

Learning through the crisis: Helping decision-makers around the world use digital technology to combat the educational challenges produced by the current COVID-19 pandemic

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REPORT (SUMMARY)

Learning through the crisis

Helping decision-makers around the world use digital technology to combat the educational challenges produced by the current COVID-19 pandemic

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1 Introduction: Centralised and informal systems

This chapter outlines our brief. It explores how the various aspects of this brief can be understood, reconciled and applied beyond education systems to the people and communities at most risk in the current crisis and its aftermath.

1.1 The brief and the background

The purpose of this report is twofold, identifying digital ideas, in whatever form that **firstly** might maintain the continuity of education systems and that **secondly** might stop existing or potential disadvantages being amplified or exacerbated by COVID-19 or indeed by the responses to it. It is intended for decision-makers at local and national level, in areas of good infrastructure, meaning connectivity, coverage, bandwidth, electricity, buildings and roads for example and in areas of less good infrastructure. It is based on a large-scale review of literature, from both academic sources and non-academic sources, on consultations with specific groups of experts, and on material and ideas from a wide network of contacts and collaborators.

Since most schools, colleges and universities across the world went into lockdown following the outbreak of the COVID-19 pandemic, education has been affected globally. By April 2020, nearly 90% of learners were unable to go to school. In July of 2020, more than £1.1 billion learners are still affected.

To combat the unprecedented scale of this crisis, governments, schools, colleges and universities are turning increasingly to educational technology. There are however, several issues that need to be addressed if the disadvantaged and marginalised are to benefit alongside other learners. On a wider scale, COVID-19, the economic recession that will inevitably follow and the psychological trauma that many children will experience, will likely lead to higher rates of school dropout, leave many learners more anxious, experiencing a decline in the quality of the teaching and at a higher risk of abuse in all its forms. How do we know this? As explained in the methods appendix, we ran online Delphi sessions, conducted with a range of experts in the course of drafting this report. Our groups of experts explained from their experience the importance of listening to those directly affected:

'During the most acute stages of an emergency, education would not be possible as there would be a heavy psycho-emotional toll, travel to safe locations, and interruption in services. In the aftermath of the acute stage of the emergency, education can resume. In crises, the first responses to, management of and information about the situation will be by the general public. Official authorities come later. Authorities responses must be need-centric. Official managers/responders must listen to the voice(s) of the people who are directly affected.'

(Please note: all of the texts in this style throughout the document are drawn from the online Delphi groups. They are expert responses and reactions to the literature.)

In this current report, we, the Education Observatory at the University of Wolverhampton and the EdTech Hub, examine responses to previous crises, as well as to this one, in order to highlight emergent trends, issues and opportunities.

1.2 Setting the scene

Many accounts and responses focus on what might be called the 'EdTech' hotspots.

To give some greater context and contrast we have this brief account from Algeria:

Everything is closed; schools, middle schools and secondary schools and there is no alternative. Algerian ministry of education tried to deliver the textbook's lessons through TV and radio, but it does not work.

And from elsewhere:

Global responses to the COVID-19-induced lockdown of schools where internet access is poor or patchy (Bozkurt et al., 2020).

Uganda: by end of April, the MoES (The Ministry of Education and Sports of the Republic of Uganda) started rolling out measures for the second scenario: distributing of printed self-home study material to learners adapted into large print and braille for learners with special needs through local councils.

Turkey: while it seems that emergency remote education practices were merely online, it should be noted that education in Turkey is for free at all levels and free printed books are already given to K12 students at the beginning of each school/academic year.

Brazil: municipal schools in late April 2020 began to receive printed didactic workbooks aimed at elementary school students, which parents needed to pick up at the schools and these students were pretty much left to their own devices to learn.

Russia: internet connection, access from smartphones, tablets, laptops and, less frequently, desktop computers are being used. In areas with poor or no internet access, telephone connections are used to transfer tasks to schoolchildren. In some of these places, initially, education continued on a paper-based system where students received

paper media (notebooks) and completed tasks were placed in boxes for transmission that were installed at a school or in a local shop.

Australia: there has been a continuum of delivery between paper-based packs of materials to work through and fully online delivery, with a mixture of the two often used. Even within the same schools, there is often a range of paper/online responses depending on year level, online tools and support and teacher/learner/parent comfort levels.

Ireland: schools without adequate online learning management systems initially sent out paper-based workbooks and photocopies of activities for students to complete, due to the relatively short amount of notice they were given to prepare for the shutdown.

1.3 A discussion and definition of context and connectivity

We were initially tasked to address our search in terms of:

- Connectivity/access to tech.
 - Good connectivity and 2) better access to technology.
 - Low connectivity 2) poor access to technology.

We could address connectivity and access directly but would argue instead to group these under a broader but looser envelope of infrastructure. This which might, depending on the context, embrace secure buildings, mains electricity, commercial, educational and municipal internet hubs and labs, mobile network coverage, bandwidth and reliability, or even the availability of mobile base-stations. This was however an imperfect, ostensibly objective, and supply-side definition that might be especially inappropriate for 'hard-to-reach' marginalised communities. We also had to consider the physical ownership, competence, confidence and access amongst learners around, for example, feature phones, laptops and tablets. We looked at, and how these played out in the social, economic and cultural contexts of marginalised groups, for example, women and girls in family contexts, nomadic communities in relation to services and buildings, poor communities in terms of tariffs and charges, the physically or cognitively challenged in relation to mainstream digital technologies, or indigenous cultures, in relation to national or global language interfaces. It is important therefore to recognise that:

'Connectivity is just a cornerpiece of a much more complex jigsaw'.

'Policy must be customised, contextualised and have a cultural fit'.

Understandably, these considerations weakened the primacy of any one attribute, for example connectivity, in defining or determining what constituted good access or poor access, and also weakening a focus on low/middle income countries or countries in crisis or emergency, or indeed countries per se as a unique source of research findings and ideas.

Rural areas in many countries share the same challenges irrespective of the designation of their host country, likewise indigenous languages and cultures, be they Welsh or Cree in high income countries, or Luo or Tuva in low income countries. Similarly, the refugee crisis plays out in, for example in Morocco, Kenya and Syria but also in Turkey, Greece and Spain and reaches as far as Sweden and Germany.

Furthermore, whilst our comments and those of our Delphi session experts may be referring to specific groups, communities or cultures, they are all variously marginalised, at the margins of education systems and of Centralised EdTech Systems.

Moreover, our initial findings highlighted the paramount importance of broader ideas of context in educational projects and programmes, subsuming any specific characteristics outlined above. So, by context, we might mean infrastructure, that is objective and tangible concerns such as connectivity, coverage, bandwidth, computers, electricity, buildings and roads.

‘Without a robust infrastructure and a sustainable plan to achieve that, other aspects of digital technology such as economic and educational usages will struggle’.

We might also mean everything else, such as the people, the personalities, the culture, the community, the curriculum, the organisation, the livelihoods, the environment and the economy in which education or learning could be happening. This is true of the projects and programmes that we report here and true of subsequent projects or programmes being planned by our readers since our reporting. It is however, obviously impossible to ever know contexts fully and completely. So, predicting whether transplanting or transferring a project or programme from one context to another based on matching up characteristics of the respective contexts will also always be impossible. Given the accounts of multi-causality and ‘unexpected consequences’ in educational projects and international development, it is also impossible to select those components of context that are significant and need to be matched to ensure a successful transfer and those which can be ignored. Trying to do this is merely imposing an external understanding of situations that promotes some parts of the context to narrative and demotes other parts to anecdotes.

‘Availability of a solution does not mean that the solution will be adopted and used’.

This tells us that a successful project in one context will not necessarily be successful transferred into a different context. It does however also tell us though that an unsuccessful project in one context might be successful in another.

‘When importing solutions from one setting, no matter how well these solutions might have worked elsewhere, understanding the new context, the dynamics surrounding it, with the help of local people, is critical for the success of designing educational technology interventions’.

Consequently, our report focuses on, not the contexts or connectivity, but what was done, why it was done, how it was done, and on what made it worthwhile, unusual and provocative. We do however mention various limitations of the literature in the methodology appendix that make these difficult attributes to identify and abstract. Also, for the same reasons, our search strategy attempted to look beyond what might

have been obvious in terms of context. We have been conscious of the tension between observations and findings that are generic and abstract but difficult for readers to implement and those that are specific and concrete but irrelevant to most readers. Furthermore, our understanding of context, causality, happenstance, unexpected consequences and hidden variables probably means we know much less than we think about transferability or relevance.

'Designing solutions, here education solutions, needs to be informed by research, learners, and those who have practical experience of the context, operations for example. 'People from the inside'. In addition, there is a need for buy-in of the community. Participatory design requires socio-cultural considerations, thorough understanding of the problem, getting rid of assumptions for example. There is a risk of neo-colonisation in the implementation of technological solutions as technology is not neutral.'

These are necessarily important practical considerations for our readers in thinking about their context and situation although, as we argue, not necessarily very important in terms of the provenance of ideas.

1.4 EdTech systems

We were also initially tasked to address EdTech systems, without directly confronting at this point the tension between 'EdTech systems' and a much looser ecology of informal digital systems that have use and value amongst learners irrespective of any association with the institutions, procedures or professionals of education systems. Thus we make the point that 'centralised EdTech systems' could be decomposed into:

- Centralised EdTech admin systems, for example, EMIS (educational management information systems) such as SEMA (School Education Management Application (Traxler & Leach, 2006).
- Centralised EdTech teaching systems, for example, e-sgol in Ceredigion, Wales.
- Centralised EdTech systems providing counselling, support and guidance, for example various Education-in-Emergency initiatives such as that of UNRWA (The United Nations Relief and Works Agency) in its fields.
- Centralised EdTech systems providing teacher development and capacity building.

Many countries and regions already have such systems but focussed on the maintenance of aspects of education systems in place before the outbreak of any crisis or pandemic. These include delivering educational content to outlying rural school or making minority subjects economically viable, supporting teaching and learning on a campus using an LMS (learner management system), for a college, school or university and running an entire distance learning institution. For them, the challenges are adapting these systems to an entirely autonomous and remote modality whilst not further excluding or disadvantaging those people and communities already struggling within the system. Most of our subsequent chapter address these issues. This does however confine the impact and support of 'EdTech systems' to those within formal education systems, namely pupils, teachers, advisors and perhaps parents. So it is important to understand:

'During school closure, learners are spending most of the time with their parents and guardians. It has therefore become increasingly important to consider ways of supporting parents and guardians to effectively promote continuation of learning when schools are closed.'

We were however, already conscious of a much wider community outside the reach of these centralised dedicated systems and so a further category is:

- Informal tech systems being used or appropriated for learning.

What this might mean we discuss later.

1.5 Decision-makers

'Education gaps will not be corrected through technology alone, but also changes in policy and priorities. Reliance on technology alone may exacerbate access (to education, to technology).'

Therefore we were also tasked to target our work on decision-making and on a readership of decision-makers including:

- Decision making and EdTech from central ministry (for example, large procurement/government digital service).
- Distributed decision making — by teachers and schools.

But again, any focus on decision-making within formal education systems, at any level from state ministry down to village school, misses out decision-makers in organisations on the outside of those systems, perhaps in health education, NGOs (Non-Governmental Organisation) or civil society, and actually those learners or would-be learners beyond the reach and outside the control of any decision-makers, or in communities where leadership is more informal. Furthermore there are decisions to be taken in relation to time periods, planning and maintenance:

'What is the lifetime of an emergency (or refugee) intervention? To what extent are they maintained? And, do they include ongoing maintenance plans? Strategic, long-term planning needed, too often initiatives are started ('quick fixes') without thoughts on how to sustain support and maintenance.'

At the very least, it is worth considering the interactions, at whatever level and however formal or informal, between decision-makers within education systems and those without but also to recognise the needs of people and communities beyond the reach of any decision-making.

'Each Indigenous community has unique circumstances — whether by environmental differences, historic differences, community/cultural/traditional differences, cultural practices, linguistics, and world views. This directly challenges one-size-fits-all strategies. Refugees circumstances are highly diverse and interventions should be equally diverse.'

We are implicitly recognising that not only do some people and communities drop through education systems but that others are actively oppressed by them. This might be true of traveller communities in Europe or nomadic communities in Africa who rightly or wrongly see schools as trying to sedentarise them, and indigenous communities, the San for example, who see a national curriculum as a weapon against their culture.

'The word intervention carries unwelcome connotations with some indigenous groups. We should aim for multiplicity instead of hybridity; collaboration instead of two-way assimilation; respect for all cultures' traditions and ways of life'.

1.6 Supporting the system or falling through it

As we said previously, our brief is twofold, focused on identifying digital ideas, in whatever form that **firstly** might maintain the continuity of education systems and that **secondly** might stop existing or potential disadvantages being amplified or exacerbated by COVID-19 or indeed by the responses to it.

'In South Africa, HEIs (higher education institutions) have partnered with the mobile network providers to zero-rate some websites including learning management portals, among others and embarked on initiatives to loan students laptops. However, with the lockdown, families in households are in the houses 24/7 and for some students this has created non-favourable conditions for any studies to happen. This means failure to consider students' learning context could be a recipe for failure'.

This seems at the least to be potentially contradictory, since digitally strengthening or maintaining education systems might further disadvantage those that have already fallen through them, been oppressed by them or lost touch with them.

'Avoiding the notion that technology will solve problems, rather than the way it is used, which could also cause them. Technologies alone can't address all the educational needs of refugees. More focus needed on the conditions under which technology can make positive contributions to education, and how to create them, rather than discussing the merits of this or that particular technology. Conduct appropriate research and act on findings to support particular communities of refugees in their education'.

These groups could include individuals and communities at the margins of their societies, people from nomadic, indigenous or linguistic minority communities, people with physiological or cognitive disadvantages, people with poor literacy or poor digital literacy, the homeless and the displaced, and probably adults and adolescents in general since, globally, most people do not get much further than primary schooling. This is especially true of women and girls in more conservative societies.

This contradiction is perhaps partly a consequence of *EdTech* itself, in that there is always an implicit alignment between dedicated EdTech systems, the 'centralised EdTech systems', and formal education systems. These Centralised EdTech systems seem to be often to tacitly and uncritically defined as those technologies dedicated to supporting or enhancing the work of teachers and their institutions, managers and ministries.

So, the focus of EdTech can often be the very systems that the disadvantaged have already fallen through or are missing out on.

'The pandemic presents an opportunity to engage in educational outreach with marginal communities such as the Irish and other traveller communities as mobile pedagogy technologies undergo a rapid evolution'.

'It is a simple extrapolation to use this technology to engage with such communities in normal times post COVID-19 as this is a marginalised community with trust issues based on pervasive and semi-tolerated racism from mainstream communities'.

People everywhere are, however, using whatever mobile and social digital technologies that they access or own to produce, share, discuss, transform and store whatever ideas, images, information and opinions they value or need.

'People will develop skills and use technology that fit their aspirations'.

They have the capacity to learn from each other, from blogs, podcasts, videos and chats on web 2.0 technologies, facilitated by their own (near-)universal mobile digital technologies. It may not be 'good' learning, it may not be in a form or language educators recognise or endorse, and it may not be learning as they know it but looking at iTunes, Flickr, Wikipedia, Twitter, YouTube or Facebook will confront professional educators with vast amounts of content and discussion, if not any formal pedagogy. This activity, if we look at it in the current context of rapid, cost-effective reactions to COVID-19, is potentially self-sustaining, inclusive, flexible and responsive.

'As higher education institutions embark on emergency remote teaching due to COVID-19, the need to consider the social context of students is a critical success factor'.

These observations resolve the incipient contradiction of supporting the education system whilst also supporting those people and communities that have dropped through it. From our positions within such systems, however, it can be difficult to figure out how to make that happen. It is sadly indicative that we regard some of these people and communities as 'hard-to-reach'. They may however think about us and our systems in the same way. Perhaps we are the hard-to-reach. Also, within the ICT4D (Information and Communications Technologies for Development) community we hear talk of the 'last-mile', the perspective or viewpoint of the providers of infrastructure, services and administration, being countered by re-presenting it as the 'first-mile', not necessarily just in terms of geography or infrastructure but sometimes in terms of social, cultural, technological, economical, financial or environmental distance or difference. This is an argument for letting people themselves define their learning and themselves as learners.

'Ahhh, yes, the "deficit" model can be damaging. And, I suspect that the deficit model also leads to reactive solutions rather than proactive. In contemplating needs (need-centric approach) and resource restructuring, it is important to examine both the current situation as well as potential future situations. So, it is not just adapting to current conditions, but being creative and innovative.'

The marginalised people and communities identified in our brief are likely 'hard-to-reach' and so responses to COVID-19 must start from where they are.

'The problem with maintaining systems designed to facilitate education for traveller groups is an issue of principle-agent problem, in other words where does the agency lie? This is a valid concern as it strikes at the core of the issues of trust; would the Irish or other traveller communities trust an external body to facilitate education, or would the community itself be interested in maintaining a system, even if it is to its own benefit?'

This would be largely in tune with recent moves to 'decolonise the curriculum' and to recognise the rights of minority communities. There is a parallel with the call from various activist groups, including ethnic minorities and disability rights for, 'nothing about **us** without **us**'.

