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COMMONWEALTH of LEARNING



Digital Learning:

Reforming Teacher Education to Promote Access, Equity and Quality in Sub-Saharan Africa

Bob Moon and Charmaine Villet

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COMMONWEALTH *of* LEARNING

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.



Commonwealth of Learning, 2016

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Foreword

The Commonwealth of Learning (COL) works with Member States to harness the potential of technologies to improve access to education and skills training. We believe that learning must lead to sustainable development, which includes economic growth, equity and environmental conservation. COL's work aligns itself very closely with Sustainable Development Goal 4, which speaks specifically to education and the need for well-prepared, qualified teachers. COL is working to equip more teacher education institutions to deliver effective learning opportunities for pre- and in-service teacher training. This includes supporting the creation of professional development courses for teachers and teacher-educators, and the integration of information and communication technology (ICT) and open educational resources (OER) into programmes.

As this report points out, 58 million children, the majority of whom live in Sub-Saharan Africa, are not in school. Meanwhile, the number of school-aged children in Sub-Saharan Africa is growing steadily, and UNESCO has indicated that Sub-Saharan Africa will need 6.2 million more teachers by 2030 to meet demand. Another major challenge is the quality of teachers and teacher-educators. According to the most recent Global Education Monitoring Report, more than half of pre-primary teachers and one quarter of upper secondary school teachers in Sub-Saharan Africa are not trained. Further, there is a significant need for qualified teachers and trainers for technical and vocational education and training. If we are to meet the challenges of both quantity and quality in this area, we must take an innovative approach to teacher education — a brick-and-mortar approach will not be sufficient.

In 2010, COL commissioned Hillary Perraton to produce a report titled “Teacher Education: The Role of Open and Distance Learning.” That report was a critical review of the major role that open, distance and technology-mediated learning had already played in both pre-service and in-service education. Since then, there have been a number of new developments in the provision of teacher education using distance and open learning. However, it is obvious that much more still needs to be done. This report focuses on some of the recent initiatives, but also provides an overview of how teacher education, training and development in Sub-Saharan Africa should look in the future. The authors recommend that Africa adopt more school-based teacher education strategies, incorporating digital technologies, and posit that this can be done in a phased manner.

COL believes a paradigm shift around policy and practice is vital and sees the proposed phases as an opportunity for further dialogue and debate about ways to rethink teacher education in Sub-Saharan Africa. This publication is a continuation of our ongoing efforts to not only support improvements in quality teaching and education, but to do so at speed and at scale.



Professor Asha Kanwar
President and Chief Executive Officer
Commonwealth of Learning

Preface

This report looks towards the future of teacher education, training and development in Sub-Saharan Africa and has been prepared in consultation with teacher-educators across the continent. Both of us have been involved extensively with this issue over many years, not only in Africa but also across the world, through development programmes, research and writing. We believe it is no exaggeration to say that finding and educating sufficient teachers for the rapidly expanding school systems of most African countries represents one of the world's most formidable educational challenges.

We are encouraged that this challenge has been recognised in the 2015–2030 Sustainable Development Goals. Goal 4 (Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all) specifically mentions teachers and talks of the need for international co-operation to meet the dual challenge of recruiting and educating teachers. This is timely. Over the last two decades, international organisations have used global research and partnerships to address the great health challenges of the day (e.g. malaria, tuberculosis, HIV/AIDS). We believe that international co-operation, and the resulting exchange of ideas, could be applied equally successfully in education.

Successive studies show that many teachers do not have sufficient subject and pedagogic knowledge to teach effectively.

Sub-Saharan Africa needs significantly more teachers. It is also imperative to provide continuing professional development (CPD) for the millions of teachers (qualified and unqualified) now in schools. Existing institutional structures do not have the capacity to meet this demand. Yet the need is urgent.

Successive studies show that many teachers do not have sufficient subject and pedagogic knowledge to teach effectively. There is also strong evidence of high learner dropout rates in schools and poor levels of achievement at all grades. There has been much critical scrutiny of the ways in which teachers are prepared for the classroom. A strong body of opinion favours a more hands-on, school-based model of teacher preparation. Certainly in Africa, teacher

education will have to be primarily school-based. We therefore suggest that incorporating and blending digital learning into the provision of teacher education would offer many possibilities for rethinking existing paradigms around policy and practice. We note how much is happening in Africa already. But we think there is a need for new systemic phases of reform if the full potential of digital technologies to help promote greater access, equity and quality is to be achieved.

We see the phasing in of digital learning as evolutionary, not revolutionary. Teacher education will almost always need some form of human interaction. However, if teacher-educators in universities, colleges, regional structures and non-governmental organisations (NGOs) are to reach out to all teachers, an element of digital learning seems both inevitable and desirable.

This report aims to provoke discussion, and the Commonwealth of Learning (COL) provides such a forum. It is not a “how-to” report, although references to existing digital learning initiatives and programmes have been included. We are seeking to set out a logical narrative about how the enormous challenge of educating teachers can be met in the coming decades.

We acknowledge the stimulus that has come from the many people we consulted in debating these issues, and we thank COL for providing us with this platform. The content and analyses, however, are our responsibility.

Bob Moon
Emeritus Professor of Education
The Open University (UK)

Charmaine Villet
Dean of Education
The University of Namibia

Executive Summary

The purpose of this report is to provide an overview of the present and future impact of digital learning on teacher education in Sub-Saharan Africa. Digital learning in this report is defined as any instructional practice that uses new communication technologies effectively to improve access to and strengthen learning. The focus of the report is student-teachers and teachers. The 2015–2030 Sustainable Development Goals (SDGs) explicitly seek to substantially increase the supply of well-qualified teachers in the region, drawing on international forms of development and co-operation where necessary (Goal 4).

Four contextual factors are identified as key to the teacher supply challenge:

- The very rapid developments in technology (most notably online communication and resource provision) that are already beginning to affect teacher education programmes. This has followed increasingly rapid improvements in connectivity across the region.
- The very high number of additional teachers needed to staff the growing number of pre-, primary and secondary schools.
- The concerns about low levels of teacher knowledge and learner achievement.
- The increasing global recognition that teacher education should have a strong focus on school- and classroom-based practice.

The central argument of this report is that existing institutional structures will be unable to meet the scale of demand for well-prepared, qualified teachers. This is already apparent in the recruitment of millions of unqualified contract teachers. The large-scale growth of initial teacher education systems will be necessary through to the middle years

of the century and beyond. Most programmes will need to have strong school-based elements in order to overcome the capacity shortfalls of the existing systems. This challenge is now becoming acute. However, digital learning technologies that

can support teachers in more diverse and distributed modes of education and training are now becoming more available.

This report also argues that large-scale, school-based, digitally enhanced programmes of continuing professional development (CPD) will need to be established to educate and train existing teachers. The quality outcomes of many systems are not only poor but also significantly below international norms. This is particularly true of the levels of teaching of basic literacy and numeracy, an area where teacher re-training is an important, but currently neglected, priority. Existing teacher education providers (i.e. universities, colleges, local and national governments, and private organisations) will continue, it is suggested, to play an important role, but will most likely act as a hub around which varied networks of school-based programmes develop. The provision of high-quality digital resources to support school-based teacher education will require collaborative networks that draw on international experiences of best practice where necessary. More integrated advance planning of policies and practice will be required to achieve this.

This report describes digitally enhanced programme innovations that can be identified in many institutions across the region. But it also notes that few of these initiatives have been adopted in a systemic way. The development of open educational resources (OER) and the potential of Massive Open Online Courses (MOOCs) in teacher education are both described. This report suggests that the impact of new technologies is being felt across the higher education sector globally and that teacher education cannot ignore these advances. It also reviews a range of forthcoming digital applications that could be particularly relevant to teacher education.

Three phases in the movement to full-scale adoption of new digital technologies are described. It is proposed that these might provide benchmarks of progress at system and institutional levels. This report suggests that, in moving towards the third phase, the current divide between campus-based and school-based training provision will disappear. It concludes by setting out a series of questions that provide the basis for a more robust research agenda to support the development of digital learning in teacher education.

There has been much critical scrutiny of the ways in which teachers are prepared for the classroom.



Section 1 – The Challenge for

Teacher Education

Since the 1990s, there have been strenuous global attempts to provide schooling for all. The Millennium Development Goals (MDGs) aimed to place every child in primary school by 2015. Despite some notable successes in Sub-Saharan Africa, however, with some countries improving enrolment ratios by more than 20 percentage points between 1999 and 2012, the overall targets were not met. Around 58 million children remain out of school, with the majority of them living in Sub-Saharan Africa. Progress in providing school places appeared to stall after 2007 and, perhaps most worrying, the quality of the expanding school systems was brought into question. At least one in five children enrolled in primary school drop out, and, after four years in school, around 250 million children still cannot read, write or count well enough to meet even basic standards (UNESCO, 2015a). Sub-Saharan Africa is the region facing the biggest challenge in this regard.

Efforts to develop stronger and fairer educational systems are therefore being redoubled. A new set of Sustainable Development Goals (SDGs) for the period 2015–2030 has been formulated with the support of all the global organisations and the vast majority of countries. Goal 4 of the SDGs specifically addresses education – “Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all” – and the targets are more ambitious than any previously set. It is intended that all boys and girls will have complete primary and secondary schooling and that it will lead to relevant and effective learning outcomes. Gender disparities will disappear. All children, it is proposed, should have pre-primary learning opportunities as well as basic primary and secondary education. Vocational education should become available for all who need it. The SDGs, unlike the earlier MDGs, also create a target for teachers through the commitment to “substantially increase the supply of qualified teachers, including through international co-operation for teacher training in developing countries, especially the least developed countries and small island developing countries” by 2030.

Sub-Saharan Africa faces the greatest challenge in the drive to achieve these new goals. There is now a substantive literature, not least the successive UNESCO Education for All (EFA) reports, documenting the difficulties experienced by many countries in achieving the MDGs. There are large variations in the capacities of different countries to provide school places and address related disparities in the effectiveness of the schooling that is made available. There are also difficulties in scaling up to meet the needs of a growing population. By the middle of this century, the number of young people under the age of 14 in Sub-Saharan Africa will have doubled.

Achieving the new goals requires imaginative and purposeful policies in all parts of the region’s education systems. Governance structures will need to be strengthened, financial provision must be made, and planning strategies and practices will need to be appropriate to the task (scrutiny of the UNESCO Institute of Statistics databases shows that a number of countries, particularly in Sub-Saharan Africa, have failed to collect the basic statistical data that are so essential to system-wide improvement). The quality of school systems has come under close scrutiny in recent years, although the benchmarks for understanding and debating quality are not yet explicitly set out in many parts of the region.

