



COMMONWEALTH *of* LEARNING

**Policies, Pedagogies  
and Technologies to  
Complement  
MOOCs for Teacher  
Professional  
Development**

# **Policies, Pedagogies and Technologies to Complement MOOCs for Teacher Professional Development**



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The Commonwealth of Learning (COL) is an intergovernmental organisation created by Commonwealth Heads of Government to promote the development and sharing of open learning and distance education knowledge, resources and technologies.

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This report was prepared by Professor John Traxler, Professor of Digital Learning, School of Education, University of Wolverhampton, UK, and Dr Betty Ogange, Education Specialist: Teacher Education, Commonwealth of Learning.

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Commonwealth of Learning

4710 Kingsway, Suite 2500

Burnaby, British Columbia

Canada V5H 4M2

Telephone: +1 604 775 8200

Fax: +1 604 775 8210

Web: [www.col.org](http://www.col.org)

E-mail: [info@col.org](mailto:info@col.org)

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## Abbreviations and Acronyms

AI	Artificial Intelligence
API	Application Programming Interface
CAL	Computer-Assisted Learning
COL	Commonwealth of Learning
CPD	Continuing Professional Development
CPTD	Continuing Professional Teacher Development
EMIS	Educational Management Information System
GPT	Generative Pre-trained Transformer
HCI4D	Human–Computer Interaction for Development
ITU	International Telecommunication Union
IVR	Interactive Voice Recognition
LMS	Learning Management System
LOOCs	Local Open Online Courses
MNO	Mobile Network Operator
MO	Mobile Originating
MOOC	Massive Open Online Course
MT	Mobile Terminating
OECD	Organization for Economic Cooperation and Development
OER	Open Educational Resources
OSS	Open-Source Software
PLE	Personal Learning Environment
pMOOCs	Project-Based MOOCs
SBC	Single-Board Computers
SMS	Short Messaging Service
TVWS	Television White Space
UNESCO	United Nations Educational, Scientific and Cultural Organization
USAID	United States Agency for International Development
USB	Universal Serial Bus
VAS	Value-Added Suppliers
VLE	Virtual Learning Environment
WMN	Wireless Mesh Networks

## Executive Summary

This desktop study reports on the innovative uses of digital technology to support and deliver teacher development for low-income countries and disadvantaged regions. The study sought to improve and complement current global MOOC provision. A wide-ranging analysis underpins recommendations and options for greater flexibility, permeability, sensitivity and sustainability based on a portfolio of social media applications, the adaptation of emerging innovative pedagogies, and the exploitation of varied technological solutions or “hacks.”

The research grows from ongoing ambitions to improve access and opportunities to teacher development for these countries and regions, and especially those areas and communities distant, diverse and different from mainstream urban or national norms, culture and resources of the Global North, and specifically to respond to the impact of the waves of the global Covid-19 pandemic and its aftermath.

The research recognises the tensions, on the one hand, between delivering “at scale” sustainably and cost-effectively and, on the other hand, working with multiple small, marginal, diverse, “hard-to-reach” and culturally fragile communities in low-income countries and disadvantaged regions. So, to repeat, this report seeks to provide ideas that can complement global MOOC provision, not replace it.

Recommendations are based on some common principles. Recommendations must be resilient, adaptable and flexible. They must encourage active, sustainable, open, critical and autonomous lifelong learning appropriate to teacher development in low-income countries and disadvantaged regions. Crucially, they must not skew policy or practice in favour of the already digitally, economically and educationally privileged. They must encourage approaches that exploit the benefits of global digital resources such as MOOCs and, at the same time, develop and deploy policies, pedagogies and technologies for sustainable local communities of practice grounded in the experiences and expectations of their own culture and environment. Consequently, the recommendations encourage ongoing discussion, refinement and improvement.

There must be a clearer articulation of the longer-term purpose and direction of global MOOC courses and platforms. They could be, for example, passed on to an established educational provider and transitioned away from developing individual teachers towards developing the trainers of teachers who can, in turn, better contextualise training by using local examples and languages (Ogange & Carr, 2021).

Recommendations:

- Make a wider, richer and more flexible range of resources – in terms of tools, content and communities – available appropriate to different and diverse regions and cultures of

teachers by developing permeability and synergy between evolving global MOOC platforms and courses and

- emerging pedagogies such as critical digital literacy, content curation, badges and micro-credentials, user-generated content, game mechanics, flipped learning, e-moderating, project-based learning and others as they emerge
  - popular social media, Web 2.0 and mobile technologies such as Facebook, Pinterest, WhatsApp, Twitter, podcasts, and YouTube, according to their local popularity and practices.
- Promote active learning, learner contributions, cultural sensitivity, local languages, authentic examples and social interaction by doing the following:
    - progressive redesign of MOOC courses, services and platforms for low, intermittent or unreliable bandwidth and coverage, according to “mobile-first” and “inclusive design” approaches
    - horizon scan to critically evaluate emerging technologies, for example, AI technologies called generative pre-trained transformers (GPT), in relation to teacher development in low-income countries and underserved regions
    - evaluate at a local and regional level technologies and systems that address infrastructural barriers such as poor network coverage, poor mains electrical supply, insecure buildings, lack of local computer hubs, and also the licenses, regulations and agreements that govern such infrastructure
    - establish pilot networks in low-income countries and disadvantaged regions in order to explore and empower remote collaborative and participatory practices to inform redesign and achieve greater specificity in terms of national conditions and institutions, and in terms of local language and culture
    - explore the piloting of local and regional hubs to distribute media, for example, universal serial bus (USB) memory, and to adapt courses, both content and pedagogy, to local conditions and culture, and to support networks of local teachers, for example, in creating their own resources, specifically prioritising these activities for the most disadvantaged teachers
    - develop strategies to reach and engage people and communities outside the national norms and mainstreams and under-resourced in infrastructure and access, for example, by developing cadres of “barefoot teachers”, and contextualising a “teacher development for disadvantage” curriculum to support capacity and activity within communities
    - investigate, through research literature, online seminars and global contacts, the relationships and tensions between those styles and approaches to learning embodied or implied in global digital culture, those in national education systems and those in local, informal and community cultures, and the implications of these three domains for teacher development at the intersection of these three



contrasting influences, especially in low-income countries and disadvantaged regions

- give increased priority and resources at a country level to “decolonise the curriculum” of teacher development, to decolonise the research approaches that inform the teacher development curriculum, to decolonise the technologies that deliver it, and to explore the relevance of current research in these areas to the values and practices in MOOC pedagogy and curriculum
- explore strategies to progressively hand over ownership and development of MOOC platforms and courses to established educational providers, or several based regionally, and explore strategies to move the objective of the courses towards “training the trainers” and building local communities of practice rather than developing individual teachers directly while recognising the need for lifelong learning and continuing professional teacher development (CPTD) which addresses an evermore complex and chaotic professional and digital world, addressing and assessing both its threats and its opportunities
- pursue a debate about the tensions between the needs and aspirations of scattered and disadvantaged communities versus the nature and benefits of systems operating “at scale”. A comprehensive and rigorous analysis is needed to identify the synergies and conflicts. Some of the obvious synergies are around infrastructure and technology, and around transmissive learning based around text and media. Conversely, the obvious conflict is around culture, epistemology, language, pedagogy and constructivist learning based around discussion. Somewhere in the middle, ambiguously, are content and the nature of its universality or adaptation.

The report was co-authored by Professor John Traxler, the United Nations Educational, Scientific and Cultural Organization (UNESCO) Chair on Innovative Informal Digital Learning in Disadvantaged and Development Contexts, and Commonwealth of Learning Chair, and Dr Betty Ogange, Education Specialist for Teacher Education, Commonwealth of Learning. It is based on the experience and expertise of the authors gained while guiding ministries of education and teacher training institutions, as well as from their involvement in academic and policy communities, as explained in the report.

The report is original in that it recognises and attempts to address the systemic bias built into conventional research methods and established research communities and is a significant contribution to “decolonising the curriculum” by looking at local rather than global factors. It does, however, also recognise the need to change safely and slowly to minimise risk and maximise acceptance.

# 1. Introduction to the Report

This introduction covers the context and purpose of the report. The objectives and structure of the report are outlined at the end of the introduction.

This report was written to explore a range of complementary pedagogies and technologies in teacher professional development. It does, however, have a far wider and more inclusive readership, including professionals commissioning, procuring or designing global digital platforms for teacher development or the courses presented on such platforms; policy, pedagogical and technical professionals in countries and regions that might want access, enhance or promote such courses; the global donor, policy and funding communities who might see such courses as a possible way to deliver their specific missions; and researchers and activists looking for an overview of the issues and options.

There is already considerable activity, discussion and publication on teacher professional development at scale in the Global South, some derived from the [TPD@Scale Coalition for the Global South](#), whose recommendations are broadly in line with those in this report, though more generalised, globalised and conservative. They include insights aligned to our own to “design for scale, localise for inclusion” and “match technology choice with professional learning needs” (TPD@Scale Coalition for the Global South, 2020). They recognise the “inherent tensions between equity, quality, and efficiency” (and we should add “sustainability”), advocate digital technologies “to make content and support available through multiple formats” and cycles of “act, evaluate, improve”. An earlier publication entitled “How could digital learning at scale address the issue of equity in education?” (Laurillard et al., 2018, p. 1), from the same community, is one of the most comprehensive reviews of the factors and possibilities but limits its recommendations largely to provision based on MOOCs. The current report moves on from these prescriptions by identifying a range of emerging pedagogies and popular technologies that might support more flexible, sustainable and local formulations less likely to need ongoing external official, technical, professional and financial support (Traxler et al., 2020) and iterative and organic improvement based on increasing user empowerment, ownership and control.

The structure of the report is as follows:

- The first section addresses some of the major concepts involved to clarify the terms being used. It is followed by a review of some current MOOC courses by COL to give concrete examples and a starting point for possible changes.
- Then, the Pedagogic Options section looks at emerging pedagogies that might be suitable to support, enhance and extend MOOC courses, and the Technological Options section explores varied ways that might deliver these. The emphasis is on those countries and regions that current initiatives and methods struggle to reach.

- The Methodological Issues section draws attention to the ways in which current understanding, research and policy on low-income countries and disadvantaged regions do not always increase their participation, opportunity and inclusion.
- The Recommendations section synthesises and integrates the Pedagogic and Technological Options.
- An accompanying Policy Brief (Traxler & Ogange, 2021) specifically looks at the overarching policy frameworks that would structure, support and resource the activities of technological and pedagogic professionals and specialists.

## 2. Policy and Context: MOOCs, Divides, Scale and Pandemic

### 2.1 Policy

This report is intended for a readership that is professionally involved in teacher development in a pedagogical or technological capacity. It shows that global resources, including MOOCs, can be more effectively and appropriately used at a local and regional level, especially in low-income countries and disadvantaged regions. It is, however, important to look briefly at the overall policy context of this work. Policy, at a local, regional and national level, is about the priorities, resources, organisations, personnel and strategy that empower, enable and promote what professionals can do, but can conversely also disable and inhibit what those professionals are able to do. So, it is obviously important to think about how and where policy is made and by whom. Clearly, this is highly specific to any given country and perhaps its states, provinces, departments and their respective ministries, officials and politicians.

A UNESCO workshop with researchers, activists and policymakers explored the relationships, transactions and discourses between these various communities to help them understand each other (Traxler, 2016). It was obvious that these were all deeply flawed and can certainly work against the interests of the minorities and less-advantaged groups in this report, unless targeted and specific priorities and resources are designed for them. It is vital that those responsible for technological and pedagogic change in teacher development understand their policy context and perhaps how it works in their favour.

The UK's [EdTech Hub](#) (Pellini et al., 2021) has been researching these issues more systematically, which it calls “the political economy of EdTech”, and makes some general observations based on its work in African countries. EdTech Hub documented an “evidence ecosystem”, the array of actors – including government, the private sector, and civil society organisations – that provide and demand evidence to support the development and implementation of public policies, in this case, EdTech, and, in our case, digital technology's capacity to support teacher development. This ecosystem breaks down into:

- evidence producers: individuals and organisations that produce evidence to inform policies
- evidence intermediaries: individuals and organisations that communicate different types of evidence
- evidence users: individuals and organisations that demand and utilise evidence to inform policy and programming decisions, operating within environments comprising the policies, regulations and procedures that govern how evidence production, intermediation and use operate.

Understanding who and what these are for specific local, sectoral, regional and national contexts is vital for initiating change in teacher development, especially in defining the nature of evidence that might be suitable for different stakeholders, perhaps stakeholders with little technical, research or educational background or responsibilities.

At the same time, EdTech Hub outlined a framework specifically for evidence uptake consisting of five core elements:

- the issue – the specific problem or question that the political economy analysis seeks to address; the factors that enable or hinder evidence uptake – in our case, digital teacher development, leading to
- structural factors – the country-level structures for policy decision-making and evidence uptake influencing the extent to which evidence is a factor in digital teacher development policymaking and if it is a feature, the type of evidence sought
- the rules of the game – the formal and informal rules and norms that influence the behaviours of the actors in the evidence ecosystems; the formal legal frameworks as well as incentives, relationships, capacity and power dynamics, influences; which evidence producers and which types of evidence are seen as most credible by policymakers; and the receptiveness of the education system and individuals within it
- stakeholders' interests and power – the different interests of the stakeholders' in the evidence ecosystem in terms of influencing digital teacher development policies, their power to pursue those interests, and the consequences of those interests
- finally, opportunities – the findings from the analysis conducted above to try to identify opportunities to strengthen evidence uptake processes systems.