'Therefore, whilst the current crisis provides a great opportunity in terms of a plethora of new resources, techniques and methods for remote and online learning, there remains the very fact that communities must be involved from the start and feeling a sense of "buy-in" for it to work, otherwise the self-isolation and sense of separateness will remain.'

These points underpin our approach to decision-makers and to the centralised EdTech systems mentioned earlier, namely that these are certainly appropriate actors and systems but not definitive or exclusive actors and systems. There is a place for what we earlier called 'informal tech systems being used or appropriated for learning' alongside the 'centralised EdTech systems' and this will be a cheap and rapid complement to centralised EdTech systems.

1.7 Informal tech systems for learning

As we said, the world, every corner of it, each in its own way, has people and communities connected by their own personal mobile digital technologies. Unlike any other digital technology, for example desktops and laptops, data projectors and plasma screens, mobiles are nearly universal. They are ubiquitous, pervasive and indeed intrusive; they reach near to the bottom of every socio-economic pyramid; they reach beyond centralised EdTech systems. Furthermore, they have characteristics of familiarity, ownership and presence that are unlike any of the more institutional, communal or domestic technologies. They are more like clothing than furniture and more like leisure wear than school uniforms. Indeed, the literature talks about mobiles becoming embodied, becoming prosthetic, becoming part of us.

For many people, those with adequate functionality and bandwidth, these devices are the portal to all the tools and technologies of web 2.0. These have taken us from the world of web 1.0, characterised by top-down, centre-out content, of which 'centralised

EdTech systems' are a clear example, from the few to the many, to a world of peer-to-peer interactions and exchanges of the many to the many, changing the agency, control and ownership of the discourse, making it at least demotic if not democratic. The postdigital nature of this discourse is apparent with the pandemic revealing many ways that this is enacted and not just discussed (Jandrić & Hayes, 2019; Jandrić & Hayes, 2020).

The tools of web 2.0 turn everyone from passive readers and consumers to active writers and producers. These technologies are allowing people to create, share, broadcast, discuss, transform, store and valorise images, ideas, information and opinions, even identities. As we said, looking at YouTube, WeChat, Facebook, Instagram, TikTok, Pinterest, Wikipedia, Flickr or Twitter would however show that there is a vast amount of it going on and it reaches learners inside education systems and those people outside them, including the teachers, parents and employers of learners. Is there a big difference between these two populations? Probably not, not really. They overlap and the diversity of learners within each population may be much greater than the differences between one population and the other and so any strategy for building on this other learning can ignore and build on the wealth of individual difference and diversity.

In the current context, of responses that could complement the activities of national and local decision-makers and of centralised EdTech systems, this leads to complementary recommendations that are about building resources and capacity with mobile-accessible social media communities and deploying facilitators and experts to guide and support these communities.

1.8 The principles of informal tech systems for learning

So, what axioms or precepts would underpin this? We propose a threefold approach.

Firstly, let people speak, write and share, underlining their value, their values, their interests, their language, their culture and their concerns. **Secondly**, start from where they are, building on what they do, acknowledging that their agency, autonomy and control are important in their learning. **Thirdly**, recognise, again, that context is everything, manifest in diversity and difference, and in fluidity and variety, in learners' experiences and expectations, as well as in their aspirations, challenges, barriers and habits, and equally in more objective and tangible factors such their local economy, services and infrastructure. At the moment, COVID-19 is very much part of their context, not just the physical and medical part but the social and emotional part, including for example issues of trust:

'How to communicate to the traveller community presents a genuine problem based on long standing trust issues and antagonism; yes, SMS, emails and radio may present opportunities for communication but whether or not it is trusted or believed is another matter'.

This argues, at least at a conceptual level, for local informal digital learning spaces that communities can create, populate and control.

'It is likely that direct methods of communication with community leaders as intermediaries would work better, here, and that would involve tailored communication methods or their involvement in wider communications via text/ radio to add an air of authenticity. That is the core trust issue that needs to be

addressed and during the COVID-19 pandemic, that a lack of trust could reduce the effectiveness of any attempts at communication or educations with regards to the virus'.

At a practical level, however, what are the tools and techniques — pedagogic and technological — that communities can appropriate and adapt? The technological answer is easy, and we can return to the details, but it is clearly those technologies that any given community is already using day-by-day.

'A key feature of African mobile phone use is its convergence with radio listening'.

'A multi-pronged approach with different media (with radio stations in different languages at the heart of the strategy) reinforcing one another can be effective. We used this model for basic health education in disadvantaged rural areas in South Africa in the 1990s, with some evidence of its effectiveness'.

This could be very different between urban and rural settings. The following example is from Dr Sir Michael Nkwenti from Cameroon:

Within the Sub-Saharan African context, our communities are classified into *urban*, *semi-urban* and *rural*. Each of them has a certain level of socio-economic development with the urban settings being the most developed, semi-urban averagely developed and rural settings being the least developed.

Rural: the least developed settings are often characterised by little or no electricity supply, little or no television/radio signal, little or no mobile telephone signals for example. In such settings, we focus more on the print media as a learning solution.

Semi-urban: settings have some level development with TV/ radio signals coverage, mobile phone coverage and electricity supply network though characterise by slow Internet connectivity and frequent electricity power failure that could even go for weeks. In such context we design solutions that can be delivered using the television, radio, mobile and print.

Urban settings: are the most developed hence all learning solutions available in the semi-urban settings are available in the urban areas including web-based solution. Although these solutions are available in their varieties, the major challenges are that learners' difficulties accessing them due to lack of requisite tools, unstable/slow internet connection and frequent electricity interruption.

The pedagogic answer can then possibly be discerned amongst ideas emerging around informal innovative digital learning in different sectors and countries (Traxler, 2019). This is by definition not complete and not definitive. Some of these ideas are described below.

1.9 The techniques of informal tech systems for learning

It is possible for decision-makers to use short-term staff development and capacity building amongst teachers and community leaders to explore exploiting some of the following ideas.

Curating resources: the idea that people and communities can find, evaluate and organise what they need to learn from the vast amount of free content, communities and tools available online (Mihailidis & Cohen, 2013). Not only are there clear direct benefits in terms of the wealth and breadth of resources, but also indirect benefits in terms of an increased critical understanding of the organisational resources and the meta-cognitive skills that come with this. We should emphasise that the term ‘resources’ has been used here to explicitly embrace people and cultures who learn by absorbing and understanding content, in whatever medium; people and cultures who learn from discussion with other learners; and people and cultures who learn by using tools to undertake tasks and projects. Disadvantaged people and communities may learn in very different ways and in very different languages from national education systems.

Open learning: the movement and systems based on the notion that there should be no barriers to learning, and that organisations — for example authors, publishers, universities and ministries — should make resources freely available with no restrictions on copying, adaptation and distribution. This is however part of a wider movement that includes: Open Educational Resources (OER) (Butcher, 2015; Atkins, Brown, & Hammond, 2007), often housed in freely-accessible repositories; open practices, meaning teaching and learning consistent with open principles; open-source software systems, free to download, install and modify (von Hippel, 2001); and open development (Reilly & Smith, 2013), the application of the open movement to international development.

‘Open educational resources (OERs), although there are issues associated with them, are a viable way of beginning to overcome the lack of teaching materials in many contexts. If teacher trainers or facilitators of communities of practice for teachers are familiar with open educational resources, they can work with communities to produce localised versions of generic resources, and can also feed new resources into the “pool” for others to use.’

Personal learning environments: the notion that each learner should adapt and adopt those tools that most suit them and their needs and preferences, irrespective of institutional or organisational priorities or provisions (Dabbagh & Kitsantas, 2012; Wilson, et al., 2007).

E-portfolios: a digital collection created by a learner of their work, like essays, posters, photographs, videos, and artwork; and also capture other aspects of a learner’s life, such as volunteer experiences, employment history, extracurricular activities, and more. They document and make visible learning. but good e-portfolio is both about being a product (a digital collection of artifacts) and a process (of reflecting on those artifacts and what they represent). Open-source systems are available including ones that integrate with

other functionality mentioned here (Attwell, 2007; Roberts et al., 2005). They can provide the necessary evidence for admission to employment, training or formal education (Wuetherick & Dickinson, 2015; Heinrich, et al., 2007)

Learner-generated content: the practice of learners contributing their own material, be it text, images, video or audio, for other learners in their community, based on shared values and experiences (Dyson, 2012). There is a resonance here with the worker-writer groups and community publishers of the adult literacy movement of the 1980s. Many of these groups and communities published the poems, narratives and autobiographies of their learners (Woodin, 2005; Pollard, 2012). These formats could align with cultures that learn from stories and with the ideas of digital story telling (Robin, 2006). There is also an alignment with both the learning involved in citizen science and the preservation and transmission of indigenous knowledge.

‘Embedding participatory evaluation from the start of any new projects will increase the possibility of effective co-creation of future resources and support systems’.

Game mechanics: the practices of levels, leagues, badges, missions and teams borrowed from gaming can motivate learners in a community to collaborate and compete in their learning (Callaghan, et al., 2016; Kim, 2015; Lameris, et al., 2017; Chorney, 2012). **Badges,** a sort of informal micro-credential for achieving a particular educational task, are a related technique for recognising and incentivising informal learning (Ostashewski & Reid, 2015).

Self-directed learning: sometimes called heutagogy (Blaschke, 2012; McLoughlin & Lee, 2010), the principles and practices that enable learners to manage and control their own learning. There is a relationship between heutagogy and connectivism, the pedagogy associated with the early MOOCs (Massive Open Online Courses) that attempted to capitalise on the ‘wisdom of the crowd’ (Conole 2014), on the capacity of large numbers of learners to contribute to an emergent course. These ideas, and many of the others we mention, must be reconceptualised in the context of different target communities (Traxler, 2018c; de Waard et al., 2012), perhaps characterised by very different levels of educational attainment, pedagogic traditions, access and infrastructure from those where these ideas originated.

Project-based learning: whilst in lockdown or whilst schools are closed, learners could still be engaged in individual learning tasks, such as natural history, local history, family history, urban geography, citizen science, personal reflection, creative writing and physical exercise; they could use phones or laptops to log and share ideas and data and adopt a flipped learning approach, convening online to discuss, compare and critique their findings, results and thoughts (Kokotsaki et al., 2016).

Mobile learning: not specifically in the current sense of small-scale subsidised high-tech pilots (Traxler, 2008; Kukulka-Hulme & Traxler, 2005) but learning adapted and appropriate to societies characterised, each in their different ways, by massive movement and connection (Traxler, 2018d). There are overlaps with both blended learning and with distance learning but our emphasis in relation to all of these is those aspects that encourage ownership and control within communities rather those that are either imposed or supplied externally. With any kind of access, mobile or desktop, there is always an equity issue, ensuring that the most marginal have the same educational experience as everyone

else. With mobiles, this includes bandwidth, connectivity and costs (Traxler & Crompton, 2020).

Flipping learning: meaning in this context, structuring learning so that content and individual tasks can be accessed asynchronously and individually in order to maximise that time and bandwidth available for groups to convene online synchronously for discussion and diagnostics (Bishop & Verleger, 2013). This may be with a tutor or it may be without. There are various factors at work such as availability of suitable tutors and how they can be deployed most effectively, the nature of the content, curriculum and resources.

e-Moderating: the tactics, developed and designed to transform communities of online learners, dependent on a teacher or tutor to a community of learners that is self-supporting, self-managing and potentially self-sustaining, allowing the teacher or tutor to step back (Salmon, 2003), merely intervening to review progress, set tasks and correct errors. This could be a role taken by a knowledgeable community member, adaptable to mobile formats (Brett, 2011).

Critical digital literacy: an underpinning concept, based on digital literacy (Bawden, 2008), that is those digital skills, knowledge, attitudes and affordances that enable individuals and communities to survive and flourish in their own physical and digital worlds, but additionally recognising the need for criticality, the ability to recognise and make judgments about the interests, forces and pressures at work amongst the stakeholders, organisations and practices behind these resources. These are all culturally and contextually specific (Traxler, 2018a).

'A caution about online resources in general — I have anecdotal evidence from a handful of interview respondents who had fled Pakistan and Afghanistan, that their communities "back home" mistrusted the internet entirely, as all online activity was associated with scams and corruption. These individuals needed face-to-face mentoring/coaching in getting started on MOOCs or finding OERs, in order to be assured that they were accessing trustworthy sites. They had no benchmarks from their own experience with which to make these judgments.'

This example shows why critical digital literacy is crucial, for example, in empowering learners to reconcile the conflicting language, ideas, values, issues, culture and artefacts in the resources from the outside world, from the global knowledge economy and the information superhighway, and those from within their own local family, region, community and culture.

'The use of OERs is only useful for communities if the content is designed solely for their culture perceptions of education and the role of state-led endeavours in enforcing integration and homogeneity with the non-traveller society. In many ways this echoes sentiments from the Aboriginal Australian community in that for many years, particularly in the Republic of Ireland, there has been official state led efforts to assimilate Irish and other traveller communities. This reaction, therefore is one against colonialism and if the use of OERs are seen as preachy or insensitive, they will be ignored. Again, COVID-19 presents as opportunity to utilise the burgeoning technology for greater outreach to marginalised groups but we have to be sensitive at the same time.'

The tools are implicit in our earlier argument, namely those tools that individuals and communities already freely access and confidently use, within the context and infrastructure for any specific community. They could be very familiar and generic or slightly more specialised tools. Many of our suggestions are speculative, needing to be tested, adapted and integrated but they illustrate ways forward depending on the size, formality, resources and expertise of the groups of learners.

1.10 Ways forward

These ideas, and the exploitation of free and familiar resources to deliver them, implies a shift in the emphasis of external and expert support, **away from the installation and maintenance of large-scale proprietary and dedicated systems** — away from mainstream ‘centralised EdTech systems’ in fact — **to contextually- and sensitive and culturally-sensitive collaboration and capacity-building, empowering local catalysts and agents of change**. This is similar to Richard Heeks’s (2008) notion of ICT4D 2.0, *with, amongst and alongside* the poor, not ICT4D 1.0, just *for* the poor, but actually only the educational version of the transition from web 1.0 to web 2.0 as outlined earlier. It forms the basis in the medium-term for resolving the paradox or tension we outlined earlier, namely supporting education systems through crisis and supporting those outside formal education systems.

1.11 Conclusion

This introductory discussion provides a context for our recommendations, findings and methods. We recognise the need to address our brief but also to contextualise and highlight issues that might not be raised with a more constrained and conventional focus on schools and education systems. This is not to say that the latter have less value than normally assumed, merely that responses to COVID-19 need to be as broad, inclusive and flexible as possible. The following chapters address setting the context, pedagogy, technical aspects and a short conclusion followed by recommendations and references with appendices on methods and sources.

2 Context-setting

This chapter outlines what is meant by context and its significance thinking about education and about potential applications and interventions within and beyond education systems. This sets the scene for particular problems encountered and considerations made in a meta-review that seeks granularity with specific and pragmatic lessons for stakeholders.

2.1 Literature

‘The change we are living could be summarised in the words “Where are you?”. This “perfect” mobile question elicits the perfect answer: “on the cellphone”. Being “on your cell phone” is not the same as being “on the telephone”; the substantial difference between talking on the phone and talking on the cell phone teaches us about mobile ontology and points to digital nomadism’ (de Salvador-Agra & Martinez Suarez, 2015).

To contextualise, we should probably start by looking in the mirror at our own contexts — what it is to be a teacher, what it means to attend a course and to participate in formal education, what resources are available and the paucity of those, alongside knowledge, skills and opportunities for mobility — in order to understand how COVID-19 has impacted those.

Bauman (2000) explained that disruption was a natural factor that threatens systems in an era of ‘liquid modernity’: where hitherto normal ways of being have lost their moorings and become unstable. Unstable systems are characterised by insecure and vulnerable features that cannot adapt as a result. Education, as one such system, has in some ways struggled to contend with the fast-moving ubiquity of digital technologies and all that they symbolise — the emancipation of knowledge from textbooks and authoritarian figures, the distribution of community learning through networks, connectivity that bypasses normal routes to improve access to learning, assessment re-considered. Digital technologies have exposed paradoxes and tensions inherent within education as, for example, the ‘teach and test’ methods of recalling knowledge suddenly seeming archaic and ill-fitting. In light of the advent of mobile technologies and the world of resources and information available, some have even previously questioned the relevance, authority and credibility of educational institutions themselves (Pachler et al., 2010).

Nassim Nicholas Taleb (2012) captures the unstable context of our time in similar ways to Bauman. The COVID-19 pandemic could be viewed as what he labels a ‘Black Swan’ event, which would be to suggest that what it represents to our education systems is a necessary stress test for fragility — not entirely negative, and precipitating a paradigm shift that was, if not inevitable, then necessary in its disruptive impact, namely through prompting consideration of the adverse events of disorder to understand how the fragility of those systems can benefit and grow from such disorder.

