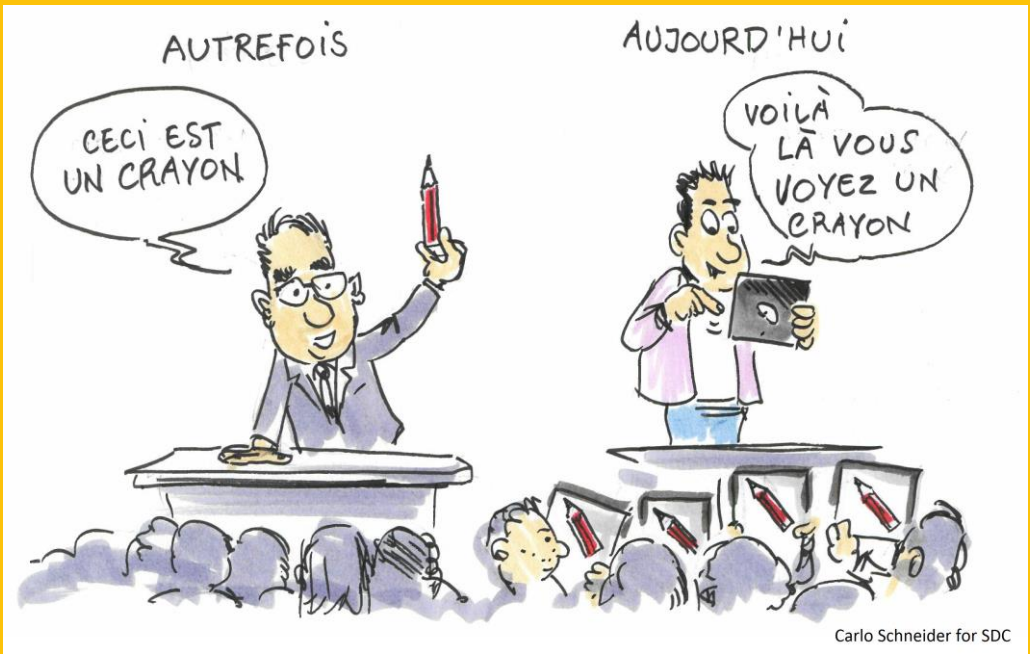
Information Communication Technologies (ICT) and Education



Joel Mitchell, David Hollow, Meaghan Brugha and John Patch

Jigsaw Consult

Prepared for
The Swiss Agency for Development and Cooperation - SDC

2019

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC

Education
SDC Network

Authors

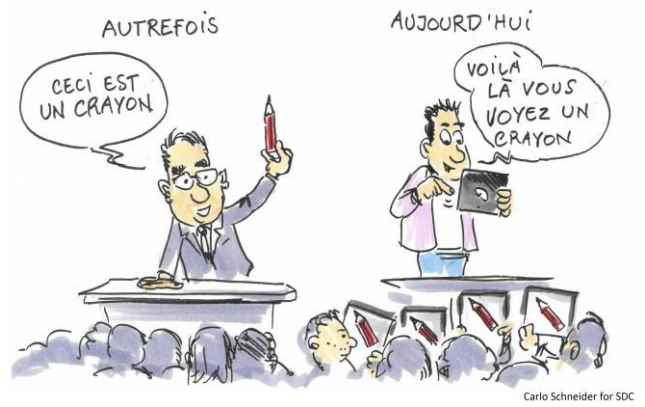
This report was written by Joel Mitchell, David Hollow and Meaghan Brugha of Jigsaw Consult (www.jigsawconsult.com). Technical input was provided by John Patch.

Suggested citation: Mitchell, J., Hollow, D., Brugha, M., Patch, J. (2019). Information Communication Technologies (ICT) and Education.

Acknowledgements

We are grateful for the strong support of the SDC education team throughout the process. We would also like to thank all the interviewees who gave their time to contribute their experiences and expertise to the report.

Translation of cover page cartoon:



BEFORE *TODAY*

This is a pen *So here you see a pen*

Table of contents

Abbreviations

CABI	Centre for Agriculture and Biosciences International
CAFS	Conflict-Affected and Fragile States
CLCC	Connected Learning in Crisis Consortium
CSTL – MIET	Care and Support for Teaching and Learning by Media in Education Trust
DFID	Department for International Development
EiE	Education in Emergencies
FELS	Free Education Library for Syrians
GBV	Gender Based Violence
GDL	Global Digital Library
GESCI	Global e-Schools and Communities Initiative
ICT	Information Communication Technology
INS	Instant Network Schools
OLE	Open Learning Exchange
OLPC	One Laptop Per Child
RCT	Randomised controlled trial
SADC	Southern African Development Community
SDC	Swiss Agency for Development and Cooperation
SDGs	Sustainable Development Goals
SRHR	Sexual and reproductive health and rights
TCO	Total Cost of Ownership
ToC	Theory of Change
VfM	Value for Money
VSD	Vocational Skills Development

Executive summary

SDC is committed to making effective use of technology to enhance outcomes within its education portfolio. This report provides an initial resource to help SDC to achieve this objective. In doing this it reviews the ways in which technology is used in education at present, drawing on examples from other organizations and the lessons they have learned regarding good practice. It also provides specific guidance for SDC staff, explaining how they can begin to use technology aligned with the six strategic orientations of the organisation and in an evidence-based manner. The report is intended to be useful for all SDC staff at both country-level and in headquarters.

There are extensive annexes at the end of the report and readers are encouraged to engage with the specific resources that are of relevance for their needs and context. The report is based on a combination of research tools including: extensive literature review, workshop for SDC staff, interviews with SDC staff, programme review, and the pre-existing expertise of the research team.

In chapter 3 the report provides an overview of the sector. It documents future possible trends, provides example frameworks for engaging with education technology, and reviews the evidence that currently exists regarding what works. It then provides a narrative on operating principles and summarises the way technology features within national government plans. Building on this, chapter 4 overviews current SDC educational programmes which are relevant to technology use, the challenges already encountered by staff, as well as future plans for using technology. It also includes seven 'spotlights' of notable programme examples. Chapter 5 draws together the lessons from a wide range of programmes, demonstrates a potential framework for assessing both existing and future programmes, and considers how SDC may engage specifically in education in emergencies, social media, private sector collaboration, and institutional partnerships.

Chapter 6 provides practical recommendations for SDC, drawing from the previous sections of analysis. This begins with nine good practice recommendations relating to decision making across the SDC portfolio, building appropriate partnerships, project design and implementation considerations, and contributing to the wider sector. Following this is examples of strategic entry points based on SDC current activities, and a series of practical potential next steps. Because SDC is at an early stage of engagement with education technology the recommendations cover a wide range of possible options – their primary purpose is to catalyse further dialogue and inform initial decision making.

1. Introduction

1.1. Purpose and objectives of the study

Education has an increasingly important position within the dialogue of SDC, and a new education strategy was approved in 2017. The education strategy has engaged with the potential for education technology but there has been limited activity thus far. Multiple stakeholders within SDC are keen to have more information and support to know how they can engage effectively in the sector. SDC is committed to incorporating technology within its education programming in a range of forms. SDC would like to be able to make effective decisions regarding what is most beneficial in each different context, and how that can be implemented. Technology is likely to be the centre point of some new programmes and integrated into other pre-existing programmes. This study provides an initial resource for SDC to equip the organisation within this broader context.

The overall goal is that SDC is enabled to make effective use of technology to enhance the outcomes and impact of its education work. Within this the specific objectives of the study are to:

- Provide an overview of how technology is used in education in low-resource environments in international cooperation in development and humanitarian contexts.
- Provide examples of what other organisations are doing to make effective use of technology within education, and the lessons that have been learned from this that could be of benefit for SDC
- Provide guidance for how SDC can make effective use of technology within education in alignment with the six strategic orientations and other cross cutting themes
- Provide SDC staff with the knowledge and capacity for effective evidence-based decision making regarding appropriate use of technology in education.

The intended audience of the report is all SDC staff involved in education policy and programmes, in the country teams and at the headquarters.

1.2. Structure of the report

The report begins with a brief review of the methodological approach employed (chapter 2). It then provides a summary of how technology has been used in education (chapter 3) and how SDC has engaged with education to date (chapter 4). The analysis (chapter 5) provides a framework aligned with the strategic orientations and significant cross-cutting themes. The main report closes with a series of applied recommendations (chapter 6) for SDC. An extensive set of annexes follow the main report. These are organised into the following four sections: tools for SDC, resources to draw on, case studies, and interview resources. The intention is that the annexes help the reader to engage with specific elements that are of particular relevance to them.

2. Methodology

2.1. Activities

The first phase of the study was a background review of relevant literature. This included strategy and programme documentation from SDC, national education plans, academic articles, policy and programme guides, and programme evaluations. Each of these informed the approach and the most relevant are included within the annexes for reference. The second phase of the study was a strategic workshop held at SDC headquarters and interviews conducted with nine staff members. The workshop ensured that the study was aligned with the strategic priorities of the SDC education team. The interviews ensured that the report was written with an understanding of the actual needs, challenges and opportunities as understood by the in-country staff. Each interview lasted approximately 60 minutes and the template of interview questions is included in Annex section 4. The final phase of the study was the analysis of data and formation of applicable recommendations in the final report.

2.2. Parameters and limitations

It is important to note that this report is an introductory resource for early-stage engagement with the use of technology in education. As such it does not provide comprehensive guidance for any specific policy or programme priority. The report focuses on the concerns of both country teams and headquarters, thus not all the content will be applicable to all readers. There has been no country-specific analysis of the use of technology in education within the report. Therefore it would be premature to provide any country-specific recommendations.

The focus of the study is on basic education and there is deliberately no explicit focus on VSD. SDC is engaged in education-related work in various sectors beyond the specific remit of the education team (such as the way basic literacy enhances the effectiveness of health programmes). The focus of the report is not on these related issues, although the lessons are transferable to a degree.

Each of the annexes provides introductory resources. The lists of programmes and articles are intended as signposts for useful content that SDC can learn from: their inclusion does not mean they are indicative of good practice unless stated as such. Similarly, each tool in section 1 of the annexes would require significant expansion in order to be used in an operational context.

3. Summary of education technology

This section provides an overview of how the sector has evolved and potential future trends, three framings of education technology that are used by other organisations, a review of the evidence base, good practice operating principles, and the place of education technology within national education plans. In combination each of these provide a foundation for SDC as the organisation begins to engage in the sector.

3.1. Definitions of key terminology

There is a significant volume of sector-specific terminology that applies to education technology. For those who are new to the sector it is helpful to understand the terms that are commonly used. A list of these terms is included for reference in Annex section 2. It should be noted that this is an introductory rather than comprehensive list. Because each term is complex and could be discussed at length, the purpose of this annex is to provide a brief definition as an initial reference point. The definitions of key terminology are provided under three themes: specific technologies and equipment, models of delivery, and relevant pedagogical strategies.

3.2. Future possible trends in the sector

The following future trends are based on a previous research study identifying trends in how technology is likely to be used education[1]. There is a high degree of uncertainty in speculating anything within a sector that is changing so quickly, however it still enables reflection on likely future risks and opportunities that will be encountered. In summary:

- Technology is likely to become increasingly embedded in school systems, for learning as well as management, changing the role of teachers and their relationships with students.
- Inequality in access and use of technology is likely to be exacerbated, both between wealthy and less wealthy countries, and within countries between urban and rural communities, and different classes.
- Assessment, not only of students, but of teachers and schools, is likely to rely more and more on integrated technology systems, facilitating and encouraging more individualised learning approaches.
- Access to information and connectivity through device sharing and digital multi-purpose hubs is likely to still be significant in the most marginalised areas.
- Non-formal and informal learning is likely to be increasingly important not only for young people but continuing learners, and especially for those who have faced displacement or disrupted education.

These trends suggest a trajectory significantly different than the onward march of technological progress toward a utopian future. Indeed, the potential for improper use of technology to widen the gulf between the wealthy and the impoverished should be taken seriously in developing technology programmes for education. The pertinent point is that those seeking to shape the future of the sector should be cognizant of the various ways technologies can be used in different contexts, and should work to optimize the use of technology to increase equity and education outcomes.

[1] The future of learning and technology in deprived contexts https://resourcecentre.savethechildren.net/sites/default/files/documents/the_future_of_learning_and_technology.pdf.

3.3. Framing education technology

The use of technology in education takes on many different forms and means different things according to the context. It is therefore helpful to categorise the types of activities that take place within the sector. There is no perfect way to do this, but various organisations make use of frameworks in order to structure decision making. This section provides three illustrative frameworks to help SDC consider how to structure its engagement with the sector. Each of them has been amended from their initial structure in order to be of maximum utility for the SDC context. No model or framework is fully transferable, the intention is that they provide a means by which SDC can begin to think strategically regarding where it is situated, changes that may be made, and how it can add value to and through the use of technology within its education work. In addition to these frameworks it is also worth considering the World Bank's SABER-ICT framework with eight key policy areas[2]. A potential framework for SDC engagement with education technology is provided in chapter 5, building on the illustrative frameworks provided here.

Framework 1: amended from the European Commission

This framework (publication pending) provides three primary categories within which technology can be used in education, with four sub-categories within each.

Primary category	**Sub-category**
A: Technology for teaching and learning	A1: Support for teacher development A2: Personalised and self-directed learning for students A3: Software and materials for use in the classroom A4: Networking and links beyond the school
B: Technology for planning and management	B1: School data and management B2: National system data for policy and planning B3: Fund transfer and financial management B4: Communication and advocacy
C: Enabling the use of technology	C1: Infrastructure (electricity, connectivity, device ownership) C2: Financial costs - initial and ongoing C3: Government and regulatory environment C4: Multi-stakeholder partnerships

Framework 2: amended from DFID

The framework below is adapted from one that was developed for DFID in 2016[3] to categorise research and evidence within education technology. It is included because it demonstrates the way in which technology can be used within education at each stage of a programme lifecycle, as aligned with the Theory of Change approach. It shows the different inputs / interventions, outputs, and outcomes within which technology may play a role in education for this particular donor.