This is relatively abstract and generic, especially for professional cadres reporting to policymakers. The framework does, however, provide an understanding of what evidence could achieve in terms of improvements in teacher development using digital tools, content and communities if it can be gathered and presented in the right way, at the right time, in the right place. EdTech Hub (Pellini et al., 2021) points out that there are opportunities to bring emerging evidence into discussion and to influence decision-making through cultivating relationships and sharing information with:

- senior education officials at various levels responsible for decisions on teacher development
- development partners and donor working groups involved in the education and technology sectors
- consultancy firms and individual consultants working in teacher development and digital spaces.

In different countries, this work pointed to the role of the president, the role of external donors, a judicious choice of colleagues and collaborators, national strategic priorities, existing

programmes, and in some countries, to popular sentiment, including in our case, to parents and teachers, and media coverage.

To summarise, the conclusions of EdTech Hub about influencing EdTech policy were considered in order to identify opportunities for evidence uptake: structural enabling and hindering factors for using evidence in policymaking; the rules of the game and the strengths and weakness of regulatorily frameworks around evidence; and various stakeholders' interests and their level of power.

## 2.2 Divides

There is clearly a widespread and understandable desire to address teacher development in “low-income countries” and in “disadvantaged regions”. There are, however, problems with both defining these in practice and then developing appropriate strategies and responses. We should notice in passing that terms like “North” and “South”, “developed” and “developing”, and “First World” and “Third World” are all problematic, since they are stark, country-level binaries that all come with an understanding of a particular history and perspective, and each pair represents an attempt to move on from flaws of the previous pair (Eckl & Weber, 2007; Therien, 1999; Weiss, 2009). Nevertheless, they may have productive implications for learning (McFarlane, 2006).

Furthermore, “low-income countries” should be straightforward, for example, the Organization for Economic Cooperation and Development (OECD) [listing](#) is widely used, and there are [others](#). They do, of course, change over time, and they do, of course, lag behind the recent and ongoing impact of the Covid-19 pandemic, but their main weakness in the current context is granularity – they average out differences within countries and focus on the differences between countries.

Thus, even on a purely regional or geographical basis, differences between rural, deeply rural, urban and metropolitan can be glossed over by national data, as can distinctions between coastal, pastoral, mountainous, arid and arable livelihoods. This is, however, not a merely semantic quibble. The idea of “disadvantaged regions” should be relevant to communities that are disadvantaged but not only by their location or geography. There might be a concern that a focus on the regional basis of disadvantage distracts attention, resources and research away from these other ways in which disadvantage manifests. It is not limited to places or countries, and teacher development must also address these dimensions of disadvantage.

So, there are other dimensions of disadvantage, orthogonal or independent of location and geography, including gender, age, sparsity, disability, visa status, for example, asylum seeker, unregistered “alien”, refugee, internally displaced person (IDP). They may include language, literacy, ethnicity, livelihood, including forms of modern slavery, and stigma, for example, of groups such as LGBT, disabled, homeless or nomadic people. Teacher development targeting

disadvantage must recognise that disadvantage occurs in many forms and each needs its own pedagogies and technologies to complement global MOOC provision.

Without greater specificity and precision, there is a risk that attempts to address disadvantage, for example, by increased national teacher development, especially in-service teacher development, may backfire, may increase the divides between those people and communities at the margins and the majorities and the mainstream already established within the school system and the teaching profession. A recent report (Traxler et al., 2020) addressed some aspects of this challenge. It observed that responses to the pandemic that consisted of pumping extra resources, in the form of personnel, connectivity, content, effort and money, into education systems in a generalised and undifferentiated fashion would, in fact, not address the problems of those people, communities and cultures at the edge of those education systems or beyond the edge of those education systems. They would, in fact, merely increase the extent of the disadvantage of those people, communities and cultures.

It is possible, perhaps, to enumerate and identify who those people, communities and cultures might be, but the point is that they are all different, distinct and diverse and perhaps only characterised collectively by their distance and their difference from the norms, standards, practices, values, and indeed languages, lifestyles and livelihoods embodied, embedded and expressed in the education system of the national majority. This means that each person, community or culture needs interventions, infrastructure, resources, and pedagogies specific to their situations, contexts and circumstances, optimally growing from their situations, traditions and circumstances rather than being imposed or imported from the outside or from the majority.

Education professionals and their institutions, and sometimes the wider public in the UK, for example (Brown, 2018), subscribe to a myth that education can address disadvantage – specifically that education can catalyse social mobility, that educational capital is the foundation of economic capital, whereas it is more likely that economic capital is the foundation of educational capital. The truth is that poverty is caused by lack of money, not by lack of education! Education professionals must use their experience and expertise judiciously. They must think through the impact of, for example, specific teacher development interventions and ask, do they, for example, only improve education systems for those already inside them, perhaps owing to their location or socio-economic status, and should agencies and officials be thinking about developing contextualised “teacher-development-for-disadvantage” strategies for specific peoples, communities and cultures? It might be the case, for example, that different forms of teacher development could tune the curriculum and its delivery to support emergent livelihoods that could gradually break out of a cycle of lack of education/lack of employment.

These strategies are, of course, at odds with drives for sustainability, cost-effectiveness and scalability expressed and experienced by many global agencies and their funders, since they

imply much more nuanced and local perspectives. There is potentially a dilemma for global agencies often forced to work in a largely remote and transmissive mode, perhaps slightly less so for those with a narrower focus, such as the Commonwealth of Learning (COL) with its Commonwealth focus; though, even then, the hegemony of local official English might be at odds with a myriad of mother tongues, dialects, creoles and patois, especially given the likely prevalence of these among more disadvantaged communities.

Anyway, there are two immediate issues. Firstly, many types of “disadvantaged regions” are “hard to reach” – to their national governments, they might be invisible, unrecognisable, remote, subversive or disconcerting. Providing education for the “hard to reach” is thus, by definition, difficult, but so is researching and understanding their circumstances and their situations, and so is devising how to reach them. Secondly, some of the categories or communities we identify would have been overlooked by the institutions of the state, specifically the national school system, and so the activities of the state, however well-intentioned, to address disadvantage may merely privilege those within the system rather than those who have been excluded from it. These two factors obviously overlap.

One factor that would often separate Commonwealth countries from the wider global Anglophone community is the legacy of British conceptions of education, namely, what it is, what its purpose and philosophy are, and how to manage, organise, deliver and assess it, and, to a lesser exclusive extent, the commonality of the British English language. At the very least, this implies the need for education (including teacher development) that enables learners to critique in concrete and specific instances, at whatever level, the threats and opportunities presented by the World Wide Web, the information superhighway, social media, and the global knowledge economy, but also residual British institutions and values set against their own local language, traditions, artefacts, culture and heritage. This represents a challenge, responsibility and paradox for any teacher development delivered globally and digitally. British colonial conceptions of education against informal and indigenous ideas about knowledge, its acquisition and composition is perhaps an earlier pre-digital version of this dilemma.

In terms of subjects, it may be argued that a judicious choice of topics delivered on MOOC platforms, favouring “hard” technical subjects, such as mobile data comms, rather than “soft” social science subjects, such as school leadership, might avoid this problem, but the problem affects not only what is taught on the platform but how it is taught. In any case, the notion that “hard” subjects and sciences are somehow abstract and universal has been widely challenged (Stefanidou & Skordoulis, 2014), and the balance, content, examples and relevance of these subjects are nationally and culturally sensitive.



## 2.3 Pandemic

The aim of this summary is to provide a brief account of the global pandemic in order to think about its relevance to teacher development. The pandemic and its aftermath will linger for several more years, if not longer, and has many repercussions for teacher development. As we point out in the accompanying Policy Brief (Traxler & Ogange, 2021), the pandemic, its successive waves, the responses to these successive waves and the aftermath of these waves and responses mean that, for the foreseeable future, and in different places, in different ways, any “new normal” would not resemble the “old normal” – that the pandemic is not a “blip” or a perturbation but a profound disruption to the world order, its economies, its societies, and its systems. This would problematise the purpose and role of education, if only in reconfiguring the employment markets that education systems serve and the tax base with which governments finance these education systems. Thus, there are consequences for teacher development, firstly, in recognising that the widespread “pivot” on remote digital learning would have changed the experiences and expectations of learners and teachers, and secondly, in recognising that the curriculum must respond to changed economic conditions and configurations and to changes in livelihoods and communities.

It is difficult to summarise the current impact on education across different demographics and across different countries. The statistics, country by country, of the pandemic are available online, but these are at a national level for low-income countries, and the better the gathering of these statistics becomes, the more the rapidity of changes becomes apparent. The John Hopkins University [Coronavirus Resource Center](#) emerged as a focal point for such statistics, specifically the “by region” display. Since most schools, colleges and universities across the world went into lockdown following the “first wave” outbreak of the Covid-19 pandemic, education has been affected globally. National education systems – especially in those aspects that are driven from the top–down and the centre–out – display a degree of consistency and uniformity across their respective nations, and perhaps to a slightly lesser extent, so do any smaller units of national educational organisations such as provinces, states or cities at a lower level. There are, however, limits to any such generalisations, findings or observations at a national level.

School closures, proposed re-openings and possible recovery plans would, in theory, be within the scope of these generalisations. In many countries, we have seen coherent and compliant national lockdowns and closures in the face of the pandemic’s “first wave”. This was followed by a far more fragmentary and unstable picture as outbreaks constituting a “second wave” take place locally and incoherently as government awareness of the complexity of the pandemic increases, as reserves and resources run down, as populations become less compliant, especially as governments oscillate/vacillate between prioritising lives and prioritising livelihoods, vaccinations become available slowly and unevenly, and as high-profile transgressions undermine popular buy-in.

It is in any case, simplistic to portray schools as merely “open” or “closed” because many might be admitting some year groups, cohorts or categories of learners but not others, admitting groups but in staggered shifts, admitting some subjects, for example, those requiring laboratory access but not others, or admitting the children of “key workers” but no others. “Curriculum trimming”, as reported in South Africa, is another example of responses that have not shown up as simple closure or re-opening (Hockly et al., 2021). As similar responses are apparent in colleges and universities, initial teacher training would be directly affected, but trainee teachers, in addition, would have their placements or practicum in schools reduced. In-service teacher development would also suffer, especially any face-to-face training, meetings, observations or workshops. Also, the widespread “pivot” on remote digital learning (and homeschooling) may have reached teacher development but is unlikely to have been a high priority.

The various strategies adopted by education systems have had to vary quickly as individual teachers go into/out of quarantine or hospital and as the transmission rate varies. There are perceptions that “open” schools have been acting as “super spreaders” and that the authorities need to respond. There are informal accounts of enthusiasm waning for home-schooling. There are reports of home-schooling reinforcing educational divides. The available sources do not make the necessary kinds of distinctions, and there are bound to be other variables such as schools outside the state system, for example, missionary schools, private schools and boarding schools, and communities funding or subsidising extra “community” teachers. These would not necessarily show up in any reporting (Hockly et al., 2021).

The “pivot” on online digital learning mentioned here and elsewhere has raised the profile of digital learning but also raised concerns that this pivot has been driven by the need for quick, safe, large-scale transitions based on existing systems and existing ideas with little input from innovators, experts, thought leaders or researchers; it has favoured pedagogies based around the delivery of content, has largely been conservative, has targeted education within the mainstream education system and raised concerns about equity (Belluigi et al., 2020; Shackleton & Mann, 2021; Traxler et al., 2020; Williamson et al., 2020).

There is clearly a significant opportunity and a desperate need for online digital teacher development, such as MOOC courses that would address these concerns and help teachers “build back better” and that would exploit the dramatically increased awareness of the existing forms and practices of digital learning. There is also, however, the need and opportunity, based on this increased awareness, for exploring the new forms of digital learning for teacher development described in this report that would exploit the awareness of social media and personal digital technologies.

## 2.4 MOOCs and the digital age

Connectivism, the original theory (Duke et al., 2013; Jobe et al., 2014; Kop & Hill, 2008) underpinning MOOCs, was promoted as a learning theory for a digital age characterised by connectivity and by the use of social media, search engines, web browsers and online forums. These technologies would enable people to learn and share information across the World Wide Web and among themselves in ways that were not possible before the digital age – however, of course, there are assumptions about infrastructure, access, educational capacity and digital literacy that cannot go unchallenged in the context of teacher development for the disadvantaged regions and low-income countries.

Connectivism emphasises not the individual learner but instead, the networks of learners, learning happening within and across networks, specifically massively numbers of networked connected learners. Drawing from one of its earliest proponents (Siemens, 2005, 2008), the principles of connectivism are as follows:

- Learning and knowledge rests in diversity of opinions.
- Learning is a process of connecting specialised nodes or information sources.
- Learning may reside in nonhuman appliances.
- Capacity to know more is more critical than what is currently known
- Nurturing and maintaining connections are needed to facilitate continual learning.
- Ability to see connections between fields, ideas and concepts is a core skill.
- Currency (accurate, up-to-date knowledge) is the intent of all connectivist learning activities.
- Decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow because of alterations in the information climate affecting the decision.