One such example is in the traditional educational institution. A school, college or university is often understood as a microcosm of society in its structure, but it is a misnomer to describe it as such (Hayes & Jandrić, 2014). Schools and colleges, unlike society, are subject to rigid controls and regulation that make their structures fragile to unprecedented

disruption and uncertainty. They are, indeed, almost the paradigm institution: one that near everybody experiences and to which we are shaped. The mechanisms of such systems are challenged and made vulnerable by the 'social distancing' that has been imposed in the light of COVID-19 in ways that make remote learning via technologies seem an easy fix, but this is a simplistic and ill-fitting resolution to apply, given the numbers of the disadvantaged at home without hardware, or where sharing a device in a family of users is necessary. This is made worse by households with children in multiple year groups and with parents who also need to use any devices and bandwidth whilst enforcedly working from home.

Rather, it is more appropriate to **avoid 'quick-fix' solutions and seek to transform that which is vulnerable**. This is obvious in the sudden halt to face-to-face learning environments, the impossibility of carrying out terminal assessment such as exams, and in the notion that students at all levels fall behind and must 'catch up'.

However, there are many examples where for disadvantaged students, access to learning throughout COVID-19 has been a challenge. As schools have remained closed, education inequalities have widened, and COVID-19 has exacerbated learning gaps. Since COVID-19 began, radio-based learning has been an effective medium in many rural areas where television and internet networks are weak, with free radio devices being distributed to students (Akinwotu, 2020). Online classes can become inaccessible because the data becomes too expensive and an erratic power supply can mean that students are days without lessons. In the Nigerian city of Lagos, freely distributed smartphones loaded with data and an app containing the curriculum and video, audio and chat-based classes are being supplied, with students commenting that although they miss school and being in the class the phone makes a major difference, is effective and gives them stability.

Even where lockdown is easing, new cases continue to accelerate in Nigeria, and this is a pattern being repeated globally at the time of writing. Education officials admit that they haven't invested sufficiently until now in educational technology and that things cannot return to how they were before the lockdown. Full school re-openings present challenges, as do exams and understanding how effective online learning has been so far. Whilst teachers may not agree that technology can replace a school, many suggest that it can at least help. However, there are also linked structural issues when in Lagos only one in 10 schools are publicly funded and the rest are recently founded private institutions (Akinwotu, 2020).

Some of our contacts describe the issues arising from educational institutions that are corporations subject to market pressures and the related inequalities that become further entrenched. In the following example, Leonard Mware shares experiences of the effects of different funding mechanisms on educational institutions in the Kenyan context:

[...] there are some private primary and secondary schools continuing with learning because otherwise they will lose revenue. At same time some parents have gone to court to stop their schools from continuing with online teaching while

public schools are closed. The reason? What will happen with all this curriculum coverage if the government decides national exams will be pushed to next year? There is a myriad of policy realignment that needs to be addressed. Should those with ability to continue learning go on while those unable to, remain behind, until the pandemic is over? In the midst of the pandemic my son a student at USIU (United States International University Africa) continued learning and did his semester exams from home. They have now started a new semester while still at home. The largest and oldest universities such as Nairobi Uni, Kenyatta Uni, Jomo Kenyatta universities are left behind and are now struggling to pay salaries. They have asked staff to take a pay cut. The issue is all these universities declined to embrace online learning, though they had capacity and a head start. The cost of their inaction is showing clearly. Post COVID-19 we must do soul searching and redefine what learning is delivered. It will take policy to force change but maybe COVID-19 will accelerate the urgency.

It is highly probable that further disruption along the same lines as COVID-19 will arise in the future, therefore for future policies to be effective, responding to the diverse voices of students and teachers in their localities, as they describe their direct experiences is crucial (Peters et al., 2020; Jandrić & Hayes et al., 2020; Watermeyer et al., 2020).

Rajan Madhok, chair of Peoples-uni, describes below this Open Access Education initiative and the activity through the COVID-19 developments:

Peoples-uni (The Peoples Open Access Education Initiative — www.peoples-uni.org and <https://ooc.peoples-uni.org>) is a UK-based charity which has been helping to build public health capacity in low and middle income countries through a social model with volunteer academic and administrative staff for nearly ten years. The organisation was highlighted by Lord Crisp as an example (1) and further details of the work of Peoples-uni are available (2,3).

We have actively tracked the COVID-19 developments through our extensive network of faculty and alumni initially to create a learning forum from across the globe and to support individuals who have been on the front line in their respective settings and now turning attention to how to accelerate our capacity building plans.

We do not seek to rationalise the disruption, but to set out an argument that from this disorder there is much to gain. We read literature from contexts where disruption (as a fact of life elsewhere in the world) has often led to innovation that may solve or strengthen fragile states. We sought to ‘reverse engineer’ methods and practice from the Global South, according to our remit. In a sense, we know this is flawed, since we recognise that all contexts are uniquely different. This is borne out by the work of Hargittai (2010) who raised doubts surrounding the extent to which technology’s affordances extend from the privileged to the less privileged. This means caution must be exercised when endorsing the outcome of any study that does not represent the behaviour (and access opportunities) of a wide range of users. This needs to be recalled as we present the following, but we are confident in the opportunity for innovative educators to interpret and apply lessons outlined from contexts that hold similarities with the present, for example, those where disruption has drawn out lessons learnt.

2.2 Digital divides

What is immediately apparent when we discuss context is that the ubiquity of mobile technologies and widespread connectivity can increase gaps in inequality (Ho & Tseng, 2006; Rasmussen & Ihlen, 2017), between those who have access and those without (Billon et al., 2017). Writing of low-income countries (LIC), Unwin (2020) makes several recommendations in how digital technologies might potentially reduce inequality, such as in lowering the cost of access to broadband in the poorest countries and communities — or at least to educational facilities/students in those countries. But Fuchs & Horak (2008) make the case that simple loading of technology into deprived areas does not alleviate conditions nor promote a sustainable response (their own recommendations are returned to in more detail in the chapter on ‘Technical’). Indeed Alain et al. (2018), writing about refugee education, warn that ‘technology should not be seen as a solution, but as a possible mediator that tackle specific problems towards achieving specific identified goals’. Although it seems easy for Western researchers to advocate such solutions from a position of commodification excess, communities that are scarce of both natural and synthetic resources are as much in dire need of hardware and improved access as they are in the knowledge to manipulate them.

And herein lies an inherent problem where advances in technological evolution mean the disadvantaged are always ‘a step behind’, so technological infrastructure itself not only reproduces inequality (DiMaggio et al., 2004) but imposes new forms on people — not just in personal hardware, as Unwin (2020) registers, but geographically, as urban environments tend to have better connections than rural ones.

‘Structural inequality in society is the main cause of different types of digital divide. Digital divide is still here and was showcased during COVID-19 where so many learners could not learn!’

Access to the technology is only part of the solution to inequality and disadvantage. We outlined earlier that the mobile represents multiple channels in its reach and can be sufficient if coverage is available. We may equate the mobile directly with the types of informal learning approaches outlined in section 1.9, since they require little more than a mobile, the knowledge of where to go and who to talk with. We are aware that these are more instinctive behaviours for adult learners than younger, particularly school-aged, ones. This is why the networks of practitioners recommended in section 1.7 are imperative,

as understanding how to teach students how to learn using technology will support the engagement of vulnerable and disadvantaged learners and should be a key priority for those involved in teacher education (McAleavy & Gorgen, 2020).

2.3 Culturally situated education — from the general to the local

Moving from the digital divides to the chasm in knowledge, Alain et al. (2018) highlight the priority for any potential solutions to consider the immediate people and population where potential interventions may take place. For them, 'designing in this space (in other words technology enhanced learning) requires knowledge of the specific population and the contextual dynamics surrounding it. Design should therefore be informed by both existing research across relevant disciplines, and from the practical experience of those who are on the ground facing the problem in real life' (Alain et al., 2018).

Almost every paper we have encountered, discussing groups as diverse as from marginalised communities in India (Malhotra et al., 2017) to refugees in Syria (von Bayeur, 2018) and from indigenous peoples in Australia (Robinson et al., 2016) to rural Kenya (Njagi, 2015), focuses on the need for local contextual dynamics to be taken into account in any decision-making processes. Moreover, there is a strident call for local voices to be heard — for governments to do 'with them' and not 'to them' — coming through all of the literature we have assembled. The expert opinion we sought through the Delphi sessions has repeatedly stressed that locality and culture are crucial, or put another way: 'context is king' and, as argued by Cottom (2019), 'learning technologies do not exist in a vacuum'.

'Some other broad factors affecting technology-based learning in developing contexts: human capacity (for example, need for context-appropriate training and support); infrastructure and resources (for example appropriate devices, power/energy, internet signal, internet affordability); the involvement of stakeholders (for example learners, teachers, school management, political and community leadership, parents and guardians, regulators)'.

It is therefore imperative that we recognise the ways that circumstances and contexts create unique issues, for example of digital access and equity, see for example (Humphry, 2014), and any policy framework or practical solutions need to be responsive to the diversity and uniqueness of local contexts (Park & Middleton, 2019), and to involve the community these seek to support. The issue of context is most important for learners or communities with characteristics that differ most from national, established or mainstream norms.

It is the natural disposition of teachers to harness the existing knowledge and skills of the community (through, for example initial assessment or diagnostics), which leads us to consider that the emphasis on approaching any problem needs fixation on:

- Clear understanding of a local problem.
- Identification of local need.
- Evaluation of community assets (knowledge, skills, resources).

This leads to a logical verdict that all contexts are local and specific, and that scale can be perilous when blanket solutions or grand plans become the one-size-fits-all recommendation. In education, this is evident through instrumentalist endorsements where 'a means to an end' becomes the focus and, in wider society, where determinist

perspectives of technology to any conceivable problem have become culpable in this 'one solution' respect. This reminds us to treat the above human qualities (in other words problem, need and the human resources of knowledge and skills) as paramount, for technology implementation can certainly benefit from multi-stakeholder collaborative design, but will likely be more personal and purposeful if participatory and driven from local perceptions and applications (particularly if it is to be embedded with sustainable longevity).

'Understanding the context, and 'involving' local people is essential in guiding the design and development of technology solutions for education. Research to sensitise external individuals to the realities of the context, practical experience from local learners and teachers to contribute to the technology design and development, as well as practical experience of external stakeholders to understand the realities of applying educational technology within constrained environments. This is about empathy, which should be the first step. Participatory approaches to solution designs is the best approach'.

In this example, Dr. Tharindu Liyanagunawardena, University College of Estate Management, describes:

In Sri Lanka there are many students learning with WhatsApp. However, as you can imagine, being a developing country not all pupils are able to afford this. The Sri Lankan government was working on giving 'free data' as a supporting mechanism. Previous work showed that when the government introduced online distance education courses as a way to overcome the acute shortage of university places in Sri Lanka, people who benefited were urban, and well to do (work internet/printer access, computer/internet access at home, high income households, for example). While the government's vision was that people would go to telecentres set up to do these courses. However, the amount of barriers that were there in accessing the telecentres were too much for the vision to be a success. For example, YouTube or programmes needing software to be downloaded and installed were not allowed, meaning many could not really use the centres for their course work. There were also difficulties in accessing the places — some would-be users were faced with a 2-hour+ bus journey. Some of the restrictions on telecentres were due to poor internet connectivity (bandwidth) and a perception that 'watching videos is not learning' and so this was frowned on in some telecentres. Due to virus threats students were not allowed to use pen drives and they could not take (or save) work they did on telecentre with them to be accessed elsewhere (this was in the pre Google Drive/Dropbox era).

Conclusions surrounding ‘local context, local need and existing local skills’ were encountered in much of the literature we read. One such paper (Botha et al., 2017) documents attempts to adapt a rural curriculum into broader distribution, where ‘gamification’ was considered too problematic to transfer to scale across wider schools in a South African district. This study surmised that technology implementation suits teachers’ curriculum objectives when fitting with their existing choices and uses of technologies, rather than prescribed by external sources. As such, and a main point that often comes through, is that endorsements of technology are problematic when separated from the learning context (compare, for example, Menashy & Zakharia (2020)).

It is imperative to consider the *form* of the curriculum when treating disadvantaged and marginalised groups, there is a need for a curriculum that enables participation in the wider world, but also a consistent message is the need for a culturally-situated, relevant curriculum (Hakami, 2016). This is significant because endorsements of technology can be abstract when separated from the local learning context. Therefore, for context-setting treatments and interventions to be planned, decision-makers need to closely understand the context and people involved (see for example, Malhotra et al. (2018); von Bayeur (2018); Njagi (2015)). This seems to consistently involve curricula that are culturally sensitive and socially situated being formatted to relevant education programmes *with* (not *for*) marginalised and disadvantaged communities. But it is also important to **consider curriculum as making room not just for ‘what we learn’ as ‘how we learn it’** and how to continually master our own metacognition for learning, our environment and to think about why we are learning what we are learning. Do existing curricula, for example, fit local need, fulfil a sense of purpose in the world, enable closer community co-operation and promote continued learning? In fact, it is often worth reconsidering, in times of ecological, epidemiological and economic uncertainty, what is education for.

Form is the (curriculum) content based on local and wider need and also the vehicle for education. If we translate these studies to the UK, we may draw parallels with the 2014 FELTAG (Further Education Learning Technologies Action Group) report that helped shape tertiary and vocational education’s use of learning technologies. The report was apposite for a changing skills and training sector and one of its main recommendations was in the preparation of professional teaching staff to embrace technology and innovate delivery (the vehicle for teaching and learning). But it made equally significant recommendations regarding form and content: promoting more personalised learning to allow for more choice and specialism at the local (individual) level and as facilitating more formal assessment to foster the mastery of technical skills, with timely feedback provided through technology’s channels. Opportunities for self-assessment improve and are based on individual need, rather than necessarily fulfilling the requirements of others.

The forecasting in the FELTAG (Further Education Learning Technology Action Group) report arguably made the Further Education sector more agile, robust and potentially responsive to incidence such as the current disruption to service being experienced. FELTAG’s aspirations were for staff to have been enabled to create learning opportunities that promoted ownership and self-determination, social and collaborative learning practices, through whatever tools and affinity spaces educators could utilise.

We may draw parallels between the disadvantaged in the UK, where Internet access is still intricately linked to wealth, and — for instance — Kenyan refugee camps. Boškić et al. (2018) report that restrictions in bandwidth make connectivity a continual challenge, so users

prefer to adopt communication channels such as WhatsApp over 'slow-moving' virtual learning environments (VLEs) or learning management systems (LMS), like Blackboard or Moodle which are commonly used by institutions in the UK. Innovators find a way to tailor for local need and locate focal points: educators in these contexts understand that synchronous online teaching is not always best and exploit what is more locally available and shareable — portable hardware like MP3 players, which allow podcasts to reinforce troublesome learning content (Boškić et al., 2018). Thus, the curriculum was shaped to accommodate the facilities, needs and resources of the student population.

Similarly, David et al. (2020) circumvent poor internet connection by highlighting the value of educational television and radio broadcasts in combination with SMS. In a study of 'anytime anywhere' mobile learning among Amazonian indigenous communities, de Salvador-Agra & Martinez Suarez (2015) report how poor coverage gives locals 'intermittent ubiquity' that sees them migrate towards areas of connectivity, thus de-territorialising them to more urban ecologies. While the authors liken nomadic ubiquity with mobiles to snails who carry their worlds with them, the opposite could be viewed as true: the erosion of remote and local identities into a homogenised state. Although it is very much an anthropological study, it has parallels with the concerns stated in an aboriginal critique of Australian indigenous education policy that conflates a standardised education system with the norms of social and cultural assimilation and pedagogy predicated on testing regimes, literacy and numeracy (Fogarty et al., 2015). It can be alternately viewed that mobile learning comprises both content and a vehicle for its delivery, allowing for personalised and culturally-situated and sensitive curricula, just as the mobile is also cited as anchoring individualism and self-perception through interactions in social networks, while nomadic technologies enable diaspora to virtually inhabit other spaces.

It is clear from this that access is not just about internet infrastructure and connectivity to prevent physical and digital isolation, but meant as access to educational aspiration, signposting direction and human agency, as shown in the role of mobile technologies to facilitate pathways for displaced Somalian refugees amidst 'local and global interactions' (Dahya & Dryden-Peterson, 2017).

'There is a call to consider education via different world views, such as how Heckler (2018) reflects on how the San "StoryMind" relates to education'.

Correlation is again drawn from what has been discussed here with the FELTAG report's initiatives to upgrade the use of digital technology in technical and vocational education in the UK. Ultimately, this is about tackling a co-operative approach to teaching and learning and between the learner and the object of their learning. Incapacity to utilise technologies for learning purposes will only lead to those with digital skills getting the advantages, while those without suffer — hence a widening gap of inequality (Hargittai, 2010) known as the 'Matthew Effect' (Trucano, 2013). As students are themselves the subject and object of their own learning, it is important, as FELTAG states, that education is not something done to them, but in tandem *with* them, so they are not left alone to their own devices, a view shared by Unwin (2020): 'We need to understand that digital technologies in themselves have no power to effect change. Such an instrumental view of technology has been hugely damaging because it hides the interests underlying their design and production. Unless new technologies are created with marginalised people to serve their specific interests and empowerment, then inequalities will continue to grow'. This underlines our ongoing message.

In the following chapter, we turn our attention to discussing the 'pedagogical', showing overlap between teaching and technologies. We explore the ways that technology informs teacher education and teaching strategies and how those systems can be improved and strengthened.