[2] http://saber.worldbank.org/index.cfm?indx=8&pd=10&sub=0

[3] see DFID 2016 - https://www.gov.uk/dfid-research-outputs/education-technology-evidence-map

Inputs / interventions	Outputs	Outcomes
• Curriculum / pedagogy • Teacher training • Leadership and admin training • School management, governance, culture • Political and regulatory environment • Educational advocacy and awareness raising • Education M&E, 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 outcomes • Non-mother tongue language acquisition • Student life chances • Student worldview • Inclusivity • Value of education in society • Accountability / governance • Income generation • Security and corruption

Framework 3: amended from the Digital Principles

The Digital Principles[4] are nine principles led initially by UNICEF and agreed upon by a wide range of donors and implementers to guide best practice and encourage knowledge sharing around best practices in implementing technology. They are designed to be transferable across sectors. The table below provides an illustrative application of the principles for education.

Digital principle	Potential application for education
Design with the User	User-centered design starts with getting to know the teachers and students you are designing for through conversation, observation and co-creation.
Understand the Existing Ecosystem	Well-designed initiatives and digital tools consider the particular structures and needs that exist in each country, region, school and community.
Design for Scale	Achieving scale requires adoption beyond an initiative's pilot population and often necessitates securing funding or partners that take the initiative to new communities or regions.
Build for Sustainability	Building sustainable programmes, platforms and digital tools is essential to maintain user and stakeholder support, as well as to maximize long-term impact.
Be Data Driven	When an initiative is data driven, quality information is available to the appropriate people when they need it, and they can use the data to take effective action.

[4] https://digitalprinciples.org/principles/

Use Open Standards, Open Data, Open Source, and Open Innovation	An open approach to education can help to increase collaboration between educators and institutions and avoid duplicating work that has already been done.
Reuse and Improve	Reusing and improving is about taking the learning and best practice of education technology further than any organization or programme can do alone, especially reusing and improving on open educational resources.
Address Privacy and Security	Addressing privacy and security in education involves careful consideration of which data are collected and how data are acquired, used, stored and shared. Particular concerns around child protection and learner privacy should be prioritised.
Be Collaborative	Being collaborative means sharing information, insights, strategies and resources across projects, organisations and sectors, leading to increased efficiency and impact.

3.4. Evidence of impact

For many years analysts working in education technology have bemoaned the absence of a comprehensive evidence base that can guide effective decision making[5]. A mapping exercise conducted in 2016 provides an overview of the academic evidence that exists regarding education technology[6]. It does not provide insight on the quality of the evidence that exists but does show what topics and locations have been the focus of most evidence building, and therefore where future efforts can sensibly be focused. For example, it indicates that:

- The majority of research evidence within the education technology sector is based on observational studies (278 of the 401 articles reviewed) and only a small number are based on experimental studies (23 of 401).
- There are relatively few (22 of 401) multi-country studies and this makes it difficult to engage in reliable cross-country analysis and comparison.
- The areas of input that are most regularly researched are curriculum and pedagogy (263 of 401) and teacher training (139 of 401).
- The areas of output most frequently observed within the research are teacher ICT literacy and use (262 of 401) and student ICT literacy and use (223 of 401).

The dependence on observational studies is somewhat understandable at this stage of the development of the sector. However, it does demonstrate the importance of interrogating the methodological rigour of any study cited as evidence with education technology, because most of what exists is heavily dependent on the personal interpretation of the researcher. There are many difficulties associated with running experimental and quasi-experimental studies on the role of technology within education, and there is inevitably a significant time investment required in order to assess impact on learning outcomes. There are several large-scale studies of this nature currently underway (such as the XPrize for global learning[7] currently running in

[5] see DFID 2014 - http://www.heart-resources.org/topic/educational-technology/
[6] see DFID 2016 - https://www.gov.uk/dfid-research-outputs/education-technology-evidence-map
[7] https://learning.xprize.org/prizes/global-learning

Tanzania) which will in time provide a valuable contribution to the evidence base.

In addition to the academic research base, there are multiple policy and programme guides produced by donors and other stakeholders that contain a range of guidance regarding the effective use of technology in education. They have a range of emphases and formats, but in combination provide a valuable summary of agreed good operating principles. A sample of these is provided in Annex section 2.

3.5. Operating principles

Digital technology has led to significant change across all sectors of international development work. While there are examples of how technology has led to transformative benefits within the education sector, there are far more examples of how the promise of technology has led to expensive investments with little or no positive impact. Significant lessons have been learned in the last decade regarding the appropriate uses of technology in education in low-resource environments. There is still no definitive understanding of how technology can have the most significant impact on education outcomes, but there is an emerging consensus regarding the principles that can maximise the chances of success. These include many self-evident things that are worth stating because they have so often been ignored.

In the past, programmes such as One Laptop Per Child[8] (OLPC) promoted the idea that technology could effectively replace the need for teachers, based on a constructivist pedagogy. It is now increasingly recognised that, whenever possible, teachers should be central to any change process that introduces technology into schools. This requires a sustained focus on training teachers how to utilise the technology. This needs to be intensive and continuous training that takes place in the classroom and focuses on how to embed the effective use of technology within classroom practice rather than just training in basic technology usage. Large-scale programmes from the last decade have also demonstrated that embedding technology within an education system requires a long time, and that the large majority of programmes have underestimated the time, effort and resources that are required in order to achieve the anticipated change. It has become clear that it is difficult to scale or sustain initiatives which are based on the distribution of hardware. However, the political appeal of these high-profile programmes remains present, and various governments continue to invest heavily in providing laptops for students (such as Kenya's Digital Literacy Programme[9] launched in 2016). In contrast, there are encouraging examples of how programmes can identify technology that is already available within a population and then utilise it for educational purposes (such as helping teachers make use of their mobile phones for finding new teaching resources).

Many programmes have struggled to sustain themselves because of overly optimistic cost-calculations made at the outset. Many initiatives rely on demonstrating low cost-per-beneficiary figures as this is likely to increase their traction with donors. However this leads to future challenges (see Annex 1B). There are countless examples of education technology programmes that have collapsed because they did not account for ongoing and future costs within their operating model. Calculations should be based on total cost and require a systems-level assessment at the outset. Alongside cost calculations, it is necessary to consider the regulatory environment within which the programme is operating, and the extent to which the necessary supporting infrastructure is in place (namely reliable electricity and internet connectivity).

It is increasingly apparent that, in order to be most effective, education technology should not be understood as a discrete area of education policy within the education sector, but rather as

[8] http://one.laptop.org
[9] http://icta.go.ke/digischool/

a cross-cutting theme that can enhance many areas of education when used appropriately. When viewed as its own sector, education technology is likely to be technology-driven and increasingly detached from the wider strategic objectives of the education sector as defined in the Sustainable Development Goals[10] (SDGs). All those engaging in education technology should seek to embed efforts within the mainstream education sector whenever possible. Many education technology programmes launch in parallel to government priorities and without paying sufficient attention to the requirements of the curriculum within the country in question. If the programme is successful then the lack of integration leads to significant challenges once it is operating at scale. Therefore it is important for any programme that is using technology to ensure it is in full alignment with the national curriculum and national priorities from the outset. Similarly, many programmes can be characterised as having been 'technology led' rather than 'education led'. This means they have often tended to focus on how a specific predetermined new technology-based solution can be used to solve anticipated or imagined problems, rather than driven by a genuine analysis of what tools will best address an actual problem and demand. Thus the use of technology should, perhaps counter-intuitively, focus more on problems that need to be solved rather than solutions that need to be promoted.

It should be noted that, although seemingly commonsensical, many of these principles and lessons are still largely ignored by those designing and implementing policies and programmes that use technology within education. The sector is still too often characterised by enthusiasm, innovation, and optimism regarding anticipated impact. In order to achieve sustainable impact on education at scale through the use of technology there needs to be a significant shift in the way decisions are made regarding the use of technology in education. The established norm should be that programme design and implementation is based on established evidence rather than technophile optimism. The context summarised above provides SDC with an unusual opportunity. SDC has the potential to achieve strategic positive impact because of its relatively belated engagement in education technology. The organisation can learn fast from the experience of others and can build on good practice to maximise positive impact on education outcomes.

[10] https://www.un.org/sustainabledevelopment/sustainable-development-goals/

Programme spotlight: Instant Network Schools (INS)[11] (non SDC)

Programme summary: The INS programme aims to support the delivery of quality education in refugee camps (in Kenya, Tanzania, South Sudan and the DRC) through the provision of the following for each school:

- A laptop, projector, sound system, inbuilt charging, and 25 tablets
- Internet connectivity with solar-based energy supply
- Open-source offline educational content
- ICT and pedagogical training for teachers

Key learning: The INS programme is a key example of a holistic approach to programming that provides a comprehensive package of inputs in addition to the provision of technical equipment. Learning includes the importance of working closely with school leadership and obtaining and applying their input, as well as ensuring that school management decision-making is supported through access to monitoring and evaluation data generated by the programme.

Good practice considerations to carry forward: (1) Devices administered to schools should be robust, durable and suitable for the environment. (2) Focus should be placed on the capacity building of local staff as on-the-ground support for the intervention. (3) Support structures that facilitate peer-to-peer learning should be invested in. (4) There should be strong collaboration with implementing partners.

Programme spotlight: Eneza Education[12] (non SDC)

Programme summary: Eneza Education is a comprehensive virtual tutor that provides multi-device access to interactive learning content for a range of audiences: primary and secondary school learners, teachers, parents, and small business owners.

Key learning: Eneza Education is a noteworthy example mobile learning, although they now offer multi-device access, including through tablets and desktops. The Eneza model allows learners with different abilities to access different subjects and track their performance.

Good practice considerations to carry forward: (1) Importance of individualised pathway creation for learners with different abilities. (2) Importance of offering interaction with live teachers. The learners on the Eneza platform can interact with live teachers from 8am to 9pm. (3) Ensuring a wide range of audiences can benefit from the platform. Eneza also offers small business owners a basic business course that aims to improve their entrepreneurial skills.

[11] https://www.vodafone.com/content/foundation/instant-network-schools.html
[12] http://enezaeducation.com/

Programme spotlight: Open Learning Exchange (OLE) - Free Education Library for Syrians (FELS) (non SDC)

Programme summary: OLE coordinates an international network of organisations exploring the use of low-cost, locally relevant teaching and learning content in local languages. In January 2018 they launched FELS, which is a repository of free learning and career-related multimedia resources to help Syrian refugees develop competencies and skills that support them advancing their opportunities and their capacity to contribute to the communities in their host countries.

Key learning: Despite offering a large repository of content and resources, FELS also provides a uniquely individualised experience with each learner having a personal dashboard with the resources and courses they have chosen that can be used online or downloaded in Arabic and/or host-country local languages. This emphasises the empowerment that comes from accessing meaningful quality learning resources and career pathways.

Good practice considerations to carry forward: (1) Importance of local language translation of quality learning content as this can lead to a sense of agency, meaning and connection needed for marginalised learners to thrive. (2) Importance of offline capabilities for content repositories when used in areas with poor and periodic network connection. (3) Large databases and repositories should focus on extracting relevant and meaningful data to determine outcomes and progress.

Programme spotlight: Global Digital Library (GDL)[13] (non SDC)

Programme summary: The GDL aims to increase the availability of high-quality reading resources in underserved languages globally. Ethiopia was chosen as the first country to launch it, and will be hosting openly licensed reading resources in seven Ethiopian languages.

Key learning: Provision of reading materials for marginalised groups should focus on underserved languages (i.e. languages where there is currently a lack of quality early grade reading resources). While the goal of the GDL for the end of 2018 is to offer resources in at least 25 languages (and 100 by end of 2020), the platform will also facilitate translation and localisation of these resources to more than 300 languages.

Good practice considerations to carry forward: (1) The use of quality assurance standards, since all resources hosted on the GDL are quality assured. (2) Creation of guidelines for organisations to consider before submitting their content to the GDL platform. (3) Importance of a platform of this nature being a collaborative venture to ensure that the content pool will continue to be regularly expanded.

[13] https://www.digitallibrary.io

3.6. The place of technology within national education plans

National plans relating to education and technology provide an opportunity to understand what countries are saying publicly about their engagement with technology in their education sectors. This can range from plans which are ambitious but not implemented (e.g. Papua New Guinea) to significant documents shaping practice (e.g. Kenya). In order to engage constructively in the sector at a country level it is necessary to be cognisant of the way in which national plans are formed, what interests drive them, and how they influence policy. This section therefore presents an introductory summary of education plans from SDC-priority countries involving the use of technology. Within the 21 SDC priority countries or regions covered in this review, although 12 of the education national plans identified mention ICTs in some manner, only five have an explicit mention of technology within education policy or plan.

The variety of national plans demonstrates the different approaches that countries adopt. In Rwanda and Zambia the national plan plays a significant role in dictating most activities. In others the plans cover a few key areas, leaving lots of room for activities to take place that are not linked to the plan. The purpose of national plans also varies from one country to another. Some are long-term and visionary, with an aspirational tone, such as Nepal's School Sector Development Plan (with over 200 mentions of ICT). Other plans are operational and focused on shorter-term strategies, and past performance, such as Zambia, Benin and Chad.