Also, Downes outlines conceptual factors of connectivist experiences. These are:

- Diversity – Is the widest possible spectrum of points of view revealed?
- Autonomy – Were the individual knowers contributing to the interaction of their own accord, according to their own knowledge, values and decisions, or were they acting at the behest of some external agency seeking to magnify a certain point of view through quantity rather than reason and reflection?
- Interactivity – Is the knowledge being produced the product of an interaction between the members, or is it a (mere) aggregation of the members' perspectives?
- Openness – Is there a mechanism that allows a given perspective to be entered into the system, to be heard and interacted with by others? (Downes, 2005)

These factors do not, as it were, automatically help to design a MOOC but do give clear indications of what to look for in a putative MOOC and why, in terms of these principles, the current global platforms are a sad departure from the early principles, and also why, looking at the implied educational sophistication, infrastructure and connectivity, and at “connecting specialized nodes or information sources”, MOOCs in this formulation may be inappropriate to many users in disadvantaged communities and low-income countries. The ideas and recommendations in this report seek to address the latter issue.

Some MOOCs, referred to as xMOOCs, use a traditional lecture format but with video lectures for the face-to-face lecture components of a course and provide automated exercises and quizzes, along with opportunities to interact with fellow students using discussion boards or chat functions. This style has been characterised by the offerings from MOOC providers such as Coursera and Udacity and their university partners. These MOOCs tend to use custom-designed technical platforms, scheduled learning events and proprietary learning resources. They are intended for large-scale course delivery and consequently have exploited learner analytics to tune and improve outcomes and performance. However, MOOCs are often associated with perceptions of high dropout rates, and this might be one reason to retire the term.

cMOOCs use constructivist or connectivist pedagogies (Goldie, 2016), the ones outlined above. Learners are often encouraged to build their own knowledge through social learning processes within flexible timeframes, guided by course instructors, often using OER.

The pedagogy of xMOOCs is suited to learning domain knowledge that can be mastered through repetitive practice, whereas cMOOCs may be more effective for allowing learners to acquire higher-order creative skills (Bates, 2012). This is an important distinction in relation to the components of a teacher development curriculum but would need to be considered in light of other suggestions, for example, any devolved model with global content and local support.

These definitions and issues surrounding MOOCs are outlined here merely to illustrate the extent to which current practices and technologies have deviated from the original ideals and conceptions but how, in the context of teacher development for disadvantage, a judicious reconsideration and return to these initial conceptions and ideals may have practical value. Practical experience of facilitating an early MOOC built on connectivist lines (De Waard et al., 2012) did underline the need for structure and scaffolding to avert intellectual anarchy in which the able could indulge themselves, while the less able would struggle and flounder.

While early core platforms, Coursera and EdX, for example, are clearly delineated and understood, subsequent developments have seen confusion and a proliferation of new variants. The variants or derivatives on the MOOC name and model, for example, SPOC – a small private online course or, confusingly, a self-paced online course – recognise that some aspects of the

formulation, usually the massiveness, and sometimes implicitly the openness, are problematic, for example, the European Union project-based MOOCs, or pMOOCs (Phan et al., 2016), local open online courses (LOOCs) (Parker, 2013; Porter & Beale, 2015), local open online courses aimed at attracting large numbers of students to courses structured around locally relevant subjects, or “LMOOC for language” (Miyazoe, 2017).

There are also social MOOCs (sMOOCs) (De Lima & Zorrilla, 2017), which are characterised by the involvement and interaction of participants in a model based on intercreativity, with the final objective of transferring knowledge by an agile replicating process. They reach out to a specific academic community, providing learners with digital competences in order to transform them into e-teachers. The design of collaborative activities increases the involvement of learners with the course and the interaction between participants, independent of age but dependent on the area of work.

The confusion is one of definition. In our experience in the Middle East and Africa, and as observed in the literature, the term MOOC now seems to have become a replacement for generic computer-assisted learning (CAL) and even subsumed virtual learning environments (VLEs) and learner management systems (LMS) certainly insofar as they all involve mixed media content, forums, chats, announcements and tasks within a clearly defined system boundary. Ideas and instances of OER also seem present in the general confusion and overlapping of terminology. Seen in this light, perhaps the term MOOC seems to be merely the current way of labelling, discussing and promoting centralised technology-enhanced learning and should not be taken too seriously, certainly not at the expense of synthesising real solutions to real problems. We argue here that we should proceed on this basis; it is a safe, inclusive and pragmatic assumption.

Having said the early principles of connectivism may still be of value if adapted to the circumstances of teacher development in low-income countries, we should also ask whether they were culturally biased or culturally specific. Did they attempt to prescribe learning and learning approaches for digitally literate tech-savvy, highly connected Western learners in the metropolitan, global or corporate North and impose them on learners elsewhere?

Dedicated “EdTech” systems allow institutions to run a business model based on paid-for access and give these institutions ways of managing their duty of care and their legal liabilities as businesses. *Open*, the obvious anthesis, has several slightly different meanings in this context. “Open learning”, often supported by open-source software (OSS) systems, is a very specific ideology and pedagogy espoused by activists, advocates and organisations trying to open up education but within a set of parameters that still leaves control with teachers and institutions, and with the curriculum. MOOCs are open, in this sense, open to anyone. There are also systems, neither “open” nor “EdTech” and some not explicitly educational, being used to support a wide variety of learning activities, starting from those driven by momentary curiosity to quite

substantial self-directed projects. We return to these when we look at emerging or innovative pedagogies and the technology systems that could support them.

## 2.5 Scaling

From several perspectives, scaling seems to be an attractive ambition and is presented as an imperative for delivering economies of scale and potentially sustainable business models. The term *scale* is widely used and could, in fact, mean a variety of things – large numbers of students, courses, countries, or certificates awarded – but generally, it means large enrolments. It has been driven by the perceived need for “value for money” and “cost-effectiveness” coming from funders, either government ones, conscious of their voters, or from commercial ones, conscious of their shareholders. It is commendable. Technology seems to provide the mechanisms for scale because the unit costs of hardware go down with mass production, and the unit costs of software are negligible. The pressure for scale does, however, have certainly consequences or risks, namely it favours:

- pedagogies based on content because content merely requires transmission or broadcasting
- existing content because it can be quickly repurposed and adapted
- stable content because of its durability
- content based on English because it is the language of the Internet and of many international agencies and corporations.

This is done at the expense of:

- pedagogies based on discussion and interaction, because of logistical, organisational and administrative overheads, diversity of languages and the need for moderators and tutors
- topical content because of the need to continually revise, re-write and distribute
- local pedagogies, the learning habits and practices of diverse small communities
- new content because it needs commissioning, authoring, developing, designing and publishing.

At first sight, these arguments would seem to undermine ODL as practised historically. Our argument is now that technology, in our discussion of “mass customisation” and our exposition of technologically enabled local communities and content, means that ODL could become much more responsive and flexible.

It is worth asking whether scale in any given situation is at odds with equity, diversity, inclusion, agility and variety. Does the drive to scale merely skew content, recruitment, presentation and pedagogy in favour of a perceived global mainstream? It is true that digital technologies, especially those of computers and mobile phones, embody the language, gestures, expressions, values and assumptions of individualistic and Anglophone American-based global digital corporations and away from minority languages, hidden cultures, local images, vocabularies and

metaphors, regional and subcultural dialects, non-European fonts, scripts and character sets, indigenous gestures and many other aspects of interaction, communication and socialisation (Traxler, 2017).

Even if agencies and donors feel that scale is desirable, benign and equitable and could favour low-income countries and disadvantaged regions, there are questions for them to address, such as how do they work “at scale”, what exactly does “at scale” mean in the context of educational interventions, and how do they get to scale? And in practical terms, do they launch at scale, or do they start small? What skillsets, managerial, technical and pedagogic, are needed and how do they need to evolve as scaling proceeds? What capacity needs to be built? Does “scale” compromise sustainability? What might be the critical failure factors? So, while “at scale” might be perceived as desirable, it is not without challenges. One technical way through the contradictions of scale might be “mass customisation” and the “long tail” that we describe later in the Technology Options section.

Two potential mechanisms for a “natural” scaling up were trickle-down or diffusion (Bennett & Bennett, 2003), the slightly different versions of the idea that a development or a change initiated by a core of innovators and activists (Kaminski, 2011) could somehow spread widely across an organisation, culture, community or society (Tolba & Mourad, 2011). Furthermore, there seemed to be ways in which these “natural” processes could be understood and thus promoted, protected or accelerated.

Notions of “the diffusion of innovation” were problematic and over-simplified, probably derived from data and evidence that were skewed in favour of successful innovations, rather than including the failed innovations that never got noticed, in situations that were driven by consensus rather than command and assumed the gradual swell of individual decisions. In many organisations, social systems, contexts and cultures, especially outside the individualistic and consensual social systems in or derived from Western Europe and North America (Zanello et al., 2016), “the diffusion of innovations” probably raised inappropriate expectations.

There is a long history of worthwhile prototypes with a good match to a specific problem domain. The question, in spite of their reported and repeated successes, is why were they not sustained or scaled? Is it perhaps that a limited focus on technology and pedagogy failed to address capacity and infrastructure, or that they were subsidised by resources and enthusiasts and failed to measure cost-effectiveness, or that they were external solutions based on an external perception of the problems? Any or all of these answers are plausible.

Now, “theories of change” (Bentley, 2010) are popular, defining long-term goals and then mapping backwards to identify necessary preconditions. Theories of change in a particular context should explain the intended process of change by outlining causal linkages in an

initiative – meaning its shorter-term, intermediate and longer-term outcomes. The identified changes should be mapped, showing each outcome in logical relationship to all the others, as well as the chronological flow, each with a rationale. These approaches are replacing log frames (Harley, 2005; Hummelbrunner, 2010; Prinsen & Nijhof, 2015) as a way of managing change in an increasingly volatile and chaotic world and any consideration of scale needs to articulate an appropriate method and an understanding of how scaling will happen. Elsewhere we mention “agile” methods as another alternative.

A novel starting point for [theory of change](#), which addresses where we are with teacher professional development in disadvantaged regions and where we would like to be, would be to explore the constraints and barriers at work. This would define what is even possible. The issues and concerns of pilots, often the details of technology and pedagogy, are not usually the barriers to scaling up, which may be capacity, infrastructure and sustainability. Perhaps in future studies, it would be more efficient to explore the possibilities and limitations of a scalable innovation before designing and developing it rather than after. Within any specific context, various factors – which may be cultural and social, institutional and organisational, or technical and financial – limit the breadth of innovations that might be scalable. They define, in effect, the “innovation space” within which an innovation must be designed, developed and deployed if it is to be scalable. And these factors would be different for each low-income country and disadvantaged region.

While at a local, national and global level there are clearly many attractive and worthwhile innovations, improvements and changes, it is only with an understanding of whether to scale up, what to scale up and how to scale up that these innovations, improvements and changes would come about.



### 3. Structural Difficulties and Constraints

There are challenges with regard to reaching learners and their teachers, understanding learners and their teachers, and overcoming the barriers imposed on both. These topics seem not to have been researched intensively in relation to teacher development in low-income countries and disadvantaged regions, but much work is ongoing in other countries and regions as well as concerning aspects of health, including the pandemic.

#### 3.1 Reaching learners

There are a multitude of objective and infrastructural barriers that prevent us from reaching the “hard-to-reach” disadvantaged regions – and prevent *them* from reaching *us* (Boag-Munroe & Evangelou, 2012). These are conceptually easy; we can identify, measure and quantify them. The “hard-to-reach” communities in this context might be those in deep-rural areas, those in sparsely populated areas, those areas characterised by pastoralism, nomadism or subsistence farming, those suffering from inadequate infrastructure, such as under-resourced schools or poor connectivity, electricity, roads, and buildings. These are the challenges and barriers that are most easily understood by outsiders. Removing or lowering these requires planning and resources, and around these, requires capacity, logistics and organisation. There is, however, always the risk of “unexpected consequences” – of creating a new problem while solving the old one. Nonetheless, these are not the issues that education or technology professionals or a global educational provider can address directly. They should, however, design, at every level, a rich and diverse technological mix from global source to individual user in order to maximise the chances of a good reliable connection and adopt a “mobile-first” design approach (Kukulska-Hulme & Traxler, 2020; Power, 2012) to reach across the poorest infrastructure and devices.

#### 3.2 Understanding learners

Assuming we can physically reach out and connect with learners, there is another set of barriers related to different aspects of culture and community. These barriers might include literacy, language, culture and livelihoods, perhaps not so much in and of themselves, because a major part of our recommendations is about enhancing the capacity of communities to learn from each other where few such barriers exist, but in the way they represent barriers between those communities and those outside those communities mandated to provide education. They may be the consequence of competence, for example, those where the latter are not fluent in the language of the former, or they may be the consequence of attitude.

The remedies are clearly different for these two cases. Barriers of competence can be tackled by means of training, capacity building and staff development, whereas barriers of attitude require a different and more subtle approach based on understanding the roots of the attitudes (Choma & Hodson, 2008; Hadfield, 1971; Yilmaz & Argon, 2020). This might suggest that global digital

resources, such as MOOCs, could address issues of competence, whereas issues of attitudes, though they could be tackled digitally, would need to be addressed locally with discussions and support specific to the context and culture.

One such barrier is stigma, perhaps the stigma of caste, disability, visa status, sexual orientation, gender, livelihood, or something else. This is real and must be recognised. Sadly, one of its effects may be to inhibit or dissuade teachers from working with such groups. As we say elsewhere, one priority for policymakers is to provide incentives and structures to encourage and enable teachers to work with specific stigmatised groups and the courses and competences to make this happen. There is also a role for global digital resources in helping teachers understand stigma, but these only change behaviours, while local support, which could be digital, is needed to change attitudes. Stigma is, however, just one aspect or outcome of specifically cultural differences. Other such differences include differences in language, literacy, livelihoods, social interactions, social behaviour and social organisation.