3 Pedagogy

This chapter discusses the pedagogies of teaching and learning characterised variously as online, remote, blended, mobile, digital, asynchronous or distance and their relevance to COVID-19. Much of the literature is drawn from research on schools, children and professional teachers, but it is important to reflect on its additional relevance to adult learners, informal learning and community teachers.

3.1 Literature

When we talk about pedagogy, it is often informed by Northern points of reference — principally, constructivist, cognitivist, behaviourist and, increasingly, connectivist — which have illuminated understanding and theorising about learning. We are aware that there are numerous paradigms and definitions of what learning is and is for, and how different cultures do it, reflecting the vast arena of learning levels and contexts. There is a need to reconcile the global norms that reflect global digital culture, tools, practices and language with those of local, indigenous and informal communities. We iterate the earlier point that such communities exist in developed countries, for example the Roma, and may be dispersed, for example the visually impaired.

Here, we aim to consider pedagogy that is socially and culturally situated, context specific, and how it may be impacted, influenced and shaped by technologies that it utilises, as well as the questions that arise from the introduction of technology into varying contexts. All learning, even the simplest, is social and has social purpose: it relies on effective linguistic and social interaction with peers, parents and teachers as mediators of experience (Alexander, 2016). So, what happens when students — at any level — are suddenly stripped of their learning environment? Whilst learners and learning is a comparatively easy issue, teaching and teachers is a more problematic issue, especially in relation to marginal communities. Our early remarks on informal tech systems for learning were intended to point the way to self-sustaining autonomous communities of learners, where perhaps community leaders or recognised knowledgeable members, formal or informal, might provide initial structure and direction, and where the values and aspirations of the community are paramount. For some marginal communities, the national education system and its teachers may be oppressive and unacceptable, and we hope our remarks about context and culture provide ways forward. For other communities, deeply rural ones for example, state education system teachers maybe be supplemented by local teachers, not necessarily highly trained, paid for by the community. So teachers may vary widely from professional trained teachers to none at all and our discussion of teachers and thus of pedagogy must be read accordingly.

We have looked at situations from across the globe where this has happened to see what lessons can be learned. Michael Nkwenti from Cameroon says:

Within the context of COVID-19, parents play a very significant role. They are fully assuming the role of the first teacher of their children. The outbreak of COVID-19 took everyone by surprise and no parent was prepared to provide adequate follow-up to their children. Within Cameroon, statistics show that many parents are using social media — Facebook and WhatsApp. Teachers explore these channels to send content to children through their parent's smart phones. On the other hand, the state opted for a TV-based instruction response to COVID-19 since it is believed that state TV covers at least 80% of the national territory. Broadcast content are hosted on Facebook for parents to access and share with their children since it's a platform that they are more familiar with. Assignments are regularly shared through these social media platforms for parents in the urban and semi urban settings to access, download and assist their children to do them in their exercise books. Solutions are also provided through the same channels. Children with difficulties use the same channels to answer questions. Within the context of COVID-19, the inclusion of parents and learners in the design of any learning solution could be a critical a success factor. This is paramount especially within Sub-Saharan Africa where qualified human resources and poor technological infrastructure remains a major issue.

Before any lesson, it is incumbent upon educators to plan it. Formal learning should not be *ad hoc*; rather it should form a sensible and iterative step towards an overarching and developing understanding of the whole, be that in kindergarten or in a PhD seminar. In order to plan a lesson effectively, the teacher needs to know several key things: their learners' current progress (*where they are*), their next steps (*where they need to go next*), and the best teaching and learning events for the lesson (*how they get there*). These are crucial elements of assessment for learning (William, 2011), can be seen as the 'signature pedagogies of the profession' (Shulman, 2005) and are true irrespective of the status of the person facilitating learning.

In order to know these three key elements, and to effectively plan for them, it is vital that local contextual features are taken into account: the students, where they are in their learning, the ways that they learn, and any external features, such as the language they are learning in, their physical and mental conditions for example. As noted by Huang (2015) in a study on rural Taiwanese learners, where the relationships between teachers and learners are close the content of the courses can be reactive to local contexts and adjusted as required. Relationships enable interpersonal communication, informational applications and the requirements of participants, which helped to narrow the digital divides inherent in rural learning contexts and environments. It is clearly the case that a student experiencing the trauma of being made a refugee or faced with life-changing events will

not be able to learn the same way as their unaffected peers (UNESCO, 2020). This is true for individual situations and contexts, and at national and global levels.

Below, Sarita Sharma explains the context in India where teachers' needs for learning and building their pedagogic choices and critical thinking are being supported through an app to learn anytime, anywhere, and at zero cost.

COVID-19 has put a hold to all the face-to-face teacher-training efforts in Indian public and private sector schools.

Teachers in India have their training, twice a year, and centralised decisions are taken for what needs to be trained for, but this never meets teachers' needs of building their conceptual depth, pedagogic choices, and critical thinking. We wanted to create a learning app for teachers to learn anytime, anywhere, and at zero cost.

We created TheTeacherApp in 2016 and tried prototyping different kinds of digital learning experiences keeping the scale and learning needs of teachers in mind. Building the content strategy for primary teachers at the core and working on formats that include PCK (Pedagogical Content Knowledge) framework in mind building on teacher's knowledge, skills, and attitudes. We have built more than 100 hours of digital learning experiences.

Formats explored and scaled were:

1. 45–60 minutes of audiovisual courses based on pedagogy, maths, first language learning.
2. 15–20 minute-long podcasts, having various series like books teachers should read, classroom strategies, human relations and communication, for example.
3. 5–10 minute audio-visuals based on creating a teaching-learning material.

We kept the courses shorter/module to sustain interest in learning and create small wins.

These were built in de-jargonised, simple Hindi, they are interactive, ask teachers to continually reflect, and are light on data for breaking barriers of accessibility.

Over the past four years, state governments have begun including TheTeacherApp courses in their annual plans.

3.2 A blended curriculum

This is to be understood as a combination of face-to-face (f2f) and online/remote teaching and learning where possible. Incorporating blended learning, or off-site learning events, supported by in-class teaching helps learners and teachers acclimatise to online more easily (Smith & Gurton, 2020). It is best understood as a series of 'events' — pre-f2f, f2f and post-f2f, where each element complements the others.

'Blended learning may provide support and role models (teachers being strong models). I feel that this would work in my own projects in Indigenous language acquisition. Learners can access multimedia content for memory work, working through problems, for example, but then exercise their knowledge with a real human teacher(s) and other learners.'

It has been noted that students who choose to engage with each element are more absorbed, more active and more successful in both their endeavours and their outcomes. Smith & Gurton (2020) note, however, that this is highly caveated. Firstly, not all students choose to, or can, engage in pre-f2f activities, for a variety of reasons, and teachers need to take time to create or curate high-quality pre-f2f materials and resources. Unfortunately, COVID-19 challenges these f2f events and challenges teachers and administrators to think again about how they are sited and scheduled.

When planning curricula, educators must be as reactive to local needs as individual teachers are when delivering them. As already established in section 2 'context setting' earlier, a knowledge of specific contexts and needs should be established before designing curriculum for disadvantaged groups (Chugh et al., 2017; Costanza-Chock, 2020) and to these ends, a recent UNESCO (2020) report into refugee education makes several tangible recommendations on leveraging existing technology resources to deliver quick-responses that are inclusive and equitable for mobile learning projects. In such circumstances, blended learning is essential to quality provision that seeks to avoid a sense of isolation in remote learning (Corsby & Bryant, 2020), particularly among those already marginalised. Of course, blending learning — while probably optimal — is not always feasible. Where teachers have limited access or availability, student-centred learning may overcome paucity in teaching staff, but students may well struggle without a more knowledgeable other (Vygotsky, 1978), so providing high-quality collaborative tasks based on coherent models and frameworks is vital. Chugh et al. (2017) claim that it is vital to incorporate a mixture of synchronous and asynchronous environments in order to mitigate the difficulties of students working alone. This is seen for instance in recommendations to make online content available offline, through pre-loading or other means (Lewis & Thacker, 2016; Bozkurt et al., 2020).

Beyond curriculum, it is clearly the case that each lesson is bound up within unique contexts and subject to local and specific dynamics. Moreover, there is a strident call for these local voices to be heard — for governments to do with them and not to them — coming through all of the literature we have assembled. As stated earlier, the Delphi contributors repeatedly stressed that locality and culture are crucial, or put another way: 'context is key' and as argued by Cottom (2019), learning technologies are not 'value-free' and so must be guided by principles.

‘Teaching will be more resilient if systems are set in place to enable team teaching. Teachers who are paired/teamed can jointly solve problems, share ideas, and help each other with technology issues. They will also be able to step in if one teacher is unavailable due to illness or family caring responsibilities’.

‘Over longer-term crises, learner engagement may wane and require strategies for maintaining motivation such as gamification and personalisation of education (standardised, one-size-fits-all solutions may be problematic)’.

‘There is also a hint that involvement of the general public could be important to close the loop (for practitioners to understand what is happening within communities)’.

Following Ebola and other earlier outbreaks and epidemics, it can be noted that ‘the increasing pervasiveness of internet-enabled devices means that technology enabled professional development is making significant progress in low-income settings’ (McAleavy et al., 2018). ‘While evidence is emerging on the efficacy of some professional learning programmes in protracted conflicts — for instance, the IRC’s Connect to Learn (which includes a psycho-social element called *Healing Classrooms*), the potential of these programmes to transfer to disease-impacted contexts remains speculative and untested’ (Dahya et al., 2016).

There has also been a much-needed research focus on refugee education in recent years and we have tried to dovetail such research on displaced and marginalised peoples with papers on other groups, so that our remit was not too narrow. This was not done for correlation but to cast a wide net on information. On pedagogy that is culturally situated for particular communities, Pasch (2015) writes on the importance of culture, voice, language and identity being upheld in Inuit peoples. He sees much stock in the uses of digital archives to record the presence of an isolated people, which can then transcend physical distance to anchor local identity and disseminate these regional voices. The paper argues for both digital training and digital hardware in order to develop local industries, so that digital technologies can give representation to those cultural groups.

3.3 Assessment

The integration of multimodal communications through digital technologies may naturally disrupt how we approach assessment. Without a clear picture of where a learner is, it is impossible to effectively plan for their next steps. This is problematic with remote teaching, due to the difficulties in receiving learners’ work, especially where the teaching content is delivered via radio or TV. Ideally, students should be able to demonstrate their learning as frequently as possible. de Villiers et al. (2016) provide a coherent principle-based framework for e-assessment that combines the disparate elements of formative, summative and dialogic assessment that can strengthen relationships between teacher and learner and learner and goals, through online mechanisms. Methods of evaluating and assessing learning will vary across contexts, age ranges and learning groups, and is clearly affected by the infrastructure. There will still be very specific challenges with the assessment of lab-based learning, practice-based courses, portfolio development and professional skills, though for example both the MOLENET (Mobile Learning Network) programme and the CETL (Centre for Excellence in Teaching and Learning) programme in the UK trialled secure forms of skills assessment, physiotherapy was one, motor vehicle maintenance another, with learners’ own mobile phones.

3.4 Global educational responses

COVID-19 has seen a significant proportion of the world's formal learning population move online. As noted at the start of this report, by April 2020, nearly 90% of learners were unable to go to school, and in July of 2020, more than £1.1 billion learners are still affected. There has been a frantic and mostly unplanned shift to online modalities of teaching and learning. This has led to anxiety for both learners and educators, and the lack of preparedness has thrown some things into stark relief. Baha Mali presents the following as an interesting response to the crisis from Egypt (further details in: Bozkurt et al., 2020):

In the following example, Koledafe Olawale Sunday from the Centre for Open and Distance Learning, at the University of Ilorin, Ilorin, Nigeria describes how two schools have coped very differently. The schools are Quest Academy, Ibadan (a primary school) and Sacred Heart Catholic College, Ijebu Ode (secondary school). Each school posed a different case, and these are completely different from each other as can be seen below:

Egypt, in a direct response to the COVID-19 pandemic, have removed the exam requirement for students in transition years. Transition year students now conduct a research project appropriate to their age and integrating knowledge across all subjects. Students would have choices in subject matter and could conduct research from school textbooks, internet and subscription-based resources that are freely available via the Egyptian Knowledge Bank (EKB) website. Where students could not do the project on their own or didn't have internet access, they could do the project upon the reopening of schools whenever that may be.

Sacred Heart Catholic College, Ijebu-Ode, Ogun State

Sacred Heart is a privately-owned secondary school, located in a small town called Ijebu-Ode. Students of Sacred Heart are mostly residing in the school boarding house. Due to the lockdown, all the students were mandated to travel back to their homes (mostly in the cities like Lagos, Ibadan, for example). In response to the COVID-19 lockdown, the school deployed Google Classroom in engaging the learners. The teachers were first trained on the use of the Google Classroom platform. They were also given a crash training on online engagement. A community of support was also created to help the teachers undergoing one difficulty or another. Lessons were taken in piecemeal, one subject at a time. Challenges being faced includes technical glitches from the app provider and difficulties in assessment.

Quest Academy, Ibadan, Oyo State

Quest Academy, Ibadan is a primary school, owned by a non-governmental organisation. The school provides absolutely free education to the less privileged around Alakia area of Ibadan, the capital city of Oyo state. The lockdown became effective in the State, schools and many other activities were ban and movements were restricted. The team considered the use of online instruction versus use of instructional video on DVD. We conducted a simple interview to ascertain the degree of device ownership among the parents and the following result was obtained.

About 80% of the parents possess either a DVD or a smartphone. We were so much concerned about the remaining 20% so we needed to find an alternative approach to this. After much deliberation, we consulted with the teachers to prepare a week-long lesson with an assignment typed on paper. This was parcelled with each individual pupil's name written at the back. The parcels were dropped at the school premises by the teachers, then the parents come to pick these up for their wards. After completion of the assignment the parcels were returned to the school by individual parents, then they pick another one up for the subsequent week.

We planned our assessment to be individualized. Each class teacher made an arrangement with the parent of the child for a convenient day for them to visit with the test questions. The teacher presents the question one on one to the pupil, supervised and retrieves the answer-sheet from the pupil upon completion. This method was possible because we have a teacher-student ratio of 1:10. One of the key reasons for success so far is low student to teacher ratio. Another factor is the close proximity of the pupils' houses to the school location.

Our Primary challenge was that some of the parents were solving the assignments for their wards. Another challenge is the untimely submission of parcels by some parents. We responded to the latter challenge by not giving out a new parcel until the previous one is submitted.

For contextual commentaries from different parts of the world on Higher Education responses please see Jandrić & Hayes, et al. (2020) and Peters, et al. (2020). The following commentaries on educational responses to COVID-19 come from a study of 31 countries across the world (Bozkurt et al., 2020). In China, for example, K12 teachers were 'overwhelmed by the deep learning curve involved' (p13), whilst in Japan — globally known as a leader in digital innovation — 'educators are generally not competent with ICT-enhanced (information

and communications technology) teaching practice' (p15). In Saudi Arabia, despite some excellent responses from the Ministry of Education, 'most of the burden of supervising and following up with students to assess and ensure proper learning was placed on parents' (p23). In Namibia, COVID-19 has shown the country's 'gross inequality by highlighting economic disparities, especially as they relate to access' (p41). In Australia, 'underlying issues of inequality and de-funding have been exacerbated' (p52), a phenomenon that seems to be sadly less than unique.

This last point is another reminder of the UK's digital divides between those who do and do not have access to electricity, internet infrastructure, data packages, and devices that can access these. And it is worse in other areas of the world. As of 2019, fewer than 40% of Africans have internet access compared to 87.7% of Europeans and 95% of North Americans (Internet World Stats, 2020). Moreover, only 11% of learners in sub-Saharan Africa have a household computer and only 18% have internet access in the house, as compared to the 50% of learners globally who have computers in the home and the 57% who have access to internet (International Commission on the Futures of Education). There are further inequalities shaped by socio-economic factors of gender, age, employment, educational background, neighbourhood and household income (Rohs & Ganz, 2015). These include bandwidth distribution, data price and internet speed, all of which have a direct bearing on access to online learning (Bozkurt et al., 2020). Governments must work with providers to make data and bandwidth more available and more affordable so that the most disadvantaged can access it too.

These calls reach back into past literature (Fuchs, 2008), but are all the more urgent to strengthen fragile communities, institutions and systems against COVID-19. There is also a repeated call for learning institutions and educational groups to lobby for subsidised internet bundles from service providers, and for policymakers to reduce tax levies in order to offer affordable and reliable internet connections for educators and learners off campus, which is, in the 21st century, a basic need. In the early days of SMS, Jisc, the national digital university agents, negotiated bulk purchasing with SMS 'aggregators' on behalf of the entire UK university sector, effecting enormous saving and providing a model for other sectors and countries.