Examples of good practice with national plans include Rwanda's 'ICT and Education Master Plan', created by the Ministry of Education, which demonstrates Rwanda's leadership in ICT in the Great Lakes Region, one of SDC's priority areas. This policy indicates an informed approach to how technology can be used across the education sector, including non-formal education, use for management and curriculum development and training and capacity building. This integrated plan also indicates an awareness of the need for partnerships and monitoring and evaluation, as well some mention of financial implications, although this does not appear to follow a total cost of ownership (TCO) approach to devices, accounting for their maintenance and support for the full lifecycle.

Another example is the Nepal 'ICT in Education Master Plan 2013-2016' and the 'School Sector Development Plan', which likewise demonstrate a good example of integrated technology approaches. Nepal shows the progression from a standalone ICT in Education policy approach in their 2013-2016 Master Plan, which Rwanda has also taken, to a policy approach integrating ICT within education. This trend can be seen in other countries as well: as the integrated role of ICT within every sector becomes established it becomes increasingly untenable to maintain ICT plans that are designed separately from their sector specific operating context.

An initial analysis of country plans shows that there is a frequent gap between aspirational planning and actual implementation. However, if such reports are well designed, they can provide an overarching framework so that any activity (whether at planning or implementation stage) can be aligned within a broader system.

One of the most important issues necessary to understanding national plans is whether they correspond to an actual budgetary allocation. Important questions to ask include whether the budget is realistic and whether it considers the total cost of ownership, and infrastructural capacity. As a donor, SDC should be aware that within many country plans, the inclusion of technology represents an aspiration for a 'digital future' and does not necessarily translate into actual budget allocation or implementation strategy.

4. SDC and education technology

This section provides a review of current SDC educational programmes which are relevant to technology use, as well as future plans for using technology, and a potential framework for assessing both existing and future programmes.

4.1. SDC current use of technology in education

This section presents a summary of examples from SDC country and regional teams that have already started to make use of technology in education. These examples are derived from interviews with nine key stakeholders representing the field team perspectives (see Annex section 4 for list of interviewees), as well as a review of project documentation.

SDC engages with education and learning through programmes beyond the scope of its formal education work, including in VSD, health education, agricultural extension, and education in humanitarian response. In each of these areas, examples of technology use can help to inform the development of SDC's approach to engaging with technology in basic education, and integrating the use of technology across education programming. The three 'SDC programme spotlight' examples (Project Humanity, Vocational training for the hospitality sector in Myanmar, CABI and CSTL - MIET) each demonstrate how SDC is already engaged in the use of technology in education. There is valuable learning already held within these initiatives which can be shared across the organisation. Additional detail regarding each programme can be found in Annex section 2 and section 3.

Programme spotlight: Project Humanity[14] (SDC)

Programme summary: Project Humanity (multi-country) includes a curriculum and teaching resources for learning about the humanitarian principles, conflict resolution and global citizenship, which can be delivered using ICTs.

Key learning: The content-focused nature of the programme which makes it accessible across ICT and non-ICT platforms also means that digital pedagogy is not prioritised/fully utilised.

Good practice considerations to carry forward: This project exemplifies the need for ICT use to be one of several access points for learning - though the project was designed to be delivered with ICTs from the beginning, it is possible to deliver the training by paper, or with nothing at all.

[14] https://www.project-humanity.info/en.html

Programme spotlight: Centre for Agriculture and Biosciences International (CABI) (SDC)

Programme summary: CABI is an agricultural extension programme in sub-Saharan Africa with tablets and crowdsourced databases of crop diseases.

Key learning: The instrumental and applied nature of knowledge sharing in the rural agricultural context may not also provide opportunities for farmers to explore learning more deeply or to proceed into formal education.

Good practice considerations to carry forward: Peer learning and local knowledge have an important contribution to digitally-enhanced learning.

Programme spotlight: Care and Support for Teaching and Learning by Media in Education Trust (CSTL - MIET) (SDC)

Programme summary: Care and Support for Teaching and Learning is a programme by SADC which provides a comprehensive approach to addressing the barriers to teaching and learning that are associated with health- and poverty-related challenges, including SRHR education.

Key learning: Multi-national programmes have different ICT challenges in each context, and it can be difficult to provide support for all of these challenges, and unrealistic to expect similar levels of ICT engagement.

Good practice considerations to carry forward: Educational programmes that focus on teachers and are embedded within national education systems are more effective and sustainable.

4.2. Challenges in SDC current use of technology

The interviews with SDC team members provided an opportunity to understand the challenges and barriers to using technology that they have encountered and observed within their work. The three most significant recurring themes from the interviews are the proliferation of failed pilots, a lack of infrastructure, and immature digital ecosystems: each of these is summarised below based on interviews with SDC staff members. It is noteworthy that these three issues are also widely identified as challenges in the broader literature.

Failed pilots

Many technology related programmes test their viability through running ‘pilots’. This is an important way to provide evidence for effectiveness before a large-scale implementation. However, it has often led to ‘pilot fatigue’ where the same communities repeatedly participate in trials which are not conceived in a manner that is relevant to the context, and do not have any viable strategy for how they will be taken to scale. The interviews with those in field sites confirm the widespread use of pilot programmes to provide ICT without any consideration for the context or the sustainability of the initiative. This leads to a context of mistrust and disinterest in external interventions, particularly where new technologies are provided without adequate training and support. Similarly, the use of technology in short-term pilots in East Africa has been so prevalent that the Ugandan government has chosen to place a moratorium

on mobile health interventions, in order to take control and responsibility for health interventions.

The concern about pilot programmes that are unlikely to be scalable is particularly significant in the context of education, because of the potentially adverse effect it can have on the development of children. The piloting of untested interventions implies an assumption that current education provision is of such poor quality that any type of intervention would be an improvement. SDC interviewees explained that other organisations in their contexts pilot education technology programmes in an inappropriate manner. This constitutes a concern and risk which should be accounted for in programme planning. In each of the SDC programme contexts, the role of partnership with local implementing partners has been highlighted, and co-operation with local actors is an important step in preventing unnecessary ineffective pilots. In addition, learning from past pilots and research can help to ensure that an appropriate process for roll-out can be undertaken.

Infrastructure

A prerequisite to the effective use of technology is having the supporting infrastructure in place. This includes internet and mobile connectivity and electricity. While consistent access to electricity may be taken for granted in some contexts, the lack of power can be a major barrier to using technology in a reliable manner in education. Local SDC staff report that only 10% of Afghan government schools have electricity. Examples of initiatives providing internet access, while inadequately accounting for the lack of access to power demonstrate the lack of proper understanding of infrastructure limitations. This demonstrates that sustainability depends on the presence of critical infrastructure and a detailed understanding of the local context of the intervention.

Further examples were cited in the context of West Africa, where infrastructure limitations in rural schools, or among non-settled populations present a real barrier of inaccessibility. In the context of Myanmar, mobile and internet connectivity are relatively new due to the previous regulatory environment which severely limited access prior to 2014. The noted loosening of regulations on mobile ownership in Myanmar has led to high growth rates in the last few years. This growth means that infrastructure rollout is still inconsistent, and is likely to be unavailable in more remote areas.

Immature digital ecosystems

A third challenge and barrier noted in the interviews, and related to the issue of infrastructure noted above, is the immaturity of the digital ecosystems within the operating context. This was observed in Myanmar where mobile adoption has been relatively recent, as well as in Afghanistan where mobile use is largely restricted to voice calls, except in urban areas. Additionally, the observation in some African contexts that digital services were not consistently available reflects an underdeveloped ecosystem.

These observations also relate to how the availability of technology interacts with other cultural factors. For example, low rates of literacy affect mobile usage patterns in Afghanistan as much as lack of availability of smartphones. In West Africa several countries have high mobile penetration rates yet low usage of social media, indicating the network effect of a lack of critical mass on social media. Additional factors which contribute to underdeveloped digital ecosystems include the lack of support for minority languages, digitally and on the internet, and the dominance of global social networks, websites and software over locally produced and locally relevant services and content. Even some of the strongest examples of localised content platforms, such as Wikipedia, which supports 278 languages, have often failed to develop a vibrant ecosystem of content production in local languages, because of a reliance on gatekeepers and moderators from majority languages and cultures.

5. Analysis

This section brings together the lessons from other programmes as well as SDC programmes to provide a synthesis and a potential framework for SDC engagement with education technology.

5.1. A framework for SDC and education technology

This framework provides a structured approach to considering good practice and examples reviewed from within and beyond SDC. It is based on the six strategic orientations which have a significant role in informing programming decisions. Alongside this, opportunities in local contexts also shape how strategy and programming objectives are operationalised in every region. However, basing the framework on the six orientations shows how technology could be used across the different areas of strategic importance. For greater detail, each of the six orientations can also be assessed according to the criteria in Annex 1A.

Six strategic orientations	Illustrative considerations	Illustrative programmes in this area
Global and regional agenda *Enhance international policy-dialogue for effective, efficient and resilient national education systems.*	Engaging in the global dialogue can be achieved by building evidence, sharing good practice, and potentially engaging in innovative partnership with the private sector.	This orientation does not link to a specific programme but examples of initiatives that influence the global agenda can be found in section 5.2 on institutional partnerships.
Education system governance *Contribute to effective, inclusive and equitable education systems through strengthened governance and institutional capacities at national and decentralised levels, increasing community responsibility and locally adapted solutions.*	EMIS and other digital tools for education system governance can empower and resource local school leaders while also linking into regional and national oversight structures. Transparency of governance and privacy of data can be uniquely maintained through well designed digital systems. Mobile-based messaging systems can be used to communicate effectively with parents.	**VISHWAS[15]:** Mobile-based app to enhance the academic attainment of the school's students and performance of school staff through its reporting system.

[15] http://softsystems.org

Quality and relevance *Enable relevant quality learning that provides competencies for life and work and has a transformative impact on human development.*	Access to learning resources through global online networks can enhance their quality. Connectivity can broaden horizons and connections to other relevant communities (ie language communities in other locations), but it still requires contextualisation. Technology can be used for teacher pre-service and in-service training, and has a particular benefit for on-going use in remote and marginalized regions.	**Open Learning Exchange[16] (OLE):** OLE coordinates an international network of organisations exploring the use of low-cost, locally relevant teaching and learning content in local languages. **Mindspark[17]:** Adaptive learning programme that allows each student to follow a unique learning pathway that is based on their current level.
Inclusion and equity *Enhance equitable access to quality basic education for all and to expand vocational skills development options, with special attention to the disadvantaged and marginalised, including crisis-affected societies.*	Technologies can expand access to otherwise marginalised communities – but this requires targeted investments as the 'natural' spread of technology is likely to exacerbate pre-existing inequalities. The flexibility of digital resources can provide particular benefits for SEN learners (for example with visual or hearing impairment).	**inABLE[18]:** Programme that explores innovative uses of tech to support the education of students with visual impairments. **iMlango[19]:** Ed tech programme that aims to improve learning through the delivery of satellite connectivity, individualised simulated Maths tutoring, CPD, and content.
Sustainability, cohesion, resilience *Make use of the transformative role of education for sustainable development, civic participation, social cohesion and resilience.*	Social cohesion can be encouraged among divided groups through online platforms and social media, but sensitive moderation is key to mitigate negative discourse. For technology-enhanced education programmes to	**Project Humanity:** Curriculum for the humanitarian principles and global citizenship. **Habari RDC[20]:** Online platform for encouraging civic debate and participation among young people in the DRC.

[16] https://www.ole.org/#section-3725
[17] https://mindspark.in
[18] https://www.inable.org
[19] https://www.imlango.com
[20] https://habarirdc.net

	operate sustainably it is necessary for realistic long-term planning to be considered at the design phase (see Annexes 1A and 1B).	
Transition to work *Enhance labour market outcomes through informed choices, improved matching, entrepreneurship support and facilitated access to gainful employment.*	Links between educational institutions and employment opportunities can be made across labour markets, ensuring multiple pathways into employment. Labour-market information systems can provide valuable data on supply and demand, and VSD programmes can be tailored accordingly to be of maximum use value.	**OLE FELS:** Pilot by OLE that offers a repository of free instructional resources and career pathways to help Syrian refugees develop specific competencies and skills. **University of the People[21]:** Tuition-free online university that offers accredited degrees.

5.2. Additional and cross-cutting themes

In addition to the above analysis of the six strategic orientations, SDC is keen to understand the implications of education technology for the four following cross-cutting themes: education in emergencies, social media, private sector engagement, and institutional partnerships. Each of these is a complex and contested area of work and the following analysis only provides an initial entry point for further consideration of the topic, with potential areas of engagement.

Education in emergencies

There is significant global attention on the role of education within emergencies (EiE). Productive engagement regarding the use of technology in this area requires distinguishing between three areas of EiE: education in first phase humanitarian response, education in conflict-affected and fragile states (CAFS), and refugee education. While SDC has different roles within each of these areas, the applicability of technology within them differs greatly. Efforts to incorporate technology in education in the context of first-phase humanitarian response do exist, however the role of education in this context has a greater emphasis on psycho-social support, safe spaces and continuity of basic provision for children in vulnerable circumstances. In education for CAFS, the contexts can vary greatly: the instability of the environments can be a major barrier for technology use that is dependent on fixed infrastructure, but mobile interventions have the potential to facilitate some degree of education provision even in highly volatile contexts. In addition, technology has a potential role to play in bridge-building between emergency contexts and development contexts, and the area of overlap between the two. Potential examples include the transition from use of mobile phones for early stage rapid education assessments, embedded from the outset with the re-development of EMIS.