Given these challenges, this report seeks to look at the issue of teachers and, in particular, the ways in which they are educated and trained. Teaching must be a central concern in any school reform programme. Expanding school systems requires expanding the teacher population, not just in overall terms but also in respect of the specialist knowledge that many teacher roles require. The SDGs explicitly incorporate new targets for basic education, secondary schooling and vocational education, each of which involves a range of new teacher knowledge and expertise. The EFA Global Monitoring report for the 2000–2015 period made clear that investing in teachers was essential to meeting the targets. The report said that, “to attract and retain good teachers, policy-makers need to improve teacher education, deploy teachers more fairly,

By the middle of this century, the number of young people under the age of 14 in Sub-Saharan Africa will have doubled.



provide incentives in the form of appropriate salaries, and create attractive career paths” (UNESCO, 2015a, p. 196).

This report aims to focus on the ways in which teachers are educated both at the beginning of and also throughout their careers. The analysis is planned to be relevant to those planning teacher

education structures as well as those tasked with their implementation. The Commonwealth of Learning (COL) has an impressive record in giving prominence to the education of teachers through open and distance teaching and learning. Bernadette Robinson and Colin Latchem (2003), for example, produced an important book on teacher education as part of a Commonwealth of Learning series. Hilary Perraton, who

became known for his particular interest in the issue of teachers over many decades, authored a 2010 report that highlighted the problems in developing countries where more than half of all teachers are unqualified in terms of their own country’s formal standards for teacher education. His report is the most

recent COL analysis of the nature and effectiveness of providing teacher education through open and distance education rather than campus-based instruction. Other organisations have also contributed. The World Bank, for example, published *Designing Open and Distance Learning for Teacher Education in Sub-Saharan Africa: A Toolkit for Educators and Planners* (Moon, Leach & Stevens, 2007). There are also a range of country-specific publications (see, for example, Kangai & Bukaliya, 2011).

These publications provided evidence that open and distance modes of part-time study could be as effective as full-time programmes. Robinson and Latchem state that “Enough evidence and experience are available to show that open and distance education can be a viable, effective and even cost-effective way of providing initial training and professional development for teachers if well planned, adequately resourced and well managed” (2003, p. 234).

Moon et al.’s (2007) paper contains extensive discussion of what well-planned and managed programmes might look like. In their paper, they anticipated the emergence of digital technologies and reported a “scenario for the future” that had been part of a South African audit of teacher education “because of its commitment to equity and justice, ... [and]

The Commonwealth of Learning (COL) has an impressive record in giving prominence to the education of teachers through open and distance teaching and learning.



will thoroughly embrace new digital technologies for learning” (p. 97).

The development of new digital communication technologies is already having a major impact on campus-based forms of higher education as well as the established modes of open and distance learning (ODL). In many parts of Sub-Saharan Africa, digital developments are creating a new confidence around the use of part-time ODL modes. UNISA in South Africa and The National Teachers Institute in Nigeria, both distance learning institutions, have been part of national policy making on teacher education for many years. Newer universities, such as the Open University of Tanzania, are playing a significant role in meeting the need for more, and better trained, teachers.

The University of Pretoria in South Africa, the University of Zambia and the University of Education, Winneba in Ghana have also developed offsite training programmes. More recently, and as part of a national policy initiative, the University of Namibia has taken on the task of training upwards of 5,000 primary teachers through school-based education and training. There are also signs of increasing mobilisation of international co-operation to address the teacher education challenge. The Teacher Education

in Sub-Saharan Africa (TESSA) programme is one example of this. TESSA represents one of the new wave of digital programmes that support moves to school-based education and training. In such initiatives, the concept of digital rather than distance learning is beginning to take hold. In an important sense, digital approaches are a variant of well-planned distance education, but given the interactive and social dimension of digital learning today, the word “distance” is becoming outmoded. The exciting digital developments taking place in higher education throughout the world are certainly not presented as distance provision. There are no good reasons why school-based teacher education should not profit from the improved status that these new ideas bring to the task.

TESSA represents one of the new wave of digital programmes that support moves to school-based education and training.

Section 2 – The Changing

Context of Teacher Education

In this report, four major contextual factors are considered particularly significant for teacher education in Sub-Saharan Africa:

- The rapidly evolving deployment of digital learning, particularly in higher education and teacher education programmes.
- The question of scale and the extent of the demand for teacher education in the coming decades.
- The contemporary evidence about teacher knowledge and learner outcomes across the region.
- The international debates about the quality and effectiveness of teacher education and the emerging consensus supporting more school-based and practice-focussed approaches.

Digital learning is defined in this report as any instructional practice that uses new communication technologies effectively to improve access to and strengthen learning. While it focuses on the education of pre-service and in-service teachers, developments in teacher education should be seen against the broader context of increasing connectivity and the take-up of digital technologies.

The Rapidly Evolving Deployment of Digital Learning

In the period 2008–2013, the number of students in the USA taking online courses grew by 96 per cent, with 45 per cent of all students taking one or more online courses as part of their higher education programme (Bolkan, 2013). In the same period, an international survey revealed that Africa had the fastest-growing self-paced eLearning sector in the world (Sawahel, 2013), and a more recent report showed an annual growth rate of 15.3 per cent for revenues from eLearning across Africa (DOCEBO, 2014). Although connectivity in parts of Africa remains a problem, and not one to be underestimated, particularly in rural areas, digital learning

opportunities are expanding rapidly across the continent. Mobile telecommunications technology has leapfrogged conventional landline infrastructure, and non-voice applications such as text messaging are widely used. This is illustrated by the example of Namibia, where the Mobile Telecommunications Company (MTC) alone recruited 2 million subscribers in 2012 (New Era, 2012). It is estimated that within the next five years there will be 700 million smartphone connections in Africa, more than twice the projected number in North America. Mobile data traffic in Africa is set to increase fifteen-fold by 2020. “The mobile industry will account for 8% of GDP by 2020 — double what it will be in the rest of the world. And internet penetration is rising faster than anywhere else as costs of data and devices fall” (Flood & Rice-Oxley, 2016).

It is important to acknowledge that, despite these impressive advances, connectivity and the skills to use these technologies are not equally distributed. There are, however, a host of projects to address the problems of access at least. TV White Spaces, for example, are the unused broadcasting frequencies in the wireless spectrum. Television networks leave gaps between channels for buffering purposes. This space in the wireless spectrum is similar to what is used for 4G and can be used to deliver widespread broadband Internet. This works through a new approach to spectrum utilisation called Dynamic Spectrum Access (DSA). Essentially, the technology utilises spare space on the available radio spectrum without interfering with licensed users such as broadcasters. This model is particularly appropriate for delivering low-cost broadband access to rural and other underserved communities and has been successfully trialled in Kenya, Tanzania, Ghana, Botswana, Namibia and South Africa (Roberts, Garnett & Ranveer, 2015).

Such technology can meet the last mile connectivity needs of villages, rural schools and clinics, as well as enable the development of national knowledge-hub networks. Providing connectivity to rural Namibia is aimed at encouraging rural entrepreneurship, reducing youth unemployment and closing the urban-rural divide in education and health. The resulting projected increase to Namibia’s GDP by 2025 could be US\$2.7 billion to US\$9.9 billion. (This estimation comes from a World Bank report that states that for every 10 per cent increase in Internet penetration in a country, there is a positive correlation of

1.38 per cent increase in that country's GDP.) Namibian policy makers appear to recognise the importance of improving connectivity. A Vision 2030 document specifically noted the benefits of improved access for education, health and economic development (Thanki, 2016).

The use of the new digital technologies has been likened by some commentators to the major social transformations that marked the agrarian and industrial revolutions (see, for example, Castells, 2000). More recently, others have suggested that we are experiencing a second digitised renaissance (see, for example, Martin & Kutarna, 2016). Whatever the analogy, there appears little doubt that digital technologies will have a marked impact on educational institutions in the years to come. The consequences for higher education are already being debated. For example, Anya Kamenetz (2010) has argued that “in the age of information immersion and constant connectedness, it’s time for centuries-old, ivy-covered walls to undergo a phase change into something lighter, more permeable, and fluid.” For Kamenetz, the “choice is clear: Radically change the way higher education is delivered or resign ourselves to never having enough of it” (p. xiii).

The Question of Scale and the Extent of the Demand for Teacher Education

Teacher education is beginning to embrace these changes. The need to expand provision on an almost continuous basis is already generating new models of provision. Such expansion is needed in all phases of teacher development and is crucial to raising the quality of learning in schools. Teacher education also has to take account of the ways in which digital technologies will affect the professional needs of teachers in coming decades. Digital learning now exists inside many classrooms. New open schooling structures are requiring new skill sets for teachers. Teacher education and teacher-educators will also need to exploit the possibilities of the new digital world.

A central argument of this report is that the changes that will be taking place in higher education and professional training generally can be appropriated to significantly scale up and improve the quality of teacher education. Teacher-educators will need to develop new skills and knowledge, but so too will all those working in higher education and professional training organisations.

The need is great. UNESCO’s Institute of Statistics (UNESCO, 2015b) has estimated that, globally, 25.8 million extra teachers will need to be recruited by 2030 to meet EFA targets (to put that in context, this is equivalent to the population of Ghana).



Of these, 3.2 million would be filling new posts and 22.6 million would be replacing teachers retiring or leaving the profession. There were 59 million children out of school in 2015. To have them all in school would require the recruitment of 2.7 million teachers if pupil-teacher ratios are not to exceed 40:1. According to the Institute’s forecasts, without such recruitment, 33 countries will not have enough teachers to achieve universal primary education (UPE) by 2030. Sub-Saharan Africa faces the biggest challenge

of any major world region in this respect. For every 100 children beginning school in 2015, there will be 142 in 2030. And the figure is projected to continue growing at this rate through the middle years of the century. Of the 3.2 million posts to be filled worldwide, Sub-Saharan Africa will need 2.2 million to deal with this growth and, at a conservative estimate, 3.9 million teachers will be required to replace those leaving the profession.

At present, it is clear that the traditional structures for training teachers cannot keep pace with such expansion. In a third of countries, fewer than 75 per cent of teachers hold the national standard qualification to become a teacher. In a majority of countries, the percentage of unqualified or underqualified teachers is growing. Furthermore, the UNESCO Institute report (UNESCO, 2015b) lists 32 countries globally where fewer than 75 per cent of teachers have appropriate qualifications. Of these countries, 19 are in Sub-Saharan Africa. And of the 18 countries with pupil-teacher ratios exceeding 40:1, all but one are in the same region.

Many countries have put in place policies to increase the supply of teachers. But in most, the rate of growth of this supply only just catches up with population needs by the latter part of the 2015–2030 period. Zambia, for example, has been increasing teacher recruitment by an average of 4 per cent a year, but to achieve Universal Primary Education (UPE), that

figure would need to be 10 per cent per year. The current recruitment levels mean the country would not have enough teachers in schools until 2029. In other countries, the problems are even more challenging. The United Republic of Tanzania will continue to face a shortage of teachers even after 2030 if current trends continue. To achieve UPE by 2030, the country would have to recruit 4 per cent more teachers each year compared to the current average growth rate of 3 per cent.