It is important that learners acquire both competencies and capabilities (McAuliffe et al., 2008). Competency is seen here as the ability to acquire knowledge and skills, and capability is characterised by learner confidence in their competency and, as a direct result of it, the ability 'to take appropriate and effective action to formulate and solve problems in both familiar and unfamiliar and changing settings' (Cairns, 2000). This is even more important following a shift online. Many countries are massively scaling up their online content during the COVID-19 pandemic, but this alone is not enough. **Having the digital literacy, especially the critical digital literacy that enables independent judgments and evaluations, to make use of the content in order to learn, especially without a teacher presence, will be vital moving forward**, as will having the self-regulatory skills to engage. In short, education needs to become more about learning to learn, the creative manipulation, meaning-making and application as much as the acquisition of knowledge. But for now, it is those people who are privileged to have data, device and digital literacy who can shift to what has been termed emergency remote education far more effectively.

Countries with widely-dispersed populations in marginalised, remote areas (such as Uganda, Ghana, Mexico, Peru, Brazil and India) are offering learning through dedicated programming on TV and radio broadcasts, live and recorded YouTube videos, self-assessment

exercises, and downloadable textbooks and learning resources; delivering printed materials to learners; and even experimenting with SD (secure digital) reader cards and memory cards for those with specific needs. In Nigeria, one university distributes the high-bandwidth content of its courses on a memory stick that integrates with its LMS (learning management system) meaning learners are only charged for low-bandwidth updating and messaging when they connect.

Radio use during Ebola in Sierra Leone

One existing programme was rapidly adapted to incorporate radio-based learning opportunities. In Kailahun, one of the poorest districts in Sierra Leone, with very high infection rates, an existing project 'Getting Ready for School' rapidly redesigned itself to become a radio programme — Pikin to Pikin Tok (Child to Child Talk). Delivered by a partnership between UK-based Child to Child and local NGO Pikin-To-Pikin. 36 existing 'young facilitators' created content in three languages. Radios were distributed to another 252 facilitators who created listening groups. Overall, the programmes reached an audience of 137,000. Working with national agencies and local leaders ensured strong buy-in at all levels, and that the content was gender-responsive. The final evaluation showed high levels of child engagement, and strong agreement from adults that the programming had contributed to children's learning (Institute for Development, 2016). Children could also recall many of the key messages from the programmes. The programming has continued since the conclusion of the project in 2016, with radios allocated to re-opened schools (Barnett et al., 2018).

The most marginalised populations, in remote rural areas, however, may not even have access to radio and TV and, even where these are present in households, the educational needs of multiple children as well as parents who may need them for remote working at the same time cannot be adequately met.

These may be uncomfortable truths, but they are the lived experiences of a significant proportion of the world's learners. This paper, however, focuses on the use of online learning and what is needed to do this effectively. Corsby & Bryant (2020) identify four key themes: 'the quality of technology available, the familiarity with it, the level of tutor facilitation for students and the degree to which users feel isolated, and they state that tutors require a nuanced understanding to enrol and engage distance learners remotely. Returning to an earlier point, the 'isolation' of the learner should give a heightened awareness of context; this can help tutors develop robust and durable environments, which embrace both traditional classroom settings where possible, and facilitate the addition of distance learners' (Corsby & Bryant, 2020).

We must be cognizant that there is a strong and articulate movement for the decolonisation of research (Prior, 2007; Desai & Potter 2006; Simonds & Christopher 2013; Sumner, 2006),

and research ethics (Coram, 2011) including work on decolonising research ethics (Kruger et al., 2014) and research project governance (Bozalek, 2011; Binns, 2006). Futher et al. (2010) that critically explore 'the language of "participation" and "empowerment" to create an impression of including all stakeholders in their work'. It remains the case that, for much of the world, learning materials are 'given' rather than created.

'While MOOCs (massive open online courses) offer an extension of access to knowledge, the provision of these massive courses by Western universities can lead to the silencing of minority voices, in particular those of indigenous knowledge. Potential for increased access to lead, not to increased knowledge, but instead to the privileging of the dominant model.'

This has been an issue for decades: 'Throughout Africa in the early 1960s, the language of education was not the language of the people's culture. The imitation of Western values has changed African behaviour and attitudes. As a result, African languages have become static compared to dynamic European languages. It is much easier to express ourselves as Africans in foreign languages because new words, for example those for digital technology, have not been reflected in local languages' (Ndemo, 2014). As Traxler (2017) noted, 'Consequently, mother tongue and minority languages are under pressure both from and through mobile technology'.

An even more vivid terminology is that of 'epistemicide' (Bennett, 2013; Hall, 2015) to highlight the encroachment and impact of alien epistemologies, usually Northern ones, buried inside language, technology and learning, on indigenous cultures.

'Pasch (2015) warns against the dangers of imposing a colonial perspective at the expense of indigenous knowledge and ways of knowing. This is particularly acute when looking at language and cultural artefacts, the loss of Inuit voice in the development of digital industries and infrastructure.'

'Non-majority cultural groups must become digitally proactive in order to maintain sociolinguistic vibrancy. It is vital that native culture and knowledge is made digitally available since it is in danger of being drowned out in the flood of majority culture. We note criticisms of interference, albeit well-meaning, from majority culture on indigenous groups. The key is to enable them to help themselves.'

OER (open educational resources) in Africa has been critiqued as information imperialism (Mulder, 2008). 'Africa's learning methods through imitation and the oral tradition of knowledge transmission are dying. Modernity is destroying the little that was transmitted' (Ndemo, 2014).

'Africans appreciate dialogue, and discussion — sometimes rigid platforms that do not support this are not easily adopted.'

'Modernity is destroying the little that was transmitted' (Ndemo, 2014). However, mobile and digital technologies are both a manifestation of and a conduit for modernism, and whilst these remarks illustrate a dynamic between learning, technology and language, it is perhaps one overall inexorable direction of travel. The goal for educators will be to include the voices of the learners — and preferably in their own languages, with their own

cultural reference points and — in time — their own ecologies and tools. Responses to COVID-19 must take place within those over-arching concerns.

3.5 Dialogic teaching

Learning is socially mediated and constructed — created and sustained through dialogue. How do educators allow for this discussion online? Platforms such as Microsoft Teams, Zoom, Webex — even FaceTime and House Party — facilitate an element of face-to-face (f2f) participation, but not the informal discussions characterised in millions of classrooms as ‘talk to your partner’ time. This is a vital part of education, where learners grapple with ideas together, with multiple benefits: removing some of the fear of contributing for fear of getting it wrong, allowing the social construction of knowledge (Vygotsky, 1978), and for interactions between peers where those working at a higher level can support those **further behind without the power relation between teacher and student. We call here for further thinking around online presentation-style lessons and lectures**, noting that students find these unappealing, difficult and boring. Instead, we suggest more of a ‘flipped’ approach (see, for example: Abeysekera & Dawson, 2015; Yough et al., 2017; Smith & Gurton, 2020), where educators direct students to curated materials and work to complete and then host four small-group seminars where discussion is possible in the same two-hour lecture slot. For younger learners, this might look like downloaded materials to work on offline, using books or worksheets, and then a space and time to reupload and discuss with tutors.

Working online with colleagues, for example using Microsoft Teams or Zoom has become the new norm for many educators. Many staff meetings, governor meetings, senior management discussions and joint planning sessions are now held from each member’s own home. This has had many reported positives, including the fostering of greater collegiality due to the need to work together and provide feedback to one another (Pouzevara & Khan, 2007).

3.6 Affordances

Grimus (2020) gives a list of affordances of technology, adapted from New Zealand in *Modern New Zealand Learning Practice* (2015). Some of these are given below:

- Where state-of-the-art information communication technology (ICT) infrastructure is in place, it allows learning to occur anytime, anywhere, at a student’s own pace.
- ‘21st century teaching and learning’ can be achieved through digitally-literate teachers and students engaged in innovative practices.
- Good access allows for easy and safe access to quality digital content, resources, and tools, which is imbued with the necessity for this access to be provided to all.
- Equitable access to digital technologies will enable every student to learn regardless of location, learning needs, or family background.

Aape Pohjavirta explains below how the Funzi COVID-19 'Adapt and thrive' and 'Future Pack' courses on funzi.mobi were introduced to the community and how they engaged users in South Africa:

Since 2015, Funzi has delivered the calming message of information and learning to millions of mobile users in many types of crises in collaboration with governments, the UN (United Nations) system, and third sector organisations. Our capability to deliver effective and motivating learning to all connected devices is unique. And hence, it is our responsibility to contribute to the fight against COVID-19. Our intent is to do this on a systems-level globally while being locally relevant everywhere. The recently-launched the Funzi Future Pack which consists of four high-quality free mobile courses that equip the users with the skills needed during the crisis and for building a better future thereafter.

Get that future (created in collaboration with UNESCO (United Nations Educational, Scientific and Cultural Organization)): creating an understanding of the importance of our active role in building our futures.

Sustainable world (created in collaboration with UNDP (United Nations Development Programme) and UNA (UN Association) Finland): increasing awareness of the challenges we are facing and how to make more sustainable choices after the crisis that will have a lasting impact.

Founder 101: inspiring entrepreneurial mindset and initiatives to lead the change for a brighter future.

Get that Job: enhancing livelihoods through job-seeking skills that enable users to discover their career path and become better versions of themselves at work.

3.1.6 Implications for teacher education

Teachers and school management remain crucial parts of the learning process within education systems, even when learning is accessed remotely. For any lasting educational change, teachers will need to be involved. This highlights the need for changes to both in-service and pre-service training. Without effective support and **clear guidance, however, educators are likely to be lost in the plethora of advice and resources available. Teachers and school leaders alike need support and guidance on how to quickly master digital skills, how to effectively integrate ICT into their teaching and learning**, and how to work successfully remotely (Beteille, 2020; Kimenyi et al., 2020). Moving forward, as well as the immediate response to COVID-19, clear plans need to be made to improve teachers' skills in order to facilitate future online, remote and mobile learning especially in the context of the uncertainty and instability of any 'new normal' (Wilichowski & Cobo, 2020). We must

remember, teachers and school management remain crucial parts of the learning process within education systems, even when learning is accessed remotely. For any lasting educational change, teachers will need to be involved. This highlights the need for changes to in-service and pre-service training. Without effective support and clear guidance, however, educators are likely to be lost in the plethora of advice and resources available. Teachers and school leaders alike need support and guidance on how to quickly master digital skills, how to effectively integrate ICT into their teaching and learning, and how to work successfully remotely (Beteille, 2020; Kimenyi et al., 2020). Moving forward, as well as the immediate response to COVID-19, clear plans need to be made to improve teachers' skills in order to facilitate future online, remote and mobile learning (Wilichowski & Cobo, 2020).

Open educational resources (OER) are a viable way of beginning to overcome the lack of teaching materials in many contexts. If teacher trainers or facilitators of communities of practice for teachers are familiar with open educational resources, they can work with communities to produce localised versions of generic resources, and can also feed new resources into the 'pool' for others to use. Issues associated with OERs, include the need for pedagogical design and mechanisms for tracking learner progress, resources are often scattered across different platforms, lack of quality control, lack of compatibility, and lack of contextualisation. Personalisation, localisation, use of local languages and dialects are very important. There may be few resources in tribal languages, few bilingual dictionaries, no online translation tools for Indigenous languages. The OER metadata may be unsuited to some cultural contexts (Traxler, 2018b). Lothian et al. (2019) observe that learners are less likely to use apps that are not in their own dialect — particularly for language learning. There is also the importance of embedding participatory evaluation in all strategies from the start of any new projects. This will increase the possibility of effective co-creation of future resources and support systems. Subsequent non-formal, informal and formal learning must use resources that fit the context.

In order to respond rapidly to crises such as COVID-19, educators may resort to using (American) English content, curricular and tools, for example OER, and pedagogies based on the large-scale transmission of content, for example the distribution of e-book readers, so educators working with indigenous, minority or nomadic communities must provide reassurance that in the longer-term, mother tongue resources will be deployed, participative development facilitated, community educators empowered and a balance developed between the global knowledge economy and local traditions, languages and values.

In looking at the 'open' philosophy and disciplines, we should remember 'open development' (Smith & Reilly, 2014) and consider firstly how 'open' ideas play out in different contexts and cultures but secondly whether this then reflects back on 'open' in the contexts of the marginal in more developed countries and regions.

3.7 Summary

Interaction through technologies such as WhatsApp means that this has now become an educational technology. However, what is missing is any 'design justice' (Costanza-Chock, 2020) and it is necessary to design inclusive, participatory ways to centre the learners who are not usually thought about. This 'design justice' is culturally specific but potentially profoundly effective in the face of the purely financial arguments for designing at scale,

and resonates with our argument for community participation, ownership and control of learning.

'For me, the necessity to provide training to teachers has emerged as a significant factor. Teachers may also benefit from team teaching, community of practice, and collaboration with families so as to support family literacy.'

There are also arguments that we are now in a position in educational technology to exploit the 'long-tail' of highly individual needs and attributes seen in the 'mass-customisation' already exploited commercially (Seely Brown & Adler, 2008).

'Good' online pedagogy is different to in-class pedagogy; teacher educators must innovate with methods and explore practice in risk-free circumstances. Planning, teaching and assessment, based on local — even individual — contexts, dynamics and needs are still the vital components of education and need to be maintained, even if that is through new modalities.

Loading technologies and providing hardware into a void is not an effective means to reducing a gap between advantaged and disadvantaged communities and members: teacher presence remains vital, be it through face-to-face online meetings, YouTube videos, TV or radio broadcasts, or simple phone calls or SMS messages.

Pedagogical knowledge and its application through digital technologies needs to be enmeshed throughout teacher education to continually develop innovation.

Strong examples of practice show collegiate support offered by mentors or through CPD (continual professional development), and these have been enacted through mobile technologies in impressive ways that allow for both on-hand help and the self-determination and — regulation of the developing teacher.

'Other key factors are motivation to use the technology by both learners and teachers, and capacity to use the technology as well.'

While student-centred learning and collaboration are fine aspirations of technology-enhanced learning, they are not innate and are predicated on strong foundational knowledge, co-operative approaches, strong offline cohesion (for communities to bind online) and developing awareness of what learning is, how and why we do it.

'A sense of independent learning is expected among learners, but this does not come too easily for many children/learners/students in developing countries. They do not have the support and motivation to be independent learners — as the teacher is seen as the be-all-end-all route to knowledge generation. Quite sad — and needs to be addressed.'

'What would happen if we redesigned the education system for indigenous communities based on their norms, community needs and culture? If we could view their situation as central rather than peripheral and help them to see their own place in a wider world context but not as victims but active contributors.'

These principles are likely to be equally true for informal community learning.

4 Technical

This chapter outlines technical constraints in improving provision, infrastructure and access that can support wider participation. We look at examples of interventions or responses to situations where technology has supported education. References to the technical here cover issues and challenges, and include infrastructure and connectivity, use of mobile, online, apps and social media, OERs or other non-digital related technologies for learning such as radio, camera or TV.

4.1 Literature

As has previously been indicated, the advent of digital technologies has brought into question much about the notion of education — about the missions and operations of the institutions which comprise formal learning, the relationships between agents within these institutions, the manner in which we learn, the curriculum content and even education's greater purpose. But one central problem undermines all theoretical speculation and any underpinning pedagogical considerations about the deployment of technology: namely, issues of access and the problem stated earlier of those who are left behind by not having hardware, infrastructural connectivity and the knowledge of locating educational focal points and appropriate resources.

In Game Theory, the Schelling Point (Schelling, 1960) is a concept which suggests that people use social norms to anticipate a default solution where communication has become unavailable. The focal point is prominent and helps to overcome problems. From a Northern hemisphere, Western perspective, we may consider the internet or mobile phone to be our Schelling Point in environments where formal face-to-face educational contexts are disrupted by circumstances, like environmental catastrophe, migration, or social crises. Digital technologies have become our default because we are largely in highly connected societies with a wealth of material objects to access a world of information and potential solutions. Once 'connections' are removed or unavailable, we confront the digital divides: obstacles to natural convergence that make affinity spaces (Gee, 2007), Communities of Inquiry (Anderson & Garrison, 2001), Communities of Practice (Lave & Wenger, 1991) or physical *tools of conviviality* (Illich, 1973) for mutual engagement and co-operative learning completely obsolete.

4.2 Access and infrastructure issues and challenges

The technical challenges in closing the digital divides are numerous and both physical and abstract: hardware, bandwidth, affordability, knowledge and skills for use, ownership of territories, temporal, physical and social uses, hierarchies, norms and behaviours of being online (and more) are complex and multiple, and can become so culturally, historically and politically entrenched as to be beyond the remit of what is possible to confront in this literature review.

'We need to avoid the notion that technology will solve problems, rather than the way it is used, which could also cause them. Technologies alone can't address all the educational needs of refugees. More focus is needed on the conditions under which technology can make positive contributions to education, and how to create them, rather than discussing the merits of this or that particular technology.'

'We need to conduct appropriate research and act on findings to support particular communities of refugees in their education. Education gaps will not be corrected through technology alone, but also changes by in policy and priorities. Reliance on technology alone may exacerbate the gaps in access to education and to technology'.

Sites such as *balancingact-africa* (online) give frequent and timely news and country-by-country analyses of the mobile, telecoms, broadcast and network situation in Africa. Unwin (2020) cites the *Measuring the Information Society* report to show that the gap between developed, developing and LIC of active mobile-broadband subscriptions per 100 inhabitants has widened year on year since 2007, which reflects not only the rapid leap forward of those in the developed, but sluggish acquisition elsewhere. Affordability is isolated as a main factor — in many African countries broadband subscriptions can cost a quarter of the average salary, while the quality of service is disproportionate also.