Further exploration of the use of technology in schools in areas of Mali that are not under government control can help to orientate SDC's engagement in this area. Initial indications

[21] https://www.uopeople.edu

suggest that this may not be a strategic priority in Mali due to the risk it may pose to schools, with technology leading to increased risk of schools being attacked. Because of this, any decision to introduce technology into the formal schooling system in such a context should be taken with extreme caution. The more promising uses of technology within EiE thus far have been seen in contexts of more long term refugee education. One example of this is the INS programme of the Vodafone Foundation[22]. Another example is the work of the Connected Learning in Crisis Consortium[23] (CLCC), a global body coordinating the use of technology in higher education for refugees. Within the CLCC there are 16 member organisations, each working to make effective use of technology – largely through blended learning approaches – to help refugees participate in fully-accredited higher education programmes.

As discussed above, it may be possible for SDC to expand engagement in refugee education by building on the successes of Project Humanity. This not only engages with EiE from a position of experience and strength in an environment that may be more stable and appropriate for technology use, but also deals with subject matter that relates to humanitarian response. This opportunity gives SDC a strategic means of engaging with EiE in two sub-domains, while also ensuring the contexts are appropriate for technology use.

Social media

Social media is a major growth area and there is significant potential in the overlap of youth usage and education. However, there is a lack of evidence regarding what actually drives positive interactions. The dominance of large social media companies, and the poorly understood terms of engagement have led many educators to consider social media use a hindrance to learning because of the distractions caused to students. However, there are some early indications that social media is being used by teachers to form and develop peer learning and support networks. Several large donor-funded education programmes have noted the positive impact that WhatsApp groups have had on building teacher engagement, even though they were not a formal component of the programmes. In addition, there are emerging opportunities for social media to broaden horizons and enhance the capabilities of learners such as in the cases of Beebac[24], and iEARN. Beebac is an educational social network used in francophone schools in West Africa. iEARN is active in Mali (and other countries across the region) leveraging existing social platforms like Facebook to connect learners around the world who share experiences in project-based learning.

Currently there is very little activity within SDC programmes in social media, however there are social functions and platforms within projects such as Teenwyze, Tuneme and Project Humanity. While the social functions of these interventions indicate promise for engagement with social media more broadly, concerns are rightly posed about engagement with the privacy of the major platforms like Facebook and Twitter. Understanding these platforms as new communications protocols, that are neither personal websites for private information, nor traditional broadcast media, can help to inform engagement with education.

Private sector collaboration

Private sector collaboration provides an important opportunity in education. The scale of education systems means that it is necessary to engage with partners who have the capacity to replicate and scale their initiatives, and sometimes these are found in the private sector. This is particularly pertinent within the context of education technology. Governments want to harness technology in education, not only because of the opportunity to drive change, but

---

[22] https://www.vodafone.com/content/foundation/instant-network-schools.html
[23] http://www.connectedlearning4refugees.org/
[24] http://www.beebac.com/

because there is political pressure to do so. However, the expertise in driving this change is primarily held within the private sector. Therefore this presents a range of opportunities and constraints that are challenging to navigate. Each opportunity should be assessed in significant detail, with relevant questions asked in relation to each of the four steps identified.

Tool for application - assessing private sector education technology partnerships

Assessing the suitability of a partnership between SDC and a private sector education technology provider can be helped by following these four steps in order:

1. **Gain all relevant information** - secure suitable responses to due diligence questions that address any gaps in proposed approach.
2. **Assess strategic alignment** - ensure that the offering of the partnership is appropriately aligned with SDC motivation and strategic outcomes.
3. **Conduct market analysis** - a neutral review of alternative providers to understand if the proposed option is the most appropriate organisation for delivering the type of partnership that SDC requires.
4. **Define terms of partnership** - agree the precise terms of the partnership in a manner that is sufficiently compelling to SDC strategic priorities and ensures an appropriate share of risk and reward for future outcomes.

Institutional partnerships

Institutional partnerships can be distinguished from private sector collaboration as they focus on governmental and third sector collaborators. By definition, these institutions are not generally financially motivated in the way the private sector is. The emphasis in such partnerships may therefore be more focused on learning, policy influence and coalition-building. Institutional partnerships require significant investment of time and energy, and alignment of institutional goals.

Institutions for SDC to consider connecting with:

This is an initial list to consider for connections. It requires additional dialogue to know which would be the most strategic entry points for SDC. It is not exhaustive but provides an indication of the type of organisations that would be helpful or SDC to connect with as part of the next steps in this sector.

Significant donors and international organisations in education technology:

- World Bank (long standing thought leader and investor in education technology)
- DFID (forthcoming launch of global education technology research hub)
- UNICEF (currently investing significantly in learning on education technology)
- UNESCO (long-standing work on education technology with specific teacher focus)

Annual conferences:

- eLearning Africa[25] (largest conference on education technology in Africa, now in 13th year with 1000+ participants)
- Mobile Learning Week[26] (UNESCO flagship event in Paris)

[25] https://www.elearning-africa.com/
[26] https://en.unesco.org/mlw

- mEducation Alliance[27] (annual gathering of donors and other senior stakeholders in Washington DC)

Other relevant bodies:

- Connected Learning in Crisis Consortium[28] (CLCC) - a global body coordinating the use of technology in higher education for refugees
- INEE technology and education in crises task team[29]
- The Global e-Schools and Communities Initiative[30] (GESCI) – an international non-profit organisation that works with governments and partners to provide strategic support for good technology based practice in education.

The following framework for operational guidance follows the life cycle of partnerships from inception to design and development, to implementation. These steps outline the structures that are helpful to have in place to ensure that partnerships can represent the needs of all stakeholders adequately. While not all of them are unique to education technology, they reflect important good practices that partnerships should consider:

Guidance on building institutional partnerships for education technology programmes:

- Programme inception:
  - Develop clear protocols for communication that take into account the digital communication needs of different types of partners.
  - Ensure clarity around the nature and duration of the partnership, so that partners invest in the long term, and are aware of ongoing commitments and costs (see TCO tool in Annex section 1)
- Programme design and development:
  - Consider the unique challenges that digital programmes offer for assessing cost-benefit and include such components like scalability, which may raise the value of the initiative.
  - Ensure all stakeholders have ownership over the design, without leaving this only to a 'technology partner', to prevent misunderstandings at the implementation phase.
- Programme implementation:
  - Consistent communication should take place between partners throughout implementation, taking advantage of innovative collaboration, communication and data exchange tools.
- Programme evaluation:
  - Consider what things will be measured and understand what type of impact matters for each party.
  - Consider what technology will be used for tracking impact and whether this is effective for each party.
  - Explore the potential for real-time data or rapid feedback of data to help shape programme learning throughout

[27] https://medalliance.wpengine.com/
[28] http://www.connectedlearning4refugees.org/
[29] http://www.ineesite.org/en/task-teams/technology
[30] http://gesci.org/

6. Recommendations

6.1. Recommendations for good practice

The final section of the main report provides practical recommendations for SDC, drawing from the previous sections of analysis. This includes the identification of strategic entry points for SDC for mainstreaming and integrating technology into its educational programmes and operations within existing projects and when launching new initiatives. SDC is at an early stage of engagement with education technology: the following recommendations therefore cover a range of options to catalyse further dialogue. It is not anticipated that SDC should seek to implement all the recommendations in the short term.

Decision making across SDC portfolio

Recommendation 1. Decide the type of education technology engagement that is best aligned with SDC's overall strategic engagement

There are multiple ways in which SDC could engage in education technology and making a decision regarding the most appropriate choices (globally and in-country) will depend on having a clear agreement internally regarding the desired level of risk, desired rate-of-return, and outcome / impact indicators for SDC. It also requires a decision regarding the focus of the use of technology, this could be on student learning, teacher training, management, governance or another issue. This should be a collaborative, facilitated process that engages with each of these issues in turn (and could also be based around the framework in Annex 1A).

Recommendation 2. Integrate the framework for effective decision making (Annex 1A) into project selection and development.

SDC could begin to utilise the proposed framework for effective decision making (Annex 1A). This would ensure that education technology project design, development and selection is aligned with the priorities of SDC, and the comparative advantages of Swiss Education. In order to lead to an actual change in practice, the framework will need to be both refined with intended users and operationalized for each different context. It may be sensible to apply the framework in three countries or programmes in the first instance in order to test its utility and refine accordingly.

Recommendation 3. Invest in detailed country-level understanding of the technology landscape and particular application for how technology can be used to enhance education in that context

It is necessary to pay particular attention to contextual understanding of technology in education because of the unanticipated ways in which technology is used and appropriated, as well as the unanticipated consequences of its introduction into school systems. Good practice and lessons learned from other contexts of technology use cannot always be applied to education and good practice in education does not always transfer to technology-enabled learning environments. Because of this it is necessary to invest time and resources at the country level to ensure that all proposed interventions are appropriate for that specific operating context. This means conducting a thorough:

- Needs assessment – to understand what is required in the context
- Landscape review – to understand what is already happening in the context
- Feasibility study - to understand what is possible in the context

It is important that within each of these, sufficient attention is given to the country-level educational context, the level of pre-existing knowledge regarding technology, the level of technology infrastructure, and the broader political economy within which education is situated

in the country. Working from an evidence base will help ensure that all SDC interventions with technology in education are built on good foundations rather than inadvertently repeating expensive and time-consuming mistakes that have been made elsewhere.

Building appropriate partnerships

Recommendation 4. Establish working partnerships which will effectively advance SDC engagement in the sector

SDC can participate actively in a community of learning and practice concerned with engaging well with education technology. It will likely be beneficial to begin with a small number of partnerships with established organisations (see 5.2 for institutional partnerships). To begin with, this could involve meeting with a small number of other donors and participating in relevant global gatherings. This also requires initial work to decide the specific ways in which SDC can add most value to such partnerships and decide how SDC should be positioned within the global dialogue. Alongside this, SDC should consider whether it may be beneficial to sign up to the Digital Principles.

Recommendation 5. Build several initial partnerships with suppliers but avoid aligning with one 'solution'.

Partnerships with different suppliers in early phases of engaging with education technology can help SDC learn more practically about its needs in an operational context. Having a clear set of outcomes and indicators for success will allow SDC to assess what is working and why, moving forward with positive partnerships and minimising waste cost and effort with unproductive partnerships. Because of the uncertainty inherent in any early-stage partnership it is advisable to establish clear KPIs at the outset and ensure that the exit strategy is clearly defined for if these are not met. Operating in partnership with a donor is not simple for many education technology suppliers so it would be strategic to consider building a 'learning community' with suppliers. A regular rhythm of gatherings for structured reflection could help fast-track organizational learning within SDC regarding how to work in effective partnership with education technology providers.

Recommendation 6: Work in full partnership with government from the outset

Integration with government priorities should be simpler to achieve for SDC than for many other actors because it is already the established way in which the organization operates. Specifically, this involves ensuring that all elements of a programme are structured in a way that enables it to operate within mainstream curriculum, assessment, teacher training, and in alignment with national plans. If this is not done at the outset then it is complex to facilitate the transition at a later stage once operating at scale. Integration from the outset is also often helped by aligning with the priorities articulated within the national plan (see chapter 3.6), especially if it is considered a priority to engage in effective policy dialogue within the country.

Project design and implementation considerations

Recommendation 7: Start with an understanding of the problem that needs to be solved, and build a Theory of Change for how this will happen

Many proponents of technology in education tend to begin with a solution rather than a problem. The consideration of whether to use technology within a programme should begin with a technology-agnostic assessment of the educational problem in question and how it can best be addressed. The decision to utilize a particular technology is most effective when it is the rational outcome of a rigorous programme design, rather than a pre-determined conclusion. Achieving this is dependent on building a coherent Theory of Change and undertaking an assessment of whether the technology in question will assist at each stage. Education programmes that use technology often give insufficient attention to the connection points between inputs, outputs and outcomes, including the risks within them and how they

will be mitigated. SDC should regularly ask those using technology: is there another way the same education outcomes could be achieved by using a different technology, or without using technology?

Recommendation 8. Build on successful technology use in refugee education

Project Humanity has enjoyed some success in teaching young people about humanitarian principles and conflict resolution. This could be further developed now with a strategic expansion into refugee communities, and an evidence-based approach to developing a mobile-first digital pedagogy. Building from a pre-existing foundation is likely to yield results more quickly than starting with a new pilot programme, and can also help inform and inspire others within SDC by demonstrating what it is possible to achieve.

Contributing to the wider sector

Recommendation 9: Make a specific contribution to the knowledge of the education technology sector to establish SDC as a source of thought leadership and good practice.

Become established within the sector by making a significant contribution to advancing the understanding of 'good practice' for those using technology in education. Below are three options of how this could be done through addressing current recognized gaps in knowledge:

- Build an initiative that establishes an agreed 'gold standard' for education technology research to confirm the rigor of methodological approach, analysis and findings. This would enable decision makers (both practitioners and researchers) to effectively assess the quality of the research that exists and thus make more evidence-based decisions.
- Build a resource that enables potential education technology implementers to understand what might be effective in their context, with a quadrant model that shows the trade-off between cost per child and overall impact (i.e. what types of education technology interventions are expensive and low impact / expensive and high impact / cheap and low impact / cheap and high impact).
- Build a tool-kit that addresses the gap regarding VfM and TCO within education technology. This could be based on the tools in Annex 1 and provide a more detailed and context-specific resource to help guide decisions regarding programme design and policy making.