For teacher development, we should be able to assume teachers have certain levels of literacy and certain constraints on language. In theory, these are imposed by their own education system; but firstly, the reality of their literacy might not match the official expectations, and secondly, teachers' professional language might not match the mother tongue, lingua franca or the dialect of their learners. In the first case, this implies using teacher professional courses, such as MOOCs, as the basis for improving teacher literacy and for the second case, this implies using teacher professional courses to support teachers working in mother tongues, lingua francas, or dialects. All of these must be considered alongside digital language, digital literacy and digital culture.

For teacher development, the livelihood dimension ought to be self-evident, but many teachers in rural communities supplement their income by farming, or vice versa, some communities supplement their professional teachers with volunteer teachers from within the community. This might mean that these teachers have a greater breadth of life experiences that could enrich their teaching if teacher development could capitalise on them (Glassman et al., 2007).

Finally, irrespective of the actual community in question, it is important to understand the nature of learning for them: what community members need to know and do, how they come to learn these things they need to know and do, who they learn them from, and how they demonstrate that they have learnt them. Teachers in these communities must align their teaching with these community experiences and expectations. Any misalignment is a barrier between the teacher and the learners. One role of teacher development in low-income countries and disadvantaged regions is exploring how teachers can understand and adapt to local pedagogic traditions and habits (Biermann & Townsend-Cross, 2008; Madden, 2015) and how programmes could support this (Bennet & Moriarty, 2015; Davis & Cabello, 1989). For example, there is already a great

deal of work relating to rural India (Shukla et al., 2017), science (Marin & Bang, 2015; Sutherland & Swayze, 2013) and mathematics (Nichol & Robinson, 2000). This is something that the pedagogies, for example, user-generated content, in the Pedagogic Options section, could also support, but it does also argue for robust, effective and culturally appropriate research tools that teachers could use with their community (Atkinson & Flint, 2001; Benoit et al., 2005) so that research moves beyond merely answering the questions of outsiders.

As we said, there are barriers, or rather differences, which prevent the dominant culture from understanding or perhaps sympathising with those cultures at their margins, either at a national level or globally or socio-economically, and imposing their own understandings, desires, needs, priorities or methods onto subordinate or marginal cultures. In the Methods section, we make the case for research tools, techniques, ethics, governance and projects that might enable a more authentic understanding of how communities see themselves and their needs, aspirations, experiences and experiences, and thus facilitate the learning, and teacher development, that they themselves need rather than that imagined, interpreted, imposed or assumed by outsiders. Cultural barriers not only impede teacher development but also impede the research that might improve teacher development. This is an aspect of needing to “decolonise research” – that is, the tools, techniques, ethics and governance of research with disadvantaged communities before we can “decolonise the curriculum”, specifically the teacher development curriculum, though there are parallel developments in the latter (Sathorar & Geduld, 2018). As might be expected from earlier remarks, much of this innovative thinking and activity comes from a limited number of “hotspots” – South Africa, Kenya, India, New Zealand/Aotearoa and Canada, among others – and this creates problems as well as solutions to them.

### **3.3 Academic, ministry and policy players and processes**

The previous remarks referred to those barriers related to the nature of “hard-to-reach” communities and the differences between them and their national or mainstream ethos. There are other barriers that are part of the international and national context and the pressures and expectations that these impose on teacher development at a local level.

It is quite possible that some countries or communities are very “donor friendly” – that is, they attract projects, initiatives and pilots, and these increase local capacity, outputs and visibility, and then lead to more projects, initiatives and pilots. This is a “virtuous circle” for those involved, but less so for those countries and communities that find themselves locked out of the loop by low visibility and poor press. It is easy to think of examples of the former but harder to think of examples of the latter, and that is the point: some communities and countries are “hard to reach” because they are nearly invisible and overlooked, which is what constitutes their specific disadvantage. So, in seeking to improve teacher development, we must recognise the need for some positive discrimination in favour of what might be called “unfashionable” countries and communities. Additional aspects of the ways in which relationships between international

fundings and policymakers and regional and local communities can be skewed and biased are discussed in the Methods section.

One specific and very different barrier to teacher development is that of crisis and conflict – not only natural disasters but also self-inflicted human ones, of invasion, occupation, strife, blockade, insurrection, civil war, persecution, inter-community strife, censorship, along with the suppression of freedom of speech, freedom of association, freedom of movement, and freedom of the press. These initiate significant infrastructural, organisational and logistical barriers and massive interruptions to teacher development. One thing to remember is the extraordinary resilience of mobile phone networks and the tenacity with which people continue to engage with social media. The Covid-19 pandemic has, in a global but less direct sense, forced education systems to confront crises and to use digital technologies to sustain and support learning. This has not been wholly successful, and there are many lessons to learn. There are already examples of school systems and teacher development in crisis and conflict; UNRWA working with the Palestinian refugee communities across several countries in the Levant is the best example (Lewis & Thacker, 2016). It has been observed that in such situations of natural disaster or human conflict, mobile phone networks are very resilient, partly because some networks keep mobile-based stations with generators mounted on trucks in readiness. The other most resilient network is analogue radio broadcasting.

Aspects of this barrier include the prestige of Western approaches, standards, technologies and corporations, perhaps taking over from the power and legacy of colonial and imperial hierarchies, institutions and habits; funder preferences include the drive for scale, sustainability and cost-effectiveness, and the simplistic and misplaced belief in evidence-based policy formulation; global academic league tables, leading to the adoption poorly understood metrics and criteria driving local academic priorities, for example, fetishising high-impact research publications; and forms of short-term capacity building pasted onto established practices, personnel and organisation. These can all inhibit confidence in local experience and expertise and thus lead to teacher development based on imported and external models. The “hard-to-reach” communities in this context are those that were small or scattered, underresearched or underdocumented and are clearly a feature of low-income countries and disadvantaged regions.

### **3.4 Covid-19 pandemic**

As was mentioned earlier, the Covid-19 pandemic has exemplified and amplified the barriers to teacher development and, in general, increased these barriers disproportionately for disadvantaged countries and communities. Low-income countries and disadvantaged regions, by their nature, had fewer resources, less infrastructure and less capacity even before the pandemic, and the impact of successive waves only makes this worse. The pandemic, in its waves and mutations, and in the variety of responses and consequences, has been characterised by rapid and

unpredictable changes, and these are a further barrier to understanding the situations in many low-income countries and disadvantaged regions (Haßler et al., 2020; Traxler et al., 2020).

## 4. Pedagogic Options

This section looks at a variety of innovative and exciting pedagogic options, interpreted, presented, connected and critiqued specifically in the context of teacher development in low-income countries. These are intended to complement the approaches used on MOOC platforms and in courses. It is perhaps the core of the report – offering a systematic review of the options before the realities of local infrastructure, capacity and institutions are taken into account. These include:

- the curation or orchestration of external resources
- the production and exploitation of learner-generated content
- blogging
- game mechanics
- open learning
- heutagogy
- e-portfolios
- project-based learning
- e-moderation
- digital literacy.

There are now an enormous variety of Web 2.0 tools and technologies, ones that change the Web from its original hierarchic top-down mode, where the majority consumed what a minority produced, to a flat peer-to-peer mode, where everyone can consume what everyone produces (De Wever et al., 2007; Hage & Aïmeur, 2008). Social media, wikis, file-sharing and blogs are some of the formats; Twitter, WeChat, Facebook, WhatsApp, Instagram, Pinterest, Wikipedia, Flickr, YouTube, and WordPress are some of the best-known exemplars, and for most people in low-income countries and disadvantaged regions, their personal mobile phones are the portal to these resources and activities, allowing them to produce their own text, voice, images, audio, video, events, chronology and location and to share, discuss, merge, transform, broadcast and discard them.

The pedagogies outlined here have evolved to exploit this transformation and put isolated examples into a structured framework, but the challenge in the current context is the interaction and interface between these technologies and their pedagogies and those of more formal and complex systems of structured online education, including MOOCs.

There are, of course, already local examples of using social media to support teacher development in low-income countries, for example, maths teaching in Indonesia (Patahuddin & Logan, 2019), English teaching continuing professional development (CPD) in Kenya (Bett & Makewa, 2020), maths teaching in Turkey (Yildirim, 2019), and elsewhere.

Some MOOC courses support teacher development and are therefore targeted at teachers. Consequently, we refer to this target constituency as “teachers,” their learners as “learners,” and the wider universe of people accessing these pedagogies as “users.”

#### 4.1 Curation of external resources

Our starting point is that the digital world is awash with digital resources, many of them “free” or “open” and easily available. These resources include:

- content, for example, websites, podcasts, downloads, audio, e-books, video, documents, images and text
- communities, for example, Listserv, mail bases, special interest groups and, to give a concrete example, groups and communities on WhatsApp, Facebook and LinkedIn
- tools, for example, for creating content, building communities or connecting people, using a keyboard, a microphone and a camera.

Educators, teachers and learners must develop the skills to exploit these resources (Mihailidis & Cohen, 2013). These skills include not only the technical skills of online searching, classification and storage but also the critical skills of judging the provenance, purpose, credibility, stability, value and assumptions of the resources. They are the skills of “curation” or “orchestration”. The wealth of resources for teachers can enable lifelong learning and CPD in their subjects, their disciplines and their specialisms, in pedagogy, teaching and learning, in professional issues, such as educational leadership, inclusive education, curriculum development and assessment regimes, and in technical issues like copyright and cybersecurity.

Curation has several indirect educational benefits. It encourages teachers to think about how their students learn best – for example, is it from absorbing content, from having a discussion, or from using a tool (Dougherty, 2012; Martin, 2015)? Curation also encourages identifying and articulating the key arguments, issues or assets of a resource – is it any good, is it any better, why is it useful, is it original, is it permanent? Curation encourages classification and organisation – how should a resource be described and what is its metadata, attributes or characteristics? What folksonomy – meaning what user-generated organisation, classification or structure – works best for the cadre, the community, or the school?

There are, nevertheless, reasons for caution, including the predominance of resources that embody American English culture and language, raising concerns about fragile, marginal, endangered or indigenous languages and cultures and about the exact nature of both “open” and “free”. Many “open” educational resources in practice have highly formal and institutional characteristics, and their repositories and metadata reflect Western ways of thinking about knowledge, education and learning. This makes searching and finding challenging. On the other hand, resources, having been found, can be organised – that is, “curated” – in ways that reflect the learners’ own knowledge structures using “tagging” and “folksonomies” (Gupta et al., 2010;

Trant, 2009) and using easy and lightweight tools such as [Diigo](#) to create and organise individual or community libraries – a process sometimes known as “social bookmarking.”

Another reason for caution is the occurrence of what has been called “fake news” or “post-truth”, meaning content that deliberately distorts or misrepresents reality, perhaps for malign or political reasons. We argue later that this sadly is a fact of modern life, and rather than ignoring or avoiding it, in teacher professional development, for example, we must develop the skills and attitudes of critical digital literacy, encouraging teachers to check, scrutinise, question and evaluate and to encourage their own learners to do the same.

Seen from a different perspective, curation could be viewed as a flipped-classroom activity (Bishop & Verleger, 2013; Yough et al., 2017) where teachers are encouraged to find and critique resources before regrouping in the digital classroom or shared digital space to discuss and compare them.

It is, of course, also possible for users, especially teachers, to create and contribute open educational resources (OER), reflecting their own cultures, languages and varieties of English, to suitable online searchable repositories, for example, [OpenLearn Create](#), [Merlot](#) or [OER Commons](#). Furthermore, many forms of “open” licenses allow for the adaption and alteration of OER. Note that “free” resources often serve an implied commercial or political purpose or organisation; one immediately thinks of the shareholders and owners of Google, Facebook, YouTube and Twitter, and of the ongoing disquiet about some of their policies and activities.

There are obviously arguments for shifting the focus and effort in teacher development away from creating the content and communities for teacher development courses from scratch towards developing those skills of “curation” or “orchestration” among teachers in training that would enable them to search efficiently, organise systematically and evaluate critically (Ogange & Carr, 2021) among the myriad existing digital resources for themselves and developing the skills of critical digital literacy that scrutinise and question such technologies. In the next section, we discuss a complementary pedagogy, one of encouraging learners themselves to develop resources.

Finally, the notion of “localisation” is sometimes presented as a solution but can be a problematic distraction if it merely means the adaptation of resources, which might be content, communities or tools, from the Global North to the specifics of cultures of the Global South (Wolfenden & Adinolfi, 2019). This seems economically attractive but may, in practice, mean the superficial replacement of images and vocabulary, leaving the underlying dominant culture and pedagogy unchanged, merely masked and, for this reason, we later articulate a critical digital literacy intended to expose and problematise these issues of localisation rather than conceal them.



## 4.2 User-generated resources

Learner-generated resources are the content, communities and tools that users produce themselves. There are arguments complementary to those for curation, namely that learners learn best from resources to which they can most closely relate, resources produced by other learners like themselves, and that this process validates them as worthwhile participants in and contributors to the learning of other learners (Dyson, 2012). They are no longer just consumers. These resources may be content, meaning learners can produce and contribute to ideas and images – perhaps, stories, explanations, examples, opinions and anecdotes.

