview, tolerance, ICT skills, motivation, and collaboration
Non-mother tongue language acquisition	Resulting in language use, confidence, motivation, incentives, approach, and skills
Student life chances	Relating to student enthusiasm for learning, employability, readiness for higher education, resilience, critical thinking skills, life-long learning attributes, sense of self-efficacy and identity
Student worldview	Relating to student perspective of the world and their place within it, including worldview, tolerance, global citizenship
Inclusivity	Students with disabilities and SEN, marginalised girls, marginalised boys, students from ethnic / religious minorities, rural schools, out-of-school children
Value of education in community / society	Change in perception, outside the school environment, regarding the value of education
Accountability and governance	School management, feedback, use of technology standards in decision-making, use of technology strategies in decision-making
Income generation	Community use of technology in school, community wifi initiatives
Security and corruption	Relating to change in security and corruption because of education technology, such as in school finance, teacher pay roll
6. Effect [the author's own assessment of the evidence]	
Positive	The author asserts that a positive relationship was observed
Negative	The author asserts that a negative relationship was observed
Mixed	The author asserts that both positive and negative relationships were observed
No effect	The author asserts that the inputs / intervention areas had no effect

Unknown	The author asserts that the effect remains unknown despite the research conducted
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Annex B List of databases and journals included in exercise

The following search locations were identified during the initial interrogation of the evidence and testing of the search strings as either being specifically focused on education or with a breadth of materials relevant to the evidence map. The list was reviewed throughout the process and with the feedback of interviewees.

Bibliographic databases	BECTA British Education Resource Association (BERA) Commonwealth of Learning CREET/Open University Eldis Elsevier ERIC Google Scholar Harvard Educational Review IngentaConnect JSTOR OpenDocs SAGE
Research Institutes	Centre for Development Informatics at University of Manchester ICT4D Centre at Royal Holloway, University of London International Development Research Centre Overseas Development Institute Institute for Development Studies South African National Research Foundation (NRF) in ICT4D SRI International The Danish Institute for International Studies University of Cape Town: Bertha Centre for Social Innovation & Entrepreneurship Centre in ICT for Development Centre for Innovation, Learning and Teaching
Other sources	3ie Database of Impact Evaluations 3ie Systematic Review Database and Web of Knowledge Africa Education Review African Journal of Information & Communication Technology Asian Journal of Information Technology AusAID (Australian Aid, Department of Foreign Affairs and Trade OECD Education Innovations Electronic Journal of Information Systems in Developing Countries

	<p>Evaluation Resource Centre</p> <p>Global Education Financing Commission</p> <p>GSDRC</p> <p>Information Technology for Development</p> <p>Information Technologies and International Development</p> <p>Inter-American Development Bank</p> <p>International Journal on Advances in ICT for Emerging Regions</p> <p>Kenyatta University - The Department of Educational Communication and Technology repository</p> <p>M-education alliance</p> <p>Millions Learning</p> <p>R4D (through www.gov.uk with DFID filter)</p> <p>REAP (Rural Education Action Project)</p> <p>Research ICT Africa</p> <p>SSR Resource Centre</p> <p>Research on Open Educational Resources for Development (ROER4D)</p> <p>UNESCO</p> <p>UNICEF</p> <p>University of Cape Town (UCT) - School of Education repository</p> <p>University of Witwatersrand - Educational IT Division repository</p> <p>World Bank</p>
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Annex C List of interviewees

The following individuals participated in the mapping exercise as expert interviewees.

Name	Organisation	Country
Rosalind Gater	DFID - Education Adviser	UK / Turkey
Paul Kruchoski	US State Department - Deputy Director of the Collaboratory	USA
Nivi Mukherjee	BRCK - President, BRCK Education	Kenya
Lutz Ziob	Microsoft - Dean Microsoft 4Afrika Academy	South Africa
Andrew Ashe	One Billion	UK / Malawi
Sara Hennessy	Cambridge University - Reader in Teacher Development and Pedagogical Innovation, Faculty of Education	UK
John Traxler	University of Wolverhampton - Professor of Mobile Learning, Institute of Education	UK
Benjamin Piper	RTI International - Chief of Party, Tusome National Tablet Programme	Kenya
Sugata Mitra	Newcastle University - Professor of Educational Technology	UK
Felipe Dib	Você Aprende Agora – CEO	Brazil
Cathy Cavanaugh	Head of Teaching & Learning, Microsoft Worldwide Education	USA

Annex D Resources for learning about education technology

This is a non-comprehensive resource that provides a range of further reading for those interested in the topic. It emphasises things that are accessible contributions to conversations regarding evidence building in education technology, but do not meet the inclusion criteria for the mapping exercise.

Resource	Location
Designing effective education programmes using ICT	http://medalliance.wpengine.com/wp-content/uploads/2016/07/Bloome.pdf
Education in Conflict and Crisis: How Can Technology Make a Difference? A Landscape Review	http://www.educationinnovations.org/research-and-evidence/education-conflict-and-crisis-how-can-technology-make-difference-landscape
A framework for evaluating appropriateness of educational technology use in global development programs	http://cite.mit.edu/system/files/reports/Summary%20Report_A%20Framework%20for%20Evaluating%20Appropriateness%20of%20Educational%20Technology%20Use%20in%20Global%20Development%20Programs.pdf
The eLearning Africa Report [2012, 2013, 2014, 2015]	http://www.elearning-africa.com/press_media_ela_report_2015.php
The EduTech blog of Mike Trucano	http://blogs.worldbank.org/edutech/
Education and Technology - the World Bank	http://www.worldbank.org/en/topic/edutech
mEducation Alliance	http://www.meducationalliance.org/
Centre for education Innovations	http://www.educationinnovations.org/topics/educational-technology