The focus of the UNESCO report (UNESCO, 2015a) is on achieving UPE. Other sectors will need to be addressed over the period from today to 2030 and beyond. For example, there is a growing need for secondary teachers, including those with the more specialised knowledge needed for specific subject teaching. All countries envisage an expansion of secondary provision despite the challenge of teacher recruitment and all will find it difficult to recruit teachers of mathematics or science. There is also the need for continuing professional development (CPD) for teachers. Putting in place coherent CPD structures has proved challenging in many countries (McCormick, 2010), but the need in all Sub-Saharan African countries is acute. There is considerable evidence that even modest levels of pupil achievement have not matched the expansion of UPE. There are multiple reasons for this (including local governance structures, monitoring systems and the way teachers are paid and rewarded), but the form and quality of teacher development provision must be an important contributor to the problem.

Many additional statistics and analyses can be drawn from the UNESCO database, but it is clear that the scale of the problem means that existing institutions do not have the capacity to address it. Teacher education institutional structures built to meet the needs of the 20th century are invariably finding that the demands of the 21st century exceeds capacity. The mismatch between supply and demand has been noted for many years (Lewin & Stuart, 2003; Moon, 2000), and the international mobilisation of effort spurred by the MDGs and SDGs has confirmed that, as one commentator suggests, a business-as-usual approach is not an option in the education and training of teachers (Dosunmo, 2015).



The Contemporary Evidence about Teacher Knowledge and Learner Outcomes across the Region

The evidence about levels of teacher knowledge and learner achievement in the region is a source of concern. The Institute for International Economic Studies (IIES) has been working with the World Bank to attempt to measure primary teacher effort, knowledge and skills in seven African countries that comprise 40 per cent of the population of Sub-Saharan Africa. The initiative has been conducted using Service Delivery Indicators that can be applied across different countries and contexts. A range of data is emerging. After three years' primary public schooling,

After three years' primary public schooling, many students still lack the most basic elements of literacy and numeracy. Half of all the children assessed could not read the simplest of words, and about 70 per cent could not read a basic sentence.

many students still lack the most basic elements of literacy and numeracy. Half of all the children assessed could not read the simplest of words, and about 70 per cent could not read a basic sentence. One fifth of the children could not recognise numbers; half could not put numbers in order; and three quarters could not do single-digit subtraction. Teacher absenteeism is identified in this research as a major issue. Many children are receiving barely half of the teaching time they are entitled to (Bold, 2016). Successive EFA Global Monitoring Reports, beginning with the 2005 report that specifically addressed issues of quality, provide further evidence of the problems of inadequate teacher knowledge and learner achievement. Of the Sub-Saharan African countries, only Ghana and South Africa are willing to participate in the international assessments of education outcomes.

The International Debates about Quality and Effectiveness

Another contextual factor that must be considered in looking at the future of teacher education is the international debate about what constitutes effective forms of training. In many parts of the world, policy makers, politicians and some school principals are critically scrutinising traditional models of teacher education. Since the 1980s, teacher education across the globe has been challenged by those who see the teacher education curriculum as lacking relevance and being insufficiently practical and too concerned with abstract theorising (Duncan, 2009; Lapostelle, 2016; Levine, 2010). Such criticism has been sufficiently influential to encourage the setting up of new routes into teaching in the USA and the UK that involve bypassing the universities. Today, one third of all novice teachers in the USA come through these alternative programmes (Zeichner, 2016). A recent study of global models of teacher preparation (Moon, 2016) showed that critiques of teacher education are a global phenomenon (see also Pryor, Akyeampong, Westbrook & Lussier, 2012; UNESCO, 2005).

In many parts of the world, policy makers, politicians and some school principals are critically scrutinising traditional models of teacher education.

In recent years, leading figures in the world of teacher education have suggested ways in which a reshaping of teacher education might provide a response to the critics and lead to more effective programmes. In the USA, there have been many analyses of the present situation of teacher education (Darling-Hammond & Lieberman, 2012; Wilson, 2014; Zeichner, Payne & Brayko, 2015). However, most of the discussion about teacher education to date has focussed primarily on pre-service teacher education. In-service CPD has not received the same degree of attention, although it has been the subject of many national and international reports (Schleicher, 2012). While there is much advocacy for structured and ongoing professional opportunities for all teachers, most countries provide only poorly thought-out programmes at all levels of the education system (Ingersoll, 2004; McCormick, 2010). Aside from having a very small number of teachers studying for advanced degrees, most universities have little involvement with teachers after the pre-service phase. Provision of professional

support by regional authorities and NGOs is patchy and lacking coherence. Millions of teachers receive no professional support.

There are countries where teacher education practice has achieved a degree of public and political confidence.

There are countries where teacher education practice has achieved a degree of public and political confidence. Thus, Finland has not experienced the politicisation of teacher education that has occurred in many parts of the world (Niemi, 2016). This is also true in Singapore, for example (Goodwin,

2012). However, the general picture of teacher education suggests that:

- many politicians and policy makers and some teachers believe that initial pre-service teacher education is too theoretical and includes insufficient preparation for effective classroom practice;

- there is a lack of structures and systems to promote discourse and dialogue between schools and universities or colleges regarding both education and the academic disciplines taught in schools;
- CPD, including induction training, is both lacking and inconsistent; and
- there is an absence in many countries of policy development that strategically assesses pre-service and in-service needs and entitlements and links these to medium- and long-term plans to make effective provision available.

While these problems apply to most education systems, it is crucial to find answers for them in light of the particular challenges faced by countries in Sub-Saharan Africa.



Section 3 –

The Changing Landscape of

School-based Teacher Education

The UNESCO Institute of Statistics' EFA Global Monitoring Reports, and publications from a range of other agencies, point to the need to expand teacher education provision while also improving teacher effectiveness. There is a significant gap between the number of teachers that can be trained by current providers and the number of new teachers required by growing school systems. This is particularly true if the needs of unqualified teachers and the professional development entitlements of all teachers are to be recognised.

This is not a new situation. National governments have been trying to address shortages of educated and trained teachers for many years. Eleven African countries were listed in the most recent COL report as seeking to provide programmes that addressed

shortages of qualified teachers (Perraton, 2010). However, the engagement of governments in developing what can be termed “non-standard” routes into teaching is almost wholly episodic. All the initiatives in Sub-Saharan Africa in Perraton's 2010 report were time-limited. Sometimes, the pressure to produce large numbers of extra teachers resulted in the creation of quite elaborate infrastructure for open and distance learning (ODL) programmes which were allowed to run for three to seven years or so, and then dismantled when the pressure to produce new teachers eased off. This situation appears to be changing, albeit slowly and not in all countries. Policy planning at national and institutional levels is beginning to look at teacher education expansion as a permanent process.

Nigeria has both the largest population in Africa and the biggest teacher supply need and is facing formidable challenges in its quest to improve the qualifications and effectiveness of millions of teachers. It has also had a national

Policy planning at national and institutional levels is beginning to look at teacher education expansion as a permanent process.



infrastructure for open and distance learning for teachers in place since 1976. The National Teachers' Institute (NTI), which has its headquarters in Kaduna in the north of the country, has an extensive resource production capacity and multiple study centres spread across all the regional government authorities. In many senses, NTI is an Open University for teachers. New programmes and initiatives can make use of the resource production and local support frameworks, for example. NTI now works closely with the more recently founded National Open University of Nigeria (NOUN) to provide degree-level courses for teachers.

Over the last few years, NTI has had an annual enrolment of over 50,000 teachers. Students of NTI are primarily working teachers preparing for a range of qualifications, the most important of which is the Nigerian Certificate of Education (NCE), the national basic teaching qualification. Between 2006 and 2015, NTI trained nearly 700,000 primary teachers and 55,000 lower secondary teachers as part of the Millennium Development Goals Project to improve achievement in schools. NTI used a combination of NTI-developed resources and locally run workshops for this project.

A more recent example of a national infrastructure development to expand teacher education is the Open University of Tanzania (OUT). This institution, established in 1992, provides a national programme to prepare both pre-service teachers and serving unqualified teachers for the Diploma in Primary Teacher Education (DPTE). Annual enrolment is 800 students, of whom one quarter are pre-service trainees. Students remain in the programme for two or three years, depending on their prior qualifications, and study a range of modules, including some online courses. OUT has a range of regional study centres and students participate in two intensive face-to-face sessions per study unit. The programme has a number of interesting characteristics. For example, assessment is based on a portfolio approach with assessment activities focussed on classroom practice; and the head teachers of schools in which participants teach are involved in the portfolio and assessment process. This approach builds in-school professional support into the training process, a characteristic of the newer approaches to school-based teacher development programmes. Completion rates

for the DPTE have been increasing year on year and were 75 per cent in 2015.

The Tanzanian approach to teacher supply and training offers students the choice of following national training provision through OUT or attending private teacher training colleges. Some of the private institutions are now licensed by OUT to offer the DPTE programme.

Both NTI and OUT are examples of national infrastructure provision, although for each, the national remits must be developed with other policy issues in mind. In Nigeria, the 36 regional government authorities have significant levels of control over teacher supply and qualification, and NTI is in constant contact with them about this. OUT has had to create ways of supporting the introduction of private providers. Both these institutions are now incorporating digital learning technologies into programme design.

It is possible to observe another variant on “national” strategy towards expanding teacher education whereby the existing, primarily campus-based institutions develop outreach provision. In Ghana, existing institutions have created school-based programmes to help address the country's teacher qualification upgrading challenge. The University of Education, Winneba, for example, is an institution with a mandate to prepare both pre-service and in-service teachers for the basic and secondary schooling systems. Recruitment for the non-campus-based qualification upgrading programme now numbers 5,000 per year. Teachers in this programme are provided with mini tablets with SIM and SD cards and make extensive use of online resources in the modular programme. The Winneba course reflects the increased attention being given to practice in the new generation of programmes. To ensure students are well supported in carrying out the course activities in school, more than 500 teachers are trained through an online programme to act as teacher-mentors.

The University of Pretoria provides another example of a university-based response to educating teachers. Teacher education in South Africa moved from college-based to university-based provision in the first decade of this century. In 2002, the University of Pretoria set up a unit that offered upgrading and professional development programmes through a

“contact and technology-enhanced” resource approach. Over a 15-year period, more than 57,000 students have enrolled and 32,000 Advanced Certificates and Bachelor of Education (BEd) Honours degrees have been awarded. Additionally, the unit currently supports a total of 8,500 in-service teachers following three CPD programmes. This unit was one of the first to use Short Messaging Service (SMS) to reduce the costs of paper administration and to make communication with students more effective. The unit also pioneered the mini-lecture approach through mobile telephony.

The South African government, through successive policy guidelines, has been developing a more research-focussed approach for universities. The country is also experiencing rapidly improving access to new communications technologies. In 2016, the Distance Education Unit at the University of Pretoria therefore launched a new BEd (Honours) in Teacher Education and Professional Development based on a blended learning model. The new programme retains the continuous enrolment approach, provision of key printed resources and supported decentralised contact sessions that contributed to the success of the previous model. These strategies in the new model are accompanied by an online component aimed at encouraging student engagement with course content, with other learners and with online tutors. In alignment with new government guidelines, the new programme has a central research spine in which students work through a structured engagement with research methods, proposal development and research report writing. The University of Pretoria is also involved in a school-based certificate programme in School Management and Leadership.