Learner-generated resources resonate particularly with cultures that learn from stories and resonate with the ideas of digital storytelling (Prins, 2017; Robin, 2006). They also align with the learning implicit in citizen science (Bonney et al., 2009; Newman et al., 2012) and with the preservation and transmission of Indigenous knowledge (Kapuire et al., 2016; Maasz et al., 2018) and folk skills. For any group of learners, for example, teachers in training, these could be shared assets, archived and tagged alongside curated external resources, endorsing their validity and value. Learner-generated resources need not be textual; they could be visual, in the form of images or videos, and if shared on a platform like YouTube, enable commenting and discussion among viewers and learners, inside and outside the local community of teachers. Learner-generated resources have echoes in the UK literacy campaigns and worker-writers of the 1970s/1980s, demystifying the idea of “writing” as being elite and “other”. Many of these groups and communities published the poems, narratives and autobiographies of their learners (Pollard, 2012; Woodin, 2005).

## 4.3 Game mechanics

Information, ideas and opinions now emerge and change rapidly, and there is often no stable or authoritative source for much essential learning or training, including teacher development. So, it is important for communities of users to be able to evaluate resources among themselves and to develop their own judgments. This involves developing the skills by which users can critique and review digital resources and, crucially, can then critique and review the reviews of others in their community and understand each reviewers’ strengths and weaknesses, the likes and dislikes of colleagues within their community, in the case of other teachers, enabling the growth of a self-critical community able to calibrate each other’s judgements.

This is where we need to exploit the mechanics of games, functionalities such as points, badges (Ostashewski & Reid, 2015), levels, leader boards, etc., which allow users to compete, compare and collaborate. There is an ongoing development, and some reviews (Callaghan et al., 2016; Chorney, 2012; Kim, 2015; Kusuma et al., 2018; Lamas et al., 2017; Seaborn & Fels, 2015) provide systematic frameworks linking learning and game attributes, outcomes, feedback and roles, including the kinds of levels and roles we describe here. These can be combined with the

stars, likes and reviews more commonly associated with online retailing and entertainment – for example, Goodreads, iTunes, Duolingo, YouTube, and Amazon – to provide systems that allow learners to be more resilient, collaborative, creative, active, critical and autonomous. Whatever precise form evolves and whatever technologies are co-opted, the underlying motivation is moving users from creating content to engaging critically but constructively with each other by processes of rating, reviewing and responding.

#### **4.4 Blogging**

Blogging is not explicitly a pedagogy but might be considered as an outlet for user-generated writing, an online form of expression giving wider visibility to users' ideas, experiences, opinions and perspectives and, thus, potentially increased self-esteem and self-confidence (O'Donnell, 2006; Salen, 2007). Open-source systems, or “freemium” systems, such as the popular [WordPress](#) or the mobile-friendly [GoDaddy](#) are widely used.

Blogs are often incorporated into innovative academic assignments. Most blog packages allow reactions and comments from readers, and this would be a way to engage fellow users. For higher-level courses, for example, teacher development, especially for those teachers in under-represented languages, such as Hindi, Bengali, Swahili, Malay, Urdu, Tamil, Afrikaans, Welsh, Gujarati, Māori, Maltese, Tongan, Yoruba, Wolof, Zulu, Swazi, Xhosa, Shona, Eastern and Western Punjabi, it is possible to create mother-tongue Wikipedia entries as an assignment, perhaps describing their school, villages, livelihoods, their flora and fauna, geology and landscape, and history. There are also a variety of technologies, Google Sites, for example, with the functionality to create websites. These could be used in a similar way as an assignment for teachers. Both of these strategies have the virtues of user-generated resources described earlier.

#### **4.5 Project-based learning**

Users, in our case, in-service teachers, can be engaged and supported in individual learning tasks, generic ones, such as natural history, local history, family history, urban geography, citizen science, personal reflection, creative writing and physical exercise, or professional ones, such as developing teaching resources, devising assessment tasks, or making podcasts, videos or recordings for their learners; 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; Smith & Gurton, 2020). Citizen science, described elsewhere, could grow from teacher development, perhaps with online cohorts of teachers globally or locally gathering pollution data, traffic data, wildlife counts, community health data, or climate data.

#### **4.6 Personal learning environments**

The notion that users should adapt and adopt those tools that most suit them and their needs and preferences, irrespective of institutional or organisational priorities or provisions, is

conceptualised as personal learning environments (PLE) as an antidote to the institutional momentum, focus and values of the default and widespread virtual learning environment (VLE) (Dabbagh & Kitsantas, 2012; Wilson et al., 2007). Again, this is a concept intended to enhance user agency, self-efficacy and personalised lifelong learning and could be promoted alongside MOOC platforms.

#### 4.7 Heutagogy

Sometimes called self-directed learning, heutagogy (Blaschke, 2012; McLoughlin & Lee, 2010; Moore, 2020) comprises the principles and practices that enable users to manage and control their own learning. Heutagogy is based on the principles of human agency, self-efficacy, reflection and metacognition, and the learner is actively involved in the learning process and decides what they will learn and how and when it will be learnt. Learning takes a non-linear path, determined by the user, and assessment is collaborative, decided upon between trainer and user, for example, through the use of learning contracts, learner-directed questions, flexible curriculum, and project-based learning (Blaschke & Hase, 2015). Advocates of heutagogy talk about its “double-loop” learning (Eberle, 2013), meaning, in essence, learning about learning – learning about one’s own learning as one directs it.

Ideas similar to these have been developed in the UK as “[community open online courses](#)” saying, “[w]e want to change, or enrich, communities, help people create their own learning and sharing spaces and work together to see how learning outside the institutions can take shape”, making the point that “[b]y developing our skills to teach, we also become better aware of what we need to learn. We stop the temptation to wait for experts and people external to our communities and start to look to ourselves as producers, creators, explorers and creators. By teaching AND learning, we become active participants in the world around us. We shape the world rather than only being shaped by it” (Preston & Younie, 2014). We argue, however, that the community, not the platform, is the crucial component.

#### 4.8 Mobile learning

Currently, mobile learning often means small-scale subsidised high-tech pilots (Kukulka-Hulme & Traxler, 2005; Traxler, 2008) but should mean learning adapted and appropriate to communities and societies characterised, each in their different ways, by massive movement and connection (Traxler, 2018a). It would subsume several of the other pedagogies we describe here. Our emphasis in relation to all of these is those aspects that encourage ownership and control within communities rather than 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, but mobiles reach furthest into any community. With mobiles, this includes bandwidth, connectivity and costs (Traxler & Crompton, 2020). *Mobiles first* is the best design principle but needs continued research and

development to explore what this means in terms of pedagogy, as well as interaction design and interface design for different and diverse communities of teachers (Kukulka-Hulme & Traxler, 2020; Royle et al., 2014). Design processes must build in “design justice” (Costanza-Chock, 2020) that 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.

#### 4.9 Open learning

This is 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 learning freely available and should make their resources freely available with no restrictions on copying, adaptation and distribution. OERs (Atkins et al., 2007; Butcher, 2015), often housed in freely accessible repositories, are the most mature aspect of open learning. Other aspects include open textbooks (Pitt et al., 2019), open teaching or open praxis (Cronin, 2016, 2017; Cronin & MacLaren, 2018), though, obviously, the origins of much of “open” ideology is the Global North (Laurillard, 2008). Unfortunately, the concepts and ideals of “open learning” have shrunk in practice to mean OER and open textbooks, while critics of OER in Africa have referred to it as “information imperialism” (Mulder, 2008) and “digital neo-colonialism” (Adam, 2019) and others have worried that the schemes of metadata are not culturally neutral (Traxler, 2018b).

We should not overlook the growth of open-source operating systems and software tools, free to download, install and modify (O’Reilly, 1999; Von Hippel, 2001) in minority languages, such as Swahili, and the extent to which they can empower users and how teacher development can support these initiatives. Other aspects of “open” include open innovation (Gassmann et al., 2010; Huizingh, 2011), open data (Johnson, 2014; Molloy, 2011), copyleft (Heffan, 1997) and open development (Chib et al., 2021; Smith & Reilly, 2014), the application of the open movement to international development.

There is often an inherent paradox in much open learning intended and designed to empower learners, to raise their self-esteem and self-efficacy in that it can be quite uncritical of the authority of its content and teachers and of the “closed” command-driven institutions that deliver it, irrespective of their business model – a sense in which “open” learning is intended to empower learners but only so much, only so far, and no more. This might be especially poignant for teachers working in hierarchical and “closed” education systems.

There are also concerns that many aspects of the wider “open” movement merely increase digital, economic and educational divides by privileging the privileged, those with the educational, digital or financial capital, to exploit the “open” resources and opportunities. This cannot be solved by the privileged, whoever or whatever they may be, working “for” or “on” the

less privileged, because this merely entrenches their privilege, but must be a process by which the privileged examine their own attitudes, resources and history and by which the privileged work “alongside” or “by” the less privileged. All Web 2.0 technologies – but not Web 1.0 technologies – have the capacity to facilitate the empowerment of communities. So is critical teacher development, the movement to decolonise the curriculum, another part of such a process – one where teachers and teacher development have a vital part to play.

#### **4.10 E-moderation**

E-moderation is the set of techniques designed to incrementally transform a group of online learners, dependent on their tutor, into a self-reliant and self-sustaining group of learners functioning independently. These techniques have been set out for networked learning (Salmon, 2003) as an easy five-step programme and adapted to a limited extent for mobile learners (Brett, 2011). There are, of course, cultural dimensions to such a process, for example, moving the locus of control from the teacher and the institution to the learners and their group.

#### **4.11 E-portfolios**

Digital collections are created by a user or a trainee teacher in this context (Xerri & Campbell, 2016) of their work, for example, essays, posters, photographs, videos and artwork. These might capture other aspects of their life, such as volunteer experiences, employment history, extracurricular activities, and more. They document learning and make it visible. A good e-portfolio is both a product (a digital collection of artifacts) and a process (of reflecting on those artifacts and what they represent).

Versions are being used in low-resource settings, using mobile network coverage, or are being used offline and synchronised whenever network coverage is available, for example, PebblePad (<https://www.pebblepad.co.uk>). Open-source systems, for example, Mahara (<https://mahara.org/>), are available (Attwell, 2007; Roberts et al., 2005). They can provide the necessary evidence for admission to employment, training or formal education (Heinrich et al., 2007; Wuetherick & Dickinson, 2015). If used within a community of practice, they would enable the critical review of shared learner-generated content. They could include and collate posts and contributions from across an MOOC portfolio of courses and create a sustainable community of practice, along with a record episodes of micro-learning (Buchem & Hamelmann, 2010).

#### **4.12 Digital literacy**

Digital literacy (Bawden, 2008) is the foundation of digital learning and of living, and working in digital societies, and for teachers, it is the foundation of their digital professionalism (Labbas & Shaban, 2013). It consists of all those skills, attitudes and information needed by people and communities to survive, flourish and prosper in their respective digital societies. Digital literacy,

as a curriculum, has been most extensively developed in Europe (Martin & Grudziecki, 2006; Tornero, 2004), but often with too much emphasis on employability and job skills and on consumption and consumerism, and not enough emphasis on social, civic, cultural, political or creative aspects of living in digital societies (Goodfellow, 2011).

Two additional aspects are often overlooked:

Criticality – meaning scrutiny, evaluation, scepticism and judgement – is an important component of digital literacy, necessary to separate the good from the bad, the harmless from the harmful, and the benign from the malign, and to generate questions about the consequences and provenance of digital activities and resources (Hinrichsen & Coombs, 2013; Pangrazio, 2016; Pötzsch, 2019), asking not simply what are good resources or bad digital resources, but why are they produced, whose interests they serve, whose interests they damage, what they promote, and what they impede. Critical digital literacy is a crucial attribute of resilient, functional democracies and, thus, for teachers is a crucial component of any “civics” curriculum at whatever level (Darvin, 2017; Polizzi, 2020).

There is a necessary educational relationship between open learning and criticality (Farrow, 2017); uncritical open learning is potentially problematic.

Culture – meaning the language, traditions, values and livelihoods, specifically of small or informal communities at the margins of their nations – can often be fragile and vulnerable when compared to the language, technology, values, prestige and power of the “information superhighway” and the “global knowledge economy” and of international corporations and agencies, especially when these are all espoused by national governments and national education systems. For small and informal communities away from the mainstream, for example, pastoral, nomadic, stigmatised or indigenous peoples and their cultures, the “information superhighway” and the “knowledge economy” represent enormous and complex threats and opportunities.

Teachers in these communities have a responsibility to understand, analyse and explain these threats and opportunities, giving their communities the chance to make critical, robust and informed decisions. Teacher development plays a crucial role in this process and critical digital literacy is that part of the teacher development curriculum where this should happen, underpinning all the other aspects of digital pedagogy outlined earlier (Darvin, 2017; Domeij et al., 2019; Nedungadi et al., 2018a; Prayaga et al., 2017). These issues are, however, not limited to the low-income countries of the Global South; they also apply to minority communities in the Global North, for example, in Europe, the Sámi, Welsh, Breton, Roma, and numerous different refugee communities, to mention some specifically Western European examples.

Critical digital literacy is crucial to empowering learners and their teachers to reconcile 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.

### 4.13 Technologies for pedagogies

The following list is indicative and intended to focus on simple, free tools. Some of these are very mobile-friendly and light on data and bandwidth. Some come as “freemium” tools, meaning the basic functionality is free, but extra functions, storage or users require a subscription or a fee; sometimes, the fee is charged just for removing advertising. Sadly, most of these tools are only available in varieties of English – usually American, sometimes British – rarely any other, or some other major European languages. There may be other limitations depending on the context and situation. We must bear in mind that while many of these systems are nearly universally known, accepted and used, they are almost all expressions of global digital culture in terms of, for example, icons, interfaces, images and interactions, derived from mostly the culture of North America, not of any individual local culture. Any of them could be used independently by teachers, trainees, schools or education ministries, or perhaps be coupled, loosely or tightly, with MOOC courses and platforms.

