



Herausgegeben von

Marc Seifert, Markus Egert, Fabian Heerbaart, Kathrin Kolossa, Mareike Limanski, Meikal Mumin,  
Peter André Rodekuhr, Susanne Rous, Sylvia Stankowski und Marilena Thanassoula

## **Fostering ICT use in teacher education in Africa**

Michael Auerswald (†) & Justine Magambo, Pädagogisches Seminar der  
Universität zu Köln

### **Abstract:**

Die Implementierung und Nutzung von ICT schreitet auch in Afrika voran. Nur wenige afrikanische Untersuchungen liegen vor, die identifizieren, was als Beispiel für gutes pädagogisches Handeln im ICT-Bereich betrachtet werden kann. Vorliegender Aufsatz untersucht deshalb die Entwicklung und Anwendung von effektivem ICT-Teacher-Training in Afrika aus einer theoretischen und einer praktischen Perspektive.

Keywords: African universities, best practice, communities of practice, education, ICT-Teacher-Training, Portal-Education-Africa.

## **1. Introduction**

Within the past ten years, ICT has become an essential part of our learning and development in education. Today it is no longer an option to learn the basic skills of ICT but rather a prerequisite for academic qualifications. The rapid development of these new technologies coupled with the world-wide challenge to educate all children has led to a global reform and development of teacher education (Moon 2004a) and motivated educational institutions to redesign and restructure their teaching methods such as to enable students equip themselves for the future.

Whether ICTs are the best educational means for all societies is still a current and open debate among educationists and education implementers (Higgins 2003). However, one point they all agree upon is that ICTs are rapidly spreading globally and whoever does not equip ohimself/herself with appropriate technologies and the knowledge required to apply them will



lag behind in world development. According to the advocators of ICT use in education the question is no longer "if" ICTs are the best educational means but rather which and how these ICTs can be effectively implemented in education (Moon 2004b).

This paper looks at the development of ICT-teacher-training in Africa from a theoretical and a practical perspective and is based on a project from the Department of Educational Psychology, University of Cologne, which tries to foster ICT use in teacher education in Sub-Saharan Africa.

## **2. A theoretical view: Best Practice for ICT-Teacher education in Africa**

The development and use of ICT in the economic sector is very important for the African States, because it lastingly invigorates the still hesitant build-up of teaching-learning systems in Africa. Among other things, the political initiative "New Partnership for Africa's Development" (NEPAD 2001a) has set the target of reversing this process. Among these African states an action plan has been developed (UN 2000) helping to reach the MDG (Millennium Development).

More than 45 million schoolchildren in Africa do not have access to any kind of education.

Educational institutions rarely offer students the possibility of getting familiar with new media, such as the Internet. NEPAD in turn was designed to enlarge the African graduates' prospects of finding a good job in their home countries otherwise the much feared brain-drain will not be stopped. NEPAD has developed a number of strategies for accommodating the African states to the new ICT innovations. In addition, the drafting of binding guidelines for the educational sector as well as the publishing of uniform textbooks and uniform curricula is supposed to foster the cooperation between several African states and education systems. In its agenda NEPAD assumes that between 2006 and 2015 a functional education will come into effect, which a) will help realising primary educational aims (such as development and extension of the elementary and primary educational systems) and b) will integrate ICT into educational instruction and especially into the training of teachers (NEPAD 2001b).



Introducing ICT to the training of teachers in Africa yet raises two major problems: The access to economical hard- and software as well as the meshing of productive networks is strongly attached to the financial possibilities of the end training providers willing to carry out such programmes with multipliers in the education sector. This problem can easily be solved through a stronger financial support on the part of the concerned governments and a higher input of development assistance as well. Another serious problem arises from difficulties in the appropriation and distribution of budgets being necessary to implement ICT in Africa.

All forerunner institutions of ICT still lack a general scientific-theoretical framework within which new criteria can be set to make the training of teachers more efficient (Resta 2002). Against this background the discourse of best practice or good practice holds some successful and recommendable solutions.

The idea of best practice initially implied pointing out solutions for well optimised business management processes. Thus, by extending the idea of best practice to educational matters in general, and to the training of teachers in particular, one finds a new discursive starting point from which to claim the possibility of a fundamental transfer of singular educational structures and education processes. The recent research in education is labelled as a practical and pragmatic one. Scientists usually try to analyse the important factors in educative situations in order to generate a wide range of action. By this, "best practice" concepts are supposed to facilitate the extraction and application of success factors.