Some other examples include the North Western University in South Africa, which has an upgrading qualification programme that makes extensive use of interactive whiteboards. The Mauritius Institute of Education, which runs in-service upgrading programmes for serving teachers, currently has a Teacher Diploma Primary (TDP) with 600 participating teachers using online resources focussed on school and local community activities. The Department of Science, Technical and Vocational Education at Makerere University in Uganda has incorporated online resources into a range of pre-service courses and

is developing year-long professional development programmes focussed on online-learning learner-centred pedagogy.

These new types of programmes are emerging in a number of countries. Many programme developers, in seeking to develop teachers who can apply more learner-centred and active classroom teaching methods, are acknowledging that the teacher education curriculum therefore needs to reflect a similar approach. In Namibia, for example, the Faculty of Education at the University of Namibia has been offering a four-year BEd (Honours) degree using a school-based approach since 1999. This pathway usually served as a way of upgrading in-service teachers’ professional qualifications. Although a few pre-service students also enrolled for this programme, it was realised that, to meet the current demand for qualified teachers in the Junior Primary Phase, a new model of teacher education provisioning had to be devised. This was because close to 70 per cent of teachers (more than 5,000 teachers) working in this phase were not professionally qualified to teach at this level and there was a clear need to promote new teaching methods and raise achievement levels.

Given the current infrastructure of the University of Namibia, it would not have been possible to accommodate this number of students in face-to-face campus-based teaching programmes. In addition, the teachers in question were employed and could not be taken out of their classrooms for full-time study. The university therefore developed a site-based Teacher Education Diploma using a blended learning approach and focusing on improving the instructional competences of teachers in teaching literacy, reading and numeracy. Extensive use is made of mobile technologies to deliver content through a Learning Management System (LMS), to assess student progress through student use of e-portfolios, and to encourage the development and participation of teachers in learning communities in

Many programme developers, in seeking to develop teachers who can apply more learner-centred and active classroom teaching methods, are acknowledging that the teacher education curriculum therefore needs to reflect a similar approach.

a Virtual Learning Forum. At registration, teachers are supplied with a Junior Primary Teachers' Toolkit containing a number of teaching resources (children's literature, teaching manuals, flashcards and mathematics resources) based on the needs of teachers as revealed in the findings of a national action research study carried out in 2014 and 2015. Teachers are also expected to bring their own mobile devices to face-to-face sessions during school holiday periods and receive a 3G USB dongle to ensure their active participation in online learning activities. Assessment is based solely on the portfolio — there are no written final examinations.

These approaches are not independent of each other. In South Africa, the long-established University of South Africa (UNISA), with its headquarters in Pretoria, can accommodate 60,000 in-service up-grading teachers. Other programmes are offered by the University of Pretoria, North-West University and various other providers. The institutions highlighted here all use digital technologies in various ways to

improve and enhance provision. The benefits in respect of student engagement, costs and effective delivery have already been demonstrated through course evaluations. Certainly, more development, research and evaluation work needs to be done, but the advantages of embracing digital elements in course design and delivery are evident in the examples we discuss here. Most importantly, technology enhancement creates the opportunity of addressing

logistical and quality issues that have been problematic in the design of school-based and open and distance learning programmes.

The design of such programmes essentially involves four elements:

- Providing the learning resources through which students study.
- Creating the in-school and other support opportunities crucial to a successful practice-focussed course.

- Developing appropriate assessment arrangements.
- Creating robust quality assurance systems to monitor programme development.

A variety of texts look in detail at the options for course development in relation to these four elements (see, for example, Moon, Leach & Stevens, 2005), but most of them were developed at a time when access to digital technologies was extremely limited. Because this is changing, many countries can now offer the following services and resources:

- **Core texts can be provided online.** To facilitate this, there may be a need to provide devices to ensure access to the texts. (The University of Education, Winneba, for example, gives all students mini iPads with SMS and SD operational capacity.) Distributing tablets with uploaded resources can be more cost-effective than printing and distributing hard copy materials. A further advantage is that this method also makes it easier to keep resources up to date.
- **Core texts can be interactive and creatively designed.** In traditional distance learning texts, it was often a challenge to present teachers with imaginative and stimulating material. Although it is just as possible to be uninspiring through online material, the opportunities for more creative multimedia approaches are significant.
- **Support can be continuous and can encourage peer interaction.** Supporting teachers in the pre-digital age, especially those working in remote rural communities, was a major challenge. There are now a variety of ways to provide interactive online support to link individual teachers to each other.
- **Providers can keep in close contact with schools.** This facilitates the increasingly important provider-stakeholder engagement, with key stakeholders such as head teachers and other teachers playing mentor roles.
- **Data on student self-assessment and student progress can be more easily collected and used.** The opportunities offered by new digital technologies are meshing here with changing approaches to teacher education. There is a much stronger focus on classroom activity and practice, regular observation and self-assessment;

Most importantly, technology enhancement creates the opportunity of addressing logistical and quality issues that have been problematic in the design of school-based and open and distance learning programmes.





many programmes are moving away from end-of-course or end-of-module examinations to a practice-focussed portfolio assessment.

- **Quality assurance systems, including student evaluations, can be collected and used more cost-effectively and more quickly.** Education programmes dispersed across large, often remote, geographical areas gain important advantages from digitised evaluation systems.

It is now possible to identify a large number of interesting projects using digital applications to develop teachers. There is a sense, given the number of institutions involved, that the use of digital options is moving towards becoming a mainstream part of many programmes. How this is applied in a more systemic way across teacher education systems as a whole, however, is a key question for policy and practice development.



Section 4 –

Digital Learning, Open

Educational Resources and the Future of Teacher Education and Development

Many of the digital learning initiatives in Sub-Saharan Africa are well established, but others are still in the early stages of adoption. There are also new digital applications that will be significant for education and teacher education (see below). All offer important new possibilities for the future direction of policy and practice.

The Siyabuswa Education Campus of the newly established University of Mpumalanga in South Africa offers a four-year BEd programme for teachers of Grades 1, 2 and 3. There is an annual intake of 100 students, approximately 75 per cent of whom will be learning to teach siSwati, and 25 percent isiNdebele. Although these are official South African languages, there are very few resources for teaching and learning them. However, in partnership with the South African Institute for Distance Education's (SAIDE) African Storybook initiative, the African language lecturers are helping students to translate and create their own storybooks to teach reading in these languages.

On www.africanstorybook.org, students can find, read and download for free openly licensed picture storybooks, translate or adapt them if they are not available in siSwati or isiNdebele, or create their own storybooks. One of the assignments for third-year students requires them to work in pairs to translate one of the hundreds of storybooks on the site from English into their own language and/or create a new storybook, uploading their own illustrations or selecting from the 6,000 openly licensed illustrations on the site. The lecturers edit the storybooks and then the students make the necessary corrections before uploading and publishing them. Using action research methodology, the lecturers write up the results of this assignment and make sure that lessons learned are documented, not only to feed into the design of the assignment in the following year, but also to

make them available to other teacher-educators. In the first year of the intervention (2015), 26 stories in siSwati and 30 stories in isiNdebele were produced.

To improve the teaching of early-years literacy and numeracy in Namibia, a virtual teachers' forum, called Kopano, has been established at the University of Namibia's CPD Centre. Kopano facilitates the development of an online professional community around the work of junior primary school teachers, and enables teacher-educators from the University of Namibia (UNAM) to work closely, in between face-to-face meetings, in a virtual environment with teachers taking part in the Teacher Education programme across the country. In addition, the virtual community is also open to other key staff members from UNAM, the National Institute of Educational Development (NIED) and regional education offices, as well as staff from the Ministry of Education, Arts and Culture. The intention is for the virtual community to be facilitated and moderated by a range of staff from all of these organisations.

Kopano is an online environment in which groups of teachers in Namibia, teacher-educators and other key professionals are able to meet, share ideas, share resources, discuss topics among themselves, exchange messages, store teaching and learning materials for themselves and others to use, and get access to important news and information about the training programme. A range of other initiatives are also being incorporated in some teacher education programmes. Some of them are discussed in more detail below.

Mindset Learn

Mindset Learn (learn.mindset.co.za) delivers curriculum-aligned eLearning content and materials by television programming and over the Internet to be used by students, teachers and parents in the classroom and at home. It aims to improve learning outcomes by providing up-to-date, accessible and interactive learning experiences for South African youth. The content is developed in accordance with South Africa's Curriculum Assessment Policy Statement (CAPS), and so is aligned with and relevant to the existing school curriculum. All educational materials are available for free from Mindset Learn and on its

YouTube channel (www.youtube.com/mindsetlearn) as OER and can be used in different contexts and locations — for example, in classrooms, in tutoring centres or at home. Currently, materials reach televisions and computers in some 3.5 million homes across South Africa.

Nolwazi

CoZa Cares Foundation (www.cozacares.co.za) has created a digital library, called Nolwazi (www.nolwazi.co.za). It is a digital repository of resources aligned with the South African primary school and high school curricula, including subject research and lesson planning. A significant proportion of Nolwazi's content has been sourced from practising teachers for use by other teachers. It offers free and immediate access to digital materials, including past examination papers, videos, simulations, lesson plans, educational android apps for smartphones and tablets, worksheets and e-books.

Open Learning Tank

Open Learning Tank (OLT) (<http://ampli5yd.com/elt>) is a platform that supports and builds knowledge around the use and reuse of resources and open source eLearning technologies to democratise access to quality academic resources in Sub-Saharan Africa. OLT's goal is to maximise the power of technology to improve standards of teaching and learning and increase access to education for all.

Siyavula

Siyavula (www.siyavula.com) is a collaborative project seeded by the Shuttleworth Foundation and designed to allow educators to create, share and adapt freely accessible and openly licensed resources that are aligned with the mathematics and science curricula. Siyavula's mission is that everyone should have access to the resources and support they need to achieve the education they deserve. Unlike the vast majority of material, which is under a traditional, restrictive copyright licence, Siyavula material can be adapted to ensure cultural relevance or refreshed without incurring

costs. In addition to the online, printable resources, and in keeping with its aim of making education accessible to all, Siyavula also publishes a range of free mathematics and science textbooks for Grades 4 to 12.

African Digital Library

The African Digital Library (ADL) (www.aodl.org) is a collection of e-books that can be accessed and used free of charge by any person living on the African continent. Individuals can access the library from any personal computer that is connected to the Internet in Africa. The objective of the ADL is to develop a digital library that is available free of charge to residents and institutions of Africa, for academic, business and personal use.