6.2. Entry points for engagement

In addition to the more generally applicable recommendations above, there are also key leverage points in the existing SDC programmes where technology use has already begun. The background review and interviews with field staff have demonstrated that SDC has begun to integrate technology into existing projects, linked to the increased use of technology by learners informally in their personal lives. In addition, there appears to be a particular emphasis on new projects which can benefit from the introduction of technology, in most cases due to the nature of the anticipated beneficiary group. This represents an opportunity to begin to engage and operationalise the recommendations in areas which SDC and its partners already have some experience. This is exemplified in the efforts to use technology with:

- Young people - Technology-enabled programmes that relate to SRH and GBV such as Tuneme, Teenwyze and Ukatili provide a strategic entry point to engaging with some of the most active users of technology: young people. These programmes specifically relate to social platforms which have many of the same functions as social media. Consideration of their integration with the larger social media platforms (Facebook, Twitter, etc) should be carefully considered from a safety and scalability perspective.
- Agricultural communities - SDC's work in agricultural extension (CABI) and education

for pastoralist populations (PREPP) is a strategic entry point for technology with rural and neglected populations to provide appropriate educational opportunities that are adapted to their unique needs. This can include basic education, to bridge the digital divide that these marginalised populations face. It can also include extension education (for cultivators and livestock raisers) and other relevant non-formal educational opportunities for those of secondary school age. Conflict-resolution and peacebuilding learning resources from Project Humanity can also be applied to relevant conflicts between pastoralists and cultivators.

Initial learning in these areas can provide valuable lessons for SDC's integration of technology into other education programmes in the future. These strategic points of engagement represent an opportunity for SDC to enter more fully into greater engagement with technology in education from a point of strength based on past institutional knowledge and experience.

6.3. SDC anticipated use of technology in education

Based on these findings of key barriers and entry points, there are also a range of anticipated uses that relate to broader implementation opportunities. These include online learning for applied education and humanitarian response learning. These provide opportunities to build on strengths, similar to the entry points mentioned above, but they also chart a strategic direction forward aligned with SDC's particular values, and unique engagement with education.

Blended learning in applied education

The example of SDC's blended learning in hospitality in Myanmar illustrates the potential for online learning to supplement other modalities to meet the needs for flexibility of vocational learners. Expanding this opportunity in Myanmar within the same programme by improving the quality of these resources can serve as a model for other vocational educational opportunities in Myanmar. The opportunity for expanding vocational education through mobile learning into the industrial sectors of Yangon, where many migrant workers are seeking employment opportunities, but lack relevant education and skills.

This model is also relevant in other contexts, and beyond strictly vocational education to other applied educational needs. This can build on the recommendation to integrate basic education skills with VSD, and employment skills and certification that motivate learners. In addition, because of the young mobile populations it would target, this provides significant opportunity to engage in new education technology frontiers that are of interest, such as social media and mobile learning. Learning resources and platforms can also be adapted across contexts and sectors, enhancing the potential impact and the opportunities for partnership.

Humanitarian response learning communities

Project Humanity provides an important example for learning about humanitarian response and learning in contexts affected by emergencies. The curriculum focus on peace building and conflict resolution is relevant in many contexts, however a particularly relevant area may be in refugee education contexts. The broadly-defined category of EiE includes learning in humanitarian response, refugee education and education in CAFS. SDC is active in different ways in all three, however the area which presents the greatest potential for technology use at this point is in refugee education, and the potential for connecting refugees to other learners through Project Humanity presents an important area of current engagement that SDC could develop. This model for peer learning and global citizenship also presents an opportunity for broader partnerships and influence in global and regional agendas, particularly through mainstream social media.

6.4. Next steps

Embedding the effective use of technology with the education programmes of SDC is not a simple process. In light of all the recommendations and possibilities listed above, it may be beneficial to engage in the following practical activities:

- SDC to organize an internal review workshop for the SDC team in Berne, to go through each of the points of analysis and recommendations and decide which ones to prioritize, agreeing a strategy for how they can be implemented in turn.
- SDC to organize an initial professional development event for the in-country education teams, to introduce the report to them, present the high-level strategy, and get initial feedback regarding the opportunities and challenges for implementing it within their country contexts. For maximum benefit, the teams should come to this event with real scenarios, problems and opportunities in education technology pre-prepared that they have encountered in their country as this will ensure that the time is spent engaging with the substantive issues that are of direct relevance.
- SDC to consider how to turn the initial frameworks (such as Annex 1A and 1B) into full tools that can be used to help with effective programme decision making.
- SDC to consider identifying a small group of 'champions' within the education teams who can being to implement education technology work within their areas of responsibility, and document and share the learning across the organisation.

In combination these should help to ensure that the analysis and recommendations given can gradually translate into practical change at the level of SDC policy and country-level programmes.

Annexes

The report annexes are split into categories for ease of use: tools for SDC (section 1), resources to draw on (section 2), case studies (section 3), and interviews (section 4).

Section 1: Tools for SDC

It should be noted that the three tools in this section are introductory resources. They can be developed into full toolkits as required, and tailored for the needs of specific contexts.

1A: A framework for effective decision making

This provides an introductory framework that can be used to assist decision makers at the outset of a programme. It would ideally be used before a decision is made, in order to help screen potential projects and assess their suitability. It can also be used to refine and strengthen a project once it is operational. There are nine different topics that should each be considered in turn, and illustrative questions that facilitate constructive discussion between stakeholders.

	Topic	**Why it matters**	**Questions to consider:**
1	Demand	Many education technology programmes are too focused on a particular product or approach rather than on the problem that it will address.	1A: Does what is being proposed meet a real demand in the target population? 1B: Would an alternative approach using a different technology be more linked to the real demand? 1C: Would an alternative approach not using technology be more linked to the real demand?
2	Context	Many education technology programmes have insufficient understanding of the specific educational context within which they want to operate.	2A: Is the technology appropriate and applicable for this context? 2B: What factors are likely to mean it is not appropriate, and could these be overcome? 2C: Is there another technology that would be more appropriate? 2D: Is the programme integrated with the local context - Ministry of Education and national curriculum priorities?
3	Cost	Many education technology programmes are overly optimistic regarding total cost and do not account for 'total cost of	3A: Is this an effective use of limited resources? 3B: Do the cost per beneficiary figures account for the maintenance of the technology, the required services (connectivity and electricity), and the depreciation / cost of replacement?

		ownership'.	3C: Is there another technology which could achieve a similar outcome more cheaply?
4	Evidence	Many education technology programmes pay insufficient attention to established good practice and do not draw on the learning from past interventions.	4A: Has something similar been done before - and what can be learned from that? 4B: Is the approach aligned with good practice for how to use technology in education? 4C: What data will be available from the technology that can help build effective programme learning and development?
5	Equity	Many education technology programmes assume that equitable access will be inevitable - this is rarely the case.	5A: Will the intended users get equitable access to the technology - how will this be ensured? 5B: How will the most marginalised be prioritised - and will they have to pay for any services? 5C: Is the programme designed to be accessible to those with low levels of pre-existing technological literacy?
6	Training	Many education technology programmes put insufficient emphasis on the on-going training and support required to embed technology within an educational environment.	6A: What model of training is proposed, and will it be sufficient to lead to the anticipated level of confident and competent usage? 6B: Are all stakeholders considered within the training plan? 6C: Will the training include on-going on-site mentoring and support throughout the programme?
7	Outcomes	Many education technology programmes focus on inputs and outputs at the expense of educational outcomes because these are hard to measure and require long term investment.	7A: Is this programme focused on achieving outputs or outcomes? 7B: Is there a viable theory of change which shows how the input of technology will lead to an improvement in educational outcomes? 7C: Is there a strategy and budget in place for measuring whether the anticipated educational outcomes have been achieved?
8	Scalability	Many education	8A: Is this designed in a way that it can

		technology programmes are designed in such a way that means it would not be possible for them to scale, even if they work effectively at pilot stage.	realistically expand - in both content and geography? 8B: Is this implemented in a way that it can realistically expand - in both content and geography? 8C: Is this integrated with the wider educational context within which it operates?
9	Sustainability	Many education technology programmes have no prospect of operating without on-going significant financial investment, often resulting in obsolete hardware in project 'graveyards'.	9A: Is the programme dependent on long-term / repeated donor funding or will it gradually transition to a self-sustaining model? 9B: Is the programme designed and implemented in a way that it can realistically be sustained? 9C: Is a viable sustainability plan in place from the outset?

1B: A framework for navigating Total Cost of Ownership (TCO)

A central requirement of implementing effective education technology programmes is a rigorous assessment of their cost-effectiveness. Most simply, this requires asking the following three initial questions:

1. Does the proposed approach represent an efficient use of limited resources?
2. Could the same anticipated educational outcomes be achieved more cheaply using a different technology?
3. Could the same anticipated educational outcomes be achieved more cheaply using no technology at all?

A Total Cost of Ownership (TCO) analysis provides a useful tool to address these questions in a rigorous manner. The detail of a TCO analysis is highly dependent upon the specific operating context. TCO can be used to influence effective decision making when considering the role of technology within education. It is one part of a wider 'Value for Money' analysis which is conventionally framed around the 'four E's': Economy, Efficiency, Effectiveness and Equity. It is very difficult to do an accurate TCO analysis because of the many variables that will come into play during the lifecycle of the programme. Because of this it should be a strategic priority during the planning phase of an intervention. The bullets below provide introductory guidance to aid effective decision making[31].

[31] For additional details see *https://digitalprinciples.org/resource/howto-calculate-total-cost-enterprise-software/*

	Consideration	Questions
1	Cost per beneficiary	• What is included and excluded and does this facilitate a fair comparison with alternatives?
2	Initial outlay / procurement	• What are the upfront costs on hardware and software?
3	Licensing	• How is the software paid for and what are the ongoing liabilities?
4	Maintenance	• Is the cost of this included within an agreed support package or will it need to be sourced separately?
5	Supporting services	• How is the electricity and connectivity secured and costed - who pays for this?
6	Physical infrastructure	• What physical infrastructure will need to be upgraded in order to secure the technology within the school (such as new doors and lockable windows on classrooms)?
7	Depreciation	• What will the rate of depreciation be and how is this accounted for - including cost of replacement devices?
8	Hidden costs	• Can the programme be scaled in an affordable way - will costs increase or decrease per user? • Can the programme be easily integrated with government systems or will this be highly expensive?

Section 2: Resources

2A: Sample of programmes

This section presents a list of 20 noteworthy education technology programmes and initiatives. Some of them have been spotlighted throughout the report or are included as longer case studies in Annex section 3. Note that this list does not include any SDC programmes.

Programme name and details	Summary of programme focus
BRCK **Country / Region:** East Africa **Scale:** Thousands of BRCKs sold to 58 countries around the world **Programme cycle:** 2013 - current **Website:** https://www.brck.com	BRCK is a Kenyan start-up that focuses on designing hardware and software products to help solve connectivity problems specific to many African contexts as well as providing holistic education technology solutions for classrooms.
Bridge International Academies **Countries:** India, Kenya, Liberia, Nigeria, Uganda **Scale:** Over 500 schools and has reached over 100,000 children	Bridge International Academies is a network of schools which began in Kenya in 2008. They use ICTs in many innovative ways including streamlining school administration, delivering lesson plans to

Programme cycle: 2008 - current **Website:** http://www.bridgeinternationalacademies.com	teachers, facilitating classroom management and tracking the progress of both teachers and students in real time.
EkStep **Country:** India **Programme cycle:** 2014 - current **Websites:** https://ekstep.org; https://ekstep.in	EkStep Foundation is committed to creating open digital goods and builds open source platforms for use by the government to help meet a number of challenges. EkStep is an initiative from the foundation to deliver an open learning platform with a collection of learning resources in literacy and numeracy.
Eneza Education **Countries:** Kenya, Ghana, Côte d'Ivoire **Scale:** 4.9 million learners registered; 380,000 active learners / month **Programme cycle:** 2011 - current **Website:** http://enezaeducation.com	Eneza Education is a comprehensive virtual tutor that provides multi-device access to interactive learning content for a range of audiences: primary and secondary school learners, teachers, parents, and small business owners.
Global Digital Library **Country:** Global **Scale:** Aims to have reading materials available in over 100 languages by 2020 **Programme cycle:** 2018 - current **Website:** https://www.digitallibrary.io	The GDL aims to increase the availability of high-quality reading resources in underserved languages globally. It was launched in Ethiopia in 2018.
Habari RDC **Country:** DRC **Scale:** 100+ bloggers across the DRC **Programme cycle:** 2016 - current **Website:** https://habarirdc.net	Online platform for encouraging civic debate and participation among young people in the DRC.
iEARN Mali **Country:** Mali **Scale:** 140 countries **Programme cycle:** 2005 - current **Website:** https://iearn.org/country/iearn-mali	iEARN-Mali works with the SchoolNet Mali and the African Teachers Network to expand global project-based learning in Mali. iEARN-Mali coordinates the YES (Youth Exchange and Study) program, recruiting and selecting high school students to spend a year in the USA.
iKnowledge **Country:** Tanzania **Scale:** 250 schools (primary and secondary) **Programme cycle:** 2016 - 2018 **Website:** http://www.iknowledge.co.tz/	The iKnowledge project delivers ICT and high speed satellite internet access to schools across Tanzania. The project aims to connect, deliver, train and sustain schools in Tanzania through the support of its local and international partners.
iMlango **Country:** Kenya **Scale:** 205 primary schools	iMlango aims to improve student learning outcomes, enrolment and retention through the delivery of: connectivity,

