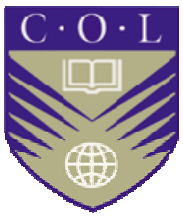

Towards a Strategy on Developing African Teacher Capabilities in the Use of Information and Communication Technology (ICT)

October 2004

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Numerous organisations deserve special thanks for supplying the research team with extensive literature and documentation for this research. These organisations include: Imfundo, the South African Institute of Distance Education (SAIDE) (Educators Development Network (EDN) Evaluation), UNESCO (ICT Training Kit and Teacher Trainers Planning Guide), SchoolNet South Africa (EDN and Intel® evaluations), World Links, SchoolNet Uganda, Connect-ED Uganda, CurriculumNet Uganda, Microsoft Partners in Learning, African Teachers Network, the Flemish Organisation for Development and Assistance (VVOB)—Better Secondary School Trained Teachers (BeSSTT) Programme (Zambia), education departments of various South African Universities, LearnLinks, Chrystal eLearning, iEARN, AIDSWeb and the producers and distributors of a large range of International Computer Driving Licence (ICDL) software.

There were also many, many interviewees who kindly participated in this research from many of the organisations described above, as well as from several African schoolnets and schools. The team from Connect-ED Uganda deserves special acknowledgement for contributing their time towards sharing their experiences for this research.

Ms Shafika Isaacs-Bardien
Project Leader
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LIST OF ABBREVIATIONS

ACE	Advanced Certificate in Education
AED	Academy for Educational Development (Uganda)
ATN	African Teachers' Network
CATT	Computer-assisted teacher training
CBT	Computer-based training
COL	Commonwealth of Learning
Connect-ED	Connectivity for Educator Development Programme (Uganda)
ECDL	European Computer Driving Licence
EDN	Educators Development Network
ERNWACA	Education Research Centre of West and Central Africa
GeSCI	Global e-Schools and Communities Initiative
ICDL	International Computer Driving Licence
ICT	Information and communication technologies
IICD	International Institute for Communication and Development
INSET	In-service teacher training
ISTE	International Society for Technology in Education
NEPAD	New Partnership for Africa's Development
NETS	National Educational Technology Standards (USA)
NGOs	Non-governmental organisations
NIE	National Institute of Education (Singapore)
OSISA	Open Society Initiative of Southern Africa
PC	Personal computer
PDLE	Professional Development Learning Environment (Connect-ED)
PiL	Partners in Learning (Microsoft)
PTC	Primary teaching colleges
SAIDE	South African Institute of Distance Education
SITE	Society for Information Technology and Teacher Education
SNA	SchoolNet Africa
UMOE	Uganda's Ministry of Education
WBT	Web-based training

EXECUTIVE SUMMARY

This study was commissioned by SchoolNet Africa (SNA) in partnership with the Commonwealth of Learning (COL), the International Institute for Communication and Development (IICD) and the Open Society Initiative of Southern Africa (OSISA). It is the most extensive examination to date of teacher training in information and communication technology (ICT) in African countries at both the pre-service and in-service levels. Through documentary review, interviews and discussions with a broad range of stakeholders and service providers involved in the field of ICT training for African teachers, this report has identified and listed as many of the ICT courses and programmes available to African teachers as possible. A broad range of these courses and programmes has been evaluated in more detail in order to highlight the obstacles and challenges to ICT integration in teacher training in Africa. This has informed some recommendations for strategic interventions at a national level to aid in moving forward with ICT integration by and for African teachers.

The literature review identified several debates currently taking place with respect to the development of African teacher capabilities in ICT. These include:

- Whether to focus on developing teachers' theme-based capabilities (ICT integration) or decontextualised ICT skills. There are arguments in favour of both, but the international preference is for ICT skills to be integrated into teaching practice. Several countries, however, have identified the requirement to start with developing teachers' basic ICT literacy prior to integration.
- Whether to focus capacity-building on pre-service or in-service teachers. The preference here is obviously to do both, but the shortage of resources available for teacher training suggests that pre-service interventions should be the higher priority (retraining later means additional costs and "old dogs" don't like "new tricks"). However, the literature review highlighted the current ICT gap in African pre-service teacher training and the need to transform teacher training colleges if pre-service ICT training is to become a reality. Current barriers to transformation in these teacher training institutions include a lack of ICT infrastructure and a lack of ICT-trained teacher educators.
- The importance of sufficient access to ICT if teachers are to be able to truly realise the potential transformative benefits of ICT integration in education.
- The importance of matching the mode of delivery and types of training to the audience in order to ensure cost effectiveness and successful integration after the training. It is a waste of money to teach teachers skills that require complex ICT infrastructure if the tools at their disposal are so basic that they cannot put what they learn into practice.
- The critical importance of contextual relevance in African teachers' ICT training in order for training to be truly worthwhile. This includes cultural, language and curriculum relevance.
- The issue of whether and how to accredit ICT skills and whether these skills should entitle African educators to better pay.

Sixty-one separate teacher training initiatives were identified for this research. These initiatives range from courses targeting several thousand teachers and spread across

several countries to those targeting fewer than 100 teachers and confined to a specific region within a country. There are courses that are delivered entirely through distance learning online, and there are those that are delivered entirely through face-to-face instruction. Twenty-seven of the courses identified are not linked to pedagogy but are designed to teach basic ICT skills to anybody. These courses have been included because they are marketed to teachers and are being used to train teachers throughout Africa.

The most notable fact about this course list is that, while there is evidence of a fair number of initiatives to teach African teachers ICT skills, these are largely fragmented and regional, and very few of them are delivered online. There are currently very few broadly based, online and scaleable ICT courses linked to African pedagogy.

The biggest gap identified in the process of this review was at the pre-service teacher training level. Despite extensive Internet searches and enquiries, very few African teacher training institutions appear to be offering pre-service ICT training. Some international case studies of countries that are undertaking successful pre-service teacher training in ICT have therefore been included in this research in order to provide African countries with examples of how pre-service teacher training in ICT can be done effectively.

The findings of this research highlight several significant challenges to integrating ICT capability into teacher training, including:

- ICT integration into teacher education is complicated by the variety of levels at which ICT capabilities can be taught (pre-service versus in-service, primary versus secondary, simple versus advanced skills) and by the variety of types of capabilities (pedagogically linked or decontextualised ICT skills, subject-specific ICT skills). These layers of complexity make it very difficult to plan broad-scale and effective strategic interventions in this field.
- Although there is evidence of a number of teacher training initiatives in Africa at both the pre-service and in-service levels, these are mostly small scale, regional and fragmented with little sharing of experience between nations. There is currently no comprehensive pan-African framework that covers the development of local technological models and local teacher training content for building African teachers' ICT capabilities.
- There is also a lack of coherent individual government policies with respect to developing teachers' ICT capabilities in Africa. Several African countries have developed national ICT policies, and several more are in the process of finalising their ICT policies. However national ICT policies with respect to teacher training remain fragmented, under-funded and inadequate.
- Many African education ministries are desperately short of funds to allocate to existing education requirements. Therefore, although most view ICT as an important new field for education development, ICT programmes for teachers are low in terms of spending priorities.
- Many of the courses and projects on ICT for teacher education identified in this research have been created with donor funding. Most are funded for specific periods of time, and it is unclear whether they will be able to sustain themselves once their external funding stops.

- Accreditation is one way to create tangible benefits for teachers from ICT training. However, the challenge is how to ensure that accreditation is consistent across a wide variety of very different courses and there is not a proliferation of poor quality courses offering the same accreditation as much better courses.
- There are serious concerns in Africa regarding the shortage of locally developed, contextually relevant course content for both teachers and learners. It is vital that considerably more emphasis be placed on developing contextually relevant African digitised content so that African teachers can realise the full potential of ICT to transform their teaching practice.
- There is currently a broad range of course materials of various levels of quality available to African teachers. There is a challenge to ensure that good quality courses get the high-level support that they require to become widely adopted, while poor quality courses are either improved or abandoned in favour of the better courses.
- The majority of African teacher training institutions are too under-resourced even to meet existing expectations. The addition of an ICT curriculum requires extra infrastructure, the development of teacher trainer ICT capabilities and the development of ICT training materials (content).
- There is no point in spending any time and effort equipping teachers with the necessary skills to integrate ICT into their teaching if schools do not have the computer laboratories and other ICT resources necessary to put their skills into practice with their learners.
- Teachers require sufficient time for training and access to information about suitable courses.
- Finally, the prohibitively high cost of training African teachers in ICT is a constant issue and underlies all of the challenges already mentioned. Everything from the development of course materials, to the implementation of training programmes (whether pre-service or in-service), to ICT access for teachers, to monitoring of course quality and consistency is limited by insufficient funds. The shortage of public funds in Africa is the fundamental challenge to be overcome before ICT capacity-building can become a reality in African education.

From the findings of this research, it is obvious that there is a requirement to start to systematise interventions in African teacher capacity-building in ICT in order to ensure greater impact from the time, energy and financial resources that are being spent in this field. Systematisation will best occur through the development of a pan-African strategy on building African teacher capacity in ICT, created in partnership with all relevant stakeholders. This report cannot speak for all stakeholders in terms of what they would require from a pan-African strategy. It can and does aim to outline some of the key elements that should form part of that strategy based on the findings of this research.

A pan-African strategy on developing African teacher capacity in ICT should include:

- A stakeholder participation process
- Inter- and intra-country collaboration and knowledge sharing on the subject
- Development of coherent national policies with respect to teacher capacity-building in ICT

- Exploration of options for ensuring ongoing sustainability of specific initiatives
- Capacity-building in the development of local digitised content and curriculum integration (getting teachers to use ICT as a tool)
- Focus on improving ICT integration at the pre-service teacher training level through helping to build ICT capacity at teacher training institutions

1. INTRODUCTION

This research was commissioned by SchoolNet Africa (SNA) to provide information for a strategy to develop African teacher capabilities in the use of information and communication technologies (ICT). To this end the South African Institute for Distance Education (SAIDE) was contracted to conduct a secondary research review of all existing online courses in English that explicitly target the development of African teacher capabilities in the use of ICT. The task was to prepare descriptive summaries of all the courses found and then to evaluate a range of these programmes by comparing their different approaches to integrating ICT capability in teacher training systems. The aim of the research is to highlight the obstacles and challenges to ICT integration in teacher training in Africa and then make recommendation on considerations for strategic intervention at the national level to aid ICT integration in going forward.

This report covers experiences in anglophone Africa predominantly. A related, separate report covers experiences in francophone Africa. This French-African report was conducted by the Senegalese team from the Education Research Network of West and Central Africa (ERNWACA/ROCARE) under the aegis of SchoolNet Africa. Some of the findings of the Senegalese team are incorporated in this report; the full French-African report is also available (see Annexure V).

This report begins by describing the conceptual framework for the development of African teacher capabilities in the use of ICT. It also defines some of the terms and concepts used. This is followed by a section on research methodology, and then a literature review highlighting some of the key issues identified. A section summarising the range of practice identified in this research is next, followed by a summary of the findings of the detailed evaluations and case studies. The obstacles and challenges to integrating ICT capabilities into teacher training, as identified by this research, are then highlighted. The report concludes with recommendations on strategic interventions at the national level for integrating ICT capability into teacher training systems.

2. OBJECTIVES OF THE STUDY

The objectives of this study are to:

- Inventory all ICT courses designed for African teachers at both pre-service and in-service levels for primary and secondary school teachers
- Highlight some of the key issues with respect to developing African teacher capabilities in the use of ICT
- Evaluate some of the identified approaches to the integration of ICT in teacher training
- Describe the identified obstacles and challenges to ICT integration
- Make recommendations for a framework that considers managerial, technological and pedagogical dimensions for the development of comprehensive teacher training programmes at both pre-service and in-service level throughout Africa

The study was to be limited to courses that were:

- Online
- Presented in English (French courses are covered in the related French report, while Portuguese was excluded owing to time and budgetary constraints)
- Explicitly targeting one or more African countries
- Explicitly targeting teachers
- Reinforcing teachers' capabilities in the use of ICT (for the purposes of teaching or school administration)

Once the research process began, some of these limitations were adapted in order to improve the research. For example, although the initial requirement was only to include online courses, the research was extended to include all initiatives that are aimed at developing African teachers' ICT capacity, regardless of their mode of delivery or whether they can be defined explicitly as a "course." All changes to the terms of reference are described in section 3.1.

3. CONCEPTUAL FRAMEWORK

At the "ICTs in African Schools" workshop[1] held in Botswana in April 2003, building human resource capacity in ICT was identified as one of the recommended project areas that African schoolnets would focus their efforts on. The workshop participants divided human resource capacity-building into the following categories of activities:

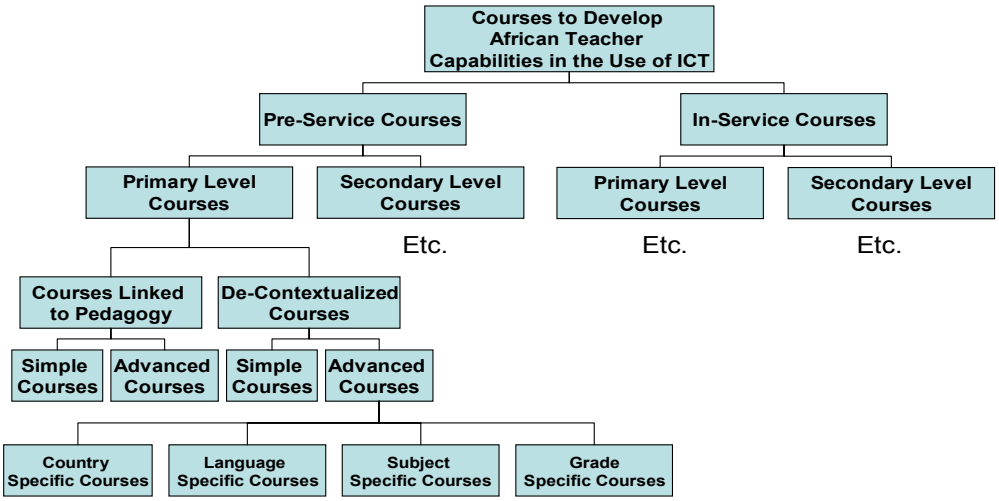
- Pre-service teacher training: Developing the capacity of teacher training institutions to train teachers to use ICT (pan-African)
- In-service teacher training: Developing the capacity to deliver in-service teacher training in ICT using both contact and distance education methods (subregional)
- Research on effective models for teacher training: Researching effective models for teacher training on using ICT in the education system (pan-African)
- Development of teacher training courses: Reviewing existing teacher training in ICT courses and developing or revising courses (including using distance education) (pan-African)

The purpose of this research is to provide a basis for the above activities.

Before proceeding with the research, it is important to note that this is an enormously broad topic of research, which is complicated by a number of factors. For example, there are a variety of levels at which ICT capabilities can be taught (pre-service versus in-service, primary versus secondary, simple versus advanced skills) and a variety of types of capabilities (e.g., pedagogically linked ICT skills or decontextualised ICT skills, subject-specific ICT skills). These layers of complexity make it very difficult to compile a single list of initiatives, and make it virtually impossible to compare the initiatives because they are not all attempting to do the same thing.

The diagram below could be called the beginning of an overall strategic framework for understanding how the "playing field" for developing African teacher capability in the use of ICT breaks down. It illustrates at which levels teacher ICT capabilities can be developed (pre-service or in-service, primary or secondary school level) and what types of courses can be developed (courses linked to pedagogy or decontextualised courses, simple courses or advanced courses). Within each type of course, there are still variations in the target audience based on language, subject or grade level, etc.