Philosophers of science consider this development to be problematic (Nicolai & Kieser 2003). They warn that a merely inductive generating of educative action patterns can have a negative impact – particularly on pedagogic interaction. In contrast to this, the whole repertoire of successful educational instruction patterns is labelled "best practice". And yet, best practice can only be evaluated thoroughly as long as the findings of a theoretically based science are being taken into consideration, too. From non-empirically generated findings in the field of education alone examples of best practice cannot be drawn and applied directly. (Frank 2003). It is thus necessary to initiate African online-communities of best practice (CoPs). Only then can best practice be applied to the training of teachers. Online communities make it possible to analyse and evaluate the explicit and implicit knowledge being effective in the training of teachers.



This process, taking place within a CoP, leads to the emergence of an educational paradigm among social groups. Best practice elements can be used in research programmes which serve to examine and formalise teacher-training – given that these elements are still outside the focus of analysis. Thus, viewing the concept of "best practice" as feature granting success automatically is too limited.

Applying best practice uncritically leads to a doubling of already existing action models in the first place. Scientific innovations will therefore not happen. To avoid a much too rash application of models of best practice, the EU has claimed that educational programmes being based on empirical data should be tested in model settings first. The EU hopes to avoid flaws in the standard of learning by this way of evaluating (European Commission 2005). Proponents of a comparative science of education have pointed out that best practice elements should only be integrated into educational processes as long as necessary contextualising grants the implementation of new educational contents (Allemann-Ghionda 2004).

Best practice oriented research, being part of the communication in CoPs, offers valuable insights into education practice and its possible modification; thus applied, best practice might become effective most profitably. This caution is due because science theory as well as cognitive psychology have claimed that best practice examples represent information structures which must not be transferred straight away to other areas (European Commission 1997).

The identification and use of best practice in the ICT- teacher-training is above all a transfer process, concerning both the curricula of the student and the training of the teacher. In the frame of advancement programmes it is often assumed that information can be "transferred" to the education systems of Africa. In this context the concept of "knowledge transfer" is being used. If in this connection knowledge cannot be transferred on new ranges of application, the cognitive psychology proceeds from "inactive knowledge". This inactive knowledge is evolved if the metaprocesses of the knowledge processing are disturbed.

Thus implicit cost-benefit calculation, volitional deficits, dysfunctional epistemological convictions, as well as deficits in the conceptual knowledge can lead to a cognitive state, in which knowledge cannot be used. Especially best practice examples cannot be transferred to other education ranges, if the metaprocesses of the cognitive data processing system are



disturbed. Furthermore, the knowledge structure also can be in deficit. This structure deficit hypothesis assumes that it comes to a lacking knowledge compiling as well as to the separation from implicit and explicit knowledge in different systems. Furthermore it can come on the level of the knowledge processing to a compartmentalisation if the knowledge was stored in unrelated memory structures.

In addition, Renkel (1996) according to his research assumes that knowledge is not stored as substance in the brain but exists in situ in a relationally state. Only a selfregulated learning process, which considered the situational bindingness of the knowledge between individual and situation, makes it possible to use knowledge in different situations.

In order to establish the identification of best practice and its application in the theoretical teacher training, it is therefore necessary to understand the identification and transmission of best practice elements as an activity that should take place in a larger community of the practice. In this way the formation of inactive knowledge within the CoPs can be prevented (Wenger 1998).

### **3. Structure and Function of Communities of Practice (CoP's)**

Within a CoP, rules and examples circulate which make ICT supported learning processes comparable. The CoPs are characterised by a common pool of documents, representations and action knowledge, with which expert's knowledge can be developed and used.

Because a CoP is based on a basic structure of accepted assumptions, the CoP is threatened by an early falsification of the basic concepts, if the fundamental postulates of the CoP are not protected against falsification.

At construction as well as at a spontaneous foundation of a CoP, it is necessary to put a protection belt from theories and assumptions around the paradigmatic core of the CoP. These statements and theories, surrounding the core, are developed by the community members. They can be changed and adapted without the core of the CoP, for example a self-regulated learning paradigm, must be rejected. Current science points out that the core of a CoP is mostly not rejected in a revolutionary manner, but slowly forgotten. This happens if too many anomalies emerge or a new core is available (Lakatos 1977).