Programme cycle: 2015 - 2016 **Website:** https://www.imlango.com	individualised simulated maths tutoring, digital learning content, continuous training and support to teachers, electronic attendance monitoring, and real-time project monitoring and measurement.
inABLE **Country:** Kenya **Scale:** 8 assistive technology computer labs, over 1800 students and 150 teachers enrolled **Programme cycle:** 2009 - current **Website:** https://www.inable.org	inABLE, a small Kenyan NGO, explores innovative uses of technologies to support the education of students with visual impairments.
INS **Countries:** Kenya, Tanzania, South Sudan, DRC **Scale:** 31 INS centres across the four countries **Programme cycle:** 2014 - current **Website:** https://www.vodafone.com/content/foundation/instant-network-schools.html	The INS programme aims to support the delivery of quality education in refugee camps through the provision of devices, internet connectivity, solar power, content, and teacher training.
Mindspark **Country:** India **Scale:** Annual usage of around 80,000 students across India **Programme cycle:** 2009 - current **Website:** https://mindspark.in	Mindspark is an adaptive learning product from Educational Innovations that aims to help children to improve their skills in mathematics and English. It allows each student to follow a learning path that is based on their current level and at a pace they are comfortable with.
One Laptop Per Child (OLPC) **Country / Region:** Global **Scale:** Roughly 2 million children and teachers in Latin America are currently part of an OLPC project, with another 500,000 in Africa and the rest of the world **Programme cycle:** 2005 - current **Website:** http://one.laptop.org	OLPC's mission is to provide each child with a rugged, low-cost, low-power, connected laptop. They have designed hardware, content and software and works to transfer knowledge to local teams in order to build local capacity and ensure the sustainability of each programme.
Open Learning Exchange (OLE) **Country:** Global **Programme cycle:** 2007 - current **Website:** https://www.ole.org/#section-3725	OLE coordinates an international network of organisations exploring the use of low-cost, locally relevant teaching and learning content in local languages.
Pratham Books' StoryWeaver **Country:** India **Scale:** Offers books in more than 60 languages	StoryWeaver is an online platform that connects readers, authors, illustrators, and translators to create free stories for children around the world in their mother

Programme cycle: 2013 - current **Website:** https://storyweaver.org.in	tongue.
PRIMR **Country:** Kenya **Scale:** 1300 schools across 7 counties **Programme cycle:** 2012 - 2014 **Website:** https://www.rti.org/sites/default/files/brochures/ie_primr_pdf.pdf	PRIMR seeks to improve reading and math abilities in Standards 1 and 2 in Kenya by helping teachers change their instructional activities, and supporting them throughout the change process.
Rumie **Country:** Global **Scale:** Products deployed in more than 20 countries worldwide **Programme cycle:** 2013 - current **Website:** https://www.rumie.org	Rumie provides free learning content to students around the world, with special attention to some of the most challenging educational environments and communities with limited internet access.
University of the People **Country:** Global **Scale:** 15,000 students **Programme cycle:** 2009 - current **Website:** https://www.uopeople.edu	University of the People is a tuition-free online university that offers accredited degrees, with a strong focus on supporting learners in developing countries.
Visiting information of schools handled with attendance system (VISHWAS) **Country:** India **Scale:** 1627 schools in 13 Talukas of Nagpur District **Programme cycle:** 2013 - current **Website:** http://softsystems.org	VISHWAS is an android mobile-based app to enhance the academic level of the school's students and performance of the school staff through its reporting system. This can verify the accuracy of data in government education systems, and is ideally meant for school inspectors visiting schools.
WorldReader **Country:** Global **Scale:** 47 countries, 551 schools and libraries, 606,356 monthly readers, 7,628,939 readers since 2010 **Programme cycle:** 2010 - current **Website:** https://www.worldreader.org	WorldReader provides free access to digital books through mobile apps and platforms to readers in developing countries.

2B: Sample of programme evaluations

This section presents a sample of relevant education technology programme evaluations. Note that there are many programme evaluations that are not publicly available.

Evaluation name and details	Summary of evaluation
Vernacular Evaluation Report: A Cost-Effectiveness study of ICT in Zambian Community Schools **Year:** 2017 **Source:** EDC / USAID	This report is an evaluation of 'Vernacular' (a set of reading activities that Zambian primary students can complete using android tablets), an RCT involving 30 Cinyanja-speaking

Status: Open **Country:** Zambia **Technology:** Tablets **Link:** http://idd.edc.org/sites/idd.edc.org/files/Vernacular%20Zambia%20RCT%20Evaluation%20Report.pdf	community schools around Lusaka.
iRead Ghana study final evaluation report **Year:** 2012 **Source:** ILC Africa and Worldreader **Status:** Open **Country:** Ghana **Technology:** e-readers **Link:** http://pdf.usaid.gov/pdf_docs/pnadz402.pdf	The iREAD (Impact on Reading of E-Readers and Digital Content) Ghana study was a pilot that aimed to give Ghana public school students access to books through e-reader technology. This final report serves as the official, summative assessment. Overall, the majority of students and teachers from the iREAD Ghana Study had positive experiences with the e-reader.
Complement or substitute? The effect of technology on student achievement in India **Year:** 2008 **Source:** infoDev: Working Paper No. 17 **Status:** Open **Country:** India **Technology:** ICTs **Link:** http://documents.worldbank.org/curated/en/804371468034237060/Complement-or-substitute-The-effect-of-technology-on-student-achievement-in-India	This study evaluates a computer-assisted learning programme designed to reinforce students' understanding of material presented in the class. The results emphasise the importance of understanding how new technologies and teaching methods both interact with existing resources and differentially affect students with different needs and abilities.
Summative evaluation of the ELSA text2teach project: Final report **Source:** Demographic Research and Development Foundation, Inc. **Status:** Open **Country:** Philippines **Technology:** Mobiles **Link:** http://pdf.usaid.gov/pdf_docs/Pdack830.pdf	This is a summative evaluation of the ELSA text2teach Project, an intervention strategy for improving the teaching of english, maths and science in grades 5 and 6 in the Philippines two years into its implementation to assess learning gains.
USAID/Kenya Primary Math and Reading (PRIMR) Initiative: Kisumu Information and Communication Technology (ICT) Intervention **Year:** 2014 **Source:** RTI International **Status:** Open **Country:** Kenya **Technology:** Tablets **Link:**	This report is the assessment of the PRIMR programme in Kenya, which studied the impact of tablets, used in a range of different ways, on student learning outcomes. Findings show the tablet use leading to a positive impact on student learning outcomes.

http://pdf.usaid.gov/pdf_docs/PA00K285.pdf	
The Bridge Effect: A Comparison of Early Grade Learning Gains in English and Maths 2013-14 Impact Evaluation Report **Year:** 2015 **Source:** Bridge International Academies **Status:** Open **Country:** Kenya **Technology:** ICTs **Link:** http://medalliance.wpengine.com/wp-content/uploads/2016/08/EGRA-EGMA-2013-2014-White-Paper-latest.pdf	This report highlights the results from the 2013-2014 administrations of EGRA / EGMA (early grade reading and maths assessments).
An investigation of appropriate new technologies to support interactive teaching in Zambian schools (ANTSIT) **Year:** 2011 **Source:** A joint report from Aptivate and the Centre for Commonwealth Education (University of Cambridge) **Country:** Zambia **Technology:** Mobiles, tablets, laptops, e-Readers, cameras, projectors, OERs **Link:** http://www.educ.cam.ac.uk/centres/archive/cce/initiatives/projects/antsit/DfIDANTSITReport_FINAL_2Mb-2.pdf	This project explored what kinds of mobile devices and uses can create an environment supportive of learning through active participation and collaborative inquiry within under-resourced and underprivileged school communities. It also examined the constraining factors. The specific focus was on using netbook, tablet and laptop computers, e-book and wiki readers, digital cameras and mini-projectors along with Open Educational Resources and Open Source software to support students' learning in mathematics and science.
TangerineTM - Electronic Data Collection Tool for Early Reading and Math Assessments January 2012 – Kenya Field Trial Report: Summary **Year:** 2012 **Source:** RTI International **Country:** Kenya **Technology:** Data collection software **Link:** http://www.educationinnovations.org/sites/default/files/Tangerine%20Kenya%20field%20trial%20report.pdf	In 2009, Tangerine electronic data collection software was conceived of as a solution to address some of the challenges encountered in paper-based administration, particularly for large, labour-intensive national samples. This report summarises the findings from trialling the software in reference to its functionality, usability and comparing it with paper assessments.
MobiLiteracy-Uganda Program. Phase 1: Endline Report **Year:** 2014 **Source:** RTI International **Status:** Open **Country:** Uganda **Technology:** Mobiles **Link:** https://www.researchgate.net/publication/30	This is an endline evaluation of MobiLiteracy in Uganda that targets parents through their mobile phones and encourages them to engage their early primary school-aged children in literacy skill-building activities outside of school hours.

3444658_MobiLiteracy-Uganda_Program_Phase_1_Endline_Report	
Technology and Child Development: Evidence from One Laptop per Child Program in Peru **Year:** 2012 **Source:** ADB **Status:** Open **Country:** Peru **Technology:** Laptops **Link:** https://www.iadb.org/en/research-and-data/publication-details-0?pub_id=IDB-WP-304	This paper presents the impact of the first large-scale randomized evaluation of the OLPC programme, using data collected after 15 months of implementation in 319 primary schools in rural Peru. The programme increased the ratio of computers per student from 0.12 to 1.18 in treatment schools which translated into substantial increases in use both at school and at home.

2C: Sample of policy and practice guides

This section provides a sample of ten available practice and policy guides on education technology.

Guide name and details	Summary
Go innovate! A guide to successful innovation for education **Author:** Cambridge Education **Publication year:** 2016 **Link:** http://www.camb-ed.com/article/227/go-innovate-a-guide-to-successful-innovation-for-education	This guide identifies the conditions that have led to successful outcomes when introducing or supporting innovative approaches for education.
Education Technology Database at a Glance **Author:** Center for Education Innovations **Publication year:** 2014 **Link:** http://educationinnovations.org/sites/default/files/CEI%20Education%20Technology%20DAG.pdf	The Center for Education Innovations provides a valuable education technology database that profiles and analyses relevant programmes.
Mobiles for Education Alliance International Symposiums **Author:** mEducation Alliance **Publication year:** Annual **Link:** http://medalliance.wpengine.com/?page_id=231	mEducation Alliance is a network and resource site that works to connect relevant stakeholders and collate evidence regarding education technology in low-resource environments.
A framework for evaluating appropriateness of educational technology use in global development programs **Author:** MIT **Publication year:** 2016 **Link:** https://goo.gl/dkRbf1	MIT's framework for assessing the appropriateness of education technology use is structured under eight main categories: teachers; students; culture; sustainability; community, social, political; learning; infrastructure; scalability and

	market impact.
SABER-ICT Framework Paper for Policy Analysis: Documenting national educational technology policies around the world and their evolution over time **Author:** Trucano, M. **Publication year:** 2016 **Institution:** World Bank **Link:** http://wbgfiles.worldbank.org/documents/hdn/ed/saber/supporting_doc/Background/ICT/112899-WP-SABER-ICTframework-SABER-ICTno01.pdf	The SABER-ICT policy framework provides a useful tool for policymakers to make well-informed decisions regarding the use of technology in education. The framework identifies either overarching themes that those involved in forming and implementing education technology policies (and by implication also large scale implementations) should be cognisant of.
Building and sustaining national ICT / education agencies: Lessons from international experiences **Author:** Trucano, M. & Dykes, G. **Publication year:** 2016 **Institution:** World Bank **Link:** https://openknowledge.worldbank.org/bitstream/handle/10986/26086/112754-NWP-ADD-SERIES-AUTHORS-PUBLIC-ICTedAgencies-SABER-ICTno02.pdf?sequence=1&isAllowed=y	This is a set of lessons that can be identified from the experiences of national agencies working in education technology. This emphasises the importance of leadership, legislation, sustainability, communication, integration with a holistic vision of education, and the need to focus on supporting and meeting the needs of teachers. The intention is to help national governments to learn from the experiences of other contexts as they embark on large scale implementation of education technology programmes.
Intel Education Transformation Policy Guide **Author:** Hinostroza, J.E., & Kozma, R.B. **Publication year:** 2014 **Institution:** Intel **Link:** https://ictedupolicy.org/system/files/education-transformation-policy-guide_small.pdf	This guide is designed to assist policymakers through a four-phased policy development model. The phases include articulating a vision, developing a master plan, implementing initiatives, and evaluating and adapting the initiatives to realise the vision.
ICT Tools in School – a Practical Guide **Author:** Kampschulte, L., & Eilert, K. **Publication year:** 2016 **Institution:** Leibniz Institute for Science and Mathematics Education at the University of Kiel **Link:** http://www.irresistible-project.eu/data_storage/resources/IRRESISTIBLE_ICT-Tools_Practical_Guide_2016.pdf	The aim of this guide is to practically support teachers in using ICT tools in class. A special focus is laid on integrating various tools in inquiry-based science education.
Information and Communication Technologies (ICTs)	The UIS is the official source of data used to monitor progress towards Sustainable

Author: UNESCO UIS **Publication year:** Ongoing **Institution:** UNESCO **Link:** http://uis.unesco.org/en/topic/information-and-communication-technologies-ict	Development Goal 4 to ensure quality and equitable education for all. To monitor this target, the UIS is tracking the proportion of schools with access to electricity, the Internet and computers for pedagogical purposes, as well as producing a series of indicators on school conditions.
Education technology map: guidance document **Author:** Hollow, D., Muyoya, C., & Brugha, M. Jigsaw Consult **Publication year:** 2017 **Institution:** DFID **Link:** https://jigsawconsult.com/sites/default/files/files/Education-technology-evidence-mapping-guide.pdf	The Jigsaw team was asked by DFID to collate the existing evidence regarding the impact that education technology has on learning outcomes in low-resource environments, identify gaps, and give guidance for future research priorities. The two products from the study are an evidence map and a guidance document, intended for all those that want to access research on education technology in low-resource environments.