[1] The English report is available at: *www.schoolnetafrica.net/fileadmin/resources/Workshop_Report.zip*. The French report is available at: *www.schoolnetafrica.net/fileadmin/resources/Workshop_Report_French.zip*.



This framework is a useful precursor to the current research as it illustrates the various sub-elements in the field of African teacher capacity development in ICT. This is important because, without this introduction, the research may be confusing because of the wide variety of training programmes and contexts that it encompasses.

The focus of this research project has been to review and evaluate existing African-focused initiatives fitting into any one (or several) of the above sub-segments. There is an expectation that the research will highlight obstacles and challenges and provide recommendations for a framework that considers future teacher training interventions at all of these levels (including managerial, technological and pedagogical dimensions).

3.1 Definitions

This section defines some of the concepts and terms that have been used in this research in order to avoid confusion about what is included or excluded when a specific term is used. These definitions may not be standard beyond the context of this report, but they will help to clarify the way the following terms are used here.

Teacher training in ICT: This can be defined as "a coherent system of initial and continuous training of teachers in the use of ICT, which also includes training in adaptation to the evolution of the profession of teachers and managers of education systems through distance training."[2] This definition recognises that the teaching profession is being transformed by the introduction of new technologies into the education system and that teacher training in ICT should therefore equip teachers not just with basic ICT skills, but should encourage the evolution towards integrating these technologies into teaching subjects and practices. In other words, this definition

[2] See Annexure V: French-African Report, p. 7

implies that teacher training in ICT is not just about how to use new technologies, but also about why and when to use them in transforming teaching practices.

Online courses: Various authors have proposed definitions of the concept of online courses. The French-African version of this report has quoted some of them as follows:[3]

> A training programme accessible through the Internet or intranet. Internet technology allows the individual to train her or himself in a visual or interactive environment. This method necessarily integrates a companion teacher for the learner in the form of a tutor.

Or

> This type of learning corresponds to a high-level system of training such as computer-based training (CBT) or Web-based training (WBT). E-learning is therefore the result of the association of interactive and multimedia contents, distribution supports (PC, Internet, intranet, extranet) and a package of software tools, which facilitate management of online training and tools for interactive training. Access to resources is thus considerably extended, as are the possibilities for collaboration and interactivity.

Or

> We call an online situation one in which students have more or less occasional access to Web sites that complement classroom teaching and, at the other extreme, a course that is designed to be broadcast in full and followed at a distance. In the best cases, the first include teaching materials for content taught in class (for example, the teacher's class notes in HTML format) and a communications environment adding to the interactions that take place during physical presence. The second offers learners the overall materials and teaching environment they need for learning without face-to-face encounters, and where communications between persons intervening are generally not synchronised.

Or

> An online course must have a teaching structure that guides participants through the contents, a teacher or facilitator, as well as interaction between the participants.

The determining factors of an online course according to these definitions are therefore:

- A teaching/learning programme through Internet or intranet
- A tutor or learning facilitator
- Communications between students and/or between students and a facilitator that is normally not synchronous

The definition of an online course could be summarised as *training that is accessible through the Internet, intranet or CD-ROM, where students, tutors, course authors and training managers all intervene. In addition to attain the teaching/learning objectives assigned to such courses, synchronised or non-synchronised means of communication, collaboration or sharing is put at the disposal of these various stakeholders.*

[3] See Annexure V: French-African Report, p. 8

However, as already mentioned, the research team decided to extend its research to include ICT-related courses and programmes for teachers, whether they are delivered online or not. The Imfundo *Review of ICT Training for Teachers in Africa*[4] stuck rigidly to the definition of "online course" and this resulted in many non-pedagogical computer-skills courses being evaluated instead of specifically teacher-focused initiatives (which often were not online). The research team realised that a large proportion of ICT courses targeting teachers in Africa are not offered purely online. (Many of these courses combine an online component with face-to-face interaction through workshops, while several are purely face-to-face lecture-based courses.) As well, pure online delivery is not necessarily always the best solution in the African context. Thus, the decision was taken to include courses that are not delivered online for this research. Instead, preference was given to courses delivered in digital format (via diskettes, CD-ROM, as an intranet version or on the Web), but courses that met all other criteria were not excluded if they were not delivered in digital format. The delivery mode of the course is described in the review, and the evaluations include the reviewer's assessment of the appropriateness of the chosen method of delivery.

Courses: Following from the previous definition, during the inventorying process, we realised that several of the courses we had identified were not specifically courses, but were actually programmes or projects. From our understanding, a "course" refers to a single series of learning materials presented in a single learning process, whereas a "programme" or a "project" often includes a series of different learning interventions in one initiative. Programmes or projects also sometimes use course materials developed by other organisations. For example, several of the LearnLinks projects use World Links course materials, and the African Teachers Network uses course materials from iEARN and the Educator Development Network (EDN).

In order to be as inclusive as possible in our inventory, we have decided to include all the ICT training initiatives that were identified and not just specific courses. This runs the risk of being somewhat confusing, but it was decided that we should take this approach so that we did not exclude any major African teacher training initiatives in ICT. As far as possible in the reviews, we have tried to indicate whether each initiative is a specific course or a programme/project. In some instances in this report we have used the term "initiative" instead of "course" in order to avoid confusion by calling something a course when it is obviously not one.

Explicitly targeting teachers: This seemed self-explanatory and initially the research team only inventoried courses whose content explicitly targets teachers. However, many non-teacher-specific ICT courses are being widely marketed to and used to train African teachers in ICT (for example, many of the International Computer Driving Licence (ICDL) courses). It was decided that the exclusion of all of these courses would give an incomplete picture of the ICT training that is currently being undertaken in Africa. Therefore, the research team decided to include any courses that are marketed at teachers in the inventory of courses, despite their content not having been designed explicitly to target teachers. However, we have differentiated between

[4] T. James, O. Hesselmark, B. Akoh and L. Mware. 2003. *Review of ICT Skills and Training Software for Educators in Africa*. London, UK: DFID/Imfundo.
http://imfundo.digitalbrain.com/imfundo/web/papers/ictreview/?verb=view (accessed 2004)

the two types of courses and given preference to courses that explicitly target teachers in their content, as well as in their marketing.

Explicitly targeting African teachers: Initially we aimed to exclude all courses that were not designed for African teachers; however, several non-African ICT courses for educators are being used in Africa. The researchers therefore included non-African courses as long as one of the target audiences for the course was African teachers.

Additionally, the researchers undertook to compile descriptive summaries of some of the best international courses that were identified in the process of this research, so that they might be used to direct any further research arising from this project (for example, some of these courses might be worth evaluating as examples of international best practice).

4. RESEARCH METHODOLOGY

This research project involved a range of activities undertaken over the course of almost a year. These activities are described briefly in this section.

4.1 LITERATURE REVIEW

Prior to attempting to identify all the ICT courses targeting African teachers, the research team conducted a detailed literature review in order to gain a clearer understanding of some of the key debates and issues related to developing African teacher capabilities in ICT. This review included an extensive Internet search and several expert interviews, as well as accessing both the SAIDE Resource Centre and SchoolNet Africa's Knowledge Warehouse. A full list of the sources used is contained in Annexure I.

The findings of this literature review are summarised in section 5 of this report.

4.2 IDENTIFYING AND GATHERING INFORMATION ON COURSES

A secondary research review was conducted to identify all ICT skills courses that explicitly target African educators. Information was gathered via:

- Existing research on ICT training for African educators
- Desktop research
- Expert interviews: face-to-face, by telephone and by e-mail
- SAIDE Resource Centre
- Recommendations from Shafika Isaacs-Bardien, SchoolNet Africa
- Visits to subject experts
- Visits to specific course developers and projects

A full list of the sources used is contained in Annexure I.

A full list of the courses identified and descriptive summaries of each of these courses is included in Annexure II.

4.3 ASSESSING THE RANGE OF PRACTICE

Once a complete inventory had been compiled, the research team assessed and summarised the range of practice in order to start to identify some of the different approaches being taken in the African context of teacher training in ICT. This range of practice is discussed in section 6.

4.4 Developing an Evaluation Framework for More Detailed Analysis

As described in the conceptual framework, many of the initiatives identified in this research have very different objectives and are not directly comparable. Some are targeting pre-service teachers, some are targeting in-service teachers and some both. Some are only focused on teaching ICT literacy, while others are applying ICT to pedagogy. Even those that are applying ICT to pedagogy are targeting a range of different skill sets and audiences. The debates about which approach is better and why are ongoing, and therefore it was not possible to define an ideal set of criteria and design a quantitative evaluation tool that ranked courses according to these criteria.

Instead it was decided that the evaluations should be descriptive and analytical rather than quantitative, and serve as case studies with assessments of appropriateness of content, delivery and cost-effectiveness. Haralambos argues that case studies are usually qualitative in nature and make no claim to be representative. However, they generate rich and detailed information and are useful for generating typologies or general categories, which can then be used in future research.[5] Thus, instead of the reviewer deciding which approach has most merit, it was decided that one or two of each type of course available would be evaluated in order to highlight some of the different approaches in terms of focus and purpose, content, delivery, pedagogy, support, assessment and cost.

The evaluation criteria were chosen following an analysis of the frameworks used in a range of other evaluations and assessing their relevance to the current research.[6] Based on this, an evaluation template was compiled and was used for each of the evaluations undertaken. Some of the evaluation categories are purely descriptive, while some are designed to assess the quality of a course's content, delivery, support and assessment and feedback functions, as well as the cost effectiveness of the course. The questions in the template were not strictly adhered to, but rather served to direct the reviewer to cover as many angles as possible with the information available to evaluate the course. This template is available in Annexure III.

4.5 Choosing Initiatives for Detailed Evaluation

Based on the decision that the evaluations would serve as case studies for knowledge development, it was necessary to evaluate as broad a range of initiatives as possible.

Various organisations have already undertaken studies that have reviewed ICT training for teachers in Africa. Some of these studies have focused on evaluating single programmes (e.g., *Review and Evaluation of the Educators' Network (EDN) Modules* conducted by SAIDE, and an evaluation of the Intel® Teach to the Future Programme conducted by Neil Butcher and Associates), while others have covered a

[5] M. Haralamobos and M. Holborn. 1995. *Sociology: Themes and Perspectives*. London: Collins Educational, p. 833.

[6] N. Roberts and N. Butcher. 2003. *Evaluation of Educational Software for the African Context: Guidelines for Educators*; T. James et al. 2003. *Review of Basic ICT Skills and Training Software for African Educators*; SAIDE. 2003. *Review and Evaluation of EDN Modules: Report to SCOPE*—set of criteria for the evaluation of the EDN modules.

broad range of programmes (e.g., Imfundo *Review of ICT Training for Teachers in Africa*). Owing to time constraints, and rather than re-inventing the wheel, this research has drawn from many of the previous reviews of online ICT training courses for teachers in Africa. It has expanded on this research and done primary research only where insufficient previous research existed or where the previous research was not relevant for the current purpose. All sources used are referenced in the evaluations.

Additionally, because so few courses that target pre-service teachers were identified in the inventorying process, the research team decided that it was necessary to augment the evaluation process by including some international case studies on pre-service teacher training in ICT. The research team focused specifically on summarising some successful national pre-service teacher training strategies in order to provide an African audience with some examples of how pre-service teacher training in ICT can be integrated into national teacher education strategies. The evaluation framework developed for specific courses was obviously unsuitable for evaluating these national strategies, so instead, more generalised summaries were compiled in this instance.

The evaluations and case studies completed in this research have been loosely grouped as follows:

African-Developed Courses/Initiatives
Educator Development Network (EDN) of SchoolNet South Africa
Connect-ED Professional Development Learning Environment
Pretoria University Advanced Certificate in Education (ACE) in Computer-Integrated Education (with FUTUREKIDS®)

Internationally Developed Courses/Initiatives (adapted for Africa)
World Links
Intel® Teach to the Future
Microsoft Partners in Learning

Internationally Developed Courses (used in Africa)
Electric Paper International Computer Driving Licence (ICDL) for schools
Advance Learning International Computer Driving Licence (ICDL)
NETg International Computer Driving Licence (ICDL)
SkillsPro

International Pre-service Training Strategies
Singapore
USA
Scotland
Other European examples
Malaysia

International Pre-service Case Study
Intel® Teach to the Future, UK

The key findings of these evaluations and case studies are summarised in section 7 of this report. The full evaluations are included in Annexure IV. In addition to these evaluations, the related French-African report on this topic has evaluated two French courses: DESS-UTICEF and DUCM Training. The French-African report is included in Annexure V of this report.

4.6 RESEARCH LIMITATIONS

The number of evaluations completed was limited by the restrictions of desktop research, together with budget and time constraints. Owing to these restrictions, it was not possible to source copies of all the course materials or information on all the initiatives that appeared to be worth evaluating. The content of each evaluation was also restricted by the amount of information available on each specific initiative.

It is important to note that this research is obviously a snapshot in time of a rapidly changing and evolving field. Some of the information contained in this research will therefore be out of date quickly. Readers who plan to use the information in this report should therefore not assume that any specific details are up to date without verifying them first.

5. LITERATURE REVIEW

The literature review identified several debates currently taking place with respect to the development of African teacher capabilities in ICT. These debates must be taken into consideration when recommending frameworks for the development of ICT courses for African teachers. The scope of this research is insufficient for a detailed literature review and analysis, but some of these issues are briefly highlighted in this section since these different perspectives are likely to influence the perceived suitability of one course over another.

5.1 THEME-BASED CAPABILITIES VERSUS DECONTEXTUALISED ICT SKILLS

This research has started from the assumption that because ICT is an increasingly integral part of modern life, teaching and using ICT in schools is important if schools are to equip young people to cope with technology. This research does not aim to test this hypothesis. Nonetheless it is important to mention that opinion across the globe varies greatly as to whether it is necessary to teach teachers and students ICT skills at school, and if it is, how best to do that. For the purposes of this research, the answer to the question of whether to teach ICT skills is assumed to be yes, but there is nonetheless a significant and ongoing debate about how to teach ICT skills to teachers.

Many people question the relevance of teaching teachers ICT skills without teaching them how to apply those skills to their teaching practice. One school of thought claims that if you teach teachers how to use a computer and give them unlimited access to that computer, they will then figure out for themselves how to apply their knowledge of ICT to their teaching practice.[7] Another school of thought argues that it is necessary to teach teachers how to apply ICT to their teaching practice and that to simply teach teachers basic ICT literacy without applying it to pedagogy is a waste of time and resources.

The Imfundo *Review of Basic ICT Skills and Training Software for Educators in Africa* highlights the fact that, in the developed world, specific ICT courses for students of education and other tertiary level students seem to be waning. This is largely because formal ICT training has been found to have limited impact in relation to the time spent on teaching ICT skills. The teaching of ICT skills is therefore increasingly being approached differently, driven by the assumption that these skills are best learned incidentally while focusing on specific education-related tasks and themes.[8] However, there is the counter-argument that African educators have not had the access to computers that their counterparts in the developed world have had, and

[7] Unlimited access to a computer is not likely to be possible in the context of most African schools where there is a limited number of computers for a large number of students, teachers and administrators.

[8] Several sources: UNIC, the Danish Center for Education and Research, Denmark; Lärarhögskolan Stockholm, Sweden; National Institute for Education Development, Namibia. Quoted in James et al, *Review of ICT Skills and Training Software for Teachers in Africa.*

they therefore might not have had sufficient grounding to dispense with the need for basic ICT literacy courses before moving to specific education-related computer usage.