CyberSmart Africa

CyberSmart Africa (www.cybersmart africa.org) has developed a digital learning platform that can deliver learning resources to communities in Sub-Saharan Africa that have no electricity. It works through an all-in-one mobile device that contains a solar panel, solar rechargeable batteries, a projector with interactive whiteboard capabilities, speakers loud enough for classroom use, 3D capability, cooling fans and a dust filtration system. Teachers receive training in how to use it. Developed with support from USAID, it has already proven successful in classrooms in Senegal.

OER and MOOCs

Two of the most interesting developments that have arisen from the development of digital technologies are the open educational resources (OER) movement and the advent of Massive Open Online Courses (MOOCs).

Research on the use of OER and MOOCs suggests that they have an important part to play in the provision of “educational opportunities through the resourcing of accessible, culturally acceptable, high quality and affordable educational materials in the global South” (Walji, 2014, para. 6). “Educators in developing countries [are given] the opportunity ... to access, change and improve content they require



... and ... can create their own OERs and share these with others globally” (para. 8).

The impact of OER is growing in higher education globally. International bodies such as UNESCO and COL are extending their call to governments in the global South to commit to developing and using OER and to look at how OER are used and are influencing policy and practices in other developing countries.

OER evolved from a 2002 project at the Massachusetts Institute of Technology (MIT) to make all their course resources freely available through Open Courseware (www.ocw.mit.edu). More than 2,000 MIT courses are now available in this form. The course resources can be taken and used as they are or adapted to suit a particular context. The Creative Commons licensing system, which now supports OER development, allows the originators of OER to retain some control over their future use. For example, some licences allow completely open use and others stipulate that the OER must not be used for commercial purposes. OER are significantly expanding the range of digital resources from which teacher education programmes can draw, and new OER programmes are being developed all the time (Hewlett Foundation, 2013).

In Sub-Saharan Africa, two substantive OER initiatives in particular have been taken up by teacher education institutions. The first is the Teacher Education in Sub-Saharan Africa (TESSA) (www.tessafrica.net) programme. TESSA is a consortium of universities and organisations representing more than ten countries on the continent that also draws on the technical expertise of the UK Open University. In the early years of this century, the consortium identified the

need for high-quality classroom-focussed resources to promote more active pedagogic approaches in the primary school sector. It has subsequently developed a wide range of modular and unit-based resources addressing the key areas of the primary school curriculum. All the study units involve classroom-based activities that are then monitored and assessed through a range of strategies. The TESSA model is currently unique in presenting the resources in multiple languages — Arabic, English, French and Kiswahili.

All the TESSA resources are freely available for use by anyone. That includes permission to freely adapt the resources to local contexts as necessary. An independent evaluation of TESSA, carried out by African experts, said the following about the programme:

Interaction with, and use of, TESSA OER has had a significant impact on the identity and practices of teacher-educators and a profound impact on those of teacher-learners. It has fused theory and practice; shifted perceptions from teacher as “know it all” to “teacher as facilitator of learning”; and greatly enhanced the relevance of pupils’ learning experiences. The materials have been used in creative ways to meet the real needs of teachers and learners. Actual use of the materials has by and large represented forms of practice that correspond with best professional practices as described by leading education theorists. All of this justifies the TESSA strategy of improving the quality of teaching through more purposeful — and OER-supported — forms of teacher education. (Harley & Barasa, 2012, p. 63)

The report then goes on to consider the impact TESSA has had on teacher education.

Reasons for impact: TESSA foregrounds and provides the resources and tools for activity-based learning. It provides the equipment for teacher practice. It does not begin by providing abstract “theory” and thereby alienating practitioners by placing the onus on them to find their own ways of enacting theory. Yet by simply using the user-friendly TESSA tools and resources, practitioners are inducted, naturally and almost by default, into best professional practice. TESSA makes child-centred, activity-based and

reflective practice real, and achievable. In this way TESSA has done much more than simply provide materials that are sufficiently generic to be useful in almost any context. Use of the materials leads practitioners into exercising their own agency in making the crucial decisions on which good practice depends: selecting, organizing and sequencing the materials in ways that are not only in line with national policy, but importantly also consistent with the contexts in which they practice. In notable cases this has led to adaptation of the materials to “these” children; in “this” classroom; and in “this” context, with its own unique permutations of promise, opportunity and constraint. (p.63)

The report concludes with some indicators of success and some general observations about the overall success of the programme.

Indicators of project success:

- significant project “take up” in diverse settings;
- significant impact on the practices and identities of teacher-educators and teacher-learners;
- significant impact, through networking, on schooling and other educational agencies. Some impact on ministries of education is evident.

TESSA is a pioneering project in that it has tackled, head on, the most intractable of all challenges facing teacher education and schooling in SSA — quality. It has been innovative in merging educational theory and modern technologies into a model that is also strategically pragmatic, and thus workable.

TESSA is a highly successful project, achieving its aims at scale. This has immense implications and promise for all teacher education in SSA. (p. 65).

TESSA has expanded into institutions in other countries (Angola, Malawi, Mauritius and Togo, for example) and it is estimated that over 300,000 teachers are following courses that use TESSA resources.

The OLA College of Education in Ghana, for example, has trained around 2,500 teachers through TESSA

units. The Education Department of OLA oversees the integration of TESSA OER in the teaching and learning of the college staff, with support from the ICT unit.

At OLA, TESSA has been incorporated into the professional development of college tutors. Two workshops per semester assess the state of TESSA integration in the teaching and learning process in order to strengthen the tutors’ use of resources and to assess the impact on student learning. Student-teachers carry out TESSA activities as part of their practicum in schools and a prize is awarded each year to a TESSA student for the most successful reporting of these activities. There is also a TESSA Club at the college that allows students to share their ideas about and experiences of using the resources. OLA has inspired three other colleges to use TESSA. TESSA has also been used for in-service training for private school teachers in Mfantseman District in the Central Region of Ghana.

In Nigeria, NTI has incorporated TESSA resources into its teaching programme. TESSA resources have also, mediated by NTI, been integrated into the national Open University programmes. Furthermore, NTI has incorporated print versions of TESSA resources into training manuals used by students in colleges across the country and, in partnership with Nigeria’s National Commission for Colleges of Education and the UK’s Open University, has produced the Teaching Practice Supervisors Toolkit that incorporates the TESSA approach to pedagogy and is available on the TESSA website.

The Open University of Tanzania is another of several universities and colleges in Tanzania that use the TESSA units as a resource base. As of 2015, NTI has begun moving to a system whereby students use pre-loaded tablets that include the TESSA resources. (Students purchase low-cost tablets in advance of their course for 45,000 Naira, equivalent to approximately US\$150 at time of writing.) Egerton University in Kenya uses TESSA in all its school-based teacher upgrading programmes, and Kyambogo



University in Uganda and the National University of Zambia have both incorporated TESSA in an upgrading External Primary Education diploma. The University of Namibia is using new forms of online connectivity to provide resources to teachers in rural areas. In this programme, teachers are seen as the producers and multipliers of learning content. The Mauritius Institute of Education, which has a teacher education curriculum strongly focussed on links with local communities, requires all teachers taking the distance-mode primary diploma to present the findings of a research project in an online OER format. These are then archived for the use of future cohorts of teachers participating in the programme.

A second example of OER for teacher education is the OER Africa site co-ordinated by SAIDE (www.oerafrica.org). This initiative is playing a leading role in driving the development and use of OER across all education sectors on the African continent. One of the projects under the OER Africa umbrella is OER4Schools. This project supports the development of professional learning resources for teachers who are focusing on interactive pedagogy for teaching with or without information and communication technologies (ICTs). Resources include videos that can be used as a stimulus for discussion, reflective practice (Plan-Teach-Reflect), leadership for learning,

an index for inclusion and change techniques that advocate for a participatory way of identifying significant changes.

Another initiative from OER Africa is the African Teacher Education Network (ATEN), which supports the development of teacher education OER in Africa. This network is made up of a loosely connected group of teacher-educators from Botswana, Ghana, Nigeria, South Africa, Tanzania, Togo, Uganda, Zambia, the UK and the USA.

A number of other projects, some of which are no longer running, have OER that are freely available. These include the following:

- **The University of Fort Hare's Bachelor in Primary Education** was a high-quality programme for in-service Eastern Cape teachers that ran from 1998 to 2006. The university then digitised their material and made it freely available online.
- **The Data Informed Practice Improvement Project (DIPIP)** aimed to create a context in which "critical friends" (postgraduate students and district facilitators) worked with school teachers on data that provided evidence of learners' performance.



- **The ACE Maths Project** aimed to pilot a collaborative process for the selection, adaptation and use of OER materials for teacher education programmes in South Africa.
- **The SAIDE Teacher Education Series** was originally conventionally published. The various parts of the series have been republished as a number of digital modules and released as OER.
- **The African Virtual University (AVU)**, based in Nairobi, has been developing a range of teacher education resources, involving, like TESSA, a consortium of countries and institutions. Since 2006, the AVU has released modules of its Teacher Education Programmes as OER. In 2010, they developed an OER repository. This has led to an increase in the use, contextualisation, sharing and dissemination of academic content. The AVU is currently a leading African institution in the provision of OER and publishes them in English, French and Portuguese. In January 2011, the AVU launched an OER online interactive portal called OER@AVU. The portal currently hosts 219 modules: 73 modules in each of the three languages, including 46 in mathematics and science, four in ICT basic skills, 19 teacher education professional courses, and four in the integration of ICTs in education. Between January 2011 and June 2012, the portal attracted more than a million users from 193 countries.
- Engaging teacher-educators in learner-centred and activity-based pedagogical approaches via OER and orientation programmes.

One important purpose of OER is to provide a knowledge base for the professional development process. The teacher-educator, through face-to-face contact and/or online social interaction, is then able to give more time to the implementation and improvement processes. This reflects the TESSA and OER Africa approach described earlier and is at the heart of the movement that MIT initiated.

Asha Kanwar, the President of COL, sees OER as having the potential to help transform education by involving all kinds of stakeholders “to participate, collaborate, create and share” knowledge, by “encouraging consumers to become the producers

of knowledge” and by enabling the harnessing “of tacit knowledge across the globe to address the great development challenges” of the age (Kanwar, 2011, Slide 19). COL itself has developed an OER repository, the Open Resources for English Language Teaching (ORELT) project, that aims to provide a bank of open content multimedia resources in online, offline and traditional text formats to support school-based teacher education and training, and parallel support resources focussed specifically on the needs of teacher-educators.

In a very short time, OER appear to have captured the imagination of educators, including teacher-educators, across the world. Systematic integration of OER into the work of higher education and other organisations appears to be on the immediate horizon.

The second substantive digital initiative that is particularly relevant to teacher-educators is the development of MOOCs. These are usually short courses using online resources and communication to meet the learning needs of as wide an audience as possible. Stanford University in the USA was in the vanguard of MOOCs. In 2011, it offered a course on Artificial Intelligence that reached 160,000 teachers. A number of consortia, among them Future Learn (www.futurelearn.com), have been established to exploit the

One important purpose of OER is to provide a knowledge base for the professional development process.