The knowledge system of an established CoP does not grow in a cumulative way. One can assume that it comes to the formation of best practice knowledge which is constantly developed in a group process. This knowledge can be changed, because the participants of the CoP learn self regulated or from each other.

The organization of a CoP is characterised by the fact that all participants share the key concepts, i.e. the core of the paradigm. This concept of sharing encloses shared information, shared experience, common training, mutual consultation and common projects (Wenger 1999).

The scientific-theoretical investigation of the African education systems within the range of the teacher-training shows phases of revolutionary radical changes, in which the education elite changed their learning and teaching practices. This post colonialist revolutionary transition to a new education paradigm takes place in Africa at the end of the 1970s. Up to this time educating theorists, who dominated the education areas in Africa, assumed that the traditional African education forms were defective in the domain of scientific training.

The promotion of western science education represented the appropriate means, in order to overcome an assumed cultural deficit (Champagne, D.W. & Saltman 1964). These centrally controlled reforms which still happened before the appearing of the ICT era led to a permanent crisis of the African educational systems. The amplified centralized implementation of western curricula in the African education area showed the African education researchers the necessity of harmonizing African culture systems with scientific knowledge (Lewien 1990). The first roots of the independent African educational paradigms can be found here.

In the year 2000, UNESCO recommended that the education at schools in Africa should be in reference to the surrounding community. Teachers, who are trained in the use of ICT, should teach and do research in those communities, in which they grew up (William W. C 1994). Therefore knowledge, which represents a current practice orientation, should flow into the teacher-education. It is necessary to accomplish the teacher training in certain regional languages so that smaller ethnic groups are not outvoted by a national linguistic dictation (SARPN 2006).



The aim of the ICT education and further education in Africa should be the creation of CoPs, which constitute progressive teacher-training and further education programmes (Education for all 1999). It is important to emphasize that the educational research always is a form of a human socially organized activity, which always represents social group processes. In educational sciences one has to differentiate between phases of revolutionary changes and phases of normal science in which negotiated examples and rules are exchanged within the CoPs. The paradigms of the CoPs are also affected by emerging crises and anomalies, so that it comes to the necessary change of educational paradigms. The high drop out rate in African education institutions represents such an anomaly.

In 2006 the UNESCO started an initiative to advance the training of teachers in the decade of 2006-2015. In the long run the introduction and the development of ICT in teacher-training forms the implicit base of a new African education science which will transform the multicultural African education areas. The new African education paradigms fix the area in which education problems are recognized and solved. The ruling paradigm determines, which methods of research are used.

In the future the implicit inside information transformed in these processes will become the reality of the teacher-training and the transformation of the school lessons which are still in its current curricular structure in a pre-scientific developmental stage (Moon 2004b).

It is a general aim of the African educational research projects that they step in a phase of normal science. This state can only occur, if the individual African society formations organize themselves in CoPs. The participating CoPs will agree upon certain curricula, which formalize and advance ICT based teacher training. This can be reached in a concerted action of central and decentralised reforms (Allemann-Ghionda 2004).

In the present report it is assumed that the production of paradigms in the area of teaching and learning can be achieved effectively by the formation and activity of African working groups. If it comes to the construction of compatible educational paradigms in the African teacher-training, then a great amount of teaching - examples can be identified and developed, which help the teacher to implement ICT in their instruction. Best practice structures then can form the discourse material as the basis of any scientific communication in the education areas.



Anomalies within the education areas flow into crises, which can also be found on the political level. Particularly within the range of intercultural learning anomalies emerge, which cannot be explained by standardized education theories, adapted from the industrial nations. At the same time the inheritance of the colonial history of the 19th and 20th century still plays a certain role, because they fragmented the African continent and its educational systems. The classification of the African education landscape into a theoretical scheme is particularly difficult, if not even impossible. A solution for all problems of the African education landscapes is rather improbable.

Apart from a structural differentiation of the education systems of the African countries the comparative analysis shows on a diachronic level that the African continent is very differentiated regarding geography, economics, language, political systems and ecological conditions. Focusing on the ICT-teaching-areas in the Sub Sahara states it is noticeable that no uniform paradigm exists, which helps to solve education problems in the ICT domain methodically, investigative and innovative.