Jeffrey Goveia and Heidi Soule in an article entitled, "Why I Don't Want to Take a Course about a Pencil: Three Traps to Avoid When Introducing New Technologies to Educators" disagree that building basic ICT literacy is a necessary precursor to adapting ICT to pedagogy.[9] These U.S. educators, who write based on their experiences in working with Namibian teachers, question why those tasked with teacher training in ICT would want to create stand-alone technology courses when their hope is to help teachers see how technologies can be integrated into their daily lives and teaching practices. They argue that teaching about technologies too easily removes the technologies from the context of their daily uses. Instead of this approach, they recommend considering approaches whose primary focus is almost immediately getting education professionals to use technologies in their daily work and teaching assignments:

> Integration does not mean teaching technologies. It means using technologies. Further, it does not mean that we should just use technologies because they are there to be used. It means using technologies where it makes sense to use them. With these thoughts in mind, we might avoid wasting time and resources on technology because we feel compelled by hype to spend time and money on technology. Technologies can be very useful when thoughtfully introduced into an education system, but we feel it makes more sense to encourage education professionals to slowly and thoughtfully adopt these technologies into their daily activities rather than forcing them to take questionably effective and pedagogically unsound technology literacy courses.[10]

The authors of SAIDE's *Review and Evaluation of EDN Modules* suggest that it is necessary in ICT teacher development programmes to deal simultaneously with teachers' "conceptual knowledge in practice" and their ICT skills. The report notes:

> The recent proliferation of computers in schools, a phenomenon likely to be accelerated as a result of the government's drive to put in computers in all public schools by 2013, has placed further challenges on teacher training. This is already having the effect of increasing the number of teacher development programmes focusing on training teachers to use ICT. However, many of these programmes concentrate almost exclusively on giving teachers ICT skills or technical competence in ICT use, and do not take into consideration the more fundamental need of increasing teachers' "conceptual knowledge in practice." Without sound subject knowledge and the ability to deploy

[9] J. Goveia and H. Soule. 2003. "Why I Don't Want to Take a Course about a Pencil: Three Traps to Avoid When Introducing New Technologies to Educators." *Reform Forum*, no. 16 (April), http://www.edsnet.na/Resources/Reform%20Forum/journal16/16art4.pdf (accessed 2004)

[10] Goveia and Soule, "Why I Don't Want to Take a Course about a Pencil," p. 8.

> this knowledge intelligently in classroom contexts, teachers' use of ICT will have little effect on the quality of teaching.[11]

Convergence of technology has meant that ICT has become increasingly widespread in society, and easier to access and use. ICT use is likely to become so common throughout society that specific lessons on how to use the computer or the Internet may well become unnecessary for teachers and learners alike. What will still be needed, however, is the skill and the wisdom to use ICT efficiently and wisely to enhance learning.

5.2 Pre-service Versus In-service Teacher Training in ICT

Teaching ICT at pre-service versus in-service levels is not a case of either/or, but rather one of both/and. However, it would seem obvious that training teachers in the use of ICT pre-service will enhance the likelihood of their using ICT for teaching and learning. It would also seem to make more sense to train teachers in the use of ICT from the beginning of their teacher training, rather than waiting until teachers are in service and then retraining them. Providing good quality pre-service teacher training in ICT would gradually reduce the need for basic ICT interventions at the in-service level, as well as overcoming the problems of the technophobia of older learners. However, the biggest problem with incorporating ICT training into pre-service teacher training courses in Africa is the lack of resources and capabilities in the training colleges themselves.

Most newly qualified teachers coming out of African teacher training colleges today have had only limited exposure to ICT and almost no actual training in how to incorporate ICT into their teaching practice. The secondary review of ICT courses for educators, conducted as part of this research, yielded almost no pre-service training courses in computer-integrated education, outside of South Africa. (The Connect-ED Programme in Uganda is a notable exception.) Some of the in-service courses identified in the review are now starting to be used by teacher training institutions (for example the University of Kwazulu Natal is going to use EDN and Pretoria University uses Intel® Teach to the Future). However, most of the courses that are being developed are at the advanced certificate level (post-graduate). This would seem to indicate that most teacher training in ICT will continue to occur in-service for some time to come, unless African teacher training colleges can be encouraged and helped to adapt their training to include ICT capabilities at the pre-service level in the short term.

As noted above, one of the reasons for lack of pre-service ICT training is likely to be the lack of ICT facilities and capacities in many African teacher-training colleges. Owing to the apparent gap in African pre-service teacher training in ICT, this study has included an annexure report that examines the issue of pre-service ICT training in more depth. Annexure IV includes an analysis of some general principles for good pre-service training in ICTs, as well as a series of international case studies, to help guide the development of future pre-service courses in Africa.

[11] SAIDE. 2003. *Review and Evaluation of EDN Modules: Report to Scope 2003*, p. 6.

Obviously, since technology is continuously and rapidly advancing, there will always be a need to provide ongoing in-service ICT training to teachers. However, if teachers already know the basics and are already using technology to teach, it is likely that they will be able to teach themselves how to use new technological applications (as most people do with newer versions of software that they are already familiar with). In-service interventions could therefore be concentrated on teaching teachers more complex and advanced ICT applications (e.g., those related to their specific subjects).

The research team identified a large body of international literature relating to the principles and practice of pre-service teacher training in ICT. Rather than attempting to repeat the full range of findings and experience contained in all this literature, this section summarises the key findings that emerge from this literature. If readers of this report are interested in reading further or more specifically on the subject of pre-service teacher training in ICT, a list of the articles identified has been included in the further reading list at the end of Annexure I.

5.2.1 Requirement for Transformation of Pre-Service Teacher Training

Over the last decade, many countries that have started to include ICT in their education policy have been slow to include it in teacher education. Teacher training institutions in a majority of these countries continue to train teachers in the same way that they have for decades. Only recently have national agencies the world over begun to realise the importance of educating teachers to use ICT at the beginning of their careers. This has led to the realisation that a transformation is required in pre-service teacher training if ICT is to be properly integrated into education.

UNESCO's *Information and Communication Technologies in Teacher Education: A Planning Guide* states the following:

> With the emerging new technologies, the teaching profession is evolving from an emphasis on teacher-centred, lecture-based instruction to student-centred, interactive learning environments. Designing and implementing successful ICT-enabled teacher education programmes is the key to fundamental, wide-ranging educational reforms.
>
> Teacher education institutions may either assume a leadership role in the transformation of education or be left behind in the swirl of rapid technological change. For education to reap the full benefits of ICTs in learning, it is essential that pre- and in-service teachers are able to effectively use these new tools for learning. Teacher education institutions and programmes must provide the leadership for pre- and in-service teachers and model the new pedagogies and tools for learning. They must also provide leadership in determining how the new technologies can best be used in the context of the culture, needs and economic conditions within their country. To accomplish these goals, teacher education institutions must work closely and effectively with teachers and administrators, national or state educational agencies, teacher unions, business and community organisations, politicians

> and other important stakeholders in the educational system. Teacher education institutions also need to develop strategies and plans to enhance the teaching-learning process within teacher education programmes and to assure that all future teachers are well prepared to use the new tools for learning. [12]

An article entitled "Making a Difference: Using Emerging Technologies and Teaching Strategies to Restructure an Undergraduate Technology Course for Pre-Service Teachers" adds to this:

> By developing instructional strategies that maintain a high-quality technology-based learning environment and by empowering pre-service teachers through authentic technology learning experiences, the best environment can extend beyond the classroom. Higher education faculty can promote the use of technology best by integrating it in their own instruction. Colleges of education must provide pre-service teachers with supportive educational experiences in the successful use of technology. Pre-service teachers must be encouraged and inspired with a variety of innovative teaching and learning strategies that effectively model the use of technology for their future classroom use. [13]

Canadian research on pre-service training curricula shows that piecemeal programme revision is a mostly futile undertaking:

> Rather than adding or rejigging content or attempting to evaluate the effects of isolated innovative interventions within fragmented programmes, curriculum developers should attempt to situate the process of learning to teach within a new overall vision. Such an alternative vision would challenge traditional multidisciplinary models and propose a new model based no longer on knowledge of the discipline, but on the knowledge of professional action and on competencies; would affirm the need to ground the training process in learning, students and the analysis of practices, rather than in theories transmitted in the form of declarative, specialized, disciplined-based knowledge; and would integrate new knowledge and competencies on ICTs and culture, all the while stressing the need to negotiate reforms with stakeholders in the field and their organizations, in order to avoid overnight, overly hasty changes. [14]

[12] UNESCO. 2002. *Information and Communication Technologies in Teacher Education: A Planning Guide*. Paris: UNESCO, p. 4. http://unesdoc.unesco.org/images/0012/001295/129533e.pdf.
[13] G. Gunter. 2001. "Making a Difference: Using Emerging Technologies and Teaching Strategies to Restructure an Undergraduate Technology Course for Pre-Service Teachers." *Educational Media International* (March 1). Vol. 38, no. 1, pp.13–20.
[14] M. Tardif et al. 2001. "Pre-service Teacher Training Programs: Outcomes of recent reforms and new trends towards effective professional training," in *2001 Pan-Canadian Education Research Agenda Symposium—Teacher/Educator Training: Current Trends and Future Directions, Symposium Report*. Toronto: Canadian Education Statistics Council, p.14. http://www.statcan.ca/english/freepub/81-593-XIE/81-593-XIE01001.pdf.

5.2.2 Barriers to ICT Training at Pre-Service Level

As educational entities around the world have started to experiment with integrating ICT into pre-service teacher education programmes, researchers and evaluators have identified several key barriers that prevent or restrict successful technology infusion at the pre-service level:[15]

- **Lack of ICT experience and skills among teacher educators:** Many teacher educators have not yet mastered ICT for themselves and have found it challenging to incorporate ICTs into their own instructional practices based on their long experiences with traditional modes of learning.
- **Lack of access to technology in pre-service training institutions:** Even where teacher educators understand the opportunities associated with integrating ICT into teacher training, without access to ICT at their teaching institutions there is no way for them to implement ICT-integration effectively. This is especially a problem in the developing world where very few teacher training institutions have the resources to build their own computer laboratories and networks.
- **Lack of access to ICT training content:** Even where teachers in training colleges have access to a computer laboratory, many still do not know what to teach their students as they do not have access to training modules and programmes that are suitable for teaching teachers to use ICT.
- **Lack of access to good quality research (including content examples) from institutions that are already integrating ICT into pre-service training:** To aid the development of new pre-service training programmes or the improvement of existing ones, it is vital that existing experience is properly documented and evaluated.

While the historically slow integration of technology into pre-service teacher training is understandable, it has become increasingly apparent that a transformation of pre-service teacher training is critical if ICT is to become truly integrated into education. For this reason, increasing international resources have been allocated to researching and developing ICT integration strategies for pre-service teacher training over the last five years.

5.2.3 Basic Principles for Effective ICT Integration into Pre-Service Training

The following basic principles for integrating ICT into pre-service teacher training were identified by the Society for Information Technology and Teacher Education (SITE):

- *Technology should be infused into the entire teacher education programme.* Throughout their teacher education experience, students should learn about and with technology and how to incorporate it into their own teaching. Restricting technology experiences to a single course or to a single area of teacher education, such as methods courses, will not prepare students to be technology-using teachers. Pre-service teacher education

15 Gunter, "Making a Difference."

students should learn about a wide range of educational technologies across their professional preparation, from introductory and foundation courses to student teaching and professional development experiences.

- *Technology should be introduced in context.* Teaching pre-service students basic computer literacy is not enough. As with any profession, there is a level of literacy beyond general computer literacy. This more specific or professional literacy involves learning to use technology to foster the educational growth of students. Professional literacy is best learned in context. Pre-service students…should see their professors and mentor teachers model innovative uses of technology; they should use it in their own learning, and they should explore creative uses of technology in their teaching….
- *Students should experience innovative technology-supported learning environments in their teacher education programme.* Technology can be used to support traditional forms of learning as well as to transform learning. A PowerPoint presentation, for example, can enhance a traditional lecture, but it does not necessarily transform the learning experience. On the other hand, using multimedia cases to teach topics that have previously been addressed through lectures may well be an example of a learning experience transformed by technology. Students should experience both types of uses of technology in their programme; however, the brightest promise of technology in education is as a support for new, innovative, and creative forms of teaching and learning.

While the proposed ICT in teacher education curriculum should aspire to no less, the trajectory of the development for countries, regions, and organisations should be appropriate to the level of resources, including expertise, leadership, and ICTs themselves.[16]

The challenge confronting countries, regions and teacher training institutions is to encourage the above basic principles for ICT in teacher education by setting standards and holding pre-service training institutions accountable to those standards. However, national agencies should also be aiming to provide incentives and resources to support the development of technology-rich programmes and initiatives for pre-service teachers if these programmes are to have any hope of being successful and sustainable.

5.2.4 Developing ICT Programmes for Pre-Service Teachers

For many teacher education programmes, the daunting task of preparing a new generation of teachers to effectively use new learning tools in their teaching practices requires the acquisition of new resources, expertise and careful planning. The framework for ICT in teacher education outlined in UNESCO's *Information and Communication Technologies in Teacher Education: A Planning Guide* is very useful in understanding the requirements for successful pre-service educator development in ICT capabilities. Any organisations planning to develop a pre-service ICT training programme would do well to use this document as a starting point.

16 UNESCO, *Information and Communication Technologies in Teacher Education: A Planning Guide*. p. 32.

UNESCO's framework describes the essential conditions that must be met for successful ICT integration in teacher education. It also offers case studies illustrating the variety of approaches that may be used in integrating ICTs into teacher education. Furthermore, it provides guidelines for the development of a high quality strategic technology plan. Lastly, it discusses the importance of planning and managing the change process and building a broad base of support among all stakeholders to achieve the goals of integrating ICTs into the teacher education programme.

According to the UNESCO guide, it is critical that faculty in teacher education programmes be included in the planning effort when a university, teacher education unit, state, region or country adopts or adapts a set of standards for determining how technology will be infused through their teacher education programmes. The faculty will plan for ICT in teacher development considering their own conditions, culture and context. During this collaborative planning phase, the teacher education unit and other university units providing courses for pre-service teachers (i.e., teacher candidates) should develop plans that consider four key themes and develop four key components.

The Four ICT Themes
The UNESCO guide identifies these four themes:

[1.] *Context and Culture* identifies the culture and other contextual factors that must be considered in infusing technology into teacher education curriculum. It includes use of technology in culturally appropriate ways and the development of respect for multiple cultures and contexts, which need to be taught and modelled by teachers.
[2.] *Leadership and Vision* are essential for the successful planning and implementation of technology into teacher education and require both leadership and support from the administration of the teacher education institution.
[3.] *Lifelong Learning* acknowledges that learning does not stop after school. In common with the other themes, it is important that teachers and teacher preparation faculty model lifelong learning as a key part of implementation, and as an ongoing commitment to ICTs in teacher education.
[4.] *Planning and Management of Change* is the final theme. It signifies the importance of careful planning and effective management of the change process.

These themes may be understood as a strategic combination of approaches that help teacher educators to develop the four core [ICT] competencies.[17]

The Four ICT Competencies
The UNESCO guide identifies these four core competencies as being essential for the successful use of ICT in teaching and learning:

[1.] *Pedagogy* is focused on teachers' instructional practices and knowledge of the curriculum and requires that they develop applications within their

[17] UNESCO, *Information and Communication Technologies in Teacher Education: A Planning Guide*, p. 40.

disciplines that make effective use of ICTs to support and extend teaching and learning.