Other OER initiatives around the world are being established to help teacher-educators address the teacher education challenge. TESS India (www.tess-india.edu.in), a multimillion-dollar initiative in India funded by UKAid, has created teacher development units as well as leadership units for teachers and school leaders to use in their everyday work. These units are designed for use in pre-service and professional development settings. The resources are adapted to meet the needs of the different regional settings in which TESS India operates.

The overarching objectives of TESS India could be applied to many forms of teacher education. Two of these objectives illustrate this perfectly:

- Making activity-based OER available to teachers in various formats (print, online, CD/DVD, SD cards for mobile phones) to promote school-based practice for their own professional development.

potential of MOOCs. The TESS India programme has now used the units it developed to create MOOCs. France has created an Open Classrooms site (www.openclassrooms.com) to make MOOCs (mostly in French but increasingly also in other languages) accessible to all. The Open Classrooms slogan is “*Des professeurs brillants et des élèves géniaux*” (Bright Teachers, Great Students).

MOOCs have created considerable controversy. Detractors question their quality and completion rates. Supporters point to their accessibility and the sheer richness of resources available. MOOCs now come in many formats, from those with a fairly traditional teaching model to those drawing on new forms of digital capabilities (Nanfito, 2014). Debate about MOOCs will be ongoing as higher and professional education begins to integrate digital modes of working into mainstream practice. There are, as yet, few examples of MOOCs across higher education or professional education in Sub-Saharan Africa (Escher, Noukakis & Aebischer, 2014). The African Virtual University is currently exploring the possibilities of developing MOOCs.

The MOOC phenomenon is attracting considerable private investment as well. One report has estimated that the global market for MOOCs will grow from US\$1.83 million in 2015 to US\$8.5 billion by 2020, a compound growth rate of 36 per cent (Research and Markets, 2016). Some US-based private organisations have also begun to explore the possibilities offered by MOOCs. Coursera is one of the largest and best-known MOOC providers (the two others with this sort of reach are Udacity and edX). With support from the World Bank, Coursera is planning a new pilot initiative in Tanzania to offer MOOCs as part of a broader initiative to help equip students with employment-relevant IT skills. Adoption of device-based computing, rapid increases in connectivity and the emergence of online and collaborative learning (including the personalisation of technology) are seen as some of the prominent factors driving the adoption of MOOC platforms and services.

There do appear to be important opportunities for teacher-educators in the evolution of OER and MOOCs. Teacher education, including in-service teacher education, operates at a large scale in most education systems. A technology designed

for working at scale offers the potential to reach out to teachers in ways previously not possible. In addition, a large number of online digital teacher professional development sites are emerging, sometimes involving university staff. There is some evidence that students are using social media, such as Facebook, for the informal exchange of ideas, and there are international examples of this moving into quite elaborate structures. For example, TeachMeet in the UK is a range of informal and online meetings of teachers outside any formal governmental or regional authority jurisdiction. TeachMeet events are a mix of formal and informal activities and usually have input from well-known educationalists, many of whom work in universities. EdCamps in the USA (Marcinek, 2014) represents a similar development, as do the TESSA clubs at OLA College in Ghana discussed earlier.

There is a range of innovations close to widespread adoption that could be of great significance for teacher education in general. OER now have a significant foothold in teacher education provision. MOOCs will appear soon as they already have done in India. Key questions for policy makers and providers follow from this. What elements in teacher education are appropriate for large-scale online provision? How are these courses mediated at the local or school level? Is there a need for an infrastructure for course development to be created? What knowledge and skill development is necessary to put such systems into place? Do governments or regional authorities lead in the incorporation of digital technologies into large-scale teacher education provision, or do they facilitate (through financing and regulatory flexibility) organisations such as universities, NGOs and private companies to do this? Whether the term MOOC is used or not, there is a need for very large-scale programmes for teachers across most of Sub-Saharan Africa, and the experience and debates around MOOCs can contribute to this process.

In addressing these questions, policy makers and providers of teacher education will need to take into account the new digital applications that will soon be available. Here this current report draws on the very

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useful work of the New Media Consortium (NMC) Horizon Report on Higher Education produced as part of the EDUCAUSE programme in 2015 (Johnson, Adams Becker, Estrada & Freeman, 2015). The NMC report lists a number of technologies that could have a significant impact on education generally. Six of these technologies appear to be relevant to teacher education: bring your own device (BYOD), flipped classrooms, makerspaces, wearable technologies, adaptive learning technologies and the Internet of Things.

BYOD and flipped classrooms are now at the near-adoption phase. BYOD refers to the practice of people bringing their own laptops, tablets or smartphones to the classroom and connecting to an institutional network. There is a rapidly growing commercial use of this strategy and claims of significant productivity gains. The practice is now spreading to higher education, with BYOD proponents at Griffith University in Australia citing mobile-device use as a way for students to engage with learning material more effectively. A Bradford Network Study has shown that 85 per cent of responding institutions allow faculty to use their own devices on campus and 52 per cent said that the use of such devices was being integrated into classroom teaching. King's College London (www.kcl.ac.uk) has implemented a private cloud platform that allows students and faculty from 150 countries to use their own devices to access a virtual desktop. The University of Pittsburgh

(www.pitt.edu) is constructing three innovative classrooms that will serve as models for future learning spaces. These classrooms feature technologies that enable students and instructors to use their own mobile devices to share documents wirelessly and securely, collaborate on projects and display content in the rooms.

One of the obstacles to taking up online and digital technologies has been the cost and upkeep of equipment for institutions. This is now disappearing as devices such as tablets and increasingly sophisticated mobile telephones become part of most people's everyday toolkit. In Sub-Saharan Africa, the growth in mobile telephony has been astonishing. Teacher education

planning and policy will be in a position to exploit these new modes of accessibility.

The flipped classroom is currently in the adoption phase. The aim is to shift ownership of learning from the teacher to the student. The flipped classroom uses technologies (including BYOD) to make ideas about blended and enquiry-based learning easier to implement. Essentially, students study content through videos, simulations and other online multimedia resources prior to engaging in virtual or face-to-face workshops where the focus is much more on interaction with other students and on debate and discussion, rather than "listening to" the teacher. In the context of school-based teacher development in many parts of Sub-Saharan Africa, opportunities for coming face-to-face with tutors and other teachers are rare. The flipped classroom concept offers significant pedagogic potential for the sort of interactive and active learning that characterises the best of professional development. Boston University (www.bu.edu) provides an example of a new flipped course model that depends on building local, collaborative learning communities of faculty and graduate and undergraduate students. There is considerable potential for linking teachers and pedagogic and academic specialists through the flipped classroom model.

As of 2016, makerspaces and wearable technologies have an adoption timeline of two to three years. In makerspaces, the worlds of design and engineering begin to have significant influence over the educational environment. Proponents of makerspaces for education highlight the benefits of engaging learners in creative, higher-order problem solving through hands-on design, construction and iteration. New technologies such as 3D printers and 3D modelling Web-based applications become part of the toolset for those working in the makerspaces. In a sense, makerspaces are a more open-ended flipped classroom. It would be possible, for example, to think about a makerspace in which science teachers, teacher-educators and leading scientists collaborated to develop teacher knowledge and skills. Agency by Design, for example, is a research initiative at the Harvard Graduate School of Education's Project Zero (www.pz.harvard.edu), which seeks to investigate how a maker-centred approach to learning can help develop students' sense of competency or agency.

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Google Glass is a current example of a technology that enables users to see information about their surroundings, and Open Colleges Australia's interactive infographic is exploring the potential of Google Glass in education for activities such as documenting learning and remote teaching and

instruction (www.opencolleges.edu.au/informed). The far too infrequent and clumsy tradition of lesson observation could be conceived in quite different terms as this particular technology becomes more common. All these technologies could lead to a stronger and deeper discourse around practice. Ethical issues will need to be addressed as the technologies are adopted, but we are close to the point where low-cost universal observation of student-teachers and teachers could become commonplace.

A longer, four- to five-year time frame is envisaged for widespread adoption of adaptive learning technologies and the Internet of Things. Adaptive learning technologies refer to software and online platforms that adjust to individual students' needs as they learn. Adaptive learning is a sophisticated data-driven, and in some cases non-linear, approach to instruction and remediation. It adjusts to learners' interactions and demonstrated performance level and subsequently anticipates what types of content and resources learners need at a specific moment in time to make progress (see <http://educationgrowthadvisors.com/gatesfoundation>).

There are two levels to adaptive learning technologies. The first reacts to individual user data and adapts instructional media accordingly, while the second leverages aggregate data across a large sample of learners for insights into the design and adaptation of curricula. These sophisticated technologies might have important implications for how to understand and judge quality and performance in the classroom. They certainly open up some fascinating prospects for research-focussed joint university-school

programmes. For example, if teachers had more detailed profiles of individual or group learning, how could these be pedagogically deployed? Brandman University in California has been working with Flat World Education to develop an online, competency-based Business Administration degree using deep adaptive learning technologies (www.brandman.edu/mypath/learning-resources). A recent Gallup and *Inside Higher Ed* survey revealed that two out of three college and university presidents believe that adaptive technologies would positively affect higher education (Zimmer, 2014).

Finally, there is the Internet of Things, a network of connected objects that link the physical world with the world of information through the Web. Learners carrying connecting devices can benefit from a host of interdisciplinary information. For example, someone exploring a new city could call on architectural, political or biological lenses in order to understand what they see. The teacher in the classroom should be able to use the same technology in drawing ready-for-purpose resources for individual or collective use. Cisco is currently teamed up with Melbourne's Swinburne University of Technology to collaborate on new research initiatives in this area (www.swinburne.edu.au/news/latest-news/2014/10/cisco-and-swinburne-to-partner-on-research.php). Perhaps most significantly, the Internet of Things offers the possibility of interactively using large data sets about how successful pedagogic practices have been in the past in terms of student achievement in order to inform practice at the level of the individual student and class.

Describing such future scenarios can quickly look dated, not least because even the six overlapping technologies discussed here will be disrupted by interaction with each other and through the arrival of new applications. The point, however, is the rather simple one that the technologies do exist to fuse the worlds of university, teacher-educator, teachers and schools in ways hitherto impossible. Exploiting this to give greater value to the teacher-educator task seems essential. The types of curriculum development that would be associated with the exploitation of these new forms of technology are equally applicable in campus- or school-based or distance education provision. The evidence thus far suggests that students working through a blended online and face-to-face

model are stimulated by the quality of the resources as well as the personal and collective autonomies that such an approach engenders.

Take-up of these forms of technology goes beyond the realm of teacher education. Innovative uses of digital learning are now widespread and, as noted already, are significantly affecting higher education and professional training in the public and private sectors. In an important sense, taking the opportunities offered by blending digital learning into teacher education is not a futuristic ambition. Many of the technologies are already there. But it does need systematic governmental and institutional planning

to ensure that structures are in place, key staff are well trained and resources are available. At national, regional and institutional levels, such planning will now need to go beyond the promulgation of new technology policy statements (of which there are many) to more detailed and creative mapping out of new modes of provision. This will almost certainly require more collaboration between the different levels of government and the different types of teacher education providers than has hitherto been the case.