2D: Sample of academic literature

This section presents a sample of academic literature related to education technology over the past ten years. This does not engage with the quality of the available evidence, but rather serves to present an overview of what is available. The following list of 20 publications is varied by research design (observational, quasi-experimental and experimental), intervention focus (see interventions in framework for DFID in section 3.3), technology focus, and geographical scope.

1	**Citation:** Adedoja, G. (2016). The influence of age and educational qualification on stakeholders perception of integrating mobile technology into basic education in Nigeria. *African Research Review, 10*(3), pp. 96-110. Retrieved from: http://www.ajol.info/index.php/afrrev/article/view/137027 **Research design:** Observational **Country:** Nigeria **Intervention:** Curriculum and pedagogy **Technology:** Mobiles
2	**Citation:** Alvarez-Marinelli, H., Blanco, M., Lara-Alecio, R., Irby, B.J., Tong, F., Stanley, K., & Fan, Y. (2016). Computer Assisted English Language Learning in Costa Rican Elementary Schools: An Experimental Study. *Computer Assisted Language Learning, 29*(1), pp. 103-196. Retrieved from: http://eric.ed.gov/?q=technology+in+schools&pr=on&ff1=subForeign+Countries&ff2=dtySince_2007&ff3=eduPrimary+Education&pg=3&id=EJ1084739 **Research design:** Experimental **Country:** Costa Rica **Intervention:** Curriculum and pedagogy **Technology:** Educational software
3	**Citation:** Bisaso, R., Kereteletswe, O., Selwood, I., & Visscher, A. (2008). The Use of Information Technology for Educational Management in Uganda and Botswana. *International Journal of Educational Development, 28*(6), pp. 656-668. Retrieved from:

	http://eric.ed.gov/?redir=http%3a%2f%2fdx.doi.org%2f10.1016%2fj.ijedudev.2007.09.008 **Research design:** Observational **Country:** Uganda and Botswana **Interventions:** Leadership and administration training; Political and regulatory environment; Education monitoring, evaluation, research and learning **Technology:** EMIS
4	**Citation:** Byker, E. (2015). The One Laptop School: Equipping Rural Elementary Schools in South India through Public Private Partnerships. *Global Education Review, 2*(4), pp. 126-143. Retrieved from: http://files.eric.ed.gov/fulltext/EJ1080913.pdf **Research design:** Observational **Country:** India **Intervention:** Curriculum and pedagogy **Technology:** Laptops
5	**Citation:** Fanni, F., Rega, I., & Cantoni, L. (2013). Using Self-Efficacy to Measure Primary School Teachers' Perception of ICT: Results from Two Studies. *International Journal of Educational and Development using Information and Communication Technology, 9*(1), pp. 100-111. Retrieved from: http://files.eric.ed.gov/fulltext/EJ1071345.pdf **Research design:** Quasi-experimental **Country:** Brazil; South Africa **Intervention:** Teacher training **Technology:** Generic ICT (not specified)
6	**Citation:** Korsah, G.A., Mostow, J., Dias, M.B., Sweet, T.M., Belousov, S.M., Dias, M.F., & Gong, H. (2010). Improving Child Literacy in Africa: Experiments with an Automated Reading Tutor. *Information Technologies and International Development, 6*(2). Retrieved from: http://itidjournal.org/index.php/itid/article/view/517 **Research design:** Experimental **Country:** Ghana; Zambia **Intervention:** Curriculum and pedagogy **Technology:** Desktops; Educational software
7	**Citation:** Hennessy, S., Haßler, B., & Hofmann, R. (2016). Pedagogic Change by Zambian Primary School Teachers Participating in the OER4Schools Professional Development Programme for One Year. *Research Papers in Education, 31*(4), pp. 399-427. Retrieved from: http://eric.ed.gov/?redir=http%3a%2f%2fdx.doi.org%2f10.1080%2f02671522.2015.1073343 **Research design:** Quasi-experimental **Country:** Zambia **Intervention:** Curriculum and pedagogy; Teacher training **Technology:** Laptops; Tablets; Connectivity; Open source
8	**Citation:** Iyengar, R., Mahal, A.R., Liya, A., Sweetland, A., Karim, A., Shin, H., Aliyu, B., Park, J.E., Modi, V., Berg, M., & Pokharel, P. (2014). The Use of Technology for Large-scale Education Planning and Decision-making. *Information Technology for Development, 22*(3). Retrieved from:

	http://www.tandfonline.com/doi/full/10.1080/02681102.2014.940267 **Research design:** Observational **Country:** Global **Intervention:** Political and regulatory environment; Education monitoring, evaluation, research and learning **Technology:** EMIS
9	**Citation:** Jere-Folotiya, J., Chansa-Kabali, T., Munachaka, J., Sampa, F., Yalukanda, C., Westerholm, J., & Lyytinen, H. (2014). The effect of using a mobile literacy game to improve literacy levels of grade one students in Zambian schools. *Educational Technology Research and Development, 62*(4), pp. 417-436. Retrieved from: http://link.springer.com.ezproxy01.rhul.ac.uk/article/10.1007/s11423-014-9342-9 **Research design:** Experimental **Country:** Zambia **Intervention:** Curriculum and pedagogy; Teacher training **Technology:** Mobiles
10	**Citation:** Mohammed, A.A., & Kanpolat, Y.E. (2010). Effectiveness of Computer-Assisted Instruction on Enhancing the Classification Skill in Second-Graders at Risk for Learning Disabilities. *Electronic Journal of Research in Educational Psychology, 8*(3), pp. 1115-1130. Retrieved from: http://eric.ed.gov/?redir=http%3a%2f%2fwww.investigacion-psicopedagogica.org%2frevista%2fnew%2fenglish%2fContadorArticulo.php%3f454 **Research design:** Observational **Country:** Egypt **Intervention:** Curriculum and pedagogy **Technology:** Assistive technology; Educational software
11	**Citation:** Natia, J.A., & Al-hassan, S. (2015). Promoting Teaching and Learning in Ghanaian Basic Schools through ICT. *International Journal of Education and Development using Information and Communication Technology, 11*(2), pp. 113-125. Retrieved from: http://files.eric.ed.gov/fulltext/EJ1074173.pdf **Research design:** Observational **Country:** Ghana **Intervention:** Curriculum and pedagogy **Technology:** Laptops; Tablets; Desktops; Display technology; Connectivity
12	**Citation:** Omwenga, E., Nyabero, C., & Okioma, L. (2015). Assessing the influence of the PTTC principal's competency in ICT on the teachers' integration of ICT in teaching science in PTTCs in Nyanza region, Kenya. *Journal of Education and Practice, 6*(35), pp. 142-148. Retrieved from: http://files.eric.ed.gov/fulltext/EJ1086387.pdf **Research design:** Observational **Country:** Kenya **Intervention:** Leadership and administration training; School management, governance, culture **Technology:** Generic ICT (not specified)
13	**Citation:** Piper, B., Zuilkowski, S.S., Kwayumba, D., & Strigel, C. (2016). Does

	technology improve reading outcomes? Comparing the effectiveness and cost-effectiveness of ICT interventions for early grade reading in Kenya. *International Journal of Educational Development, 49*, pp. 204-214. Retrieved from: http://www.sciencedirect.com.ezproxy01.rhul.ac.uk/science/article/pii/S0738059316300293 **Research design:** Experimental **Country:** Kenya **Intervention:** Curriculum and pedagogy; Teacher training **Technology:** Tablets
14	**Citation:** Pitchford, N.J., & Outhwaite, L.A. (2016). Can touch screen tablets be used to assess cognitive and motor skills in early years primary school children? A cross-cultural study. *Frontiers in Psychology.* Retrieved from: http://journal.frontiersin.org/article/10.3389/fpsyg.2016.01666/full **Research design:** Quasi-experimental **Country:** Malawi; UK **Intervention:** Curriculum and pedagogy **Technology:** Tablets
15	**Citation:** Porter, G., Hampshire, K., Milner, J., Munthali, A., Robson, E., de Lannoy, A., Bango, A., Gunguluza, N., Mashiri, M., Tanle, A., & Abane, A. (2015). Mobile Phones and Education in Sub- Saharan Africa: From Youth Practice to Public Policy. *Journal of International Development, 28*, pp. 22-39. Retrieved from: http://onlinelibrary.wiley.com/doi/10.1002/jid.3116/full **Research design:** Quasi-experimental **Country:** Ghana; Malawi; South Africa **Intervention:** Political and regulatory environment **Technology:** Mobiles
16	**Citation:** Pouezevara, S., Mekhael, S.W., & Darcy, N. (2014). Planning and Evaluating ICT in Education Programs Using the Four Dimensions of Sustainability: A Program Evaluation from Egypt. *International Journal of Education and Development using Information and Communication Technology, 10*(2), pp. 120-141. Retrieved from: http://files.eric.ed.gov/fulltext/EJ1071282.pdf **Research design:** Observational **Country:** Egypt **Intervention:** Curriculum and pedagogy **Technology:** Generic ICT (not specified)
17	**Citation:** Rubagiza, J., Were, E., & Sutherland, R. (2011). Introducing ICT into Schools in Rwanda: Educational Challenges and Opportunities. *International Journal of Educational Development, 31*(1), pp. 37-43. Retrieved from: http://www.sciencedirect.com/science/article/pii/S0738059310000866 **Research design:** Observational **Country:** Rwanda **Intervention:** Curriculum and pedagogy **Technology:** Desktops; Connectivity
18	**Citation:** Shadreck, M. (2015). Integrating ICTs into the environmental science primary school classroom in Chegutu District, Zimbabwe: problems and solutions. *European Journal of Science and Mathematics Education, 3*(1), pp.

	90-96. Retrieved from: http://files.eric.ed.gov/fulltext/EJ1107801.pdf **Research design:** Observational **Country:** Zimbabwe **Intervention:** Teacher training **Technology:** Generic ICT (not specified)
19	**Citation:** Swaffield, S., Jull, S., & Ampah-Mensah, A. (2013). Using Mobile Phone Texting to Support the Capacity of School Leaders in Ghana to Practise Leadership for Learning. *Procedia - Social and Behavioral Sciences, 103*(26), pp. 1295-1302. Retrieved from: http://www.sciencedirect.com/science/article/pii/S1877042813039049 **Research design:** Observational **Country:** Ghana **Intervention:** School management, governance, culture; Leadership and administration training **Technology:** Mobiles
20	**Citation:** Unwin, T., Tan, M., & Pauso, K. (2007). The Potential of e-Learning to Address the Needs of Out-of-School Youth in the Philippines. *Children's Geographies, 5*(4), pp. 443-462. Retrieved from: http://www.tandfonline.com/doi/abs/10.1080/14733280701631940 **Research design:** Observational **Country:** Philippines **Intervention:** Educational advocacy and awareness-raising **Technology:** Mobiles; Desktops

2E: Definitions of key terms

There is a significant volume of education technology terminology used frequently within relevant literature and programmes. The following 30 key terms and their definitions have been selected as an initial reference point for those who are new to the sector to help engage with the available literature and programme documentation. These have been framed within three categories: technologies and equipment, models of delivery, and pedagogical strategies relevant to education technology. While the pedagogical strategies are theoretical, it is considered helpful to have a working knowledge of these pedagogies while operationalising educational technology initiatives and programming.

Technologies and equipment
Computer-based assessment systems: Assessments that are delivered and graded by computers, with feedback able to be delivered automatically to the students. Note that there are also Computer Assisted Assessment systems, in which the computer is only used in part of the process of assessment. **Source:** https://now.ntu.ac.uk/d2l/lor/viewer/viewFile.d2lfile/6605/62186/CBA%20Revised/page_01.htm
Computer-mediated communication: An umbrella term referring to communication via computers, either synchronously where interaction takes place in real time (e.g. text-based online chat, audio and video conferencing, etc.) or asynchronously (e.g. discussion forums, mailing lists). **Source:** https://goo.gl/bnVAqB
Digital storytelling: Storytelling that combines multimedia with words to create a

new storytelling experience for students.
Source: http://www.bpcc.edu/educationaltechnology/glossary.html

E-books: Digital versions of books, usually read on computers or e-readers.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Gamification: Using game design and mechanics to drive motivation and increase engagement in learning.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Learning Management System (LMS): Software application for the administration, documentation, tracking, reporting and delivery of educational courses or training programmes.
Source: https://en.wikipedia.org/wiki/Learning_management_system

Learning platform: An interactive online service organised around a specific topic that gives users the ability to submit and receive information and learning materials.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Massive Open Online Courses (MOOCs): MOOCs are free online courses available for anyone to enroll. MOOCs provide an affordable and flexible way to learn new skills, advance careers and deliver quality educational experiences at scale.
Source: http://mooc.org/

Metadata: Information about content that allows it to be stored in and retrieved from a database.
Source: http://www.bpcc.edu/educationaltechnology/glossary.html

Open Educational Resources (OERs): On their website, UNESCO describes OERs as "any type of educational materials that are in the public domain or introduced with an open license. The nature of these open materials means that anyone can legally and freely copy, use, adapt and re-share them. OERs range from textbooks to curricula, syllabi, lecture notes, assignments, tests, projects, audio, video and animation".
Source: http://www.unesco.org/new/en/communication-and-information/access-to-knowledge/open-educational-resources/what-are-open-educational-resources-oers/

Models of delivery

Adaptive learning: Software that adapts its content and pacing to the current knowledge level of the user.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Blended learning: Also known as hybrid or mixed-mode learning, blended learning describes the growing practice of combining online learning with face-to-face instruction and independent study.
Source: https://www.heacademy.ac.uk/knowledge-hub/blended-learning

Computer-assisted language learning: Aims to find ways for using computers and digital multimedia tools for the purpose of teaching and learning languages.
Source: http://web.warwick.ac.uk/CELTE/tr/ovCALL/booklet1.htm