[2.] *Collaboration and Networking* acknowledges the communicative potential of ICTs to extend learning beyond the classroom walls and the implications for teachers' development of new knowledge and skills.

[3.] [*Social Issues*:] Technology brings with it new rights and responsibilities, including equitable access to technology resources, care for individual health, and respect for intellectual property.

[4.] *Technical Issues* is an aspect of the Lifelong Learning theme through which teachers update skills with hardware and software as new generations of technology emerge.[18]

The UNESCO Planning Guide proposes that these elements are necessary for a supportive environment and successful self-sustaining implementation of technology infusion within a teacher education programme.

5.2.5 Professional Development of Teacher Educators

The most critical factor in successful integration of ICT into teacher education is the extent to which teacher educators have the knowledge and skills for modelling use of ICT in their own teaching practices. Enabling them to develop these skills requires a well-conceived and sustained programme of professional development for the educators themselves. This is an element of ICT-integration training that is frequently forgotten in national plans to develop teacher ICT capabilities.

Planning and implementation of ICT-related professional development of teacher educators could usefully be led by a planning group that includes representation and expertise from teacher educators, programme administrators, teachers, school administrators, technology experts and business leaders. The diverse perspectives of a group such as this will provide an understanding of the realities of the classroom, new views of the teaching-learning process, knowledge of the array of technologies that may be used to enhance learning and community opinions. It is important for a planning group to negotiate a shared understanding of the role of ICT in the agenda for educational renewal based on their individual cares and concerns. It is also helpful to have a larger advisory or liaison group that may facilitate collaborative professional development efforts and sharing of resources across related organisations; for example, between the university and the partner schools where students are placed for teaching practice.

Additionally, professional learning communities allow teacher educators to support the professional development of colleagues and students and receive support themselves. ICT has increased access to and the reach of such professional associations. Mentorship can be fostered across geographic distances and supported by synchronous and asynchronous interaction via e-mail.

[18] UNESCO, *Information and Communication Technologies in Teacher Education: A Planning Guide*, p. 41.

5.3 TEACHER ACCESS TO ICT IN AFRICA

The biggest problem with encouraging African teachers to use ICT in their teaching is the lack of suitable access to ICT. Millions of dollars are being spent each year on providing computers to schools in developing countries, yet many schools are still very poorly resourced. Additionally, the computers that are available are often second-hand or refurbished and not powerful enough to run complex software applications. Electricity and Internet connections are also expensive and frequently unreliable in remote parts of Africa. Many African teachers complain that, even where their schools do have computer rooms, their access is restricted to certain times which are frequently inconvenient. (This is usually as a result of having to share access to a limited number of computers with students, administrators and other teachers.)

SAIDE's recently completed research on the use of ICT in 21 schools in South Africa has shown that, even where considerable support was given in the use of ICT in schools, computers were not generally regarded by most teachers as the most important resource for their work, apart from the administrative elements of it, where they were highly regarded. For teaching in most subjects across the curriculum, greater reliance was placed on textbooks and other paper references. The key problem was not that teachers did not want to use ICT for teaching and learning. Rather, the research found that teachers did not use computers for a range of reasons, including:

- ICT resource provision was poor.
- Internet connection was unreliable.
- Arrangements were not made to ensure sufficient access to school computers or the Internet for either teachers or their learners.
- Teachers lacked knowledge of how to browse and find materials efficiently on the Web.
- There was generally a lack of provision of software to support teaching and learning. Teachers seemed genuinely unaware of what might be available, or how or where they might find this. Where there was such knowledge, it was often restricted to math and/or science teachers. [19]

True computer literacy comes through regular use of computers and most users only begin to appreciate the usefulness and personal benefit deriving from ICT applications with regular access. Teaching computer skills to school educators will continue to lack contextual relevance if their chances of sufficient ICT access are negligible. This is not to say that SchoolNet Africa and other organisations should not be supporting teacher training in ICT, but rather that ICT training needs to be occurring in parallel with efforts to enhance access to ICT at the school level.

Although ICT is becoming more and more pervasive in society, not all teachers have equal ease in accessing and using ICT in their teaching or professional development. Serious differences still exist between countries and regions in terms of computer-access ratios, costs and possibilities for Internet access, and help to support the use of ICT. However, there are technological developments that offer promising new opportunities. For example, use of satellites to transmit digital network data can allow

[19] SAIDE. 2003. *The Use of Computers in Schools: Report on research into the use of computers for teaching and learning in twenty-one schools in South Africa.* Johannesburg: SAIDE. http://196.35.72.162/saide/ur/{152E5859-BE40-4684-83D0-B4A3E7D95D5A}.pdf (accessed 2004)

countries with poor telephone infrastructures to leapfrog the need to update those infrastructures before Internet access can improve. All the benefits of Web technology can be available via local area networks (intranets) where institutional access to the external Web is a problem for financial, cultural or quality control reasons.

However, these developments are unlikely to massively increase access in the short term in many contexts because of basic resource limitations.

5.4 Modes of Delivery of ICT Training

The debate about modes of delivery of ICT training is a logical extension of the issue of teacher access to ICT. Since availability of technology in African colleges of education and schools differs widely from country to country and institution to institution, modes of delivery of various ICT training options must be chosen to suit the technology. There is little use in delivering feature-rich online programmes with wonderful graphics and simulations via the Internet if teachers are using refurbished or old computers and have to rely on unreliable Internet connections and low bandwidth. Equally, if teachers have access to good quality infrastructure and facilities, they will be less than impressed by having to read through pages and pages of black text on a white background with no graphics and simulations to keep their attention. As such, a balance needs to be achieved or courses need to be clearly targeted to specific markets. An alternative option might be to have different versions of the same course available to take account of these contextual differences.

Options for delivery include:

- **Face-to-face workshops:** These courses teach ICT content, often to learners who are sitting in front of computers while they are being taught. The advantage of these courses is that teachers who are unfamiliar with computers have an actual person present to answer their questions and explain things in non-technical language. In addition, teachers can learn from each other and build an ethos of collaborative learning. These courses do not necessarily require expensive infrastructure or one computer per learner, although this would be preferable. The disadvantage is that the course is often only as good as the instructor, and teachers who are technophobes do not get as much chance to learn by doing. They often retain less and remain more wary of using a computer than they would if they had to work their way through an online course.

- **Simple lecture courses delivered via manuals, diskettes, videotapes, CDs or the Internet:** These courses often take the form of a series of written lectures (typed in a word processing package) with little or no interactivity between the learner and the material. Some make use of graphics, sound and filmed sequences. The advantage of these courses is that they are relatively cheap to produce and do not require expensive infrastructure to run. The disadvantage is that such digital content does not fully exploit the interactive possibilities that ICT offers and might not maintain the learner's interest. Some of these courses do offer mentoring support via e-mail (e.g., EDN).

- **Interactive learning environments delivered via CD, Internet or LAN using a combination of text, speech, pictures, software simulations and video sequences:** These products create a learn-by-doing environment that can be very effective for a motivated student. Software simulations are particularly useful in this regard. The drawbacks are that they generally require large memory capacity on computers and are very expensive to produce. Thus they have high licence fees or require extensive donor or private sector support. Where these environments are delivered via the Internet they need relatively fast and reliable Internet connections, the cost of which is very expensive in most African countries. These courses also frequently include distance mentoring via e-mail to a trained facilitator.

There is certainly both the space and the demand for all types of course delivery in the African teaching context. The critical thing is to recognise the relative strengths and weaknesses of each course and ensure that the delivery of a chosen course is appropriate for the specific environment.

Teacher training is likely to change in its forms and methods, partly as a result of ICT. The flexibility of ICT-learning will lead more and more teachers in training to expect flexibility in their courses and course provision. The traditional institutions might no longer be the obvious and automatic choice for their training. Students may be able to choose from online generic and specialised courses from around the world. The only constraint will be accreditation, forcing the trainee teachers to fulfill some local requirements for teaching certification.

In the field of continuing professional development, there is likely to be rapid growth and development of teachers using online collaborative networks to join and collaborate with communities of practice that best suit their development needs and educational visions, regardless of their location. Only language stands in the way of worldwide virtual professional development communities.

5.5 Content Relevance for African Educators

There are enormous contextual, cultural and sociological differences within the African continent (language and cultural differences, localised contexts and access to resources). There are also enormous differences in teaching requirements within the category of "educators" (subject focus, age group of students) and differences in levels of formal training, both in teaching and ICT skills. As such the "target market" of African educators is enormously broad and a strategy to develop African teacher capabilities in ICT cannot be so generalised as to ignore the different requirements of different subsectors within this target group.

For example, use of local languages and cultural references needs to be considered. Operating systems and basic software are available in all major world languages, but very few are produced in Africa. From a language perspective, this is generally not too problematic in large African cities where English, French, Portuguese or Arabic are spoken, but would be a problem in rural areas where exposure to these languages is likely to be lower.

From a content perspective, products from the developed world might include examples that are not culturally relevant in either a rural or an urban African context, and this might cause confusion and reduce the course's impact on the African learner. For example, the Intel® Teach to the Future programme was developed in the USA. A detailed process of adapting the materials to the South African context was undertaken, yet during the evaluation educators still remarked that more South African examples would have been helpful, as they did not always find the U.S. examples relevant.

SchoolNet Africa, in partnership with Commonwealth of Learning (COL) and the Global e-Schools and Communities Initiative (GeSCI), organised the "Digitized Content for African Education" workshop in Johannesburg in May 2004.[20] This workshop was conducted in the form of roundtable discussions and brought together experts in the field of content development to address issues on appropriate solutions for digitised content development and education portals within an African context.

The objectives of the workshop were:

- To share ideas and experiences on educational, technical and human relations aspects of developing digitised education content and building education portals
- To discuss solutions appropriate for an African education context with particular reference to content development for learning and teaching in primary and secondary education
- To inform a process of intervention by SchoolNet Africa and its partners on content development and building education portals in Africa

The workshop participants agreed that there has been a strong technological push in the application of ICT in Africa. However, the emphasis has been on technical solutions and has not taken sufficient account of pedagogical, educational and technological issues. Within this context, it has become clear that there is an urgent need for the production of digitised content that is relevant to the African continent. This workshop was significant as it was the first of its kind to examine content development within the African context.

Participants agreed that it was of profound importance to develop a working definition of digitised curriculum integration and content development in order to move forward towards a process of intervention. They agreed on the following definition of digitised curriculum integration and content development:

- It includes the capture, creation, storage, sharing and dissemination of new and existing learning objects.
- The above should be done in a way that takes cognisance of and influences curriculum processes and curriculum policies from a variety of contexts.
- It should showcase and share the value that Africa can provide in an online educational capacity.

[20] SchoolNet Africa et al. 2003. *Digitized Content for African Education—An Experts Round Table: Workshop Report*. Johannesburg: SchoolNet Africa. English report: English report: http://www.schoolnetafrica.net/fileadmin/resources/Digitised_Content_for_African_Education_Workshop_Report.pdf ; French report: http://www.schoolnetafrica.net/fileadmin/resources/Workshop_Report_French.zip

Participants also agreed that content doesn't achieve its full potential unless:

- It can be used again and again in a variety of different contexts.
- It is supported by real communities of use.
- It achieves a critical mass.
- It can be generated quickly and efficiently.
- It can be shared.
- It is rigorously evaluated.
- Ownership is recognised and protected.
- People are excited about using it.

Discussions were held about the reasons for the dearth of African content. Several suggestions were offered:

- There has been a very fragmented approach throughout Africa. It appears that everyone has been "doing their own thing" with a lack of communication between the different initiatives.
- There is a "crisis of confidence" in the African context—a lack of belief in the quality of what we can produce.
- There is a bottleneck at the policy level, which slows down the process of inducing change.
- Historically, the process of curriculum development has not been considered high on the education agenda. The challenge now therefore is to synchronise national processes with global processes that are constantly in flux.
- The process of content development also requires a process of professional development.

This workshop was just the first step in an ongoing process of refining Africa's requirements for the development of relevant local digitised content for both teachers and learners. The workshop participants agreed that there is still a place for foreign content, but that Africa need to build resourcefulness in order to create our own resources and know the optimal ways to locate good and relevant foreign content.

5.6 Motivation Through Accreditation and Incentives

A key issue that emerges repeatedly in this field relates to teachers' motivation to participate in professional development courses in the use of technology. While some teachers will request and seek out professional development opportunities in the use of technology, many teachers will not. Teachers are often reluctant to change their teaching styles and habits, are cautious of time-consuming activities that may take away from other obligations and have difficulty in seeing the potential pay-off beforehand of this type of training. They may also feel genuinely threatened by technology such that they want to distance themselves from it rather than embrace it.[21]

[21] S. Carlson. 2002. "The Missing Link in Educational Technology: Trained Teachers," *TechKnowLogia*. Vol. 4, no. 4 (October-December 2002), p. 9. http://www.techknowlogia.org/TKL_active_pages2/TableOfContents/main.asp?IssueNumber=18 (accessed 2004)

Providing accreditation to teachers who have undergone ICT training is a good way to motivate them, especially if it is linked to improved pay or promotion possibilities. However, this raises the issue of how to ensure that accreditations are worth the paper that they are written on. According to the Imfundo review, there are a myriad of inferior ICT skills courses in the African marketplace. Few commercial training courses have been accredited, and many potential trainees end up paying considerable sums of money for training that is of dubious quality.[22] There is a great need for an African-wide policy on ICT accreditation for teachers. Other possible incentives for encouraging teacher training in ICT must also be explored.

[22] James et al, *Review of Basic ICT Skills and Training Software for African Educators*, p. 7.

6. RANGE OF PRACTICE

The table below lists all 61 of the initiatives identified during the secondary research review phase of this research. Descriptive summaries of each of these courses are presented in Annexure II and detailed evaluations of some of them are presented in Annexure IV.

The findings of the French-African research team are reported separately in Annexure V.