Section 5 –

Phasing in Digital Reforms to

Teacher Education

This report proposes thinking of digital integration as taking place through three phases, each of which could be considered at national, regional or institutional levels within any education system.

- Phase 1: Teacher education systems as they are today with some digital development.
- Phase 2: Full exploitation of existing technologies when access becomes nearly universal.
- Phase 3: Incorporation of a future range of digital affordances relevant to teacher education.

It is important to note that each of these levels envisages some form of hub and network structure through which these new models would function. Such hubs already exist in one sense. Universities, regional education authorities and some private companies are playing such a role in schools in their area. In this context, however, a hub becomes a much more explicit part of any digital network. The hub might manage different forums supporting the exchange of ideas; it might act as the repository of pre-selected OER; or it might showcase how local teachers have produced new resources or reinterpreted existing OER. There will be more than one model of how a hub would function, but a hub would be essential to allowing a network to become established and evolve (Anamuah-Mensah, Banks, Moon & Wolfenden, 2013). Proactive and co-ordinated policy development is required to establish these sorts of structures.

Phase 1 – 2016-2020

For campus-based pre-service courses, it is now possible to envisage that in most contexts students will have access to online resources and digital communications. The planned integration of good quality OER (such as TESSA or OER Africa) could enrich teaching, and particularly teaching that is focussed on practical classroom understanding. Such resources could also be used for structured practicum activities.

The use of online forums to promote the exchange of ideas could be encouraged. Some institutions would incorporate online reporting of student projects and research into course provision. There may also be opportunities for providing tutors to mentor or to supervise teacher communication through email or other forms of digital media (Facebook, for example).

Many school-based teacher education programmes focus on qualification upgrading. At present, some teachers do not have easy or reliable Internet access. Providing resources may continue to be through providers who create, print and distribute course materials. There are financial and logistical consequences arising from this. There are likely to be many contexts in the immediate future where some teachers have access to material and others do not. Some institutions have begun to explore financial incentives to encourage teacher capability to connect online (supplying mobile devices or providing them at very favourable rates, for example). As already noted, in many contexts it may now be cheaper and more effective to provide resource-loaded tablets than to distribute hard copy texts.

Where teachers have reliable connectivity, there are possibilities for providing access to the forums that have been created locally for campus-based students. Some school-based courses are also using SMS to make communications less expensive and more efficient. Most upgrading courses involve some regular attendance for face-to-face sessions, and planned use of online resources and communications at the venues could feature as a new course element. There are important opportunities now for integrating online, digital course elements into CPD programmes. Planning to fully develop digital CPD programmes can take place over the coming three to four years. The technology alone, however, will not create motivating and effective instruction. Much work remains to be done on the structure and content of CPD if the potential of digital technologies is to be realised.

Where teachers have reliable connectivity, there are possibilities for providing access to the forums that have been created locally for campus-based students.

Phase 2 – 2018-2022

For campus-based provision, online access to students and teachers in schools should be universally available. There would be an opportunity to rethink practice supervision. Although some personal visits would continue, digital observations and digital collaboration with school mentors would be possible.

For school-based programmes, full connectivity offers significant advantages in terms of potential scale of take-up and quality of provision; teachers following upgrading courses would have full access to a range of OER that providers (or providing hubs) would organise. A range of topics in teacher education could be taught through international MOOC-style provision (e.g. the mathematics or science subject content knowledge required by teachers). The teachers following these upgrading courses could have access to the forums and resources created for students in the campus-based model. Full access could lead to the building of a shared virtual resource centre serving campus- and school-based programmes.

It would also be possible in this phase to think more flexibly (and cost-effectively) about the nature and extent of in-school teacher support. An experienced teacher following an upgrading programme with good in-school support would not need the same type of support as an untrained teacher who has joined a school staff for the first time. A CPD programme aimed at improving subject knowledge would work effectively with online support, whereas a programme focussed on the classroom management skills of early-years teachers in newly established schools might need more in-school support. The new structures created through universal access would require the rethinking of the role of teacher-educators; most significantly, teacher-educators would need to develop the expertise to fuse online and personal support in ways that many institutions are developing today; for providers, particularly colleges and universities, there would need to be more sensitive and more flexible policies for using skilled staff; and university providers, particularly university regulatory administrators, would need to adjust to the more flexible modes of teacher education.

Phase 3 – 2020 onwards

Phase 3 would build on the systems and structures of Phase 2 and integrate new applications into the educating and training processes. In this scenario, all students and teachers would have their own devices and broadband access. Wearable technology would permit practice observation to take place at any time. There would inevitably be concerns about privacy, and so new protocols would need to be developed with appropriate consultation. Networks offering a variety of professional collaborations would exist.

The use of flipped classroom approaches could become commonplace. It is possible to imagine a group of campus-based pre-service students and teachers in schools collaborating on a topic. Teacher-educators offering support or mentorship to the students and teachers might have identified a task, issue or problem (examples could include the achievements of girls in lower secondary mathematics or the parental role in learning to read at the primary level) that they could use to guide such groups. The technology facilitates this sort of interactive learning across a geographically dispersed site. The learning concept, however, is well established. For example, long before the digital revolution, Harvard University developed a curriculum based on the case file approach in which students are given a range of resources relating to a business or legal problem that they then seek to solve collaboratively (see www.hbs.edu). The approach could be developed in the flipped classroom teacher education context.

There have been many arguments advanced for making teacher education more active, participatory and relevant to school issues and practice (Leach & Moon, 2008). Digital learning and newly emergent applications offer opportunities to enhance this process while simultaneously expanding access. There will need to be creative approaches to developing the teacher education curriculum; policy structures will need to be realigned to take account of digital learning. This will mean dismantling some structures to build new and better digitally sensitive ones.





Section 6 – Building a Research Agenda around New Modes of Teacher Education and Development

Over the last few years, the UK's Department of International Development (DfID) has commissioned a number of systematic reviews that relate directly to the work of teacher-educators. These have ranged across a number of topics, including reform to promote teacher effectiveness, the benefits of professional development programmes and how to improve the teaching of untrained contract teachers (see www.r4d.dfid.gov.uk). A number of these reports have pointed to the paucity of recent research evidence about teacher supply, retention and education, particularly in Sub-Saharan Africa.

The issues discussed in this current report would be more clearly understood, and policy and practice concerns more informed, if greater attention were given to the development of a research agenda around technological innovation. And some international agencies are addressing the problem. DfID, for example, is expanding its research in this area. Teacher-educators also have responsibilities and opportunities to develop stronger research and evaluation to underpin developments in teacher education. This is especially true of the public and private universities that are the main providers of pre-service and qualification upgrading provision in many countries. There are strong arguments to suggest that the research community could play a more significant role than they currently do to improve and develop provision (Moon, 2016). There is also a need for more joined-up thinking between governments (i.e. ministries of Education) and researchers.

The development of digital technologies in teacher education, particularly the potential to scale up

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 stance education) ①
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Group 6
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 - Using ICT
 - Having connectivity (internet)
 Mix of full time
 and ODL
 ⇒ Diverse

Group 4:
 Role of ICT's in Context:
 - Administration of students
 - Information collected not often used for planning for effective T&L
 - ICT innovation seen as add on, little ownership of innovation projects
 - Access to mobile technology is very good, but not used effectively
 - Access is on mixed levels from high to low
 - Lack of access to research info to support innovative ICT infusion in instruction

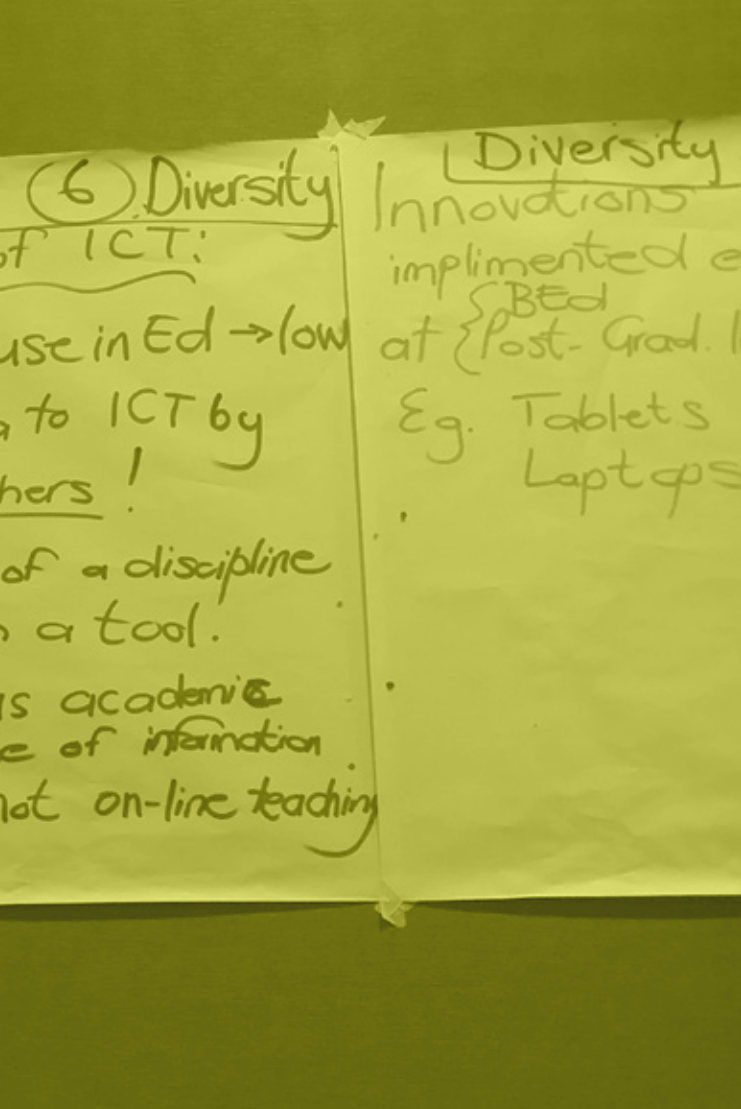
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and improve the quality of education and training, provides fascinating opportunities for the researcher.

- How does teacher education sit within the national and local systems of education? What determinants affect teacher education? How do they relate to each other? What structure of determinants seems most likely to prove effective?
- How is it possible to effectively ascertain and monitor the flow of need for pre-service and upgrading programmes? What balance of provision would give a guarantee of entitlement for the education and training of all teachers?
- How can tools and systems be developed to more closely monitor the flows of teachers in and out of the education systems and the education and professional training needed for different groups and sectors?
- What is the scale of need for effective CPD programmes? How could this realistically be

provided and who should do so? Is there a need for a more influential role for public and private universities in the professional development of teachers? How might universities provide for this?