There are, of course, very comprehensive integrated systems from Google, Apple and Microsoft that embrace much of all of the tools and functions we describe, and many tools combine a range of functions beyond their core or original function:

- Tools for hosting and sharing communities, content, resources and profiles, acting as landing pages or portals to other tools: groups in *Facebook*, *Google Sites*, *LinkedIn* or *WordPress*.
- Tools for storing and sharing content: *Dropbox*, *Amazon Cloud*, *Box*, etc.
- Tools for hosting different kinds of content: *Nextbook*, *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: *Twitter*, *Skype*, *Adobe Connect*, *Slack*, *WhatsApp*, *Gmail*, *Padlet*
- Tools for finding content: *Google*, *Bing*, *DuckDuckGo*
- Tools for e-Portfolio: *PebblePad*, *Mahara*
- Tools for conducting online quizzes/discussions: *Mentimeter*, *Kahoot*, *Padlet*, *Survey Monkey*, *Socrative*, *Google Forms*
- Tools for implementing game mechanics: *EasyChair*, *ZeroDivZero*, *Microsoft CMT*
- Tools for content creation and presentation: *Prezi*, *QuickOffice*, *Kingsoft Office*, *Sliderocket*
- Tools for helping learners to schedule and prioritise their learning: *Trello*, *Basecamp*
- Tools for coordinating tasks and discussions: *Doodle* and *Eventbrite*



- Tools for brainstorming learning tasks and activities: *SimpleMind+*

#### 4.14 Summary of pedagogies

Pedagogies clearly overlap when it comes to actual techniques and implementation and may vary according to curriculum, culture, modalities and infrastructure. Many of them would underpin critical, active and authentic lifelong learning, which, in the current context, means in-service teacher development. They can be introduced incrementally and in low-stakes settings. A closer scrutiny would reveal many shared principles and many shared techniques, perhaps with a changing terminology and a changing emphasis.

In any specific context, a design process intended to produce a viable, appropriate and sustainable learning ecosystem, embracing and interfacing with the established MOOCs, would define roughly what this might mean and then identify the “design space” (Kang et al., 2010; MacLean et al., 1991), meaning identifying all the different types of constraints and contributions that limit the designer’s options or freedom, which might be technical or infrastructural or financial, but just as likely might be cultural, linguistic or organisational, in order to juggle the various combinations and connections of tools and their functionality to find the optimal combination that would be the learning ecosystem. Existing MOOC provision would form part of this space, defining what is needed that is not already being done. Incidentally, the term “community MOOC” has been used (Traxler, 2018c). Building on early initiatives, De Waard et al. (2012) describe these informal learning spaces that can be improvised from existing popular technologies.

Finally, we must be cautious and concerned that most, probably all, of these ideas and techniques come from the cultures and communities of the Global North and represent the values and traditions of a basically European heritage transformed into the practices of contemporary digital learning. This, at its simplest, is problematic in terms of perceptions of forms of digital colonialism mentioned elsewhere. Furthermore, we must recognise that culture, for example, ideas of any culture about knowing, are crucial to successful learning, and we must recognise that cultures are different from each other. What is more difficult is identifying and calibrating the ways and the extent to which they are different and specifying how these impact the learning of different cultures.

To choose some examples, cultures differ in their attitudes to risk-taking as opposed to risk-avoidance, to individualism as opposed to community, to hierarchy and authority as opposed to egalitarianism and discussion, and to cooperation as opposed to competition, and all of these might have implications for, say, games-based learning, group projects and assessment strategies. What works in one culture may not work in another. There is, however, nothing as simple as a monolithic national culture. Every learner is at the intersection of several different



cultures – the local, traditional and informal and also the global, modern and structured, while existing in a culture that may be urban or rural, old or young, female or male.

There is, of course, the counterargument that digital technologies and much learning, especially learning in formal higher education and corporate training, are globalised and that countries and organisations are all aspiring and trending towards global standards and global formats.

#### **4.15 Conclusions**

Our purpose in this section was to alert the designers of MOOCs, both MOOC platforms and MOOC courses that support and deliver teacher development, to a range of pedagogic possibilities that might align with the pedagogic styles and technical resources of specific communities in low-income countries and disadvantaged regions. The intention of this section was to increase the extent of local ownership, participation, capacity and contributions in the context of global courses and platforms. One way forward might be to explore how specific mixtures of these pedagogies could work alongside global MOOCs for a specific community or culture, and to do this using local facilitators, implementers and designers. Some of these pedagogies could gradually be designed into the MOOC platforms and courses. We are now in a position in educational technology to exploit the “longtail” of highly individual or local needs and attributes seen in the “mass customisation” already exploited commercially (Seely Brown & Adler, 2008).

## 5. Technological Options

### 5.1 Assumptions, comments and observations

This section follows on from the Pedagogic Options section and looks into the hardware and systems technologies that might support and deliver pedagogies, both emerging pedagogies and established ones embodied in MOOC platforms. We must, however, consider technological constraints and barriers before the hardware and systems technology options and recommendations that would deliver pedagogic options. Both technological constraints and barriers and technological options would be highly specific – specific to infrastructure, specific to technology, specific to demographics, specific to culture, and specific to a host of other very unsystematic attributes. Some basic assumptions around these barriers and constraints are needed:

- teachers have mobile phones, but coverage and connectivity may not be continuous, predictable and reliable; mobile phones would not all be current models or top of the range – they may be “grey” imports; remote rural teachers may only get network coverage or electrical charging once a week when going to a market town or to training events
- teachers have intermittent or occasional access to laptop or desktop computers and perhaps access to cheap or free WiFi in municipal, commercial, retail or school spaces or some public transport
- course developers, for example, working on MOOCs, produce most of the high-bandwidth content – for example, video, images, audio, reference material and course content – before courses actually go live; users might be able receive this as a CD, USB memory stick or free WiFi download at the start of the course and subsequently access minimal online traffic synchronously as low-bandwidth corrections, chat, updates, circulars, etc.
- course developers could avoid images and video and could also use data compression techniques
- buildings may be insecure and mains electricity unreliable; mobile network, inadequate or unreliable coverage, especially for 4G in rural, sparsely populated, inaccessible, hostile, conflict or hilly areas
- mobile network coverage is a complex and changing outcome of geographical environment, regulatory environment, licensing conditions and commercial considerations; technology will continue to improve but will not always be deployed equitably or evenly; metropolitan areas, tourist areas, business districts and major highways are likely to be among those areas attracting network infrastructure investment first.

We must remember these assumptions and the possible distinctions between hardware and systems technologies that can enable existing MOOC platforms to reach more diverse and disadvantaged regions and those that can support the kinds of pedagogies we outline in the preceding section.

Bearing in mind these constraints and barriers, in general, we must also consider how these possible technological examples and options map differently onto the mobile phone and computer. There are obvious implications in terms of access, covering issues like functionality, connectivity, portability and affordability. Functionality includes differences when comparing computers with mobile phones on the availability of apps, the ability to manipulate files, the facility to connect extra peripherals, and overall storage capacity. Of course, within each category, there are wide differences, synergies and overlaps in all of these attributes.

The delivery and support of digital learning for the geographically “hard to reach” and the infrastructurally underserved is not a new challenge. The past two decades has seen a variety of technological solutions at different times in different places. Looking back, there are a couple of points to make – firstly, the personal mobile phone is the primary or sole technology for most people, teachers included, and secondly, sustaining and embedding systems is an ongoing challenge.

## 5.2 Mobiles and sustainability

On the first point, the primacy of the personal mobile phone is due to it being pervasive and ubiquitous, accessible and familiar, social and recreational, and, crucially, being the portal to social media, financial and retail services, the “global knowledge economy” and “the information superhighway”, but also the fact that, unlike laptops or desktop computers, providers of services, including the providers of educational services, do not need to provide the phones that users choose. In fact, practically every individual, including teachers in low-income countries, prioritises owning one.

Many users in the Global South now also own tablets, possibly less expensive, based on Android technology, sometimes “grey” models that have come onto the market through irregular channels, some network-enabled or “tethered” to a nearby mobile phone, effectively a local “hotspot”. The availability of wireless connectivity in public, retail or commercial spaces continues to increase.

Considering the mobile phone, we must remember that there are various ways, not just geographical or infrastructural, in which people or communities can be “hard to reach”. For the socioeconomically “hard to reach” – namely the illiterate homeless in Europe – the *m-learning* project (Attewell & Gustafsson, 2002) funded by the EU in the early years of this century built

on the finding that the homeless would still own a mobile phone and, thus, this had to be the portal to the literacy and numeracy resources being provided.

A decade later, the *Dr Math* project, based in the Meraka Institute, connected township learners with maths mentors using MXit on their mobiles (Botha & Butgereit, 2012); the *SEMA* project in Kenya used short messaging service (SMS) to support national in-service training for primary teachers (Traxler & Leach, 2006); and the BBC used mobiles to teach English in Bangladesh (Walsh, 2011). Also, recently, the British Council in Southern Africa used WhatsApp (Hockly et al., 2021) to teach English to young learners during school closures. These are just some examples that illustrate general trends and assumptions and raise general questions.

So, an assumption is that the mobile phone would reach the “bottom of the pyramid” (Stanfield, 2015), equating this with all forms of “hard to reach”. Of course, this is flawed in that the most disadvantaged, those at the bottom of the pyramid, are obviously without even a mobile phone. Hopefully, however, teachers who are in-service would not be at the bottom of the pyramid.

The mobile phone raises specific issues about sustainability since sustainability may depend on learners meeting the cost of connecting and interacting, on networks finding an alternative revenue stream, or on governments committing public funds. In the case of courses running on a MOOC platform, sustainability means meeting the cost of maintenance in the sense that the courses need updating and refreshing, further courses need to be developed, and the platform itself needs maintenance, either perfective or adaptive, as conditions and requirements evolve. However, there can be challenges in sustaining and embedding because of several overlapping factors, for example, lack of a business model generating revenue, lack of evidence to alter national priorities and resources, lack of continued new content, or lack of community buy-in.

### **5.3 Component technologies and options**

This section looks at some hardware and system technologies and how they have been used in order to consider how they might either enhance or complement the uses of global Web-based services such as MOOCs.

#### *5.3.1 Messaging*

The simplest form of SMS is universal and widely understood. There are, however, many powerful extra functions. These can be exploited at considerable discounts when the number of users is large, can generate income when users reply at premium rates and can be adapted to a range of educational uses, including tests, quizzes, surveys and queries, both qualitative and quantitative; data capturing and processing, for example, citizen science projects and supporting group chats, forums and seminars. Broadcasting SMS and functions, such as mail merge, can all be accomplished easily from a Web-enabled laptop.

Many schools in low-income countries and conflict areas already have such systems. The functions are defined as either those where the user initiates the interaction, mobile originating (MO), or those where the system initiates the interaction, mobile terminating (MT). They are usually commissioned or procured through value-added suppliers (VAS), with privileged access to the mobile network operator (MNO), sometimes cheaply due to profit-sharing agreements between the MNO and VAS.

Clearly, SMS initiatives must be regionally based, working with MNOs with multinational coverage, but this can pose problems in terms of equitable access for users subscribed across different and differing competing networks (Cavus & Ibrahim, 2009; Petrova & Li, 2009; So, 2009). The SEMA project (Traxler & Leach, 2006), part of a wider programme for in-service primary teacher development across Kenya, emulated VLE functionality and pedagogy, but with mobile phones and SMS as the digital component, within a blended distance learning format. This was an attempt to embed the social constructivist pedagogy espoused – but not usually enacted – by the VLEs used in universities, colleges and schools in the Global North and sometimes in the Global South. It also used the system to deliver the national digital educational management information system (EMIS). Technologically, the system was a success in terms of coverage, capacity and functionality but was not a success in terms of aligning with the culture and organisation of education systems in Kenya.

MXit was a comparable technology unique to South Africa, widely used by young people, who adopted [Mxlish as their language of choice](#) and exploited very successfully the *Doctor Math* project linking them to maths tutors (Botha & Butgereit, 2012).

WhatsApp is, in some senses, the successor to SMS and MXit in its appeal to educationalists. It is being widely used to teach languages and support students over large areas, for example, by the British Council across all of Southern Africa (Hockly et al., 2021; Moodley, 2019), rural India (Nedungadi et al., 2018b), by teachers in South Africa (Thaba-Nkadimene, 2020), Indonesia (Setiawan & Iasha, 2020), Ghana (Owoo, 2017), Zimbabwe (Maphosa et al., 2020) and Jordan with refugees (Motteram et al., 2020). Increased deployment has been spurred on by the global pandemic. It is sometimes blended with or into VLE/LMS provision, and these uses would suggest ways it might blend with platforms such as MOOCs.

### 5.3.2 *Speech technologies: Text to speech, speech to text (IVR)*

Interactive voice recognition (IVR) is the technology familiar to consumers accessing voice-activated menus systems to reach the service or product they require. IVR has been used educationally to support language learning (Grujić et al., 2012; Madaio et al., 2019; Moloo et al., 2018; Motiwalla & Qin, 2007; Wilder, 2011). The lack of support for minority languages, dialects and accents is potentially a barrier to wider and more equitable uptake.