Name of Course/ Programme/ Project	African Country Using Course/ Programme	Delivered Online/Digitally	Delivered Partially Online, Partially by Facilitator	Delivered Face-to-Face	For Pre-Service Training	For In-Service Training	For Anybody	Teaching ICT Skills Linked to Pedagogy	Teaching Non-Education Specific ICT Skills	Using ICT to Teach Other Skills	Basic Skills	Advanced/Applied Skills	Collaborative	Primary Level	Secondary Level	African Developed	Internationally Developed, Adapted for Africa	Internationally Developed, Used in Africa	International, Not Currently Used in Africa
1. Connect-ED PDLE, Uganda	Uganda	√			√			√			√		√	√		√			
2. Educators Development Network (EDN)	South Africa		√			√		√			√	√	√	√	√	√			
3. World Links (Blackboard)	Pan-African (International)		√			√		√			√	√	√	√	√		√		
4. Intel® Teach to the Future, SA	South Africa		√			√		√				√	√		√		√		
5. AIDSWeb Online Collaborative Project	South Africa (International)	√				√				√	√		√		√			√	
6. UNESCO ICT Training Kit	Pan-African	√					√		√	√	√	√		√	√			√	
7. LearnLinks: CATT Educational Development and Support Network in Namibia	Namibia		√			√		√		√	√	√	√	√	√		√		
8. Namibian BETD INSET EdsNet (NIED)	Namibia	√				√		√			√	√	√	√	√	√			
9. Learnlinks: CATT Educational Development and Support Network in Morocco	Morocco		√			√		√		√	√	√	√	√			√		
10. LearnLinks Project in Ghana (Community Learning Centres)	Ghana			√		√	√		√		√						√		
11. SchoolNet Uganda E-Learning with World Links	Uganda	√				√		√			√	√	√	√	√		√		

Name of Course/ Programme/ Project	African Country Using Course/ Programme	Delivered Online/Digitally	Delivered Partially Online, Partially by Facilitator	Delivered Face-to-Face	For Pre-Service Training	For In-Service Training	For Anybody	Teaching ICT Skills Linked to Pedagogy	Teaching Non-Education Specific ICT Skills	Using ICT to Teach Other Skills	Basic Skills	Advanced/Applied Skills	Collaborative	Primary Level	Secondary Level	African Developed	Internationally Developed, Adapted for Africa	Internationally Developed, Used in Africa	International, Not Currently Used in Africa
12. Microsoft Partners in Learning Programme	Pan-African			√		√		√			√		√	√	√			√	
13. Schools Online Web Mentoring Programme	Pan-African	√				√		√			√	√	√	√	√			√	
14. Chrystal eLearning	Uganda	√				√	√	√				√	√	√	√			√	
15. SchoolNet Africa's African Teachers Network (ATN)	Pan-African	√				√		√			√	√	√	√	√	√		√	
16. iEARN Prof. Development Courses for Educators	Pan-African	√		√		√		√			√	√	√	√	√		√		
17. VVOB BeSSTT programme in Zambia	Zambia			√	√				√		√			√			√		
18. INSET UNIT (School-based teacher development)	Kenya	√				√		√			√		√	√		√			
19. Rhodes University B.Ed. (Hons) ICT	South Africa			√		√		√				√		√	√	√			
20. Rhodes University ACE in Technology Education	South Africa			√		√		√				√		√	√	√			
21. University of Port Elizabeth ACE in Educational Computing	South Africa			√		√		√				√		√	√	√			
22. RAU Diploma in Technology-based Education	South Africa			√		√		√				√		√	√	√			

Name of Course/ Programme/ Project	African Country Using Course/ Programme	Delivered Online/Digitally	Delivered Partially Online, Partially by Facilitator	Delivered Face-to-Face	For Pre-Service Training	For In-Service Training	For Anybody	Teaching ICT Skills Linked to Pedagogy	Teaching Non-Education Specific ICT Skills	Using ICT to Teach Other Skills	Basic Skills	Advanced/Applied Skills	Collaborative	Primary Level	Secondary Level	African Developed	Internationally Developed, Adapted for Africa	Internationally Developed, Used in Africa	International, Not Currently Used in Africa
23. RAU ACE in Educational Computing	South Africa			√		√		√				√		√	√	√			
24. Pretoria University B.Ed. in Computer-Integrated Education	South Africa			√	√			√				√		√	√	√			
25. Pretoria University B.Ed. Hons in Computer-Integrated Education	South Africa			√		√		√				√		√	√	√			
26. Pretoria University ACE in Computer-Integrated Education	South Africa			√		√		√				√		√	√	√			
27. Pretoria University M.Ed. in Computer-Integrated Education	South Africa			√		√		√				√		√	√	√			
28. Centre for Advancement of Science and Maths Ed—Further Diploma in Technology Education	South Africa		√			√		√				√		√	√	√			
29. Integrated Educational Technology Support: Teachers Computer Practice	South Africa			√		√		√			√			√	√	√			
30. FUTUREKIDS® Educator Zone	South Africa			√		√		√				√		√	√	√			
31. Creative Learning Systems: Prof. Development for Maths Teachers	South Africa	√				√		√				√		√	√			√	
32. Knowledge Network	South Africa			√		√		√			√	√			√	√			

Name of Course/ Programme/ Project	African Country Using Course/ Programme	Delivered Online/Digitally	Delivered Partially Online, Partially by Facilitator	Delivered Face-to-Face	For Pre-Service Training	For In-Service Training	For Anybody	Teaching ICT Skills Linked to Pedagogy	Teaching Non-Education Specific ICT Skills	Using ICT to Teach Other Skills	Basic Skills	Advanced/Applied Skills	Collaborative	Primary Level	Secondary Level	African Developed	Internationally Developed, Adapted for Africa	Internationally Developed, Used in Africa	International, Not Currently Used in Africa
33. Hi-Performance Learning Snapshots	South Africa	√					√		√		√					√			
34. Community Education Computer Centre (CECS)	South Africa			√			√		√		√					√			
35. Activ-Training ICDL	Various	√					√		√		√							√	
36. Advance Learning ICDL	Various	√					√		√		√							√	
37. Applied Technology ICDL	Various	√					√		√		√							√	
38. BBC WebWise	Various	√					√		√		√							√	
39. Blackrock Education Centre ICDL	Various	√					√		√		√							√	
40. Course Technologies ICDL	Various	√					√		√		√							√	
41. Educational Multimedia Corporation IT skills	Various	√					√		√		√							√	
42. Integrated Educational Technology Support: ICDL	Various			√			√		√		√					√			
43. LearnScapes ProSkills Training	Various	√					√		√	√	√					√			
44. MindLeaders ICDL	Various	√					√		√		√							√	
45. Monash Learningfast ICT Benchmark	Various	√					√		√		√							√	
46. NetG ICDL	Various	√					√		√		√							√	
47. SkillsPro courses	Various	√					√		√		√							√	
48. Smartforce	Various	√					√		√		√							√	

Name of Course/ Programme/ Project	African Country Using Course/ Programme	Delivered Online/Digitally	Delivered Partially Online, Partially by Facilitator	Delivered Face-to-Face	For Pre-Service Training	For In-Service Training	For Anybody	Teaching ICT Skills Linked to Pedagogy	Teaching Non-Education Specific ICT Skills	Using ICT to Teach Other Skills	Basic Skills	Advanced/Applied Skills	Collaborative	Primary Level	Secondary Level	African Developed	Internationally Developed, Adapted for Africa	Internationally Developed, Used in Africa	International, Not Currently Used in Africa
49. Unique Learning	Various	√					√		√		√							√	
50. Vizion Factory ICDL	Various	√					√		√		√							√	
51. Microsoft Innovative Teachers Programme	None	√			√	√		√			√	√	√	√	√				√
52. Pedagogical ICT Licence (Denmark)	None		√	√		√		√			√			√	√				√
53. Enhancement Courses for Teaching Professionals, LMU	None	√				√		√			√	√		√	√				√
54. International LITERACY Org: Professional Development Kit (PDK) for Educators	None	√				√		√			√	√	√						√
55. MarcoPolo Internet Content for Classrooms	None	√				√		√			√	√		√	√				√
56. Cheltenham Computer Training ICDL	None	√					√		√		√								√
57. Electric Paper ECDL for schools	None	√			√	√			√		√			√	√				√
58. Freeskills IT Training	None	√					√		√		√								√
59. ISV Group ICDL	None	√					√		√		√								√
60. OlasIT ICDL	None	√					√		√		√								√
61. Thomson NetG ICDL	None	√					√		√		√								√

As can be seen from the above table, the secondary research review identified a large number and variety of ICT training initiatives targeting teachers throughout Africa. These range from courses targeting several thousand teachers and spread across several countries (e.g., World Links) to those targeting fewer than 100 teachers and confined to a specific region within a country (e.g., LearnLinks projects in Zambia, Namibia and Morocco). There are also courses that are delivered entirely through distance learning online (e.g., EDN), and there are those that are delivered entirely through face-to-face instruction (e.g., many of the university programmes).

Additionally a large number of courses (27) are not linked to pedagogy but are designed to teach basic ICT skills to anybody. These courses have been included because they are marketed to teachers and are being used to train teachers throughout Africa. It is important to note that the researchers identified several countries where ad hoc ICT training is being conducted for teachers, but this training has been excluded where it is not linked under any umbrella title. One example of this is the teacher training provided in the 36 schools of the Seychelles.

The most notable fact about the list compiled for this research is that, while there is evidence of a fair number of initiatives and courses to teach African teachers ICT skills, these are largely fragmented and regional, and very few of them are delivered online. Many of the initiatives on the list are making use of the same course materials (e.g., the LearnLinks projects, ATN and SchoolNet Uganda's e-Learning programme all use materials from courses that have also been listed separately).

It is reasonable to say that there are currently very few broadly based, online and scaleable ICT courses linked to African pedagogy. Most of the African-developed courses that have been identified are specific regional initiatives (e.g., Namibian NIED training). Although they might be replicable, most of these courses are neither online nor obviously scaleable. EDN is the notable exception to this; it is the only African-developed course that is delivered online and has the potential to be used more widely than the country in which it was developed.

Although World Links is not African-developed, this course material is being widely and very successfully used in Africa by a number of projects and programmes, as are the iEARN materials.

The Intel® Teach to the Future course also appears to be excellent, although it is currently being used only in South Africa, and this pilot initiative would indicate that more adaptation is required to make this course suitable for African teachers.

The Microsoft Partners in Learning programme is not really a course, but is helping to drive the development of teacher ICT training programmes in 16 African countries. Although still in its early stages, this initiative has the potential to help several countries develop their own teacher ICT courses by adapting and customising Microsoft's Foundation ICT Skills framework.

All the rest of the initiatives on the list are only relevant to this study in very broad terms, and it is not worth going into detail about them here. To find out more about any particular course please refer to the descriptive summaries in Annexure II.

In addition, the French-African research team identified only two courses in French Africa that met the terms of reference for this research: DESS-UTICEF (a specialised university diploma in studies of the use of information and communication for teaching and training in Senegal and Tunisia) and DUCM (a university diploma for becoming a multimedia communicator in Burkina, Togo, Madagascar and Senegal). These courses are described in the French-African report in Annexure V.

The biggest gap identified in the process of this review was at the pre-service teacher training level. Despite extensive Internet searches and enquiries, we could find very few African teacher training institutions that appear to be offering pre-service ICT training. Kenya, Uganda and Tanzania have set up an Internet site called *www.eastafricateachers.net*, which aims to network all teacher-training colleges in these countries as a first phase towards the establishment of a portal site for all education institutions in East Africa. This Web site includes a link to a page entitled "ICT for Teacher Training" but there are no institutions listed on this page. This was also found to be the case on the Association of African Universities Web site (*www.aau.org*) and on the African Education Portal (*www.africaneducation.org*).

Several South African universities offer teacher training in ICT, but mostly at post-graduate level through advanced certificates in education (ACEs). The only teacher-training institution outside of South Africa that was identified to be offering a clear ICT training programme at the pre-service level was the Connect-ED initiative for primary educators at Kyambogo University in Uganda. Although it is likely that there might be other pre-service courses that were not identified during this research, the fact that they are so difficult to identify is noteworthy in itself. If they were sufficiently broad-based or successful, then it is likely that we would have found them.

Finally, the basic ICT literacy courses on this list are predominantly courses developed in Europe by private sector institutions that market their products worldwide, including Africa. None of these courses were explicitly developed to train teachers, but all of them are being used to do so. Of particular interest is the Electric Paper European Computer Driving Licence (ECDL) for Schools, which is marketed directly to schools. However, few of these courses do anything more than teach the user how to use basic PC functions, and they certainly do not link ICT to pedagogy in any way.

7. SUMMARY OF EVALUATION FINDINGS

This section very briefly describes some of the key findings of the evaluations. Please read the detailed evaluations in Annexure IV.

7.1 EDUCATORS DEVELOPMENT NETWORK AND WORLD LINKS

The most widely used ICT courses targeting African teachers and applied to pedagogy are EDN and World Links. EDN is a distance-learning course with online mentoring and group work via e-mail, while World Links has been predominantly lecture-based but includes the development of telecollaborative skills, linking African educators to those in other parts of the world via Internet and e-mail. (The World Links materials are also now available online through their password-protected Blackboard Web site). The strength of both of these courses is that they are not about learning to use computers, but about using computers to learn. They teach a broad range of ICT skills specifically applied to pedagogy and are low-cost solutions. They are both sponsored programmes: World Links is free of charge, but EDN requires a contribution from participants. Both courses can be operated in fairly basic ICT environments, and are therefore well suited to meet the basic ICT learning needs of most African teachers.

The World Links training programme in the incorporation of technology in the classroom is a professional development programme aimed at in-service teachers. World Links provides Internet connectivity and training in the use of technology in education for teachers, teacher trainers and students in the developing world. It then links students and teachers in secondary schools in developing countries with schools in industrialised countries for collaborative learning via the Internet. World Links' services are specifically geared towards ministries of education, non-governmental organisations (NGOs) and international development agencies working in developing countries. The World Links teacher training materials are used by a large variety of these organisations in a number of different projects and different ways. This operational model has enormous potential in Africa, as illustrated by the extent to which it has already been adopted here.

EDN is open to all educators in and beyond the boundaries of South Africa. It currently targets only in-service educators. The course is offered online and includes extensive group participation and mentoring. SchoolNet South Africa is currently working with the University of KwaZulu-Natal to bring EDN into their teacher training programme as part of an advanced certificate in education in computer integration. EDN is also in the process of being translated into French and is being piloted in 10 other African countries through the African Teachers' Network. All of these developments are exciting because EDN appears to be one of very few African-developed pedagogy-linked ICT courses with the potential to become ubiquitous in Africa in the short to medium term.

One of the weaknesses of both EDN and World Links is that neither of these courses is presented in a very interactive or exciting manner (i.e., they do not fully illustrate the potential of ICT as a medium of teaching and learning). While the issue of

exciting presentation is less important and easily improved, the issue of sustainability is of critical importance. Both of these courses currently rely on sponsorship in order to be properly maintained and updated. They are both unsustainable without this support and although World Links appears to be quite well funded for now, EDN in particular does not appear to have guaranteed funding for the foreseeable future. If EDN is to reach its full potential as an African ICT course for educators this issue needs to be urgently addressed.

7.2 INTEL® TEACH TO THE FUTURE

The Intel® Teach to the Future programme has been evaluated as a more advanced ICT course that teaches African educators ICT skills linked to pedagogy. This programme is aimed at educators who can already use ICT but want to learn how to further apply their knowledge in their teaching practice. For that reason it targets more of a niche audience than either EDN or World Links. Intel® Teach to the Future is presented via workshops with a live facilitator, but learners are also given a CD and manual containing the course materials. The strength of this programme is that the course materials are of a high quality, but Intel sponsorship means that it does not cost users anything to participate. This corporate sponsorship model of course development and delivery is something that would be worth exploring and developing further in the African context. This course has the potential to bring African teachers up to the same level in the use of ICT in education as many of their counterparts in the developed world and is therefore exciting. Its weaknesses are that it will require substantial adaptation to be relevant in different African contexts as it is American in its approach and content, and it is not yet being broadly used in Africa.

The first African country in which Intel® Teach to the Future is being implemented is South Africa. The initial pilot there appears to illustrate that the African context is different from many of the other markets in which this course is being offered, particularly in terms of the numbers of teachers with sufficient ICT skills and access to the necessary ICT equipment to be able to benefit from this level of material. There will be some challenges in ensuring that this course can be successfully applied in the African context, and this requires ongoing commitment from Intel and its local partners. Intel® Teach to the Future is being considered by several South African teacher training institutions as a pre-service training course. This will be a very positive development and could point the way for other African pre-service courses to follow.

7.3 MICROSOFT PARTNERS IN LEARNING

Microsoft has launched a new programme that will help train teachers and students to integrate technology into the curriculum. The Partners in Learning (PiL) programme will provide USD250 million in cash grants, discounts on Microsoft software for participating schools and free software to some developing nations. It will also establish Microsoft IT Academy Centres, which will provide services such as information technology skills certification, professional development for teachers, curriculum and assessment tools, school-based technology support and research. Microsoft will specifically target disadvantaged primary and secondary schools.