However, a certain standardization tendency within the range of the African degrees can be detected, because the Anglophone countries accept university graduations all over Africa. Regarding teacher-training in ICT, the African education landscape shows a patchwork structure, because methods of teacher-training are not uniform yet. Only 40 per cent of the active teachers took part at a rudimentary teacher-training (Moon 2004a). This particularly applies to the ICT domain in teacher-training. On a macro-structural level this education deficit on the teachers' side can also be explained by the non-existence, the lack of influence, or the current ineffective CoP in this area. Without CoPs the development and predefinition of uniform African ICT education standards is more difficult.

In some African countries (e.g. South Africa, Uganda, Rwanda) the objects of research in the ICT domain, particularly in the universities, are differentiated. Regarding the situation from a meso-structural level it is possible to identify some scientific communities, which concentrate on doing research and development to solve education problems and to test ICT-teacher-training within a paradigm.

It is a problem that African education researchers convert to new paradigms which are developed in the industrial nations. Therefore, these African education researchers are only



restrictedly innovative, because they are not sufficiently orientated to the original education problems of the African social groups . In addition, the globalisation imposes an even stronger economic orientation of the curricula on African education researchers. This does not fit well with the needs of the African countries. Due to this, the experts agree that the African educational systems cannot be transformed into the digital modern age in an only evolutionary way. Also, it seems to be clear, that a revolutionary introduction of new ICT- learning-paradigms without tuning processes which adapted the learning and training processes on African conditions, is not possible.

The tertium comparationis can be found in a controlled evolutionary development of the African educational systems, which also permits phases of revolutionary radical changes. It is characterized by a feedback process, in which teachers and learners can adapt their learning strategies to new conditions of the African educational landscapes. This applies primarily to the ICT-area, in which too little independent African research still takes place.

The African educational research needs its own paradigm, on which ground it is possible to develop new theories and which allows to check western theories on their usefulness for developing countries. Once this process has begun, then education researchers can convert to new paradigms which are developed in Africa. The African educational research stands in front of its turning point whereby it can come to a fast successful development of its own education paradigms, which produce synergies in the range of the ICT teacher training. The African education researchers must realize that the education paradigms, which come from the industrial nations in their raw form, are incommensurable with the new African education paradigms. The direct implementation of best practice models from the industrial nations could widen the digitally division in the future (Pipa 2001).

In the context of foreign aid the supply with new hardware is a soluble problem. It should be pointed out from a scientific-theoretical point of view that an independent African educational research must exist so that the study-medium Internet supports the social consolidation as well as the construction of the economic sectors of the African states.

It is essential for the educational research, that not progress but the change lead to the development of new education paradigms (Kuhn 1962). The approach towards a basic reality, absolute truth (Popper 1959) or a cumulative development of the education area does not take



place. In Africa a multiplicity of social structures and processes affect the education areas, so CoPs make it possible to construct and spread knowledge structures, without producing inactive knowledge and training forms.

The African educational research, particularly teacher training, should not get into a too unproductive proximity of prefabricated educational programmes. Expressed from the philosophy of a scientific point of view, it can be recommended, that foreign aid in the ICT – teacher training should be regarded as a collection of best practice models which can be implemented effectively in the education sector, if they are weighted, tuned and controlled within African CoPs.

#### **4. Improving ICT use in teacher education in Africa**

In teachers' professional development, ICTs are seen as essential as they have the task of preparing students for their role in modern society. According to a UNESCO 2005 survey, only 35% of already trained teachers in secondary schools in Europe, Asia and Africa, have basic skills in ICT, which leaves the remaining 65% of the teaching work force on the three continents still in need of computer skills (Zindi & Aucoin 2006). National governments are globally realising the need to fill the gap in the teaching force and are seeking new strategies and programmes to enhance the integration of ICT in education. The construction of African CoPs could be one way of improving the communication processes in the education areas.

Global organisations have joined forces with national governments, ministries and institutions in implementing ICTs in different sectors. Institutions of learning are reforming their systems to accommodate new media of learning. Within this framework Africa is seeking to establish and improve its competence in ICT. In 2002, African states established the NEPAD (New Partnership for African Development) whose objectives strongly focus on the dual strategies of ICT Development (ICTD) and ICT for Development (ICT4D). In 2003, WSIS (the World Summit for Information Society) identified a significant role for information and communication technologies in strategies for African development (Okapaku 2003).