Many apps and systems can now read aloud from text (King, 2014; Sasirekha & Chandra, 2012). This is valuable for absorbing content without a visual distraction, for example, when driving, and for learners with inadequate literacy; in fact, it might even be an aid to literacy, as learners follow the text on-screen while listening to it read aloud. Minority languages, dialects and accents are, however, not well-served.

The opposite, namely speech to text, can also be incredibly effective built into systems working, for example, with individuals with low literacy or manual disability. However, it is available only in areas of good connectivity and with only a narrow band of languages and dialects. Speech recognition – mostly used to give spoken rather than typed commands to computers, phones, speakers, and other hardware – has similar uses. Speech recognition and text-to-speech are often available as application programming interfaces (APIs) for use in larger systems or as apps on mobile phones and tablets. There are also various audio-enhanced techniques that increase access to content, such as lecture capture, podcasts, presentations with voice-over, and data with compression (Barnes et al., 2005; Pastore & Ritzhaupt, 2015) that would enhance access and variety across poor infrastructure.

### *5.3.3 Universal Serial Bus*

USB devices, specifically high-capacity memory sticks, can distribute much content and functionality for systems such as LMS/VLEs (see below). Beni American University in Nigeria supports a number of public universities in the country. It has a technological solution to issues of low/poor bandwidth and low/poor access. Courses – that is, structure and content – are issued by post on a USB memory stick; the student plugs this into a networked computer, and this initiates a synchronisation process, bringing minor updates, chat, messages, feedback, and announcements down to the student and taking assignments up to the university server.

In addition, the memory stick acts as the route through the university paywall. Something similar could be done at a country level to support global systems such as MOOCs with the right mixture of admin and postage resources and prioritisation of remote low-bandwidth regions (Frank, 2012; Garrote Jurado & Pettersson, 2011; Mukhopadhyay, 2017), mixing global and local resources.

### *5.3.4 Fixed wireless networks*

Researchers often point out that rural communities are neglected in the rollout of communication infrastructure, delaying or even preventing the delivery of common digital services that are now ubiquitous elsewhere, and so addressing this technological gap is of paramount importance. Wireless Mesh Networks (WMNs) provide a reliable and cost-effective way to extend coverage in a rural fixed network. Mesh technology extends coverage to provide rural telecommunications services.

For rural scenarios, the infrastructure network provides connectivity to the Internet using Wi-Fi, while the routing capabilities of the nodes provide improved connectivity and coverage around WMNs (Bernardi et al., 2008; Köbel et al., 2013; Naidoo & Sewsunker, 2007; Yarali et al., 2009). Much of this work has taken place in South Africa and has allowed internet connectivity to be piped into a dispersed rural community. There have also been trials to exploit deployments of television white space (TVWS), the vacated bandwidth previously used by analogue TV across rural areas.

### *5.3.5 Open-source software*

All the variations on Unix and Minix are OSS, many with a vast user base and an enormous number of tools, with graphic user interfaces available in many of the languages of low-income countries. Several versions, notably Xubuntu and Lubuntu, both derived from Ubuntu, are intended to be more energy efficient and less demanding on hardware resources, allowing older and less powerful laptops to have an extended lifetime and utility.

Lubuntu is supported by a full range of apps and tools, including a browser, office suite, email client, and many others. As with much OSS, Lubuntu requires some basic technical skills to download and install but is available as a ready-made package from multiple sites and repositories. However, for anyone with the necessary technical skills, there are also affordable – meaning under 50 Dollars – single-board computers (SBC), of which the Raspberry Pi is the best known, supported by an enormous range of accessories and peripherals and enthusiastic and communicative users, allowing them to be assembled into effective working computers. Certainly, such a project would be within the scope of teachers of technology and geeks and nerds within any community.

### *5.3.6 Virtual learning environment/Learning management system*

These are usually mainstream, off the shelf, sometimes open source, for example, Moodle, MooKIT, WebCT, Canvas, Blackboard, and sometimes customised and branded locally. They are not necessarily suited to large-scale remote learning, especially in the face of infrastructure and connectivity challenges and may require training and support before users become confident and competent. It is worth remembering that any virtual learning environment (VLE) or learning management system (LMS) is, in essence, just two databases (namely, content and students), some logic and some interfaces.

Much of the logic is, however, recording academic progress, fee status, regulatory requirements, etc., and would seem complex and irrelevant for unassessed open courses. Building a basic proof of concept should not be difficult or expensive. Alembic, built at the University of Wolverhampton, was one such prototype for informal learning in rural areas. Images were kept to a minimum and compressed, and the static VLE branding was downloaded and stored locally



at the initial login. There are now several other LMS/VLE versions available and distributed on USB memory sticks (Hillier, 2018; Houser & Thornton, 2005; Marcial et al., 2017).

MooKIT (<https://www.mookit.in>) is an interesting and important development, recognising the prestige and visibility of the MOOC format and platforms and, at the same time, recognising the need for smaller institutions and communities to build their own. It enables these to build their own platform and deliver their own courses running an open-source server (Zhang et al., 2019). It is adaptable to varying bandwidth, from video (when high), audio (when modest), or via phone (when low). Videos can be downloaded, and content can be cached locally. Both iOS and Android apps are available.

We should, however, be aware that any of these complex systems embody a specific pedagogy, namely social constructivism, one that originates from Western European educational thinking and that this may not necessarily be appropriate to the training of teachers in other cultures.

### *5.3.7 Knowledge resources*

The Meraka Institute in Pretoria developed MobilED, a prototype system intended to help learners with simple mobiles get facts and information. The “mobile audio Wikipedia” was accessed by learners sending an SMS with a key word. The service searched the database, in this case Wikipedia, finding an entry, called back and played the information using text-to-speech conversion, leaving a sound file in the caller’s voicemail. The service could be used through any database, not just Wikipedia, and could thus be local or user-generated. Earlier simpler systems allowed learners to use SMS to query a database, for example, to look for foreign language vocabulary (Pincas, 2004).

### *5.3.8 Artificial intelligence (AI)*

In the early days of digital learning, the introduction of LMS/VLE into the education sector offered not only the apparent pedagogic benefits of social constructivism whereby learners built their understanding by discussion but also the managerial attractions of transparent quality assurance, substantial economies of scale, increased competitiveness, improved cost-effectiveness, and reusable resources. It represented something like the industrialisation of education and helped the sector in many countries deliver on political commitments to increased access, wider participation and greater inclusion.

This model of “mass production”, modelled on ideas borrowed from manufacturing, might be followed by ideas of “mass customisation” already widespread in, for example, the making of clothes, cars, housebuilding and computers for the Global North. This was the notion that algorithms could cost-effectively introduce variety into products, case courses, curricular and pedagogy (Hanna & Barman, 2014; Pham & Jaaron, 2018; Pierson, 2011; Schuwer & Kusters,



2014), thereby reaching the “long tail” of learners with previously unmet needs, attributes and ambitions (Seely Brown & Adler, 2008).

The current systems already provide educators with data on learners’ online behaviour, now known as learning analytics. The ongoing improvement in AI and renewed interest in “learning analytics” (Leitner et al., 2017; Viberg et al., 2018) promise that something like “mass customisation” will have real benefits for education. Promotion and publication by agencies such as UNESCO, the United States Agency for International Development (USAID) and Edtech Hub suggest potential benefits in low-income countries and disadvantaged regions. Conversational AI systems like *ChatGPT* are becoming widely and freely available to users with adequate bandwidth and digital skills, certainly including teachers and teacher developers.

### 5.3.9 Recommendations

Recommendations for technologies to support teacher development across a wide range of situations and contexts, specifically those that would favour diverse low-income countries and disadvantaged regions, must obviously be fairly flexible and high-level, especially given the rapidity of technological change and the rapidity with which communities appropriate and adapt these technological changes; one only has to reflect on the global “missed call” or “please call me” phenomenon to see how quickly individuals and communities can subvert a technology intended to make a profit out of them or enforce behaviour on them (Donner, 2007).

Pulling together our technical and pedagogic options and bearing in mind the diversity of situations and environments in low-income countries and disadvantaged regions, we see a strong argument for a mix of global content, delivery, administration and quality assurance delivered by platforms such as MOOCs, complemented by local mentorship and discussion, support and user contributions delivered across social media, mobile networks, user devices, and offline media.

### 5.3.10 Design

Recommendations focused on design principles are generic and universal but must always be locally relevant; designers working on remote global courses and local technologists working on supporting these can all optimise the availability and accessibility of the courses by adhering to some principles of inclusive design (Clarkson et al., 2013; McLoughlin & Oliver, 2000; Reedy, 2019) and mobile-first (Herrington et al., 2009; Kukulska-Hulme & Traxler, 2020).

The [underlying principles](#) of inclusive design have included the following: Equitable Use; Flexibility in Use; Simple and Intuitive Use; Perceptible Information; Tolerance for Error; Low Physical Effort; Size and Space for Approach; and Use. Examples and explanations are widely available. Also, the experience, tools and methods of the human-computer-interaction-for-development (HCI4D) community would be a useful and valid input (Anokwa et al., 2009).

For local technologists working in low-income countries and disadvantaged regions, open-source systems extend the range of possibilities for local adaptation, using tech-savvy community members and pushing for meaningful localisation. The principles of co-design (Steen, 2013), participatory design (Muller & Kuhn, 1993) or user-centred design (Chammas et al., 2015) would all involve and empower the intended user community, namely teachers rather than ministry officials, and produce systems that are culturally sustainable.

We are talking specifically about teacher development in low-income countries and disadvantaged regions. For an MOOC platform, part of the design process necessitates articulating the minimum or threshold user infrastructure and technologies that can be supported by the MOOC platform – for example, users must have access to minimal connectivity and occasional access to a networked laptop or desktop computer. It must also necessitate the highest specification that course developers can be allowed to deploy in order to ensure equitable access and participation. This is clearly a compromise between the quality of the educational experience and the extent of its accessibility. We might expect teachers to have slightly more educational, economic and digital resources than their immediate neighbours in these countries and regions, but there would also be the advantages of urban teachers over rural teachers in any country and other such dimensions of disadvantage and differences from country to country.

Starting at the global level, the task is to ensure that what is broadcast on the Web is as accessible as possible, meaning exploiting any techniques that reduce the necessary bandwidth and perhaps mirroring it locally. Users at the local level can access it, initially as USB, as CD or as free WiFi download as effectively and flexibly as possible when courses start, and then as reliably and cheaply as possible for the duration of the course. At a local level, this could be complemented by locally organised messaging, perhaps through a local web-based platform, or email, or texting. At a local level, the pedagogies we outlined in the previous section could be adapted and deployed. Details might vary locally, but this kind of mix would enable local support to foster communities of practice and more active, situated, social and mobile lifelong learning, and would reconcile many of the tensions mentioned earlier.

This approach is similar to one advocated in *The Policy Brief, The Digital Multiplier Model for Teacher Professional Development at Scale* (Laurillard & Kennedy, 2019), proposing a model of teacher professional development using large-scale online courses or MOOCs to provide teacher professional development directly to local teachers, supported in local face-to-face groups. The “multiplier” element refers to the judicious and efficient use of the human components of the proposed model. Something similar was used for language teaching in Africa (Hockly et al., 2021). Our contribution is to argue for the inclusion of the pedagogies outlined in the previous section deployed on popular social media or Web 2.0 apps or programs.

Concerning working with more marginal communities, the crucial issues must be reached and infrastructure, obviously, but also the nature and balance of local versus online in every aspect of pedagogy. However, this is clearly not just an issue of language, superficial “localisation”, or responsiveness to local regulatory and organisational matters. but more fundamentally about the issue of recognising the distinctiveness of local learning experiences and expectations as an expression of local culture. For marginal communities, for example, indigenous peoples or subsistence farming communities, this may not be a simply polar tension, since their language and culture may differ from those of the national dominant majority as well as from the external ones embedded or delivered by any digital technology. Minorities should be persuaded to recognise and value their own culture, language and traditions in the face of their own deference to the apparent prestige and authority of global models. The role of teacher professional development is, however, partly to transmit or impart national standards and practices, for example, within the national school system, so there might be tension between the local and informal and the national and formal.

There is clearly a benefit in getting technology to do what it does best, for example, connecting people, delivering content, crowdsourcing ideas, etc., but technology does not have to be bespoke or even “EdTech” or “educational technology”. We are advocating those Web 2.0 and social media systems that teachers already own and use. Co-design in this context would not be the co-design of new applications, but the co-design of frameworks that integrate social media systems and provide communities with means to manage, change and control their own framework as their needs and circumstances evolve. This would build capacity, agency and autonomy at a local level.

### *5.3.11 Hardware donations*

Finally, governments, agencies, corporations, foundations and philanthropists often donate computers or other hardware to low-income countries and disadvantaged regions, and, in theory, these would make remote courses like MOOCs more accessible. However, there are some vital questions:

- Sustainable – Are there guarantees that the donations will continue year-on-year?
- Scalable – Do the donations extend across all the sectors or cohorts? Are some schools or regions left out or left behind?
- Interoperable – Do the donations work with current systems? Are the donations running up-to-date systems, software, peripherals, etc.?
- Equity – Are the donations inclusive, allowing every individual to access and exploit them?
- Comprehensive – Are there hidden costs like software licences, connectivity, teacher development, technician training, etc.?

- Aligned – Are the donations aligned to current teaching methods, curriculum materials, assessment regimes, cultural values, etc.? Do they create a “lock in” or obligation to a particular vendor, standard, system, organisation, language, foundation or country?
- Colonisation – Do the donations represent or reproduce power structures that disadvantage local, marginal, rural or indigenous communities or cultures?