'Notions of assimilation of "disadvantaged" people into the market economy are based on a deficit model of those individuals that is not helpful in enabling agency for people in precarious financial circumstances'.

Jonathan Donner (2017) talks of the Fourth World, meaning those communities beyond the edges of the Third World but now increasingly connected to it (and indeed threatened by it). This Fourth World might also be at the edges of the First World. In either case, we are talking about communities beyond the reach of education systems but ones being explored by different communities of researchers and activists, many aware of the movement to decolonise research and to reconcile the local, traditional and indigenous knowledge of these communities with the scientific knowledge of the outside or mainstream world. In the context of COVID-19 it is perhaps quick and easy to resort to scalable educational solutions delivered by digital technology but there are risks to these small-scale indigenous knowledge systems and how they are transmitted and preserved. Richard Heeks (2008) makes an argument for a new ICT4D 2.0, produced in amongst, alongside the 'poor' — his choice of words — of the Global South replacing ICT4D 1.0, done to the 'poor'. He maps out what this means and how it might come about. In the current context it is worth considering, firstly how this might relate to models of education mediated by technology, secondly how it might also embrace the 'poor' of the Global North and lastly, whether this provides a template for cheap, rapid, local and digital responses to COVID-19 for those at the margins.

'In developing countries, it is common sense to avoid creating dependences on the Western technological standards. It is always best to use tech-tech and free apps'.

It is important to understand from the start that provision of ICT or hardware in itself is not a solution to the digital divides (Goedhart et al., 2019) and — significantly — that the divides are not merely due to having no hardware or connectivity, but is often about gendered use of limited equipment, the dominance of social groups, classes or castes, ulterior priorities, affordability, distribution and numerous other factors. There is, in fact, a view that solving the problems of infrastructure would merely reveal the more challenging issues of cultural, social and economic barriers and differences and that the focus on solving problems of infrastructure merely buys into the one-size-fits-all 'catching up' paradigm. van Dijk (2006) reports that in developing societies the divides (as skill access and usage access) are widening and argues that what we may call digital literacies (search, select, and process

of information in networks) and strategic skills (using sources for specific goals and to improve position in society) are 'extremely unevenly divided among the populations of both developing and developed societies' (van Dijk, 2006). These digital literacies would be at the heart of the digital ability of individuals and communities to respond flexibly, adequately, appropriately and effectively to emergencies such as COVID-19.

In spite of these challenges, the motivation for the Schelling Point exists and in Africa, despite extreme poverty and disadvantage, we may find cause for some optimism, as some of the most advanced connectivity in rural geographies in LICs alongside a plethora of projects abound that bring education to such contexts as refugee camps, rural and agricultural communities, indigenous peoples, slums, for example (Traxler & Compton, 2020). Educators and providers alike are in agreement that the strength of any network is in its reach and activity — both in terms of its number of connected devices (see for example, Metcalfe's Law), the numbers of users (see for example, Reed's Law) and the prevalence of activity in those networks (see for example, Beckstrom's Law). In other words, all parties — from end-users to providers and everyone in between — have vested interest in robust connections and networks. Our Western internal focus point of '*look it up*' or '*let's meet online*' has extended to the communities that are starting to connect around the globe.

In a study of the Digital Divide in Africa, Fuchs & Horak (2006) make many tangible solutions to improve physical (technical) access and local and sustainable projects. They reject out of hand the notion that gradually cheapening hardware will see consumer markets of digital products become more readily available to society's poorest, pointing to deep divisions in wealth that mean even old technologies (electricity, television, transport) are still not commonly owned or easily accessed.

They also condemn injections of foreign and private capital into telecommunications as misguided and potentially exploitative. In the distant year of 2008 that Fuchs and Horak published their paper, this meant the acquisition of capital by private profiteering, but today data represents capital, as a statement by the International Commission on the Futures of Education for UNESCO (2020) warns: 'We must ensure that digitalisation does not undermine privacy, free expression, informational self-determination or lead to abusive surveillance. It is an illusion to think that online learning is the way forward for all'. Issues surrounding 'surveillance' inherent to technologies may seem a separate argument, but it is one that stands when considering the planning for the future and the authors overarching recommendation is for a continued public education: 'Open educational resources must be prioritised; public education cannot be dependent on digital platforms provided by private companies'. (International Commission on the Futures of Education for UNESCO, 2020).

So, here is another tension to confront: how to improve infrastructure and provision, while harnessing the affluence of corporate enterprise and social responsibility (CSR). We have already cited Metcalfe's Law and it seems perfectly reasonable to assert that it is in the interests of all parties to improve connection and coverage and while 2008 is a long time ago in technological evolution, ever cheaper handsets and laptops to the point of virtually zero cost are becoming possible, while it can be argued that costs for individual and domestic connectivity should be eliminated altogether if we are serious about eradicating the digital divides, since software and telecommunications providers are making more profits from other sources. It could be argued that corporate

sponsorship, through corporate social responsibility, or international interventions should take the form of nation-wide donations of digital technology, kickstarting economic and educational activity, whilst putting more traffic through the networks. In terms of a purely EdTech perspective, there are many instances that suggest this could be problematic — remember the OLPC (one laptop per child).

Fuchs & Horak (2008) expressed concern with the habitual distribution of old hardware from the north to the south, stating that LICs are often excluded from capitalist technological progress situated in the global north. Some years ago, the London Science Museum's Dead Ringers exhibition¹ drew attention to the issues of discarded mobile phones and how those donated to Africa merely moved the toxic landfill problem somewhere else. Fuchs and Horak endorsed the principles of open-source software, such as Linux as a more sustainable approach (where, for instance, local developers can build their own adaptable systems and programs that can be customised and redistributed, thereby improving local expertise and potential autonomy, and have adapted the user interfaces to an increasing number of local, minority and indigenous languages) over a 'means-to-an-end' solution (particularly where culturally imperialist transactions see Western countries provide aid or equipment based on political structural reform) or charitable donations of old hardware, that would not improve a divide predicated on 'catching up'. This approach has merit with the open-design movement also supporting open-source hardware by sharing information on building and programming equipment and software. We have stated already that there is a concern that the open movement (returned to later) is a form of 'information imperialism' (Mulder, 2008), and there is a conflict between scientific knowledge and cultural beliefs (Onwu & Mosimege, 2004). Elsewhere, however, mobile has been shown to help entwine indigenous and mainstream communication channels when used in educational nutrition programs, pointing to the efficacy of mobile in promoting social participation among the marginalised by integrating local voice: 'The use of materials in the edutainment format through mobile (and internet), through a trained "last-mile interlocutor" based in the community can overcome socio-cultural and language barriers and meld exogenous channels with indigenous channels of communication' (Malhotra et al., 2017).

'Free and open-source technologies are still difficult to use. This is a blocker for using them in developing countries. In Senegal, they provided TV shows with lectures but no evaluations were added. Education is not lecturing! Also there is too much focus on the knowledge that you get from a professor; one can also learn from peers.'

Fuchs and Horak argued for Principles articulated at the WSIS (World Summit on the Information Society) in 2003, which argue for achieving a sustainable information society through multi-stakeholders, 'Governments, businesses, civil society, and international and regional institutions must take responsibility. WSIS favours a mixed strategy of political practice and economic investment for achieving a sustainable information society. Governments should devise national strategies for digital inclusion, promote public access, e-government, e-business, e-learning, e-health, e-employment, e-environment, e-agriculture, e-science, for example' all of which are underpinned by debt cancellation and a fairer distribution of wealth. These are still noble but distant aspirations; COVID-19 needs rapid responses but perhaps still under some broader framework of principles.

1 <https://www.independent.co.uk/news/business/sme/dead-ringers-giving-old-mobiles-a-second-life-in-the-developing-world-425944.html>

Such principles have guided innovative projects, such as FUST (fund for universal telecommunications services) in Brazil, which saw a 1% on telecommunications profits diverted to provide resources in disadvantaged communities. They conclude: 'an integrative strategy of fundamental redistribution mechanisms, free public access, educational and health programs, a gift economy, open-source and open access technologies seems most promising to us' (Fuchs & Horak, 2008). This should however be seen against Brazil's previously high import duties on mobile phones, prevalent through the first half of the present decade, which stifled local developments and, as in other countries, led to a confused grey market of smuggled and counterfeit phones.

It is clear that the proliferation of digital technologies, especially mobiles because of their ubiquitous and pervasive nature, carries with it many hazards and potentials, and some disruption or dismantling to formal hierarchies may be necessary to exploit its opportunities, such as the decentralisation of education systems into connected networks where learning can be conducted across homes, schools and other settings, via the enhancement of data collection and expanded use of data analytics to develop personalised learning software and AI (artificial intelligence) in education Williamson (2020). Others endorse the creation of digital maps of the education system and dashboards for decision-making, which depend on teacher's knowledge or tools to make them fit for local customisation (Pathways Commission, 2020).

4.3 Educational provision and access

Dr Gareth Lanagan, e-sgol project coordinator, describes a project that helps connect clusters of schools via a blended approach:

Situated in the rural counties of Ceredigion and Powys in Wales, and expanding to other counties in September 2020, e-sgol is a blended learning project. It is based on the e-sgol project in Scotland and provides equity of learning for pupils in rural areas and those wanting to study through the medium of Welsh. The project helps connect clusters of schools; each school is within travelling distance of each other, which allows face to face learning once every six weeks or so. This is blended with virtual lessons delivered through Microsoft Teams and supported by Hwb, a digital platform coordinated by Welsh Government. In each school, there is a pupil room and a teaching room; the staff member is separated from the pupils to ensure that every pupil receives the same experience, regardless of location.

One of the e-sgol schools is Calon Cymru, in the rural South Powys cluster, which has two sites located at Builth Wells and Llandrindod Wells. Matthew Morris and Lorraine Davies in Calon Cymru deliver A Level Welsh Second Language to pupils in Brecon, Maesydderwen and both Calon Cymru sites. With non-viable pupil

Returning to the potential of open-source as an educational movement that seeks to support education for the disadvantaged through the provision of open educational resources (OER) we now see the emergence of practice alongside provision — open educational practices (OEP), through means such as MOOCs (Massive Open Online Courses). The availability of teaching and teach-yourself materials has become more prolific and abundantly available. ‘Open’ has been dedicated to social justice with a framework provided by Lambert (2018) that OER be *redistributive* in its ‘allocation of material or human resources towards those who by circumstance have less’; *recognitive* in its respect for cultural and gender difference; and *representational* in its equitable representation and political voice for all (Lambert, 2018). Noble intentions, but these become problematic when course and material designers are separated from context, which as seen from the previous ‘context setting’ section 2, is paramount (Alain et al., 2018; Menashy & Zakharia, 2019). This is argued further by Adam (2020), who calls for more epistemically diverse course designers of MOOCs and other OERs to reflect global pluralism and the diversity of users, their language, culture, gender, location, lived experiences, living conditions, and family structure, and other factors which shape and reflect users realities. Sadly, many MOOCs, and their corporate platforms and their media-rich content, currently favour well connected and well-educated learners.

This may seem beside the point of what constitutes the ‘technical’, but the designer — as Adam observes — *is* the OER: ‘Through MOOC teams including more epistemically diverse designers, MOOCs are more likely to be more inclusive, open, relevant, and beneficial to a broader diversity of learners’. This shows the need to develop not just the infrastructural base in LICs (Logic in Computer Science) but the local knowledge and skills capacity.

MOOCs point to evolving OER, ‘accessible through the Internet and are usually open to registration without prerequisites or limits on the number of students. With their advantages of large scale, openness and self-organisation, MOOCs have attracted 160,000 students from more than 190 countries’ (Zhou, 2016). Successful British examples range from websites that enable people to practice and improve their numeracy skills (Citizen Maths) and participatory, blended CPD courses (Blended Learning Essentials, through FutureLearn), where users contribute to content in the form of knowledge construction and built on user experience, aligned to constructivism, where students build schema from linking prior knowledge and experience to new information, creating mental modes that are individually internalised. Such theoretical dispositions are bound in pedagogy, but overlap with technologies and in the case of the BLE (Bloomsbury Learning Exchange) MOOC are constructed by an active community, sharing their own practices and examples with a wider community.

As such, the community becomes the best resources for improving knowledge. Digital pedagogues, such as OER creators and users, are needed to signpost and support new colleagues in utilising online tools (Pulker & Kukulska-Hulme, 2020) as one of the significant problems in locating OER is the abundance of materials created and users recognising what constitutes high quality. Anything ‘ranked’ by a panel of experts would be against the democratic ethos of open, but perhaps a ranking by popularity of use (number of views/uses/downloads) or by the community (‘vote up’) can help make central sources and archives stable focal points accessible and improve amenability for intended users in the developing world. This is similar to the game mechanics approach we mention elsewhere.

OER and OEP needs more amplification to make users aware of their availability and stories by designers and users would help to capture and celebrate its successes.

We need digital pedagogues, such as OER creators and users to signpost and support new colleagues in utilising online tools (Pulker & Kukulska-Hulme, 2020). We also need local folksonomies alongside the externally provided metadata classifications so that communities of learners can assert their own understanding of the organisation of concepts and resources.

More epistemically diverse course designers of MOOCs and other OERs are needed to reflect global pluralism and the diversity of users, their language, culture, gender, location, lived experiences, living conditions, and family structure, and other factors, shape their epistemologies. Moreover, rather than designers being seen as creators of resources, they are OER in themselves. 'Through MOOC teams including more epistemically diverse designers, MOOCs are more likely to be more inclusive, open, relevant, and beneficial to a broader diversity of learners' (Adam, 2020).

A social justice approach underpins OER/OEP based on a framework that suggests it is:

1. Redistributive: 'allocation of material or human resources towards those who by circumstance have less'.
2. Recognitive: 'recognition and respect for cultural and gender differences'.
3. Representational: giving 'equitable representation and political voice' (Lambert, 2018).

'Make free and open-source technologies available to teachers and students. Open educational resources and open access digital tools must be supported. Education cannot thrive with ready-made content built outside of the pedagogical space and outside of human relationships between teachers and students. Nor can education be dependent on digital platforms controlled by private companies, especially those that "undermine privacy, free expression, informational self-determination or lead to abusive surveillance". Protect domestic and international financing of public education. Make free and open-source' (UNESCO, 2020).

4.4 Future technologies

References are made to LMIC 'catching up' as if technology evolves on a linear scale. We learn from the annual Gartner Hype Cycles (Gartner.com, 2020) that any technological innovation goes through a series of expectations, before reaching a plateau that is usually widely available to the masses, where real innovation in terms of manipulated and re-purposed use is often applied. Is it possible for those countries chasing the status that is accomplished in the north and west to enter at the top floor by harnessing the most up-to-date technologies or by reinvigorating previous ones and repurposing them? Examples of such 'hacking' are prevalent in Jugaad technology use, where ingenuity and improvisation circumvent restrictions, for example, an Indian villager who constructs a vehicle to transport goats and cattle by turning an irrigation hand pump into a makeshift diesel engine for a wooden cart (Singh et al., 2011). Such innovation in this type of movement has seen market proliferation from a grassroots level, with the stripped-down Tata Ace making automobiles more affordable on the market. These are the results of developing local expertise and problem-solving that can start in the school

place (McNicol & Aillerie, 2017) — discussed elsewhere in the Pedagogy chapter — but it requires a familiarity with manipulating tools can lead to a mastery of the learning and the environment that leads to human agency, as well as a sense of design ingenuity and problem-solving that is borne out of scanning the tools that are available and which can support the environment, for instance Geographic Information Systems that can map climate change or apps that can more accurately forecast weather and track patterns.

Emergent technologies often rely on ubiquitous connectivity, such as the Internet of Things, which may make them inaccessible, but since Africa has seen such great strides in organising digital money transfers, specifically mPesa from Safaricom in Kenya, it could lead in utilising blockchain to eradicate as many as 8–10 middlemen in farm-to-market channels, people who contribute to exponential price hikes and inadvertently lead to a skills drain as younger generations abandon the low-profit existence of agriculture: 'A startup in Kenya, Twiga Foods, has successfully deployed technology to provide credit to farmers and link the farmers to markets, using more efficient logistics systems' (Ndemo, 2019). In such cases, blockchain 'involves the creation of a shared ledger to record assets and transactions. It has the potential to bring about major improvements in areas such as food safety, traceability, logistics, reducing transaction costs and opening new markets' (Elletson, 2019). If blockchain is understood and used prevalently, communities may even begin developing crypto-currencies of their own and that can be a solid basis for real autonomy and self-determination.

The challenges and obstacles are clear and ongoing, with costs and training identified as prohibitive to innovation (van Deursen et al., 2020): 'Those with higher education and those with higher incomes have more positive attitudes and are the first to actually buy [the] Internet of Things. This also means that they are the first to develop the required skills and to engage in a diverse Internet of Things use... to make the Internet of Things attractive for larger parts of the population, clear terms of use and user-friendly Internet of Things should be an important objective'.

When cost is the challenge and the failure is continued poverty, the question is whether we can really afford to let things carry on the way they are.