- What are the varying profiles of teachers who need to go through upgrading programmes? What is their prior experience?
- How can teacher-educators make their pedagogic practice more effective in providing digitally enhanced programmes? What are the future education and training needs for teacher-educators?
- Can we monitor the number of students and teachers who achieve universal broadband access? What are the barriers to offering universal broadband access? And how can these be overcome?



- What governance structures, at all levels, effectively encourage the move to universal access?
- What governance structures, at all levels, promote equitable access to education and training for teachers?
- What is the most effective combination of elements in blended programmes of pre-service, upgrading and CPD? How are digital technologies effectively integrated into such programmes?
- How are OER best created for teacher education programmes? How might OER be adapted for local context? What contribution can the private sector make?
- How effective are MOOCs within teacher education programmes?
- Within blended programmes of teacher education, what are the most effective combinations

of school-based, online and personal tutor visit support? What are the implications for costs and administration of support for an alternative scenario?

- Is it possible to develop research and development instruments that robustly trace the impact of CPD on learner rather than teacher outcomes?
- How can programmes successfully help promote the professional values in teachers that would contribute to a purposeful and effective education system?

This set of questions is illustrative of the sort of profile that could be given to research and evaluation around teacher education. Digital technologies have the potential to create a new architecture for teacher education. There is a need for legitimate organisations to take a lead in mapping out the field and overseeing research progress. The newly established African Deans of Education Forum (ADEF) might have a role to play, as might international organisations such as COL, the DfID, the World Bank and the international aid agencies. The UNESCO Task Force on Teachers could raise awareness of this. The Sustainable Development Goals seek to encourage international co-operation around teacher supply and education. The research agenda would be an important way to internationalise one of the major education challenges of our time.

Acknowledgements

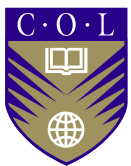
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References

- Anamuah-Mensah, J., Banks, F., Moon, B., & Wolfenden, F. (2013). New modes of teacher pre-service training and professional development. In B. Moon (Ed.), *Teacher education and the challenge of development: A global analysis* (pp. 201-211). London: Routledge.
- Bold, T. (2016, February). *What do teachers know and do? A report card on primary teachers in Sub-Saharan Africa*. Paper presented at the 2016 RISE Conference. Retrieved from <http://pubdocs.worldbank.org/en/520161466186067066/Filmer.pdf>
- Bolkan, J. (2013, 24 June). Report: Students taking online courses jumps 96 percent over five years. *Campus Technology*. Retrieved from <https://campustechnology.com/articles/2013/06/24/report-students-taking-online-courses-jumps-96-percent-over-5-years.aspx>
- Castells, M. (2000). *The rise of the network society*. Oxford: Wiley Blackwell.
- Darling-Hammond, L., & Lieberman, A. (2012). *Teacher education around the world: Changing policies and practices*. London: Routledge.
- Davidson, C. (2013, 16 February). Stop polarising the MOOCs debate. *University World News*. Retrieved from www.universityworldnews.com/article.php?story=20130213114954750
- DOCEBO. (2014). E-learning market trends & forecast 2014-2016 report. Retrieved from www.docebo.com/landing/contactform/elearning-market-trends-and-forecast-2014-2016-docebo-report.pdf
- Duncan, A. (2009). Address to Teachers College Columbia calling for a sea-change in teacher education. Retrieved from www.tc.columbia.edu
- Escher, G., Noukakis, D., & Aebischer, P. (2014). Boosting higher education in Africa through shared massive open online courses (MOOCs). *Education, Learning, Training: Critical Issues for Development, International Development Policy Series No. 5*, 195–214.
- Evans, D., Popova, A., & Arancibia, V. (2016, June). *Inside in-service training: What works, what is happening, and how do we measure it?* Paper presented at the 2016 Rise Conference. Retrieved from www.riseprogramme.org/sites/www.riseprogramme.org/files/Evans%20Inside%20In-Service%20Teacher%20Training%20-%20CLEAN%20-%20v2016-06-22.pdf
- Flood, Z., & Rice-Oxley, M. (2016, 25 July). Can the Internet reboot Africa? *The Guardian*. Retrieved from www.theguardian.com/world/2016/jul/25/can-the-internet-reboot-africa
- Goodwin, A. L. (2012). Quality teachers, Singapore style. In L. Darling-Hammond & A. Lieberman (Eds), *Teacher education around the world: Changing policies and practices* (pp. 22-43). London: Routledge.
- Harley, K., & Barasa, F. (2012). *TESSA: Teacher education in Sub-Saharan Africa formative evaluation report*. Retrieved from www.tessafrica.net/sites/www.tessafrica.net/files/TESSA%20Executive%20Summary.pdf
- Hewlett Foundation. (2013). *Open educational resources: Breaking the lockbox on education*. Menlo Park, CA: Author.
- Ingersoll, R. (2004). Four myths about America's teacher quality problem. In M. Smylie & D. Miretsky (Eds), *Developing the teacher workforce* (pp. 1-33). Chicago: University of Chicago Press.
- Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2015). *NMC Horizon Report: 2015 higher education edition*. Austin, TX: The New Media Consortium.
- Kamenetz, A. (2010). *DIY U: Edupunks, edupreneurs and the coming transformation of higher education*. New York: Chelsea Green.
- Kangai, C., & Bukaliya, R. (2011). Teacher development through open and distance learning: The case for Zimbabwe. *International Journal on New Trends in Education and Their Implications*, 2(4), 124-141.

- Kanwar, A. (2011, November). Can OER transform education? A developing world perspective [PowerPoint and video presentation given at the 2011 Conference on Open Educational Resources in Iceland]. Retrieved from <http://oasis.col.org/handle/11599/1278>
- Lapostelle, G. (2016). The role of state and university in the initial education and training of teachers in France (1990-2015). In B. Moon (Ed.), *Do universities have a role in the education and training of teachers? An international analysis of policy and practice* (pp. 75-84). Cambridge, UK: Cambridge University Press.
- Leach, J., & Moon, B. (2008). *The power of pedagogy*. London: Sage.
- Levine, A. (2010). Teacher education must respond to change in America. *Phi Delta Kappan*, 92(2), 19-24.
- Lewin, K. M., & Stuart, J. S. (2003). *Researching teacher education: New perspectives on practice, performance, and policy. Multi-Site Teacher Education Research Project (MUSTER)* (Synthesis Report No. 12882). Department for International Development (DFID) (UK). Retrieved from <https://assets.publishing.service.gov.uk/media/57a08d1d40f0b652dd001780/Educationalpaper49a.pdf>
- Marcinek, A. (2014, 19 March). EdCamps remixing professional development [Web log post]. Retrieved from www.edutopia.org/blog/edcamps-remixing-professional-development-andrew-marcinek
- Martin, I., & Kutarna, C. (2016). *Age of discovery: Navigating the risks and rewards of our New Renaissance*. London: St Martin's Press.
- McCormick, R. (2010). The state of the nation in CPD: A literature review. *The Curriculum Journal*, 21(4), 392-412.
- Moon, B. (2000). The open learning environment: A new paradigm for international development in teacher education. In B. Moon, M. Ben-Peretz, & S. Brown (Eds), *Routledge international companion to education* (pp. 756-772). London: Routledge.
- Moon, B. (Ed.). (2016). *Do universities have a role in the education and training of teachers? An international analysis of policy and practice*. Cambridge, UK: Cambridge University Press.
- Moon, B., Leach, J., & Stevens, M. (2007). *Designing open and distance learning for teacher education in Sub-Saharan Africa: A toolkit for educators and planners* (African Region Human Development Working Paper Series No. 104). Washington, DC: The World Bank.
- Nanfito, M. (2014). *MOOCs: Opportunities, impacts, and challenges: Massive open online courses in colleges and universities*. N.p.: Author.
- New Era. (2012). *MTC makes Namibia 2nd country in Africa to launch 4G* [Press release]. Retrieved from www.mtc.com.na/uploads/press-releases/4c06cfdee2115e1914606ba11eafe3eb9ec8f221.pdf
- Perraton, H. (2010). *Teacher education: The role of open and distance learning*. Vancouver: Commonwealth of Learning.
- Pryor, J., Akyeampong, K., Westbrook, J. & Lussier, K. (2012). Rethinking teacher preparation and professional development in Africa: An analysis of the curriculum of teacher education in the teaching of early reading and mathematics. *The Curriculum Journal*, 23(4), 409-502.
- Research and Markets. (2016). *Massive Open Online Course Market by Platform, Course (Humanities, Computer Science & Programming, Business Management, Education & Training), Service (Consulting, Implementation, Training & Support) & by Region - Global Forecast to 2020*. Retrieved from www.researchandmarkets.com/reports/3506951/massive-open-online-course-market-by-platform
- Roberts, S., Garnett, P., & Ranveer, C. (2015). *Connecting Africa using the TV White Spaces: From research to real world development*. Retrieved from www.microsoft.com/en-us/research/publication/connecting-africa-using-the-tv-white-spaces-from-research-to-real-world-deployments

- Robinson, B., & Latchem, C. (2003). *Teacher education through open and distance learning*. London: Routledge.
- Sawahel, W. (2013, 25 January). Africa is the most dynamic e-learning market on the planet. *University World News*, Issue 256. Retrieved from www.universityworldnews.com/article.php?story=20130125105755921
- Schleicher, A. (Ed.). (2012). *Preparing teachers and developing school leaders for the 21st Century: Lessons from around the world*. Paris: OECD.
- Thanki, R. (2016). *Achieving universal broadband connectivity in Namibia* (Unpublished report to the Namibian government to seek support for using TV White Space technology for rural connectivity).
- UNESCO. (2005). *The quality imperative: EFA global monitoring report*. Paris: Author.
- UNESCO. (2015a). *EFA global monitoring report. Education for All 2000-2015 achievements and challenges*. Paris: Author.
- UNESCO. (2015b). Sustainable Development Goal for Education cannot advance without more teachers (UIS Fact Sheet No. 33). Author.
- Walji, S. (2014, 19 September). Researching OER in Africa and the global South. *University World News*, Issue 335. Retrieved from www.universityworldnews.com/article.php?story=20140917111818454&query=Researching+OER+in+Africa+and+the+global+South+
- Wilson, S. (2014). Innovation and the evolving system of US teacher education. *Theory into Practice*, 53(3), 183-95.
- Zeichner, K. (2016). The changing role of universities in US teacher education. In B. Moon (Ed.), *Do universities have a role in the education and training of teachers? An international analysis of policy and practice* (pp. 107-126). Cambridge, UK: Cambridge University Press.
- Zeichner, K., Payne, K. A., & Brayko, K. (2015). Democratizing teacher education. *Journal of Teacher Education*, 66(2), 122-35.
- Zimmer, T. (2014, 22 October). Rethinking higher education: A case for adaptive learning. *Forbes*. Retrieved from www.forbes.com/sites/ccap/2014/10/22/rethinking-higher-ed-a-case-for-adaptive-learning/#4ae4242d6293



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