## 6. Methodological Issues

This is a critical account of the methodological challenges involved in writing this report. It is an integral part of understanding and addressing the issues being tackled. It could be included in the introduction but addresses more general issues that need to be carried forward into any future work.

As researchers working within the institutions, systems, cultures and resources of the developed Global North, we must recognise that our understanding of and responses to people and communities are different, diverse and different from our own – in this case, those of low income countries and other disadvantaged communities – are skewed and obstructed by several systemic and structural factors.

Much of this report is based on published academic literature, but biases and filters operate at several different stages in working with this and similar material. At the purely mechanical level, any systematic literature search, for example, using [PRISMA](#) or [EPPI](#) would only be as good as the search terms and the filters applied and is thus subject to personal expertise and personal preference; it can never be comprehensive or objective. It would also be skewed by the biases that many authorities claim are embedded in search engines and built into AI. This can mean a small-scale search with narrow search terms, hitting only the obvious targets – perhaps the most widely cited papers in the literature – probably reinforces the prevailing groupthink or “echo chamber”. A large-scale search with wider search terms, on the other hand, produces perhaps thousands of articles and needs much greater time and expertise to scrutinise. Furthermore, if the topic of interest, methods, for example, is not mentioned in the abstract, which might only highlight findings, articles must be at least skimmed in their entirety. There is also the issue of reification. A helpful example of reification comes from Pitkin (1987, p. 263): “When Stephen Gould, say, criticize psychologists for reifying intelligence by assuming that the I.Q. test must be testing *something* ...”, intelligence is being reified. To take an example from the current report, when we see researchers writing about “mobile learning”, there is a worry that over 20 years, they think they are talking about *something* – that there is a clear, well-defined, well-bounded and unique entity being discussed, or perhaps a community with a prescribed membership, values and creed. The term might have started as a shorthand within a small community of researchers with a common discourse and shared experiences but rapidly became *something* with a life of its own that policymakers, publishers, funders, ministries, academics, technologists and the wider public captured and promoted in papers, projects, search engines and policies.

At a deeper level, there is an understandable suspicion, in both the academic literature and the “grey” literature, that failures, as opposed to successes, were seldom reported or not reported as such by either individuals or institutions and that even if they were, that the literature of development studies and of education, indeed most social sciences, frequently resorts to phrases

like “unexpected consequences” and “multicausality” to gloss over the incomplete evidence base, participant population, analytic process or theoretical framework. It seems likely that not many researchers get funded or promoted for reporting a failure and that, conversely, a cursory glance at the prestigious funders of projects would tell readers which ones are “doomed to succeed”, whatever the outcome. Furthermore, evaluators can be faced with moral dilemmas if a negative evaluation can be the end of promising initiatives. This makes the possibility of inferring, transferring or generalising to other contexts highly problematic.

Research elsewhere (Traxler et al., 2020) suggests for educational interventions, successful or not, context, in the broadest sense, including infrastructure, institutions and culture, is paramount to understanding causality and what determines success and failure. Context is, however, practically unknowable in its full extent, and so we can never truly know what causes success or failure, or whether what works in one context would work in another. So, these remarks are provided in the hope and fear of “unexpected consequences” – that some might work even though the causes are obscure, or that original failed outcomes would not necessarily be replicated in some different context.

Of course, research, or pilots, projects, interventions and initiatives, normally only happen because funders fund it, and thus what is researched, and what is not researched, reflect funders’ stylistic, methodological and conceptual preferences, including the preferences in terms of the level of complexity and sense of closure that their customers, namely and ultimately, voters, shareholders, politicians, the ministries and foundations, can tolerate. This probably favours incremental, reformative and “safe” research rather than transformative, step-change and “risky” research – though not always, as some funders would explicitly accept greater levels of risk. There is considerable suspicion that the relationship between researchers and policymaking funders is not all “evidence-based policy formation”, but rather some “policy-based evidence formation”.

Furthermore, the research that is written, published and disseminated only gets written, published and disseminated because it is a consequence of the funder’s requirements, meaning that the work of activists, practitioners, community leaders and community members may go unpublished and unnoticed. And, of course, for academic researchers, their universities would expect publications to be in English, the language of high-impact journals that affect global academic rankings and the language of the global agencies. Academics from smaller or newer universities may not be familiar with the tactics needed to get their work published and may be working in a second language (Antonakis et al., 2014; Collyer, 2018). Some of these issues have been explored further in an African context (Confraria et al., 2018; Mitchell et al., 2015).

Research on the “hard-to-reach” and much of the Global South, and subsequent dissemination and publication, is often conducted, reviewed, evaluated and read by outsiders from the Global

North, in English as we said earlier, seldom by the “hard to reach” themselves, and then usually only as fieldworkers. Measures to build research capacity in the Global South and to involve local researchers are few and far between but may also run the risk of inculcating the methods and mindsets of the Global North in emerging researchers in the Global South rather than promoting local methods and mindsets, and preserving local knowledge systems. This may happen at an institutional level, as global academic rankings promote the practices and standards of the Global North. There are clearly concerns with the worrying extent of the authority and prestige of universities from the Global North (Bradley, 2017).

The specific communities in this report could often be characterised as “hard to reach”, or perhaps from our Western, globalised or metropolitan perspectives, as “hard to understand”, though both these terms could be used. This means that, over and above generic concerns, they would be the least in contact, the least in dialogue and the least reported. Donner (2008) and others talk of the Fourth World, beyond the margins of the Third World, beyond most contact and connection, which is certainly an apt metaphor in some cases.

What, then, is, or was the answer? In terms of the wider context, there must be continued efforts to decolonise research and the wider systems within which research takes place and with which research interacts and to develop the tools, methods, frameworks and approaches to make this happen. In the current context, much still depends on critical awareness, expertise and experience, in both writers and readers.

We would argue that the research tools and techniques used to understand the learning needs of different and disparate communities, those at the margins of the global or national mainstreams, are colonial and pre-digital era, usually only poorly adapted. They are the survey, interview, questionnaire and focus group but are now often inadequate and inappropriate for infrastructural, cultural, linguistic and methodological reasons, focused on the outsiders’ understanding and interpretation of situations and contexts rather than those of the insiders’, that is, the people, their livelihoods and their environments (Traxler & Smith, 2020). This is certainly also true of the usual research ethics of projects funded and delivered from outside the Global South since these are based on highly individualistic European notions of informed consent, inappropriate for cultures with a more communal or collective ethos, with different ideas of “harm” and different attitudes to the past, the future, and the natural world.

The other half of the relationships between policymakers and researchers is the concern to produce evidence, ideas, information and data that are of use and that are understood and consumed by their intended recipients. [Building EdTech Evidence and Research](#) is a Working Group of the most influential organisations and individuals undertaking or providing funding for research on EdTech in low- and middle-income countries. Recent work, mentioned in an earlier section (Pellini et al., 2021), shows how national and international organisations rely on a chain

of data gathering and data analysis that is potentially flawed at every step, making comparisons within and across countries extremely problematic, especially when looking at remote regions and, at times of rapid change, the pandemic, in this instance. Unfortunately, errors and misunderstandings get built in at every stage. The underlying problem, probably present at every stage, from fieldworker to policymaker, is the lack of the critical capacity to ask: How was this data gathered, what does it mean, why should I trust it, how could we improve it, and what are its implications?

## **7. Recommendations**

### **7.1 Discussion and context**

The following recommendations pull together the ideas outlined in the Pedagogic Options section and the Technological Options section within the constraints outlined in the Methodological Issues section.

The recommendations are aimed at several audiences, including professionals commissioning, procuring or designing global digital platforms for teacher development or the courses presented on such platforms; policy, pedagogic and technical professionals and officials in countries and regions who might want to access, enhance or promote such courses; and the global donor, policy and funding communities who might see such courses as a possible way to deliver or enhance their specific missions. This breadth does mean that each constituency would need to instantiate and operationalise the recommendations according to their own situations, resources and responsibilities.

The research and thus the recommendations recognise the tensions, on the one hand, between delivering “at scale”, sustainably and cost-effectively and, on the other hand, working with multiple small, diverse, “hard-to-reach” and culturally fragile communities in low-income countries and disadvantaged regions.

We argue that recommendations must be based on some common principles, namely that any recommendations must encourage:

- active, sustainable, open, critical and autonomous lifelong learning appropriate specifically to teacher development in low-income countries and disadvantaged regions, and be resilient, adaptable and flexible
- support for the least advantaged and not implicitly favour the already digitally, economically and educationally privileged
- approaches that efficiently exploit global digital resources such as MOOCs while developing and deploying policies, pedagogies and technologies for sustainable local communities of practice grounded in the experiences and expectations of their own culture and environment.



The recommendations are intended to encourage ongoing discussion, refinement and improvement. This is especially important in the turbulence and uncertainty of the global pandemic with its very direct impact on education systems and its more pervasive and longer-term impact on economies, societies and systems.

There is a need to articulate the longer-term purpose and direction of those MOOC courses and platforms coming from international agencies, such as COL or the International Telecommunication Union (ITU), for example. It is clearly outside their respective remits to provide and resource an ongoing, up-to-date and comprehensive portfolio of courses. One possibility might be to consider passing them on to an established educational provider once proven conceptually and operationally. Another possibility might be transitioning from courses that develop individual teachers towards developing courses for the trainers of teachers. Both of these possibilities would need to be considered in the context of providing greater specificity for the needs of teachers in their local communities, cultures and institutions. In this context, it would be only fair to point out that the current focus on decolonising education problematises the role of courses designed, developed or just commissioned in the metropolitan Global North intended to be broadcast to the rural Global South.

The recommendations start with the more immediate, practical, concrete and specific, and progress towards the more speculative, generic and strategic.

## 7.2 Recommendations

The recommendations are as follows:

- Make a wider, richer and more flexible range of resources – in terms of tools, content and communities – available appropriately to different and diverse regions and cultures of teachers by developing permeability and synergy between evolving global MOOC platforms and courses and
  - emerging pedagogies, such as critical digital literacy, content curation, badges and micro-credentials, user-generated content, game mechanics, flipped learning, e-moderating, project-based learning, and others as they emerge
  - popular social media, Web 2.0 and mobile technologies, such as Facebook, Pinterest, WhatsApp, Twitter, podcasts, and YouTube, according to their local popularity and practices.
- Promote active learning, learner contributions, cultural sensitivity, local languages, authentic examples and social interaction by:
  - progressive redesign of MOOC courses, services and platforms for low, intermittent or unreliable bandwidth and coverage according to “mobile-first” and “inclusive design” approaches

- horizon scan to critically evaluate emerging technologies, for example, AI technologies called GPT, in relation to teacher development in low-income countries and underserved regions
- evaluate, at a local and regional level, technologies and systems that address infrastructural barriers such as poor network coverage, poor mains electrical supply, insecure buildings, lack of local computer hubs, and also the licenses, regulations and agreements that govern such infrastructure
- establish pilot networks in low-income countries and disadvantaged regions in order to explore and empower remote collaborative and participatory practices to inform redesign and achieve greater specificity in terms of national conditions and institutions and in terms of local language and culture
- explore the piloting of local and regional hubs to distribute media, for example, USB memory, and to adapt courses, both content and pedagogy, to local conditions and culture, and to support networks of local teachers, for example, in creating their own resources, specifically prioritising these activities for the most disadvantaged teachers
- develop strategies to reach and engage people and communities outside the national norms and mainstreams and underresourced in infrastructure and access, for example, by developing cadres of “barefoot teachers” and contextualise a “teacher-development-for-disadvantage” curriculum to support capacity and activity within communities
- investigate, through research literature, online seminars and global contacts, the relationships and tensions between those styles and approaches to learning embodied or implied in global digital culture, those in national education systems and those in local, informal and community cultures, and the implications of these three domains for teacher development at the intersection of these three contrasting influences, especially in low-income countries and disadvantaged regions
- give increased priority and resources at a country level to “decolonise the curriculum” of teacher development, to decolonise the research approaches that inform the teacher development curriculum and the technologies that deliver it, and to explore the relevance of current research in these areas to the values and practices in MOOC pedagogy and curriculum
- explore strategies to progressively hand over ownership and development of MOOC platforms and courses to established educational providers, or several such based regionally, and strategies to move the objective of the courses towards “training the trainers” and building local communities of practice rather than developing individual teachers directly while recognising the need for lifelong learning and continued teacher CPD that addresses an ever more complex and

chaotic professional and digital world, addressing and assessing both its threats and opportunities

- pursue a debate about the tensions between the needs and aspirations of scattered and disadvantaged communities versus the nature and benefits of systems operating “at scale”. A comprehensive and rigorous analysis is needed to identify the synergies and conflicts. Some of the obvious synergies are around infrastructure and technology, and around transmissive learning based around text and media. Conversely, the obvious conflict is around culture, epistemology, language, pedagogy and constructivist learning based around discussion. Somewhere in the middle, ambiguously, is content and the nature of its universality or adaptation.

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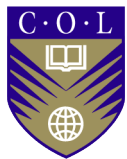
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4710 Kingsway, Suite 2500  
Burnaby, British Columbia Canada V5H4M2  
Telephone: +1 604 775 8200 | Fax: +1 604 775 8210  
Email: [info@col.org](mailto:info@col.org)

Web: [www.col.org](http://www.col.org)  
Facebook: <https://www.facebook.com/COL4D>  
Twitter: <http://twitter.com/COL4D>  
LinkedIn: <https://www.linkedin.com/company/commonwealth-of-learning>  
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