Employing a systemic and comprehensive approach to the challenge of empowering students and teachers, the PiL initiative consists of three programmes. At the heart of the initiative is the Learning Grants programme.

Microsoft PiL is a global Microsoft initiative that was launched in September 2003 to target countries and educational institutions that fall into the poorest categories of the World Bank's income index. PiL is actually an umbrella initiative that will integrate all of Microsoft's initiatives in ICT for education under one banner. PiL has been set up as a government-led programme, so the approach is to sign memoranda of understanding (MOUs) with governments, and then let these governments play a determining role in deciding where to focus Microsoft's input in that country. Without an MOU with the government, PiL will not operate in a country. Microsoft has already signed MOUs with the governments of Namibia, Kenya, Mozambique, Rwanda, Angola, Madagascar, Ghana and Burkina Faso. MOUs are pending with Senegal, Botswana, Nigeria, Gabon, Uganda, Ethiopia and the Seychelles. Once an MOU is signed, PiL invites partnership from local players in a government-led programme to determine the needs and requirements for ICT in education in that country. These partners can choose to focus on any aspect of implementation of ICT in education, from capacity-building to direct teacher training.

PiL calls itself "a new approach rather than a new solution": it does not disempower local role-players but instead provides them with the support and resources they need to drive ICT for education in their country. The aim is to develop local capacity rather than a dependency relationship.

This programme provides an investment of software and cash grants over the five years after the MOU is signed to deliver technology skills training to students and teachers and to assist in ICT integration into curricula and learning. Funding supports the establishment of local Microsoft IT Academy Centres in conjunction with local advisory councils, educational institutions and training providers. The Microsoft IT Academy Centres use a variety of training methodologies to deliver student skills certification, leadership and teacher development, curriculum and assessment tools, school-based technology support and research. The goal of the Microsoft IT Academy Centres is to empower schools to increase student achievement through teacher leadership. PiL also has a specific focus on capacity-building in the form of teacher trainers and curricula developers (investing in infrastructural capacity-building).

PiL offers partner countries a cross-curricular training model called Foundation ICT Skills. Although this model was developed outside Africa, it is simply a framework that will be adapted by local agencies to suit local contexts. Already PiL is partnering with five national agencies in five African countries (African Network for Distance Learning (RESAFAD) in Senegal, Nigerian Educational Research and Development Council (NERDC) in Nigeria, Kenyan Institute of Education, National Curriculum Development Centre in Uganda and SchoolNet Mozambique) to:

1. Support the localisation of the Foundation ICT Skills modules and content and curriculum development for teacher training colleges and classrooms
2. Assist these agencies to develop curricula development capacity
3. Assist them to develop digitised content and learning objects

These five agencies will begin the localisation process of the Foundation ICT Skills modules by the end of June 2004.

PiL also aims to create a pan-African Network of Innovative Teachers programme to identify teachers who excel at developing digitised content and provide them with a forum to be able to share the best that they have created with other teachers across the continent.

The approach of working directly with national governments to help them develop local capacity is a unique and exciting one. Many African teacher training initiatives fail because they do not have government support. The PiL approach turns this problem on its head and could be enormously influential in developing African teachers' ICT capacity in the next five years. It is hoped that ideas will be cross-pollinated across all 16 African countries currently involved in this initiative and thus speed up and improve local policy creation and project implementation.

7.4 CONNECT-ED PROFESSIONAL DEVELOPMENT LEARNING ENVIRONMENT

The Connectivity for Educator Development Programme (Connect-ED) in Uganda supports activities to improve the quality of education. It was developed in the context of Uganda's aim to improve telecommunication services and education, and it functions in close cooperation with Uganda's Ministry of Education (UMOE) and within the framework of the U.S. Education for Development and Democracy Initiative. Implemented by the Academy for Educational Development (AED), Connect-ED is equipping eight educational centres with ICT. Its aim is to increase computer literacy among teachers to enable them to integrate ICT in the classroom. As part of this effort, it is preparing a multimedia online teacher training curriculum. This curriculum, based on the Ugandan core curriculum, uses a student-centred learning approach.

Connect-ED's Professional Development Learning Environment (PDLE) is targeted at trainee primary school educators in Uganda at eight primary teaching colleges (PTCs). It is presented in a series of online workshops or as a self-paced tutorial and resource guide. The aim is to increase educators' understanding of computer and Internet technology and assist educators to effectively integrate technology into their daily professional activities.

This is a good basic, online, self-paced ICT course for Ugandan pre-service primary educators, and it is freely available to whomever wishes to access it. However, this project has been plagued by issues associated with the cost and quality of Internet connectivity in the PTCs, as well as the maintenance of the computer laboratories. Other PTCs in Uganda would like to join this programme, but the cost and technical complexities of undertaking this expansion are prohibitive. In fact, the programme is even battling to maintain its status quo. The biggest challenge for the Connect-ED programme is one of sustainability. Once the AED funding comes to an end in September 2005, the project will need a strategy to ensure its ongoing sustainability. There are several sustainability options under consideration at present, but without the

high-level support of UMOE it is unlikely that this programme will be able to continue and expand its excellent work.

7.5 Pretoria University ACE in Computer-Integrated Education (with FUTUREKIDS)

Pretoria University's ACE in computer-integrated education in South Africa is a comprehensive two-year part-time course for qualified educators wanting to infuse technology into education. The course is not designed to make participants experts on specific software applications, but rather to equip them with the knowledge of the various technology areas (e.g., operating systems, telecommunications, word processing, graphics, spreadsheets, desktop publishing, databases, multimedia) so that they have the confidence to use them to their advantage in the educational environment.

The course is activity-oriented, relevant, individually responsive and fun. Both professional tasks (keeping grade books, creating lesson plans and communicating with various educational groups) and classroom facilitating (complementing the current curricula) are addressed in the foundation, intermediate and senior phases. Basic skills, methodology and pedagogy are covered at theoretical and applied levels.

This course is highly interactive and participants can work at their own pace for the Web-based component. However, the face-to-face sessions are scheduled for specific days and attendance is required. The entire content for the course is given on a CD, including activities, hyperlinks to learning tasks and exercises, hyperlinks to related documents, a portfolio requirements list and a personal journal to log the notional hours spent on the course. Group discussion (contact sessions or online) is a vital component of most of the modules.

This course is an excellent case study of how to teach teachers computer integration in education via a tertiary training institution. Although currently offered only at advanced certificate level, it illustrates how computer-integration modules might be integrated into pre-service training.

7.6 Basic ICT Literacy Courses (Electric Paper ICDL for schools, Advance Learning ICDL, NETg ICDL, SkillsPro)

Most of these courses have been developed with extensive budgets and are therefore highly interactive and enjoyable to use. They are all delivered online via self-paced training modules. Their aim is to enable users to pass the ICDL test so they are well equipped to use the basic Windows applications on a PC. The built-in assessments in every module ensure that there is a very high likelihood that users will pass the test and be PC literate once they have completed the training. The content and delivery are generally of a high standard and their widespread marketing makes the materials very easy to obtain. While their strength from an African teaching perspective is in their interactivity and self-paced distance learning approach, their weaknesses are that they

do not link ICT directly to pedagogy, they are costly, and they require fairly advanced ICT equipment to run. Teachers who have completed one of these courses should feel comfortable using ICT for administrative tasks, but they will not be equipped with the knowledge of how to integrate ICT skills into their teaching practice.

7.7 International Pre-service Training Strategies (Singapore, USA, European examples, Malaysia)

The common feature and key success factors of the pre-service teacher training strategies in each of these examples is that they are informed by national policy and directed by the ministries of education in each of these countries.

For example, the Singaporean approach illustrates the success of developing a pre-service teacher ICT training strategy that starts from a ministry of education masterplan for IT. Singapore's only pre-service teacher training institute, the National Institute of Education (NIE), was entrusted with integrating ICT into initial teacher training programmes. NIE developed and began implementing the new ICT plan in 1998. The curriculum was revised to include three kinds of ICT courses for student teachers: basic ICT workshops, a 30-hour ICT foundation course and a 26-hour elective course. In addition, between 6 and 12 hours of ICT integration into every curricular subject was recommended. This common national policy has resulted in a high standard of ICT competence and integration across all of Singapore's pre-service teacher training institutions. It is interesting to note that Singapore has chosen to teach teachers basic ICT skills first before linking ICT to pedagogy.

The USA uses standards developed by the International Society for Technology in Education (ISTE) as its National Educational Technology Standards (NETS). These standards are designed to provide guidance and consistency to programmes that integrate technology in states, districts, schools and teacher education institutions. The standards are used widely in several countries. ISTE has also developed accreditation standards for teacher preparation programmes with a view to encouraging educators to take positions of leadership in ICT. ISTE emphasises the value of ICT standards in providing a solid foundation in weaving ICT into existing teacher education programmes or planning new teacher education programmes specialising in ICT leadership. Australia, China, Ireland, Latin America and the UK have also developed, adopted or adapted national or regional standards.

In France, the Netherlands and the UK, the content of training is determined to some extent by mandatory standards. In the UK, there is also a detailed curriculum for the use of ICT in teaching specific subjects. Countries and regions adopting standards for the first time may wish to do so in stages. This was the strategy taken by the UK, which currently has the most detailed standards of any country in Europe. A different approach has been taken in Scandinavia. A standard test was first developed that focused on ICT skills. It is known as the European Computer Driving Licence (ECDL) and is used in many professions and with students in schools. More recently, a Pedagogical ICT Driving License has been developed for primary and secondary school teachers in Denmark for the integration of ICT in education.

7.8 INTERNATIONAL PRE-SERVICE CASE STUDY (INTEL® TEACH TO THE FUTURE, UK)

In the UK, the Intel® Teach to the Future programme is delivered through more than 30 teacher training institutions around the UK. Researchers at the Oxford University Department of Educational Studies have tailored the programme to align with the UK national curriculum and help pre-service teachers meet government-prescribed standards for newly qualified teachers. The Intel® programme's curriculum is user-friendly and comprehensive and enables pre-service teachers to develop basic skills in lesson planning, designing schemes of work and developing assessment tools. It uses standard business technologies while incorporating multimedia software, Web-page design and the Internet.

An Intel®-commissioned evaluation of the Teach to the Future programme was carried out by the Telematics Centre at the University of Exeter. The evaluation involved key trainers and trainees at nine teacher training institutions and 44 schools. Intel® has reported the following highlights of the evaluation:

- The overwhelming majority of teachers (84%) reported an improvement in their confidence in using Information and Communications Technology (ICT).
- 69% of teachers surveyed said their pattern of ICT use had changed since participating in Intel® Teach to the Future and 72% of Key Trainers noted that students were now being given more opportunities by staff to use ICT as the confidence and skill level of the teachers increased.
- ¾ of Higher Education Institutions (HEI) faculty surveyed think that Intel® Teach to the Future increases understanding of different teaching and learning styles.
- 100% of HEI faculty surveyed said that they would recommend the programme to colleagues at other institutions.[23]

This example is interesting from an African perspective because a similar initiative is now being attempted in South Africa, where the Intel® Teach to the Future materials are being explored by several pre-service teacher training institutions (including the University of Pretoria and Fort Hare University) with a view to using the materials as a pre-service ICT training module. A huge advantage of this programme is that Intel funds it so it is free to users. This could make it potentially enormously attractive from an African perspective.

[23] Intel®. 2004. Evaluation, Intel® Teach to the Future. http://www.intel.com/cd/corporate/education/emea/eng/uk/elem_sec/teach/156079.htm (accessed 2004)

8. OBSTACLES AND CHALLENGES TO INTEGRATING ICT CAPABILITY IN TEACHER TRAINING

Sam Carlson, the former executive director of World Links, has said:

> Designing and implementing successful teacher professional development programmes in the application of technology is neither easy nor inexpensive. It is also woefully under-funded. There are more cases of inadequate and ineffective training programmes than there are of success stories. Moreover, success stories are not automatically transferable to other situations and the total body of experience and knowledge in this field is in its infancy. This calls for humility, innovation, a willingness to fail, ongoing evaluation, sharing of both positive and negative experiences, and constant revision of teacher professional development programmes related to technology.[24]

8.1 COMPLEXITY

The conceptual framework described in section 3 of this report highlights the enormous underlying complexity in the field of African teacher training in ICT. This is a major challenge to integrating ICT capability in teacher training. Any strategic interventions in this field must take cognisance of the fact that there are so many sub-sectors to the broad topic of "Developing African Teacher Capabilities in the Use of ICT."

8.2 LACK OF COMPREHENSIVE PAN-AFRICAN FRAMEWORK

This research has highlighted the fact that although there is evidence of a number of teacher training initiatives in Africa at both pre-service and in-service levels, these are mainly small scale, regional and fragmented with little sharing of experience among nations. Additionally, most of the content used in Africa has been developed outside of Africa and imported and adapted. There is currently no comprehensive framework that covers the development of local technological models and local teacher training content for building African teachers' ICT capabilities. This is a major obstacle to successful integration of ICT in education.

As an example, many of the organisations working in building teacher ICT capacity in Africa are currently working independently with little pooling of resources or expertise. Many of these organisations have insufficient funds and resources to be exhaustive or to create best-of-breed course materials on their own. Pooling of resources and expertise in this sector would help to get greater leverage from the money that is spent on developing teacher-training programmes in ICT. The Imfundo report states:

[24] Carlson, "The Missing Link in Educational Technology."

> In the donor community there is evidence of "re-inventing the wheel" when it comes to developing ICT skills software and manuals, and a number of ICT projects on the African continent seem to develop their own ICT training courses with little consideration for what has already been developed.[25]

It is vital that the organisations involved in this sector begin a dialogue with each other in order to reduce repetition and fragmentation in Africa and encourage more African content development. Cross-pollination of ideas is critical if Africa is to maximise return on investment of limited public and/or donor funds. However, until there is high-level commitment from African governments and pan-African NGOs to working together in this field, it is unlikely that things will improve.

8.3 Lack of Coherent Individual Government Policies

At the level of individual nations, there is a lack of coherent government policy regarding how, when and where to teach teachers effective ICT integration. Several African countries have developed national ICT policies, and several more are in the process of finalising their ICT policies; however, teacher training in ICT at national levels remains fragmented, under-funded and inadequate. Most pre-service teacher training institutions in Africa do not currently have either the resources or the expertise to integrate ICT training into their courses even though there is a proliferation of in-service courses with widely varying content and delivery. Many of these courses are targeting the same audiences while other in-service teachers do not have access to any ICT training at all.

The international case studies on pre-service teacher training strategies described in this report indicate the extent to which a coherent national policy on ICT in education facilitates successful ICT integration and training. It is critical that African governments commit to developing coherent national ICT policies. The European case study described in this report illustrates how several countries can work together to develop a common strategy and policy. This leverages the cost and resources necessary to develop effective ICT policies across a wider group and ensures that countries do not waste time reinventing what other countries have already succeeded in getting right.

8.4 Shortage of Government Funds to Implement Policies

Even where governments have developed policies related to ICT in education, implementation remains a challenge. Many African education ministries are desperately short of funds to allocate to existing education requirements. Therefore, although most view ICT as an important new field for education development, ICT programmes for teachers are low in terms of spending priorities. This is well illustrated by the Connect-ED example in Uganda. The UMOE is struggling to support primary schools with average class sizes of up to 70 students. It therefore

[25] James et al, *Review of ICT Training for Teachers in Africa*, p. 12

argues that it needs to feel sure that allocating a budget towards pre-service teacher training in ICT is a better investment than supplying textbooks to schools.