It is not possible to name all organisations/stakeholders involved in the process of harnessing Africa's education with ICTs. Neither is it in the scope of this paper to list all programmes of ICT in teacher education, but rather to illuminate some of the major and current activities in



ICT use in teacher education. There have been numerous organisations involved in supporting Africa to prepare its teachers for the information age. Leading among these are the UNESCO and the World Bank. While many of these are global organisations involved in all sectors of global development, there are also programmes initiated specifically for the development of ICTs in African teacher education on the continent. Many stakeholders are beginning to realise the potential of ICTs as the solution to the shortage of teachers in developing which would enable to realise the EFA goals as well as, in the long run, providing the most cost effective means of equipping the existing 60 million, mostly unqualified teachers, with skills to enable them to stay abreast of new developments.

However, there is a need for a deeper a comprehensive framework to train teachers in the appropriate use of ICTs. The most current knowledge on this subject is the extensive study of teacher-training in information and communication technology (ICT) in African countries, at both the pre-service and in-service levels, commissioned by SchoolNet Africa (SNA 2004 ) 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). According to UNESCO, there is no comprehensive framework of teacher-training in ICT use in Africa and the few that exist have been mostly developed outside of Africa (UNESCO 2002).

*InfoDev* (the Information for Development Program) also observes in its report (infoDev 2005) that no standard reference or methodology exists to evaluate ICT in education programmes. At this point CoPs could stimulate the construction of African education paradigms. Most African teacher-training institutions are too under-resourced to meet existing expectations of ICT training. In addition an ICT curriculum requires extra infrastructure, the development of teacher-trainer-ICT-skills and the production of ICT training materials. A shortage of public funds is a fundamental challenge to buil skills in ICTs in African education. Many educationalists have yet to realise the transformational potential of ICTs. And given so many other spending priorities, as long as ICTs are considered non-essential, they will continue to struggle for attention.

However, despite the serious challenges posed by the lack of electricity, lack of connectivity to the internet, and the low financial resources available to education in most of Sub-Saharan



Africa, Africa has to face the essential need to be at the cutting edge of technological innovation otherwise its position in world development will deteriorate even further in the next two decades (UNESCO-IICBA 2000).

UNESCO emphasises that teachers, professors and technical and administrative staff must be given training that enables them to integrate new information and communication technologies into their teaching programmes, and to examine the multiplier effect with regard to their use (UNESCO 2000). Building up African CoPs could be a chance to stop the brain – drain. In 1999 the UNESCO established the IICBA (International Institute for Capacity Building in Africa) with centres in Dakar, Pretoria and Addis Ababa which provides services to about twenty countries. Two of the major tasks of this institute are: to bring research and development closer to practical implementation programmes and, to form a network of such programmes and institutions, allowing the sharing of training facilities and experience.

All in all the responsibilities of the institute include: addressing the educational, technical and professional needs of member states; providing a forum for the sharing of both positive and negative experiences so as to enable institutions and educational systems to benefit from work done by sister bodies; bringing the latest research and development in Africa and globally to institutions in Africa; enhancing the capacities of regional, national and local level institutions; and providing the opportunity for technological improvements, such as the utilization of electronic media for networking and for educational purposes.

## **5. From Theory to Practice: the [www.portal-education-africa.org](http://www.portal-education-africa.org)**

Within the framework of enhancing ICT use in teacher education, the Department of Educational Psychology at the University of Cologne launched a project geared towards and fostering ICT use in education through establishing partnerships within African universities. This project aimed at reducing the enormous digital divide that exists between African and western nations by collaborating with African institutions at a departmental level and thereby setting a foundation for a community of practice. As part of the project goals a website was designed which serves as a platform and a network of "contacts" or "experts" in departments of education in the selected universities. This was done by writing emails to educationists in selected educational institutions in Africa that could be found on the internet or through



personal reference. All in all 30 universities were contacted. Of these 25 replied to the emails and 16 of these form our core partners in "Fostering ICT use in teacher education in Africa". Another important goal of the project is to identify ICT based learning environments in teacher education that have proven to be successful and to determine the factors that contributed to the success. These successful learning environments could then as examples of good pedagogical practice, be transferred to other educational institutions. It is considered to be important that the examples of good pedagogical practise come from African institutions and are not simply imports from non-African countries. CoPs are the ideal instruments in order to realize these aims.