5 Concluding remarks



→ 6.1	Concrete, strategic and practical recommendations
→ 6.2	Our further recommendations
→ 6.3	Recommendations for teachers
→ 6.4	Recommendations for teacher education
→ 6.5	Recommendations for educational institutions
→ 6.6	Recommendations for national decision-makers
6.6.1	Understanding local values
6.6.2	Local, customised and contextualised policy
6.6.3	Decisions that could make a difference in the short-term
6.6.4	On infrastructure

This report was compiled over three months in the spring and early summer of 2020. It is necessarily constrained in terms of deadlines and resources but is to some extent both partial and subjective as a matter of choice rather than just necessity. The authors have attempted to contribute some less common resources and perspectives, aware of the enormous amount of activity concurrently taking place. Clearly the world will move on and the crisis will evolve; hopefully some of the sources and some of our suggestions, recommendations, principles and findings will continue to have something to say and will ensure that those people, communities and cultures at the margins of their societies will not be further disadvantaged by attempts to maintain the continuity of mainstream education systems.

6 Recommendations

This section collates our recommendations and, where we feel it necessary, adds commentary to support teachers, educationalists and policymakers in their decision-making processes during the COVID-19 pandemic. These are broken down thematically. We have moved simply from the immediate and local to the national and longer-term.

6.1 Concrete, strategic and practical recommendations

High-impact, sustainable technology-enabled solutions depend on local partnership and a sense of local ownership (McAleavy et al., 2018).

It may be best to make use of the technologies you already have, know how to use, and can afford (Trucano, 2013).

Consistent and well-curated educational resources appear to be hallmarks of effective mobile learning content (Miao et al., 2018).

Governments and educational institutions need to work with providers to make data and bandwidth more available and more affordable so that the most disadvantaged can access it too (Bozkurt et al., 2020).

Online content alone is not enough. Having the (critical) digital literacy to make use of the content in order to learn, especially without a teacher presence will be vital moving forward (Bozkurt et al., 2020).

Education has to move from mere learning to learning to know; from imparting information to information literacy; from being content-centered to methodology-focused (Selvam, 2020).

Build digital maps of the education system and dashboards for decision-making; standardise data across the education system; equip teachers with knowledge tools to support their work; test digital technology and learn through local customisation (Pathways Commission, 2020).

Flexibility with deadlines for assignments within courses, course policies, and institutional policies should be considered (Hodges et al., 2020).

Scale up existing distance education modalities based on different mixes of technology, including internet, TV, radio and apps to improve communication with students (Chang & Yano, 2020).

Teaching engagement with vulnerable and disadvantaged students should be a key priority (McAleavy & Gorgen, 2020).

6.2 Our further recommendations

Use the 'flipped' approach more widely, where educators direct students to curated materials and work to complete and then host four small-group seminars where discussion is possible in the same two-hour lecture slot. For younger learners, this might look like downloaded materials to work on offline, using books or worksheets, and then a space and time to reupload and discuss with tutors.

Technology use is gendered, so decision-makers need to evaluate how to promote OER in order to impact on women's education and value ICTs skill on employability and literacy.

Make online content available offline, through pre-loading or other means. Lewis and Thacker (2016) cite the LearnSyria project; use of radio live-recorded lessons and live presentations placed on SD reader cards and memory cards in Uganda, especially for learners with additional needs (Bozkurt et al., 2020).

Use open conferences, journals, hashtag chats, curated lists, and blogging. They have all been powerful means of shaping and transforming innovative practice in the north and helped to create a surge in paradigm shift through CPD and networking — constructing and disseminating knowledge through multiple stakeholders.

Identify principles for digital learning, rather than prescription and more instruction; the approach must be systematic and values-based, face the human not the technology, for instance in promoting the co-operative relationship between students or in considering the role(s) of a teacher when technologies become configured and guidance becomes more minimalised. Innovation for teachers involves taking risks, but working with purpose.

6.3 Recommendations for teachers

6.3.1 Educators should investigate, adopt, adapt and support the following pedagogies where appropriate:

Curation of online resources	'Open learning'
Personal Learning Environments (PLE)	Learner-generated content
Game mechanics	Self-directed learning
e-moderating	Mobile learning
Flipped learning	Critical digital literacy
Problem-based learning	Project-based learning

6.3.2 Experiment with the tools and technologies already available:

Tools for hosting communities, content, resources and profiles, acting as landing pages or portals to other tools:
groups within *Facebook* or perhaps within *WordPress*...

Tools for hosting different kinds of content: *Google Docs*, *SlideShare*, *Dropbox*, *Flickr*, *YouTube*, *Panopto*...

Tools for curating both external and local content: *Scoop.It*, *Flipboard*, *Pulse*, *Evernote*, *Pinterest*, *Google Currents*, *Diigo*...

Tools for connecting learners and content: *Google Hangouts*, *Twitter*, *Skype*, *Adobe Connect*, *Slack*, *Basecamp*, *Gmail*...

Tools for finding content: *Google*, *Bing*, *DuckDuckGo*...

Tools for conducting online quizzes/discussions: *Mentimeter*, *Kahoot*, *Padlet*, *Survey Monkey*, *Socrative*...

Tools for content creation and presentation: *Prezi*, *QuickOffice*, *Kingsoft Office*, *Sliderocket*...

Tools for helping learners to schedule and prioritise their learning *Trello*

Tools for coordinating tasks and discussions: *Doodle* and *Eventbrite*

Tools for brainstorming learning tasks and activities:
SimpleMind+

6.4 Recommendations for teacher education

Teacher training is a priority and while essential, lacks funding. Mentorship for teachers working in difficult circumstances with refugees is helpful. Teachers working with refugees require not only training and support in subject areas, curriculum, and assessment, but also in learning to work with people who have mental health problems (trauma, isolation), who have language acquisition needs, and who may not be literate in their first language. Creating local and regional communities of practice (CoPs) for teachers that build on familiar/shared practices, occasionally bringing in guests from elsewhere to talk about different possible solutions to the same problems. Coordination and facilitation of these CoPs (especially across multiple CoPs in different regions) could help by providing bridges between host cultures and migrant cultures, and cross-fertilising ideas between different communities.

There is a clear need for **continued investment in staff development, shared/open platforms and shared open/resources**. Online teaching qualifications, open badges and/or micro-credentials could help promote formal acknowledgement of the importance of digital tools for teaching and learning.

Sharing teaching practices that exemplify the teaching of culturally relevant, curricula-aligned content using student-centred pedagogy and technologies will help to shape a community of professional practice.

There is an identified need for **faculty development programmes to train teachers for proper online teaching as proactive designers of remote learning**, rather than emergency responses as we are seeing.

Digital coaching and mentoring can support teaching staff to be ready and responsive.

There is a need to **invest in teachers' continuing education** to ensure that they are at least at par in the ever-changing landscape of education.

Educators should focus on their **pedagogical and disciplinary knowledge** and then analyse suitable, available technology in order to implement the pedagogical proposals they wish to make.

6.5 Recommendations for educational institutions

Commit to meeting the needs of '21st century learners': equip your teachers and learners with the technological capability to work, teach and learn online. Design, access, and implement training that explicitly teaches learners and tutors to work with mobile and digital technologies. This may mean purchasing hardware for marginalised or disadvantaged groups or individuals, which needs funding.

Invest in high-quality digital content and systems to make content easily accessible. Beyond these basic ideas, invest in training that supports collaborative, self-regulatory exploration (project learning, problem-based learning) to enhance student knowledge of how to learn remotely. Use freely available applications, content and software in order to create future-focused learning environments.

Achieve equitable access to digital devices for every learner, ensuring inclusion and gender equality in mobile learning projects for all: as far as is possible, ensure no groups are further disadvantaged, whether that be technologically, institutionally or for reason of gender, sexual orientation, religious persuasion, or any other value-laden motive, and further ensure that everyone can participate in learning whatever their circumstances.

Leverage existing technology resources to deliver quick-response mobile learning: drawing from OER can be quicker than the ongoing creation of bespoke, unique material.

Explore learning through OER: direct teachers to where this can be found, and ensure they have the pedagogical skills to use it effectively. Educational institutions should fill the gaps in digital literacy, information literacy, online education and open licensing for all educators at all levels.

Build regional capability through collaboration: work in groups, academy trusts and networks, share physical spaces and online resources so that together you can each access more than any one partner could alone.

Implement a coordinated, system-wide effort to align curriculum, digital technologies, property, infrastructure, funding and legislation: continue these collaborative efforts to the best effect for your populations.

Promote blended learning for quality provision of education: ensure access to online and mobile content and materials, as well as support, and empower teachers to play pivotal roles in facilitating mobile learning and coaching; ensure teachers access the right training and support in order to best facilitate their students' learning.

Shift from a technocentric approach to need-centric and resource restructuring models: follow the needs of the learner and utilise suitable tools.

As argued throughout, it is context that is the key to effective and successful provision: taking account of local needs, voices, languages, capacities, infrastructures and dynamics and adapting technologies and pedagogies to suit these needs.

Learn from sports and gamification: the use of rewards, leagues, missions, badges for example. to engage learners has been proven to work well; work with teachers to see how these can be incorporated in your provision.

Ensure physical and cyber security: invest in high-quality security systems to keep hardware, software, data and users safe on- and offline.

And, in order to do all of this, **design a coherent, flexible and robust funding structure to support 21st century learning.**

6.6 Recommendations for national decision-makers

Key messages

Strategic investment, and commercial stimulation is needed to help digital to be accessible for rural, excluded, or remote communities.

‘One size does NOT fit all’. Local communities should be involved in shaping their own digital-powered solutions, rather than copying approaches used by other nations.

Opening access to learning content (that can be adapted) enables learning to travel more rapidly than in closed, commercial systems.

Learning with mobiles, and any other learning cannot be seen in isolation when applied to the ‘have-nots’, but need instead to be seen more holistically, with the other issues they’re facing.

6.6.1 Understanding local values

Just as for teachers and educational institutions, understanding and responding to local and national contexts, needs and dynamics are crucial when trying to implement country-wide changes and policies.

The use of digital resources for education is varied in different countries and different regions but also in different demographics, with particular divergence between more developed, and less developed countries. Research, and evidence of possible best practice, is equally patchy, and where it exists tends to carry the cultural norms of the places it came from, which do not always sit well with the place it is being applied. The process of ‘localisation’ can be extremely superficial and counter-productive. **More local research that builds around local contexts is needed.** There is a need to build future solutions from the local community and context.

6.6.2 Policy must be customised, contextualised and have a cultural fit

Access and equity are crucial, and our review of literature highlights the particular challenge in rural areas. It also recognises that connectivity is just a corner-piece of a much more complex jigsaw. This applies to educational access, local procurement and economic activity.

6.6.3 Decisions that could make a difference in the short-term

Free, online learning provided by MOOCs and similar platforms has had a significant impact in reaching typically excluded learners. That said, there are still significant gaps, and the reach remains unequal. This provision, and the **rapid scaling-up of use of OER** are worth exploring.

The **United Nations' 17 Sustainable Development Goals** are wide ranging, have solid international agreement, but are complex, and multifaceted, making it hard to compare initiatives, to know where to focus. Lambert (2019) proposes a way to organise them under six simpler-to-manage categories, or core transformations. As two of these directly relate to digital, and education, there is an immediate relevance to current planning, particularly given the global situation, they are worth investigating.

6.6.4 On infrastructure

Without robust funding for a secure and fully accessible digital infrastructure, and a plan to achieve and sustain this, the educational, social, economic and other affordances of digital technology will struggle to develop. These include allowing learning to occur anytime, anywhere, at a student's own pace; enabling what is sometimes called 21st century teaching and learning through digitally-literate teachers and students engaged in innovative practices; allowing easy and safe access to quality digital content, resources, and tools; and enabling every student to learn regardless of location, learning needs, or family background.

Income, education and infrastructure are seen as the major drivers to help LMIC bridge the digital divide, and to accelerate the adoption of ICT. These digital divides will not naturally resolve themselves but can be reduced with strategic investment and focus. We noted in our literature review proposals that governments need to invest in enabling infrastructure and stimulating private innovation.

Used ethically, morally and skilfully, **digital technology can empower both learners and teachers and help to close existing achievement gaps**. Without this, these gaps can accelerate and accentuate existing disadvantages as the technically and digitally literate move ever further from those left behind.

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Appendix 1: Methodology

Our explicit aim was to search literature that could help people around the world during the current pandemic to:

1. Address the threats to the continuity of their education systems.
2. Combat probable reductions in educational access, engagement and opportunity amongst the already most disadvantaged.

We therefore sought to capture experiences and examples that could be useful, knowing that contexts vary considerably, and we sought ways to organise and disseminate these. This process has revealed a number of observations, challenges, insights and reflections.

Our first observation is that there is clearly already a lot going on in this space. As the pandemic takes its course in different countries and different contexts, agencies, ministries and institutions have started to share a vast array of resources alongside scrupulous overviews and critical analyses from parts of the press and authoritative bloggers.

Two challenges were already immediately apparent: firstly, avoiding duplication and repetition, and secondly avoiding any emerging or tacit groupthink or mindset about what works and where to apply it. Therefore, to specifically add value we drew on our own expertise and experience of two decades, we used academic mailbases, social and personal contacts, specifically in looking for examples and stories, and we used an extensive network of experts in related fields. We will return to this second approach later.

As we were primarily interested in learning from where education systems had faced disruption or difficulty, we were in many ways flipping the 'normal' lens of research. Frequently the developed 'West' or 'Global North' seeks to impose its ideas on the rest of the world. In this instance we were aiming to take a lead from situations across the low- and middle-income countries, from the marginalised and disadvantaged to see how what works amongst these communities could guide our own policymakers, educational institutions and teachers.

A1.1 Literature search

Searching the literature for 'mobile learning' risks hitting a high proportion of small-scale subsidised studies exploiting high-end technologies that might have little relevance to reaching out to wider populations on a sustainable basis, and so we needed to use a wide array of search terms. Amongst those we looked at, used, discarded and combined with the various Boolean Operators were the following:

Example areas of interest we investigated:

Communities at the margins of their societies, for example, people from nomadic, indigenous or linguistic minority communities; people with physiological or cognitive disadvantages; people with poor literacy or poor digital literacy; adults and adolescents in general, since globally most do not get much beyond primary schooling; the homeless and the displaced.

Search terms used individually and in combination:

Mobile, digital, education, crisis, disaster, refugee, roma, traveller, indigenous, deep rural, LMIC, global south, response, learning, intervention

We searched, analysed and organised academic sources, looking for specific concrete examples and experiences that will be of value to decision-makers, policy-makers and practitioners across a wide set of contexts and situations. We were unable to guess what those contexts and situations might be but perhaps that does not matter. Our understanding of context, causality, happenstance, unexpected consequences and hidden variables means that we cannot second-guess the levels of transferability or relevance.

These terms were searched on various search engine platforms (also shown in the above box), to further ensure that the depth of the literature review covered a broad set of data from various institutional levels as well as from international sources. This approach ensured that we located literature from a wide range of outputs in order to gather a holistic view of what is being described as a 'hard to reach' student in higher education. The terms were generated by the project team through discussion with the REACT Steering Group, which features representatives from practice, key sector bodies, students and the wider REACT team. This diverse expertise helped produce search terms that capture both a breadth of subject matter while remaining focused on relevant pieces.

Given the wide use of many of these terms and vocabulary in fields and areas irrelevant to our review and brief, it will be understood that our main challenge was the immense amount of literature produced by searches. As an example, the search 'education AND crisis' on Google alone brings up 'about 807,000,000 million results'. A tighter search (education AND crisis AND LMIC) on Google Scholar still returns 5,660. We used a number of databases (EPPI, ERIC, WOK, Google Scholar) and, so that we could focus more clearly on relevant literature, only the most successful combinations from these searches were used. Even then, we had to discount the vast majority of what we found.

Due to the volume of literature that the search terms brought up, and the short time limit, we needed to create very tight inclusion and exclusion parameters. We could not just save everything to our online library system (we used Zotero — www.zotero.org), so we worked both pro- and reactively. Proactively, we decided upon categories that we felt would

best support our work, and aimed to populate these sections with literature that fitted, and reactively we were bounded by the level of access to the literature (work that was not immediately accessible was not followed up); by the language (we limited our research almost exclusively to that which was available in English); by the academic quality (those with what we judged was poor methodology, for example, were discarded); and by the time we had available.

Our search terms failed to produce a truly methodological approach or findings, but as we read further into the subject we were led more and more by our developing expertise and immersion. We present this as a meta-analysis based on focus rather than a systematic review of the field. We sought nuanced understandings through deeper engagement (hence our categories changed over time), and we quickly realised that titles alone would not be enough; we needed to read more in depth, and frequently needed more than the precis allowed in the abstract. Clearly this led to more time taken over each article, but also more effective filtering of what was kept and categorised, and what was discarded. Based on our brief, we focused mainly on texts from and about LMIC and avoided literature from the Global North and from the most widely-cited sources such as the World Bank or UNESCO, but this has inevitably filtered in due to its importance, clarity and academic relevance.