As long as resource shortages remain a reality for African education ministries, or until ICT can be proven to be a tool that enables prompt, accessible and good-quality education at a lower cost than current methods, ICT training programmes (both pre-service and in-service) will not receive the resources from government that they require to sustain themselves. Instead they will need to be largely self-funded or to rely on sponsorship from non-governmental donors. However, this does not mean that schoolnet organisations should not continue to liaise with governments to encourage support of ICT programmes. Ongoing research into the effectiveness of ICT in education is also essential so that eventually governments might come to realise that money spent on ICT programmes is more effective than money spent elsewhere.

8.5 Lack of Sustainability Built into Initiatives

Many of the ICT courses and projects for teacher education identified in this research have been created with donor funding. Most are funded for specific periods of time, and it is unclear whether they will be able to sustain themselves once their external funding stops. Many of the projects identified are just pilot projects with no certainty about the continuation of funding once the project is complete (e.g., Intel® Teach to the Future, Connect-ED and EDN).

Funding becomes a vicious circle unless it is carefully monitored and strategic partnerships can be developed between partners in the public, non-government and private sectors. The challenge is to ensure that poor quality courses do not become ubiquitous because they are cheap, and conversely, that good quality courses do not disappear because they are too expensive to maintain. There are certainly some good quality training courses that are currently being offered free of charge (or very cheaply) in Africa, including EDN, Intel® Teach to the Future (in South Africa only), Connect-ED (in Uganda only) and World Links. The biggest question here remains the sustainability of these programmes' funding, as well as the challenge to maintain their standards of content and delivery with the funding at their disposal.

There is also the challenge of expanding access to these courses to teachers in other countries and areas with the funding that is available to do so. High-level support of certain of these programmes would go a long way towards ensuring their sustainability, ongoing improvement and expansion. A particular area of interest would be to expand the adoption of these course materials to the pre-service training level. This is already starting to be explored by EDN and Intel® Teach to the Future, but it certainly requires more funding and careful strategic planning if these examples are not to remain few and far between.

8.6 Accreditation Issues

There is a lack of clarity across the African continent about how and whether teacher training courses in ICT should be accredited. There is evidence to suggest that teachers will be more motivated to become ICT literate if they can see a tangible

benefit for themselves. Accreditation is one way to create such benefits and also to tie ICT training into pre-service teacher training. Almost all the courses identified are currently still grappling with the issue of accreditation. The best way to resolve this would be at policy level, but the challenges are how to ensure that accreditation is consistent across a wide variety of very different courses and how to prevent the proliferation of poor quality courses offering the same accreditation as much better courses. Additionally, each country is likely to have specific approaches to accreditation, making a regional approach challenging. Further, there is the question of whether ICT accreditation should entitle teachers to better pay, promotion or any other incentives.

8.7 Contextual Relevance of Course Content

There are serious concerns in Africa regarding the shortage of locally developed, contextually relevant course content for both teachers and learners. Of all the courses and programmes identified in this research, only EDN, Connect-ED and the South African university courses are actually African developed. However, all of these courses are based on international examples and are not uniquely African themselves. EDN is currently being "Africanised" and piloted in 10 African countries through SchoolNet Africa's African Teacher's Network. This is enormously exciting as it is the first of its kind in Africa. It remains to be seen whether this course can be successfully adapted and adopted in a large number of African countries.

Courses like Intel® Teach to the Future, World Links, Microsoft Partners in Learning and iEARN, which are used extensively in Africa, are also used all over the world and are therefore not specific in their content. Although some of these materials have been adapted for African use, there are still questions about their contextual relevance, as illustrated by the Intel® Teach to the Future pilot in South Africa. Few of these courses include contextually relevant examples. It is virtually impossible for poorly educated, rural African teachers who frequently don't have access to electricity or running water in their homes to understand references to sophisticated urban examples from the developed world. The collaborative approach of World Links and iEARN—linking African teachers to others from around the world via the Internet—might provide insight into teaching and living in other countries. However, these courses do not really take into consideration the difficulties and complexities associated with accessing and using ICT in Africa. None of these internationally developed courses are in any way tied to African curricula.

Of great concern is the fact that there are virtually no teacher training courses in ICT available in local African languages. It is absolutely critical that more courses get translated into African languages so that teachers who cannot speak English or French are not automatically excluded from accessing training.

It is vital that considerably more emphasis be placed on developing contextually relevant African digitised content so that African teachers will realise the full potential of ICT to transform their teaching practice. Right now it is only adventurous or forward-thinking teachers who see ICT's potential in the African teaching context. More and better African ICT course developers need to be identified and then supported and encouraged to develop course materials that are linked to curricula and

provide novel solutions to African problems of access, language and cultural relevance. Nowhere in Africa has there yet been a successful example of digitised African content development. The Ugandan National Curriculum Development Centre is in the process of piloting an initiative to put the Ugandan curriculum into digitised format, but this is the identical content to the non-digitised format. What is required is new and innovative African ideas, but until ICT is more broadly available and of significantly higher quality in Africa, it will remain the domain of the few.

8.8 Quality of Course Content

While the need for more contextually relevant course materials continues to be the primary issue in course content, there is nonetheless an ongoing issue about the quality of existing course content. A broad range of course materials of various levels of quality is currently available to African teachers. The challenge is to ensure that good quality courses get the high-level support that they require to become widely adopted, while poor quality courses are either improved or abandoned in favour of better courses. This requires constant monitoring and evaluation of course materials and must be overseen by a suitable organisation with sufficient authority. Content quality is also compromised if the materials are not updated frequently enough to keep pace with changes in technology or teaching curricula. The monitoring and evaluation of course materials needs to include a process for ensuring that course content is kept relevant and up to date.

Finally, course developers should be encouraged to explore presenting content in a more interesting and inspiring manner by using technology to illustrate the potential power and creativity of the medium. This is a problem with some of the course materials that have been developed with a limited budget and/or to be accessible on computers with limited capabilities (e.g., EDN and World Links). Much of this material is delivered via long pages of black text on a white background with little interactivity. While the actual content of these courses may be quite good, the dryness of the delivery limits their impact, and they come a poor second to some of the private sector courses in getting teachers excited about technology and holding their attention. While extensive graphics and simulations might be unnecessary, there is certainly scope for some improvement in the existing courses so that they have greater impact on teachers and maintain their interest.

8.9 Lack of Resources and Capabilities in Training Colleges

The biggest challenge to incorporating ICT training into pre-service teacher training courses in Africa is the lack of resources and capabilities in the training colleges themselves. Hillar Addo, Project Officer, SchoolNet Africa, has noted that "Though expectations of education in Africa and the nature of delivery have changed considerably, resource-deprived educator training institutions can do little more than employ the chalk-and-talk model that they are used to."

The majority of African teacher training institutions are too under-resourced even to meet existing expectations. The addition of an ICT curriculum requires extra

infrastructure, the development of teacher trainer ICT capabilities, and the development of ICT training materials (content). Despite Kyambogo University in Uganda being no better resourced than the average African teacher-training institution initially, the Connect-ED programme has managed to obtain the necessary infrastructure and teacher trainer ICT capabilities to develop an ICT training programme for pre-service teachers. Without support from a foreign donor, however, this project would not have had much chance of succeeding, although one of the key success factors that has driven this project is that the PTCs and the project team have had the will to make it happen.

The key to overcoming Africa's lack of resources and capabilities in teacher training institutions is for training institutions to be made aware of ICT's potential to transform teaching and learning, so that ICT development is made a priority in those institutions' plans and funding is targeted accordingly. Hillar Addo has made the following observation, which provides a compelling argument in favour of ICT for education development.

> Experience in Africa shows that professional teachers are ushered into a service dominated by:
>
> - Cramming and regurgitation without learner involvement, participation and understanding
> - A theoretical system of knowledge without skills
> - Examination-conscious curriculum without outcomes
> - Non-resource-based learning because of lack of textbooks, libraries, science and computer laboratories
> - Loaded teaching periods with the teacher becoming the sole source of knowledge, the only motivator of learning and the determinant of knowledge
>
> Although ICT may not necessarily make people more intelligent, it surely will add value to education in terms of quality and delivery, motivate learners and provide skills for future education and work situations.
>
> Education today should prepare African learners to:
>
> - Be independent critical thinkers
> - Take charge of what they learn and be able to learn on their own with the teacher acting as a facilitator
> - Develop marketable skills for Africa's development
> - Develop lifelong learning skills with information technology
> - Think and operate in a globalising knowledge economy while acting locally to address the unique problems that confront them
>
> The above can only be achieved when organisations provide the necessary tools where they are needed most—in classrooms and pre-service teachers' lecture halls.

The necessary resources and capabilities in teacher training institutions include: trained teacher trainers, training materials (content), ICT infrastructure (computer

laboratory, network, affordable electricity, affordable Internet connectivity, security), ICT maintenance and support, and adequate time allocation per student on the computer at sufficiently low cost to enable them to become proficient ICT users. It is critical that African teacher training institutions become aware of the potential benefits of ICT in education, so that the acquisition of the necessary resources and capabilities to transform their teacher training programmes becomes a priority.

8.10 Quality of Teacher Trainers

Courses that include an element of human facilitation, either face to face or via e-mail, are only as good as the quality of the trainer. The issue here becomes how to identify potentially good facilitators and how to give them the training they need to reach their potential. (This is important at both the pre-service and in-service level.) There is currently a dearth of suitable teacher trainers in Africa (particularly at the pre-service level) and training of teacher trainers to teach ICT capacity development needs to be a higher priority.

8.11 Lack of Teacher Access to ICT Facilities

It is vital to ensure that teachers have adequate access to good quality computers, electricity and telephone lines to enable them to access online distance ICT training courses and prepare lessons. This is especially true for in-service teachers—it is vital that schools have computer laboratories if in-service teachers are to be able to access ICT training.

There is also no point in spending any time and effort equipping teachers with the necessary skills to integrate ICT into their teaching if schools do not have the computer laboratories and other ICT resources necessary to put those skills into practice with learners. Teacher training in ICT is irrelevant if African educational bodies are not committed to improving ICT access throughout the schools in their respective regions. African schools are drastically under-resourced when it comes to ICT laboratories and facilities, and it remains essential to make ICT rollouts a priority in schools in conjunction with teacher training and content development.

8.12 Sufficient Time for Training

Where the facilities are available, teachers must be given sufficient time and access to them to complete the courses, to become comfortable with using ICT and to incorporate ICT into their teaching.

With workshop programmes like World Links and Intel® Teach to the Future, there is the additional challenge of finding suitable times and locations for the training to take place. Many teachers are understandably reluctant to give up their weekends and school holidays in order to attend these workshops. Transportation can also sometimes be an issue.

The courses that are most likely to succeed at the in-service level are ones that can be fitted into teachers' schedules without disrupting them too heavily. Thus self-paced

distance learning is attractive at the in-service level, but only where motivation can be maintained through regular interaction with fellow learners and/or a facilitator via e-mail. At the pre-service level, most training is currently presented in a face-to-face environment, so face-to-face ICT courses could work well with good quality trainers. However, online training modules might enable a greater number of pre-service teachers to receive ICT training at a lower cost.

8.13 Lack of Access to Information About Available Courses

There is an issue of lack of access to information about the ICT courses that are available for African educators. Although many African schools might be keen for their teachers to receive ICT training, many of them do not have access to the necessary information about the courses that are available, affordable and suitable for their requirements. The dissemination of information about courses is another challenge that requires high-level commitment so that schools and teachers do not end up wasting time and money on unsuitable courses. Targeting appropriate courses at appropriate audiences is vital to ensure that scarce resources are used as effectively as possible.

8.14 Cost Issues

The prohibitively high cost of training African teachers in ICT is a constant issue and underlies all of the challenges already mentioned. Everything from the development of course materials, to the implementation of training programmes (whether pre-service or in-service), to ICT access for teachers, to monitoring of course quality and consistency is limited by insufficient funds. The shortage of public funds in Africa is a perennial problem that is not going to go away. This is the fundamental challenge to be overcome before ICT capacity-building can become a reality in African education.

In the short term, African countries will remain heavily reliant on international donors and NGOs to fund the development and implementation of teacher training courses in ICT. However, as long as projects are donor driven, there will always remain a question of how to sustain the project after the project budget is exhausted. The Intel® Teach to the Future programme points to an interesting way forward where private sector corporations would sponsor high quality teacher training in Africa (in the interests of ultimately expanding their markets).

The Microsoft Partners in Learning (PiL) programme is also particularly interesting in this regard. The PiL project in West, East and Central Africa (WECA) aims to work directly with African governments to help provide a framework for the development of localised educational contexts and digitised content by local partners in each country. Microsoft has signed MOUs with eight African countries already, and another seven are pending. The ministries of education and their partners in these countries can now access cash grants from Microsoft to develop local content and curricula for teacher training colleges. Microsoft PiL focuses specifically on helping to build local capacity in teacher training and curricula development (infrastructural development). While not promising to provide all the solutions for Africa by any

stretch of the imagination, this initiative is nonetheless promising in that it is well resourced and increasingly widespread across Africa.

9. RESEARCH RECOMMENDATIONS

It is obvious from the findings of this research that there is a requirement to start to systematise interventions in African teacher capacity-building in ICT in order to ensure greater impact from the time, energy and financial resources that are being spent in this field. Systematisation will best occur through the development of a pan-African strategy on building African teacher capacity in ICT, created in partnership with all relevant stakeholders. While this report cannot speak for all stakeholders on what they would require from a pan-African strategy, it can and does aim to outline some of the key elements that should form part of that strategy, based on the findings of this research.

This section recommends some interventions that might be undertaken at the pan-African, regional or national level towards the creation and implementation of a successful strategy to develop African teacher capabilities in the use of ICT. Some of the interventions recommended here are already occurring in Africa, but mostly in an informal ad hoc manner. Even where the interventions are occurring, we have still included them as a requirement in order that they are not forgotten. Finally, this section also recommends the type of organisation or group that might take responsibility for driving each of these interventions in Africa.

A pan-African strategy on developing African teacher capacity in ICT should include:

- A stakeholder participation process
- Inter- and intra-country collaboration and knowledge-sharing on the subject
- Development of coherent national policies with respect to teacher capacity-building in ICT
- Exploration of options for ensuring ongoing sustainability of specific initiatives
- Capacity-building in the development of local digitised content and curriculum integration (getting teachers to use ICT as a tool)
- Focus on improving ICT integration at the pre-service teacher training level through helping to build ICT capacity at teacher training institutions

9.1 STAKEHOLDER PARTICIPATION PROCESS

This first intervention relates more to cause than effect: the more stakeholders involved in agreeing to a process, the more the process is likely to be accepted and adopted. The stakeholders in this process range from national ministries of education, to NGOs operating in this field (e.g., schoolnets, international donor organisations, local implementing organisations), to teacher training institutions, to schools and teachers themselves.

All of these stakeholders need to be brought into the strategic process in as formal and structured a manner as possible. This can be achieved through participation in workshops, working groups, online discussions, case studies or other research activities. A needs analysis with teachers and learners in a range of African countries could also be undertaken as part of this process.

One organisation needs to take the lead in coordinating this stakeholder dialogue: SchoolNet Africa seems to be ideally placed to coordinate this.

9.2 COLLABORATION AND KNOWLEDGE-SHARING

Since all developing nations are currently attempting to design and develop ICT for education policies, it is likely that other nations and institutions are aiming to develop similar ICT teacher training programmes (both pre-service and in-service). Inter- and intra-country collaboration and information sharing makes a lot of sense so that duplication of time and effort can be avoided. In particular it is worth sharing lessons learned from existing projects and programmes through the publishing of research and evaluations. Collaboration can take place at the governmental, organisational or individual level.