It is expected that the project will help familiarise future African teachers with the uses of ICT thus helping them to improve their teaching and allowing their students to take advantage of these new technologies. With the help of our community- of practice-platform PEA, it is planned to bring the participating teachers into contact with existing network on the use of ICT in education (like World Links, IEARN and the Africa portal that is part of the project: <http://www.portal-education-africa.org>) to facilitate their transition from the educational institutions to the schools where they will work and to provide them with support when they are actually there. It is also expected that the insights gained in this project will help to improve teacher education and particularly the use of ICT in teacher education in Africa, thus contributing to achieving the goals and targets of the Dakar Framework of Action. Within the framework of the project, a dissertation study is being carried out with six African universities. Through the examination of existing literature, projects, initiatives and an empirical study, the dissertation explores the use of ICT in teacher education in institutions in Sub-Saharan Africa. Although the major survey covers six months, the whole empirical study which involved the selection of participants, pre-test questionnaires and interviews covers a period of 2 ½ years. The results of the study are expected to identify best-practices of ICT use in teacher education in the selected universities and highlight on the reasons behind their success or failure.

The Dakar Framework for Action (April 2000) identified the use of new information and communication technologies as one of the main strategies for achieving the EFA (Education for All) goals (UNESCO 2000). In order to achieve education for all there is a need to educate



all teachers as there is a growing imbalance between the output of trained teachers and the demand as primary provision is expanded in developing countries (Moon et al 2002).

The study examines the role of teacher education in ICT in Africa and how they are being prepared to apply and integrate ICT in teaching. Teachers as multipliers are the key agent in respect to educational change and innovation and, therefore, a foundation for any new strategy to establish. Each teacher trained in the use of ICT is capable of sharing that knowledge / learning and cross-cultural awareness among at least 40 students in Africa and some cases more than 200 in one class (Moon et al 2002). The study does not only look at the measures African institutions are taking in equipping their students with the technology skills, but also at the international, regional and national efforts to implement ICT in teacher education in Africa.

Best practices in this study will refer to the guiding principles in initiating ICT in education and in teacher education recommended by international bodies. It is important that the guidelines given by international bodies are adapted to the African education areas. Communities of practice can help to realize the adaptation these processes. International bodies like the UNESCO (2002), *infoDev* (2005), and the Society for Information and Teacher Education (SITE, 2002) have recommended guidelines to be followed when applying new technology to teacher education. Summed up indicators for good practices in ICT use in teacher education should involve: (i) an ICT Policy whereby governments through their national policies and budget allocations show their support and commitment by enabling implementation of ICT policies at the institutional level, (ii) an ICT Infrastructure which enables connectivity to internet, telephone as well as access to computers and other ICT facilities, computer laboratories, internet available to students, teaching and administrative staff, (iii) an ICT Curriculum: applying ICT in education whereby (a) ICTs are integrated in the teaching and learning processes through use of ICT as a tool not just a curricular subject in the teaching-learning process, (b) teaching with various educational software; (c) students applying ICT in classroom activities and in their assignments, (d) tele-collaboration and communication between students and teachers and other schools (UNESCO-Bangkok 2003).



## **6. Investigating good and poor examples of ICT in teacher education**

The purpose of the study was to investigate pre-service teacher-training in ICT use and identify good and poor practices of ICT use in teacher education at African universities. Subjects were university teacher-students who responded to a 31-item questionnaire. Follow-up telephone interviews were conducted with lecturers selected from the participating universities to provide more in-depth information. Currently data is being analysed to provide a description of pre-service teachers-training in ICT use at the selected African universities, their evaluation of good and poor examples of ICT courses, their perceived levels in ICT skills, and their major hindrances to acquiring these skills.

## **7. Method and Data collection**

The study used both quantitative and qualitative data. The data presented here was collected from a survey distributed to African universities. This survey consisted of 31 items measuring demographic information, ICT training and course identification, ICT skills and access, and general self-assessment in ICT. Responses were in Likert-format, multiple choice as well as short-answer questions.

A structured questionnaire to assess the general situation of ICT implementation and use was distributed to the project's network of experts as a word document to the 25 members in the PEA network of education experts. The questionnaire aimed at a general assessment of ICT implementation and accessibility in the selected universities. Of the 25 universities approached, 16 of these returned the filled-out questionnaire and enrolled themselves to participate in the study project. Results from this questionnaire showed that all the universities that possessed at least one computer laboratory, had access to internet, had a website, and an ICT instructor.