Computer-supported collaborative learning: Focuses on how collaboration and technology can facilitate the sharing and distribution of knowledge (Lipponen, 2002).
Source: http://edutechwiki.unige.ch/en/Computer-supported_collaborative_learning

Distance learning: Learning format in which the instructor and students are separated by time, location, or both. Can be synchronous or asynchronous.
Source: http://www.bpcc.edu/educationaltechnology/glossary.html

Flipped classroom: In a flipped classroom, students learn lessons at home with the help of videos or other instructional materials and spend their classroom time doing assignments with help from their instructor.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Interactive learning environment: The incorporation of social networking and virtual communication into course design and delivery.
Source: https://en.wikipedia.org/wiki/Interactive_Learning

Intelligent tutoring systems: Computer system based on artificial intelligence designed to deliver content and provide feedback to its user. The programme personalizes the instruction based on every individual student.
Source: http://etec.ctlt.ubc.ca/510wiki/Intelligent_Tutoring_System

Online learning: Online learning uses access to the internet to enable the learning experience. This can encompass both e-learning and blended learning.
Source: https://en.wikipedia.org/wiki/Online_learning_in_higher_education

Self-paced learning: Learning in which the pace and timing of content delivery are determined by the learner.
Source: http://www.bpcc.edu/educationaltechnology/glossary.html

Virtual learning environment: An education system online that mimics real-world education by using virtual concepts for exams, assignments, classes and more.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Webinar: An online seminar or meeting conducted online, where participants all meet at the same time.
Source: http://edtech.ucdavis.edu/resources/glossary-of-edtech-terms/

Pedagogical strategies relevant to education technology

Asynchronous learning: A student-centred teaching method that uses online resources to facilitate learning without requiring students and instructors to be in the same place at the same time.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Constructivism: Constructivism is a paradigm or worldview that posits that learning is an active, constructive process and the learner is an information constructor.
Source: https://www.learning-theories.com/constructivism.html

Differentiated learning: Programmes or tools to present learning materials in creative ways that match every student's individual learning style. Though the tools used depend on the student, the learning goals are the same for all.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Instructionalism: Instructionalism is a traditional pedagogical approach that is considered teacher-centred, in which the pedagogy is focused on building the knowledge of facts, relations, rules or principles and to focus on teaching but not learning.
Source: https://goo.gl/csf6Fc

Lifelong learning: Lifelong learning refers to informally continued education for personal enrichment.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Personalised learning: The content, pace, structure and goals of instruction vary depending on the student's learning habits.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Socio-culturalism: Sociocultural approaches to learning suggest that learning does not only happen in the mind of the learner. Rather, it is a social process whereby learning is influenced by others as well as by cultural beliefs and attitudes.
Source: http://edutechwiki.unige.ch/en/Socio-culturalism

Synchronous online learning: A real-time learning situation in which immediate, two-way communication between instructor and participants is possible.
Source: https://edtechmagazine.com/k12/article/2012/12/24-ed-tech-terms-you-should-know

Section 3: Case studies

The following case studies provide a more detailed view of four initiatives that are making significant use of technology in sizable education programmes. The focus is on the learning that SDC can gain from each programme.

Case study 1: iEarn Mali

Websites	https://iearn.org/ https://iearn.org/country/iearn-mali https://www.facebook.com/iearnmali
Country and region of operation	iEARN is active in 140 countries throughout the world, including 30 countries in Africa. Their programming in Mali is a collaborative effort with the African Teachers Network, active throughout the country.
Years active	iEARN has been active in Mali since 2005.
Summary of initiative	iEARN-Mali works with the SchoolNet Mali and the African Teachers Network to expand global project-based learning in Mali. iEARN-Mali coordinates the YES (Youth Exchange and Study) program, recruiting and selecting high school students to spend a year in the USA.
Why it is noteworthy	This project has significant partnerships within Mali and focuses on innovative approaches to learning. The use of ICT is well-integrated and the connections between students through social media provides an innovative model for peer learning.
Demonstration of good practice	• Builds capacity of teachers through the African Teachers Network, for whom they provide materials which are shared through ICTs. • Innovative approach to teaching and learning that complements but does not compete with the traditional

	educational system. • Active use of social media and recognition that learners value this as a communication tool.
Lessons for SDC	• iEARN and ATN have valuable social infrastructure and mechanisms for peer learning that can help successful projects to expand and scale across their networks. • Project-based learning can be a useful means of engaging with traditional education with novel pedagogical approaches. • The practical, project-based approach may align well with existing VSD programmes and indeed the Swiss educational system's vocational tracks.

Case study 2: iKnowledge Tanzania

Website	http://www.iknowledge.co.tz/
Country and region of operation	The iKnowledge project operates within 25 regions in Tanzania.
Years active	The iKnowledge project has been active from 2015 until the end of 2017 with two distinct phases of implementation.
Summary of initiative	The iKnowledge project delivers connectivity, capacity building, educational content, ICT equipment and government support to primary and secondary schools across 25 regions of Tanzania. This platform of provision creates a context upon which evidence-based experimentation can take place and learning and wider knowledge sharing in the education, ICT and development sector can be enhanced.
Why it is noteworthy	The combination of the project inputs has translated into significant changes in both teacher and student knowledge, attitudes and practices in regard to the use of ICT in education. This project provides a valuable opportunity for the sector to learn about what works in technology enhanced education innovation.
Demonstration of good practice	• Teacher capacity-building interventions took place in the primary schools through in-school training. This training, alongside the provision of online resources, has proven to be an effective way in which to shift teacher mindset, acceptance and use of ICT as a teaching resources as well as confidence in training their peers. • Train the trainer model: there was an encouraging demand for teachers to train and to be trained by others, creating a successful peer-to-peer learning model that encourages greater awareness and access to ICT resources for all.

	• Community capacity building: teachers were encouraged to train community members on foundational ICT skills. This capacity was coupled with the implementation of community Wi-Fi hotspots, allowing community members to buy internet data packages, generating revenue that subsidised broadband access at the schools. • The educational content provided to teachers in digital format on the iKnowledge e-learning portal was perceived as being relevant and educational by both teachers and students. • The iKnowledge consortium provided an effective delivery unit, capitalising on expertise both in Tanzania and internationally.
Lessons for SDC	• Capacity building training should be offered to teachers, with follow-up support visits and refresher training provided. In particular, explore cost-effective means by which to offer training, such as the train-the-trainer model and refresher courses available online. • Engaging and localised educational content should be available to teachers via an e-learning portal they are familiar with, including a knowledge exchange platform between teachers. ○ Ensure that content is relevant to curriculum across all subjects and translate it to the local languages in order to engage more students and ease the process of integration. • The project should include an integrated sustainability plan and engagement with the government at national and local levels (e.g. working with both TAMI-SEMI and district education officers in local areas of implementation for the iKnowledge project).

Case study 3: Instant Network Schools

Website	https://www.vodafone.com/content/foundation/instant-network-schools.html
Country and region of operation	Kenya, Tanzania, Democratic Republic of Congo, South Sudan. As of April 2018, there were a total of 31 INS centres in refugee camps across the countries. By the end of 2018, there will be a total of 36 INS centres.
Years active	2014 – ongoing
Summary of initiative	The Instant Network Schools (INS) programme is a joint-collaboration between Vodafone Foundation and UNHCR. It aims to support the delivery of quality education in refugee camps through the provision of the infrastructure required to

	enable schools to make the most of the internet, digital educational content and tools, and latest technology advancement. Each INS school receives an Instant Classroom kit which includes a laptop, a projector, a sound system, inbuilt charging, and 25 tablets. The hardware is complemented by an Internet connection and solar-based energy. The programme also provides open-source offline educational content and ICT and pedagogical training for teachers, as it aims to build ownership of the programme within the local communities. Each classroom is managed by up to two INS coaches, from the refugee or host community, who oversee the use of the tools and offer daily support to users.
Why it is noteworthy	Holistic approach to programming that in addition to the provision of technical equipment, includes connectivity infrastructure, solar power, software, training and support and on the ground staff.
Demonstration of good practice	• Use of robust and durable hardware kits that are suitable for the harsh environments in which they are placed into • Capacity building of local staff (INS coaches), who work in the centres and provide further training and support to students, teachers and community users. • An iterative and adaptive approach, with improvements to the programme regularly made in response to feedback from local teams • Strong collaboration with implementing partners involved in education provision and service delivery
Lessons for SDC	• Develop robust equipment appropriate for the environment, consider consistent and affordable power supply and reliable connectivity • Recruit and train local staff who live in the area and know the schools well. Instead of a once-off training, continuously equip staff with both technical and leadership skills to instill responsibility and ownership. Invest in further support structures that facilitates peer to peer learning. • Facilitate initial and regular training for teachers, work with school management to schedule dedicated time for lesson planning and practice. Ensure time for exploration and unguided learning for students, and have special inclusion measures for marginalised sub-groups • Work closely with school leadership and obtain and apply their input. Ensure they are trained on use of tools, and have an appreciation for their application. Support school management decision making through access to monitoring and evaluation data generated by

	the programme • Seek mutually beneficial partnerships with NGOs, private sector and public entities to increase programme efficiency and effectiveness

Case study 4: Global Digital Library

Website	https://www.digitallibrary.io
Country and region of operation	The Global Digital Library is a global operation, intended to be available worldwide for anyone to use.
Years active	2018 - current (initial trials have just been launched)
Summary of initiative	As a flagship activity within the Global Book Alliance[32], the Global Digital Library (GDL) has been developed to increase the availability of high-quality reading resources in underserved languages worldwide (languages where there is currently a lack of quality early grade reading resources). This includes the collection of existing reading instruction books and storybooks for leisure reading as well as interactive resources such as literacy games, and making them available on the web, mobile and for print. The GDL was launched in Ethiopia in April 2018 with an initial 900 resources in 15 languages, including Kiswahili (Kenyan), Bangla, Hausa and 7 Ethiopian languages. Further user testing is currently underway. While the goal of the GDL for the end of 2018 is to offer resources in at least 25 languages (and 100 by end of 2020), the platform will also facilitate translation and localisation of these resources to more than 300 languages.
Why it is noteworthy	As taken from their website, this initiative is "a collaborative endeavour, which requires involvement from a broad range of stakeholders in order to be successful and widely used". It is noteworthy in its bottom-up approach to user engagement, encouraging a larger global shift in the promotion and use of open licensing and open educational resources.
Demonstration of good practice	• All resources hosted on the GDL are quality assured through the application of quality assurance standards that serve as the minimum criteria for accepting or rejecting various types of reading materials submitted for upload to the GDL. These guidelines are helpful for organisations to consider prior to submitting content anywhere online for public use and reuse. • Accessibility is at the core of the platform with the GDL advocating for the principles of universal design and

[32] The Global Book Alliance is an international effort involving multiple stakeholders with the mission to "guarantee that children everywhere have the books and learning materials they need to learn to read and read to learn.

	accessibility. On their website they state that the GDL will have "a strong focus on making all content generally accessible, including for those with print disabilities". • The use of a creative commons license supports GDL's goal of sharing, remixing, and translation of content and enables translators to localise resources. • A bottom-up approach to submitting content and remixing already existing content to be fit for local purpose and gaps ensures its relevance.
Lessons for SDC	• Incorporate tested methods of effective collaboration into the core structure of the intervention in order to ensure that any content will continue to be regularly expanded and mobilised and ownership will be presented as that of the user. • The provision of reading materials for marginalised groups should focus on underserved languages (i.e. languages where there is currently a lack of quality early grade reading resources). • Seek opportunities for the reuse of content. The GDL is being built based on existing quality learning resources provided from a variety of initiatives, which contributes to efficiency, relevance and sustainability.

Section 4: Interviews

4A: List of interviewees

Name	Country
Xenia Kirchofer	Afghanistan
Abdul-Wahid Zirak	Afghanistan
Carmen Thönnissen	Switzerland, Tanzania
Lars Stein	Switzerland
Gschwend Caron Muriel	Switzerland
Susanna Graf	Switzerland
Willi Graf	Chad
Nay Myo Zaw	Myanmar

4B: Interview template

The following questions were asked to each interviewee. The interviews lasted for approximately 60 minutes and were conducted in July and August 2018. A total of 8 interviews were conducted with SDC staff.

1. What do you do in your role in the country you work?
2. What is your involvement with education programmes?
3. What are the primary challenges you face in SDC's educational programming in the country you are responsible for?
4. What are the primary challenges you personally face in your role?
5. What programming (if any) do you do currently with technology in your country?
6. What are the most significant barriers to using technology in your education programmes currently?
7. Can you give an example of another context in which education technology has been effective that you think could be relevant to the country where you work?
8. What is it about this programme that you feel is particularly relevant?
9. Can you give an example of another use of technology that you think could be relevant to your education programmes?
10. What is it about this use of technology that you feel is particularly relevant?
11. Are there any other relevant examples?
12. What are the most significant ways in which technology might be easily used in education, or quickly bring a benefit (what is the "low-hanging fruit")?
13. What significant ways might technology in education be used in the long term that may be more difficult or require longer planning and implementation?
14. Can you think of a specific resource or guide that would be particularly helpful for you in order to be better equipped to make decisions regarding the use of technology in education in your country?'
15. Of SDC's six strategic orientations for education, which do you think has the highest potential for use with technology?
16. Is there anything else that you think it would be helpful for me to know about your work and education technology that we have not talked about yet?

Contact
Swiss Agency for Development and Cooperation (SDC)
Education Focal Point and Network
Freiburgstrasse 130
3003 Bern

Tel.: +41 (0)58 462 34 75
E-Mail: education@eda.admin.ch
Web: www.shareweb.ch/site/education

Education
SDC Network