Government-level collaboration occurs through processes such as the New Partnership for Africa's Development (NEPAD). The Microsoft PiL programme is also playing a role in this process by working directly with 16 African governments in the development of ICT capacity in education. Through its intervention, PiL hopes to achieve a cross-pollination of ideas between as many African governments as possible. New ways to encourage government dialogue and collaboration should be explored and developed wherever possible.

The Internet is a cheap and effective tool for institutional and individual collaboration and knowledge-sharing and is especially appropriate in this field. The development of online networks of individuals and organisations involved in the field of teacher training in ICT is extremely useful in enabling the evolution of ideas and initiatives. For example, the East African Teachers Network aims to network East African teacher training institutions. More focus needs to be put on getting this network working properly and on developing other such networks in Africa. The African Teachers Network aims to do a similar thing at the level of individual teachers. Microsoft PiL is also setting up an innovative teachers network for teachers who excel at developing and sharing digitised content to share their skills and materials.

Key criteria for the success of such networks are:

- Getting as many appropriate participants as possible to join
- Having an agreed agenda for the discussion (e.g., choosing a different topic each week)
- Nominating an online facilitator to support and direct the discussion according to the chosen topic
- Having the discussion recorded and regular summaries distributed to the network

These networks can also be used to share any relevant new research or information on the subject of building African teacher capabilities in ICT.

Another option for knowledge-sharing is through storing research in online knowledge warehouses. SchoolNet Africa, Imfundo and UNESCO already have a large quantity of their own research available on their Web sites. These organisations play an important role in disseminating ideas, and it is important that organisations such as these continue to commission relevant research and provide it as openly as

possible to stakeholders in this field. It might also be worth creating a single portal for African teacher training in ICT as a depository for relevant research from as broad a variety of sources as possible.

This African teacher training in ICT portal could include such topics as:

- International case studies of pre-service and in-service training strategies and initiatives
- Case studies of successful African strategies and initiatives
- A descriptive list of all the online courses available and how to access them

Such a repository would have to be regularly updated in order to remain relevant. A specific organisation would have to undertake the job of regular site maintenance, additions and updates.

Finally, the course developers themselves must start collaborating more so that the waste of duplicating efforts is reduced and limited resources are used effectively. Organisations such as SchoolNet Africa and its partners could assist in coordinating partnerships to ensure that selected courses are adequately resourced and developed. Through shared responsibility and partnerships, duplication of effort and waste of resources could be minimised and broader access to good quality ICT skills training could then be provided at lower cost.

This process would require an ongoing dialogue with all main providers of ICT courses for African teachers to encourage pooling of their resources and expertise and to encourage joint development and funding of some of their courses. Certain programmes or initiatives could be persuaded to invest their resources in improving or adapting an existing African course such as EDN rather than developing new materials from scratch. The identification and support of a few of the best courses available would go a long way towards the development of pan-African ICT standards. This would also reduce duplication of effort and ensure more effective use of limited resources.

9.3 Coherent Policy Development at the National Level

The Singaporean example reflects the positive impact of a coherent national policy on teacher training in ICT on raising and standardising teachers' ICT skills and integration.

Even where African governments cannot afford to make financial contributions to ICT training projects, positive ICT for education policy statements from government will go some way towards encouraging non-governmental donors to assist in the development of ICT-related projects in that country. A prime example has been the Ugandan government's removal of import duties on computers in Uganda, which has illustrated the importance that this government has placed on ICT for development in Uganda. This commitment by government has had a hugely positive impact on the development of Uganda's ICT sector as a whole.

In developing their national ICT policies, African governments should be encouraged to consider the potentially enormous contribution that ICT can make towards social development. Governments should be encouraged to adopt a liberal outlook with respect to import costs and taxation in general. Governments should also be encouraged to develop ICT policies that take into consideration their country's infrastructural development requirements. For example, their policies should encourage and support providers of telecommunications and electricity to rural areas, as well as providers of alternative technologies such as satellite connections.

Regardless of the extent of the government's direct financial involvement in teacher training in ICT, ministries or departments of education should nonetheless be working in consultation with teacher training institutions and course developers to set standards and criteria for ICT integration. Teacher training curricula should always be in harmony with governments' ICT policy and plans.

National policies with specific relevance to teacher capacity-building in ICT should take into consideration such aspects as ICT standards and performance measurement criteria for individuals and institutions, as well as the issue of accreditation and related financial implications.

9.3.1 Standards and Performance Measurement

African governments can learn a lot about setting standards and measuring institutional and teacher performance by studying the approaches of other countries. For example, as discussed in section 7.7, ISTE has developed a set of standards that are used widely in several countries, including the USA. These standards are designed to provide guidance and consistency to programmes that integrate technology in states, districts, schools and teacher education institutions. Australia, China, Ireland, Latin America and the UK have also developed, adapted or adopted national or regional standards. Detailed case studies of other developing countries' approaches to developing standards and measuring performance would be most useful in helping African countries develop their own standards. Adapting standards that have already been developed in similar countries will be cheaper and less time consuming than starting this process from scratch.

9.3.2 Accreditation

There is currently very little clarity or agreement on how ICT accreditation should be undertaken in the African teaching context. Certification options need to be identified and analysed with a view to making recommendations at the national level regarding standards and criteria for accreditation. Once again, international practice could provide useful insight into how best to tackle the issue of accreditation of ICT courses for teachers. SchoolNet Africa should play an ongoing role in ensuring that this type of research is done and disseminated. The ISTE Accreditation and Professional Standards Committee has developed accreditation standards for teacher preparation programmes for specialisation in ICT. These standards might be adaptable for African contexts, but this requires further investigation.

As a home-grown alternative, organisations such as national schoolnets could provide the educational context for how to certify applications-based ICT training options in cooperation with nationally recognised tertiary and ICT training institutions. A policy decision must be made at national levels as to whether basic computer literacy courses of the ICDL variety are warranted in the African teaching context or accreditation of pedagogically focused ICT courses should be the focus.

9.4 Ensuring Sustainability of Initiatives

Ensuring that teacher training initiatives in ICT do not cease to exist once their initial funding ends is of critical importance in the process of systematising the development of African teacher capabilities in ICT. Too many of the initiatives identified in this research hang in the balance when it comes to the question of their sustainability. Most notable on this list are EDN and Connect-ED, both of which are excellent courses with enormous potential to help build teacher capabilities in ICT throughout Africa.

In order for good courses to continue to survive and evolve, it is critical that they receive high-level support from organisations that are in a position to offer this. Raising the profile of these courses so that they are adopted and adapted for use in other countries could help to ensure that they do not fade away. A strategy of identifying and supporting best-of-breed courses could include pan-African NGOs such as SchoolNet Africa helping to market certain courses directly to African ministries of education as a cheaper and more efficient way of implementing ICT training in their country than developing new courses from scratch. These ministries could be persuaded to contribute to the adaptation and improvement of existing course materials in lieu of developing new courses. This is not necessarily a complete solution to the problem of course sustainability, but it does offer one option.

Another option is to try and get end users to contribute something towards the cost of receiving training, but one has to be careful not to exclude those who are most needy because they cannot afford to pay.

A further alternative is for ministries of education and NGOs such as schoolnets to work together to lobby private corporations to support further development of some of these courses as part of their corporate social investment.

Sustainability will always remain a challenge in a field that is so short of financial resources. It is critical that other sustainability options for worthwhile initiatives continue to be explored through ongoing experimentation and research on a case-by-case basis.

9.5 Building Local Capacity in Digitised Content and Curriculum Integration

This report has already identified the problem of the shortage of African digitised content and ICT curriculum integration. Instead of providing separate recommendations for building local capacity in digitised content and curriculum

integration, this research has summarised a plan of action for the development of localised digital content developed at the "Digitized Content for African Education" workshop held in Johannesburg in May 2004. This concrete plan of action will go some way towards addressing Africa's requirements for the development of local digitised content, it includes:

- Undertaking an overview of existing initiatives in Africa
- Undertaking a thorough review of needs in order to unpack what educators need to become content developers
- Linking this initiative to a conceptual framework
- Premising a rollout based on existing initiatives (e.g., those of the Kenyan Institute of Education and the National Curriculum Development Centre in Uganda). It was agreed that the research would focus initially on seven countries where such initiatives exist (Kenya, Uganda, Senegal, Mozambique, South Africa, Nigeria and Egypt), as well as on Tanzania, where there are currently no such initiatives.
- Adding value to existing initiatives, expanding these through capacity-building and expanding the network of content-building expertise

Of importance was the agreement that the research must be linked to and include the ability to develop content. The workshop participants agreed on the need for a thorough analysis to determine the most useful capacity-building investments and the form they should take. By building the capacity of those involved in content development, it will be possible to develop best practice models that can subsequently be distributed throughout the African continent.

It was also agreed that an action research exercise should examine how these various content development practices in each country share their content at the level above national borders. The workshop participants agreed that they should seek to ensure that whatever content is generated through this project is captured and placed either on the Web or in CD format. These repositories may potentially need to be independent in terms of their respective countries; however, all such countries and repositories should agree on certain standards of inter-operability.

Ultimately the research would seek to ascertain what conditions need to be in place to stimulate content development. In addition, the research should incorporate skills development and a pedagogical explanation.

The end goal would be to:

- Develop guidelines or "toolkits" incorporating the best processes that African countries use
- Develop local African content that will be used to enhance teaching and learning
- Use ICT to guide this process of content development

As a final point on this subject, one of the Microsoft PiL programme's decisive interventions in West, East and Central Africa is focused on working with local partners to develop local capacity in digitised content creation and curriculum integration. The activities and effect of the PiL programme should thus form part of the above research agenda.

9.6 Improving ICT Integration in Pre-Service Teacher Training

It seems that one of the greatest barriers to ICT development in African teacher training institutions is that many of these institutions have not realised the transformational potential of ICT in what they do. Right now these institutions just add ICT integration to a long list of nice-to-haves that they cannot afford. There are so many other spending priorities that, as long as it is considered non-essential, ICT will continue to struggle for attention. However, if teacher training institutions can be encouraged to understand the potential that ICT has to transform education—replacing many existing priorities and skills requirements with a more efficient and effective system (i.e., where teachers are taught to be facilitators and enablers for students to gather their own knowledge, rather than being the sole source of knowledge)—this could be the catalyst that is required to develop more pre-service ICT training courses in Africa. Teacher training institutions could then start to explore cheaper ways of offering pre-service teacher training programmes using technology (e.g., by delivering lessons from a distance over radio). Alternatively, many innovative teacher training courses in ICT have already been developed by other organisations and could be acquired and adapted quite cheaply if teacher training institutions had the will to do so.

Thus an initial awareness-raising exercise is required to convince teacher training institutions of the importance of exploring the possibilities of ICT to transform their activities.

To truly integrate ICT capabilities into teaching practice, it is important that technology modules not be taught separately, but rather they should become core to the teaching process of every subject. This requires a massive transformation in the way that pre-service teacher training is currently undertaken and is likely to be a long-term process incorporating several consecutive steps. Ensuring that effective pre-service training is implemented requires a series of inter-related activities, including:

- Development of appropriate training materials
- Retraining of teacher trainers
- Provision of adequate ICT access at training institutions

All of these require strategic intervention that could be facilitated by an organisation such as SchoolNet Africa and its partners. As a first step there is a need to look at best practice in this area and start developing and disseminating guidelines for incorporating ICT into pre-service teacher training.

9.6.1 Upgrade Infrastructure, Faculty Skills and Technical Support as a Necessary Precursor to ICT Integration

Before pre-service ICT programmes can be implemented, it is vital that teacher training institutions focus on upgrading their ICT infrastructure (e.g., installing computer laboratories and Internet connectivity) and developing the ICT skills of their faculty. Trainee teachers need to see and experience models that demonstrate the kind of access desired in the classroom if pre-service training is to be effective. The

Connect-ED example illustrates the positive impact that the setting up of PC laboratories in eight Ugandan teacher training institutions had on encouraging ICT integration at the pre-service level.

A programme to equip as many African teacher training institutions as possible with PC laboratories (e.g., 20 PCs and a server) would go a long way towards supporting the development of ICT training at pre-service level.

Additionally, teacher educators and their students need technical assistance to use and maintain technology. When technology does not function well, a learning opportunity is lost and frustration grows. Timely technical assistance is imperative for faculty and students to feel confident that they can use technology in their teaching and learning. With these key enablers in place the integration of ICT in pre-service training is far more likely to be successful.

9.6.2 Investing in Training Teacher Trainers

Teacher trainers are the key change agents behind the adoption and use of ICT in pre-service teacher training. The Singaporean experience indicates the importance of providing a variety of formal and informal teacher-trainer training so that teacher trainers can access those methods that suit them best. In order to enlist staff support and involvement it is useful to:

- Employ a variety of training methods (from face-to-face workshops to online self-study programmes)
- Integrate informal support into the formal teacher-training system so that less-experienced teacher trainers obtain timely assistance
- Provide multiple incentives such as workload reduction, recognition and reward in faculty evaluations, increased research allocations to encourage the use of ICT in teaching and compensation for those providing educational or technological assistance to others

Uganda's Connect-ED programme is a good example of how staff involvement has been achieved through the establishment of ICT committees (made up of both teacher trainers and students) in each college. This model could be explored further in developing similar initiatives in other African teacher training institutions.

9.6.3 Implementing Cost-Saving Policies

Budgetary constraints are the biggest limiting factor in the plans of most teacher training institutions to design and implement pre-service ICT training. While acknowledging that this is a reality, these institutions need to be encouraged to begin thinking differently about the transformative potential of ICT integration in education. This will allow them to become more innovative in allocating funds within their budgets for designing new or accessing existing ICT programmes or for accessing donor funds.

Teacher training institutions must make decisions based on cost-effectiveness. Cost-saving strategies could include:

- Maximising the use of computer facilities in training centres to lower user contact/hour costs through efficient scheduling. This could include opening computer laboratories to the public for a small fee outside of training hours (as the Connect-ED project does).
- Sharing Web-based resources and training materials with other training institutions
- Standardising hardware and software to negotiate best prices with vendors or opting for freeware
- Forming partnerships across public and private sectors (both inside and outside the country) to share the costs of innovation, infrastructure, hardware and software systems, recruiting of students and technical skills

9.6.4 Adapting Existing In-service Courses for Pre-service Training

In-service training models such as EDN, World Links and Intel® Teach to the Future are already being considered for use at the pre-service level in several teacher training institutions, particularly in South Africa. The use of these types of training models at the pre-service level would make a lot of sense for several reasons, including:

- They have already been developed, and adapting an existing in-service course for pre-service training would be easier and less costly than developing a new course from scratch.
- The use of these collaborative courses at both pre-service and in-service levels would place pre-service African teachers among a network of educators where they would also benefit from learning about current teaching practices from in-service teachers.

10. CONCLUSION

This report has summarised a large volume of research in an attempt to describe the current situation in Africa with respect to the development of teacher capability in the use of ICT and to offer recommendations for the systematisation of this development through the design of strategic frameworks.

It is worth re-emphasising that none of these strategic interventions will have any impact without the adequate provision of an acceptable quality of ICT access to African teachers. Although beyond the scope of this research it is vital that ongoing work is done to expand and improve ICT access in schools and teacher training institutions throughout Africa as a necessary enabler to the expansion and development of African teacher capabilities in the use of ICT. This is currently an essential element of the work of SchoolNet Africa, national schoolnet organisations and many other pan-African NGOs, and it should remain so.

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