The two primary researchers divided the load, in that one was engaged in a primary literature search and populated Zotero with what was encountered, and the other completed an initial sort-and-categorisation. The categories we finally decided upon were:

Categories for literature on Zotero:

Context-setting; post-event lessons; interventions; technical solutions; recommendations for policymakers; closing the gap projects; pedagogy/curriculum; grey literature; and 'miscellaneous'.

Almost 600 papers were initially deposited after reading the abstract. These were then moderated, memoed, cross-referenced and discussed. The final tally of papers was 365. The rest were discarded primarily for irrelevance, but partly to avoid duplication of papers and themes. Notes and metatags were added to the literature we kept in order to help with sorting, categorisation and for ease of recovery. This supported the whole team in understanding what each individual article said, and helped with the emergent picture. It also aided everyone when mining Zotero for specifics. The next stage was closer reading of the texts that seemed key in order to discover those key ideas, themes and lessons that our brief had asked us to report on.

A1.2 Ethical approval

Alongside a detailed reading of the sources in the database of literature collected, we invited experts to comment on batches of articles from their own experience, through an iterative Delphi process, with four groups of experts, looking across a selection of papers looking for emergent themes.

Ethical approval was sought from the ethics committee in the Faculty of Education, Health and Wellbeing, at University of Wolverhampton at the beginning of the project for the systematic literature review. A modification was made to extend this approval to include the Delphi process, with a copy of the covering email that would be sent to participants included. The modification explained how confidentiality would be maintained with regard to the comments from participants and how their data would be stored and protected.

The ethics extension was agreed by the chair of the faculty ethics committee. The consent from participants to participate in the Delphi process was obtained via a two-stage email process. The first email asked if the respondent was happy to take part and confirmed that in appreciation for their time, we would acknowledge them in our forthcoming report. Therefore, whilst data provided remained anonymous, and could not be linked to any individuals, the names of participants are listed with their permission to acknowledge that they made a contribution. Once participation was confirmed, a second email was sent out as detailed below.

A1.3 Delphi process

The Delphi method is a systematic means for a panel of experts to respond to questions and share views (see for example, Brady, 2015; Fish & Busby, 2005; Hasson et al., 2003; Okoli & Pawlowski, 2004; Rowe et al., 1991; Skulmoski, 2007). As the literature shows, there are many online versions and adaptations for different cultures and communities. Our own adaptation of Delphi involved initially listing groups of experts known to us. This long list of contacts was drawn from people known to members of project team through previous research and professional networks. From the list potential participants were drawn in the areas of minority groups, specialists in different regions of Africa, those with considerable experience in distance learning and others with expertise in policy making. These areas of focus complemented our detailed reading of the papers gathered.

For each group we emailed approximately 6–8 potential participants. Though a few of our emails received no response, the majority of people we contacted replied with a positive answer and very few people declined our invitation. The first email sent out was a personalised invitation that simply asked for the consent of the recipient to participate. It included an explanation of the DFID (Department for International Development) EdTech Research Hub funded COVID-19 project, the process we were asking respondents to undertake and an approximate amount of time that we anticipated they would need to spend on this. They were told they would each receive up to six articles, should spend just an hour or two reading across these papers whilst keeping their own expertise in mind. They should then add their responses on the headlines they perceived to be of value and significance from each paper, into a shared, collaborative Google form, view the responses of others, reflect on the group's views and revise their own comments, if they wished. They were asked to also recommend any further sources.

We suggested they keep their responses to the articles short, just like a face-to-face discussion, and draw on their own experience from projects and programmes they have led using digital technology of all kinds to support learning in the face of barriers, difficulties and crisis. We also stressed our awareness that contexts around the world are different and complex and that we were keen not to let our own expectations filter out any ideas, tools or techniques that may be of value to others, when trying to reduce inequalities and maintain education during crisis.

After consent to participate, a follow-up email was sent out detailing what to do to complete the Delphi-style exchange. This email contained the articles, a link to a Google form where each group could post their responses and a date to respond by. Later the comments were gathered from each Google form and emerging themes were connected into this report as contributions to the chapters and literature review sections. In the appendix the participants and their affiliations and demographics are listed under each Delphi group, along with details of the articles each group was asked to review.

A1.4 Limitations

There are limitations, not confined to this report but nearly universal, as we have tried to understand evidence and experience derived from widely different and widely dispersed projects, programmes and interventions. Whilst trying to support decision-makers with findings and recommendations, we must also outline the consequences of these limitations. Some arise from the ways in which projects are funded, implemented, documented and discovered, meaning that any reporting is necessarily partial, skewed and biased in spite of our best endeavours.

The academic publishing cycle would usually mean that research papers reach their intended readership year or more after the end of the project they describe; the research funding cycle would often mean large projects only start a year after the funding call has gone out and this might have been preceded by six months in which the funder analysed the need and drafted the call. Pressures for the appearance of interdisciplinarity, multi-national consortia, societal impact or capacity building might not necessarily be helpful. Further limitations of the study include:

Limitations:

- Restricting our searching and reviewing to English. This not only ignored sources in other languages but privileged a specific culture and world view, and implicitly voiced the hegemony of specific global corporations, technologies, countries and agencies, to the partial exclusion of others
- The academic literature, specifically the culture, institutions and ethnicity of those communities writing, reviewing, publishing and reading it, as opposed to those that get written about, can establish a very partial understanding of the wider world
- The relationship between the findings from projects and the priorities of those organisations that fund them, once summed up, perhaps simplistically, as ‘policy-based evidence-formulation’ rather than ‘evidence-based policy-formulation’. Whilst jocular

in tone, this makes explicit a probable bias in funding projects likely to make incremental advances to established thinking rather than making risky challenges to that thinking, and for success to beget success. The personnel, infrastructure, sighting and sampling of projects may be based on all sorts of extraneous reasons whilst environment may impose limits on rigour, repeatability and scope. Reading papers and reports will not always reveal these background issues.

- The algorithms of search engines. These are clearly complex and commercially confidential, and are constantly scrutinised and criticised for implicit bias and inappropriate rankings.

Searching the grey literature posed comparable problems and of course the material embodies comparable though different biases but we followed the same procedures of selection on initial reading of title and abstract, categorisation and then filtration following a closer reading. We also invited our Delphi participants to comment on several of these papers, policy documents, blog posts and interventions not found in academic journals.

In many respects, we set ourselves a hard task, in trying not to filter or prejudge what we found and in trying to find accounts and ideas that might not get picked up elsewhere. We originally envisaged a systematic search, but this needed modifying since search terms were hitting as much useless stuff as useful stuff irrespective of the number of hits or the width of the search. As described, making the search terms wider or narrower did not increase or decrease the proportion of stuff we hoped would be useful, only the total volume. The process required close reading, paper-by-paper, not just the abstracts, and we moved onto summarising what we felt was of practical value irrespective of its background or context. Everything is stored in a shareable bibliographic database.

We were challenged in terms of the organisation and structure of the findings. We worked on getting the relevant details out of each source, loosely based around, 'what, why, how, so what?' and we used a similar approach for direct offers of case studies that were sent in. The database itself is organised thematically and we are conscious that the potential readership is characterised by two attributes, local/regional/national locus of decision-making and poor or good infrastructure, connectivit, and so on.

At the conclusion of this brief, we acknowledge a lingering doubt: we will never know what we missed and also, we will never know what could be potentially useful. Not knowing what we've missed is not just a methodological problem, it is a reflection of who we've missed, who our literature has missed — which voices, stories, case studies and projects could inform our own policymakers and educationalists.

The nature of the ideas and contributions we have found and reported on only underlined the question of how to best organise and present what we have produced in ways that help the people who need it find it even though we cannot guess or prejudge the diversity of their circumstances and situations. Our imposed organisation or structure (indeed, any such organisation we had enforced on our material) implies some underlying conceptualisation, and some formats, especially printed ones, do not facilitate flexible folksonomies, multi-faceted tagging or multi-dimensional repositories. However, we feel that we have gathered together a host of useful material, comprised of insights from projects, responses and initiatives from across the globe, and pulled out some key responses that might direct policymakers, educational institutions and teachers towards effective provision for learners during this pandemic and for future-proofing education against further disruption, whether a second epidemic or any other crisis. Finally, we hope to make our bibliographic database openly accessible as an additional resource that might show our sources, expose our reasoning and perhaps provoke new insights.

Appendix 2: Delphi participants

Delphi Groups, affiliations and the articles they read

Delphi Group 1: Experts who work with minorities

Name	Affiliation	Articles the group commented on
Dr Marguerite Koole (Cree)	Assistant Professor, College of Education University of Saskatchewan	UNESCO. (2018). <i>A lifeline to learning: Leveraging technology to support education for refugees</i> . UNESCO.
Dr Duncan Connors (Roma)	Assistant Professor, Business School Durham University	Joynes, C. & James, Z. (2018). <i>An overview of ICT for education of refugees and IDPs. K4D helpdesk report</i> . Institute of Development Studies.
Gabi Witthaus (refugees)	Digital Instructional Design Consultant, HEFi, University of Birmingham	Abdulhamid, N. G., Ayoung, D. A., Kashefi, A., & Sigweni, B. (2020). <i>A survey of social media use in emergency situations: A literature review</i> . Information Development.
Candi Miller (indigenous San)	Senior Lecturer in Creative and Professional Writing, University of Wolverhampton	Altman, J., & Fogarty, W. (2010). Indigenous Australians as 'no gaps' subjects: Education and development in remote Indigenous Australia. In Snyder, I., & Nieuwenhuysen, J. (Eds.) <i>Closing the gap in education: Improving outcomes in southern world societies</i> . Monash University Publishing.
Dr Philip Townsend (indigenous)	Flinders University, Australia	
Dr Roger Harris (indigenous)	Roger Harris Associates, Borneo	Collins, M., Neville, K., Hynes, W., & Madden, M. (2016). Communication in a disaster — the development of a crisis communication tool within the S-HELP project. <i>Journal of Decision Systems</i> , 25(sup1), 160–170.
		David, R., Pellini, A., Jordan, K., & Phillips, T. (2020). <i>Education during the COVID-19 crisis. Opportunities and constraints of using EdTech in low-income countries. Policy Brief. EdTechHub</i> . https://edtechhub.org/wp-content/uploads/2020/04/education-during-covid-19-crisis.pdf .

Delphi Group 2: Experts in relation to Africa

Name	Affiliation	Articles the group commented on
Dr Stephen Kimani	School of Computing and Information Technology, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya	Alain, G., Coughlan, T., Adams, A. & Yanacopulos, H. (2018). A process for co-designing educational technology systems for refugee children. In <i>Proceedings of the 32nd International BCS Human Computer Interaction Conference (HCI) 2018</i> .
Dr Sir Michael Nkwenti	Cameroon Knight of Academic Honour Senior Lecturer in Educational Technology, University of Yaounde I, Ministry of Basic Education Cameroon	Boškić, N., Sork, T. J., Irwin, R., Nashon, S., Nicol, C., Meyer, K., & Hu, S. (2018). Using technology to provide higher education for refugees. In Jean-Francois, E. (Eds.), <i>Transnational perspectives on innovation in teaching and learning technologies</i> (pp. 285–304). Brill Sense. Fuchs, C., & Horak, E. (2008). Africa and the digital divide. <i>Telematics and Informatics</i> , 25(2), 99–116.
Dr Christelle Scharff	Associate Professor of Computer Science Pace University, New York, US	Velghe, F. (2013). Literacy acquisition, informal learning and mobile phones in a South African township. In <i>Proceedings of the Sixth International Conference on Information and Communication Technologies and Development 2013</i> .
Dr Kassimu Nihuka	Deputy Director for Academic, Research and Consultancy, Institute of Adult Education, Open University of Tanzania	Grimus, M., Ebner, M., & Holzinger, A. (2013). Mobile learning as a chance to enhance education in developing countries — on the example of Ghana. In <i>Proceedings of the 11th International Conference on Mobile and Contextual Learning 2012</i> (pp. 340–345).
Dr Caroline Khene	Senior Lecturer, School of Computer Science and Informatics, De Montfort University, Leicester	Dahya, N., & Dryden-Peterson, S. (2017). Tracing pathways to higher education for refugees: The role of virtual support networks and mobile phones for women in refugee camps. <i>Comparative Education</i> , 53(2), 284–301.
Dr Dick Ng'ambi	Associate Professor Educational Technology Programmes University of Cape Town	

Delphi Group 3: Experts in relation to distance learning

Name	Affiliation	Articles the group commented on
Dr Tim Read	Senior Lecturer in Computer Languages and Systems, Universidad Nacional de Educación a Distancia (UNED), Madrid, Spain	Crea, T. M., & Sparnon, N. (2017). Democratizing education at the margins: Faculty and practitioner perspectives on delivering online tertiary education for refugees. <i>International Journal of Educational Technology in Higher Education</i> , 14(1), 1–19.
Dr Nilgun Özdamar	Associate Professor, Anadolu University, Turkey	Adam, T. (2019). Digital neocolonialism and massive open online courses (MOOCs): Colonial pasts and neoliberal futures. <i>Learning, Media and Technology</i> , 44(3), 365–380
Dr Celia Popovic	Associate Professor, Faculty of Education, York University, Toronto, Canada	Guenther, J., Bat, M., & Osborne, S. (2014). Red dirt thinking on remote educational advantage. <i>Australian and International Journal of Rural Education</i> , 24(1), 51.
Alastair Creelman	E-Learning Specialist, Linnaeus University, Kalmar, Sweden	Lambert, S.R. (2019). Six critical dimensions: A model for widening participation in open, online and blended programs. <i>Australasian Journal of Educational Technology</i> , 35(6), 161–182. Pasch, T. J. (2015). Towards the enhancement of Arctic digital industries: ‘Translating’ cultural content to new media platforms. <i>The Journal of Specialized Translations</i> , 24. Malhotra, A., Sharma, R., Srinivasan, R., & Mathew, N. (2018). Widening the arc of indigenous communication: Examining potential for use of ICT in strengthening social and behaviour change communication efforts with marginalized communities in India. <i>The Electronic Journal of Information Systems in Developing Countries</i> , 84(4).

Delphi Group 4: Experts in relation to policy

Name	Affiliation	Articles the group commented on
Geoff Stead	Chief Product Officer at Babbel	Quibria, M. G., Ahmed, S. N., Tschang, T., & Reyes-Macasaquit, M. L. (2003). Digital divide: Determinants and policies with special reference to Asia. <i>Journal of Asian Economics</i> , 13(6), 811–825.
Professor Carol Bond	Professor of Learning and Teaching, Health in Higher Education, Faculty of Education, Health and Wellbeing, University of Wolverhampton	Livingstone, S., Lemish, D., Lim, S. S., Bulger, M., Cabello, P., Claro, M., & Nayar, P. (2017). Global perspectives on children’s digital opportunities: An emerging research and policy agenda. <i>Pediatrics</i> , 140(Supplement 2), S137–S141.
Bob Harrison	Formerly education adviser to Toshiba, National College of Teaching and Leadership, UK Department for Education and the lead on Digital Futures for the Building Schools for the Future leadership programme	Park, S., Freeman, J., & Middleton, C. (2019). Intersections between connectivity and digital inclusion in rural communities. <i>Communication Research and Practice</i> , 5(2), 139–155. Lambert, S. R. (2019). Six critical dimensions: A model for widening participation in open, online and blended programs. <i>Australasian Journal of Educational Technology</i> , 35(6), 161–182.
Aape Pohjavirta	Founder and President of Funzi, Finland	Sachs, J. D., Schmidt-Traub, G., Mazzucato, M., Messner, D., Nakicenovic, N., & Rockström, J. (2019). Six transformations to achieve the sustainable development goals. <i>Nature Sustainability</i> , 2(9), 805–814.

Further expert input and stories from the field from our extensive network of contacts

Experts across a range of fields

Name	Affiliation	Material offered
Dr Gareth Lanagan	Post 14 Curriculum Coordinator, Schools Service, Ceredigion County Council	e-sgol is a blended learning project, providing equity of learning for pupils in rural areas and those wanting to study through the medium of Welsh
Tharindu Liyanagunawardena	Learning Technology researcher, University College of Estate Management, Reading, UK	<i>Using non-personal computers for eLearning: Sri Lankan experience</i>
Rajan Madhok	Chair of Peoples-uni, UK	<i>Open Access Education initiative in LMIC countries</i>
Leonard Mware	Managing Director, Technology Partners Ltd, Kenya	<i>Finances dictating school policy on closure</i>
Red Ouane	Université d'Alger III, Algeria	<i>Algerian National Television, a TV programme called 'Mafatif Al-Nnadjah' or 'The Success' Keys' for remote learners</i>
Aape Pohjavirta	Founder and President of Funzi, Finland	<i>Funzi Future Pack, consisting of four high-quality free mobile courses</i>
Sarita Sharma	Academic Lead, TheTeacherApp	<i>Teacher CPD through a free app</i>
Koledafe Olawale Sunday	Centre for Open and Distance Learning, University of Ilorin, Ilorin, Nigeria	<i>Approaches to engage hard-to-reach learners during this Pandemic Era</i>
Dr Robert White	Leader on the Future Schools Report partnered with the UNESCO Institute for Information Technology in Education	<i>Global Review of Technology in Education</i>

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