The data presented here are based on the online survey in February 2006 of 16 universities. This questionnaire was designed basing on other studies in ICT use in teacher education (Williams et al 1997; UNESCO-Bangkok 2003; Angeli & Valanides 2004). In addition to the general assessment of ICT implementation and accessibility, the questionnaire investigates



the available training in ICT for teacher-student in these institutions. The questionnaire was distributed to the 16 universities that were approached and could either be filled in and saved electronically on the web or manually and mailed by post to the source, depending on the most cost-effective means of the participants. Both lecturers and students were encouraged to participate in the survey and responses have been received from six universities from Cameroon, Kenya, Rwanda and Uganda. The survey was open for a period of six months which covers a semester. The questionnaire was categorised into four groups of questions addressing: demography, ICT training and course identification, ICT skills and access, and general self-assessment in ICT.

## **8. Results**

### **8.1. Demographic information**

128 responses from six universities or institutions were returned. 74 of the respondents were male and 54 female. The majority of the respondents, 81, were resided in urban areas as compared to 47 in rural. Although the survey was sent only to universities, 75 teachers identified themselves as teachers and 53 as teacher-students. 96% of the respondents use English as language of instruction.

### **8.2. Training in ICT**

In the questionnaire, students had been asked if, in the course of their studies, they had received training on ICT use. They had also been asked to indicate the duration of the training course. Categories were (1) two weeks, (2) one month, (3) one semester, (4) 12 months and (5) never. In table 1, training experiences of skilled students and low skill students are compared. More specifically, the numbers of students who had indicated that they had never received any training with respect to the different computer applications are given.



	Skilled students (N=62)		Low skill students (N=66)	
	N1	%	N2	%
word processing	12	19,4	47	71,2
spreadsheets	19	30,6	56	84,9
presentation tools e.g. Powerpoint	25	40,3	63	95,5
internet research	22	35,5	64	97,0
email, chat	31	50,0	63	95,5
education networks, fora	44	71,0	64	97,0
statistics	38	61,3	62	94,0
elearning	41	66,1	64	97,0
databases	31	50,0	61	92,4
programming	40	64,5	64	97,0

Table 1: Numbers of students with no training experience

### 8.3. Evaluation of good and poor examples

Students were asked to evaluate two courses which they had attended, one which they had been content with and another one which they had been less satisfied with. It was expected that this would give some idea of what students considered to be good and poor examples of ICT use in teacher education. Students were asked to use two sets of Likert scales for each course. The first set contained four items which referred to possible positive effects of the course on the students (see table 2) while the second contained somewhat more global items (table 3). Agreement with the statements was to be indicated on a scale from 1 to 5 where 5 indicated strong agreement.



For this course, please indicate to what extent you agree with the following comments:

1. The context of the coursework was empowering to me
2. The method courses are/were relevant and prepared me well for the real classroom
3. Many of the ICT teacher preparation courses integrated examples and experiences I can relate to
4. The courses provide opportunities for me to improve my knowledge in teaching with ICT

Table 2: Course evaluation, part 1

I found this ICT teacher training course

5. Relevant – I acquired knowledge and skills to prepare me for teaching using ICT
6. Exciting – I was inspired to find creative ways to work with the computer
7. Validating – I was encouraged to value my background and experiences as a teacher
8. Empowering – I had meaningful interactions with instructors and peers
9. Methodic – I was taught processes and procedures to follow

Table 3: Course evaluation part 2

#### 8.4. Evaluation of good and poor examples by skilled and low skilled students

In order to find out how skilled and low skilled students evaluated good and poor examples of ICT use, mean values for each group of students and each group of examples (table 4) were calculated and differences in mean values were tested with t-tests for independent samples.



	Good examples			Poor examples		
	skilled	low skill		skilled	low skilled	
context empowering	3,50	2,50	**	2,92	2,11	*
Relevant	3,11	2,53	*	2,45	2,24	ns
examples I can relate to	3,18	2,32	**	2,52	2,35	ns
Improve my knowledge	3,48	2,48	**	3,03	2,42	*
Relevant	3,61	2,48	**	3,18	2,05	**
Exciting	3,60	2,56	**	3,08	2,50	*
validating	3,31	2,48	*	2,97	2,26	**
empowering	3,05	2,38	**	2,94	2,33	**
methodic	3,34	2,35	**	2,89	2,38	*

Table 4: Evaluation of good and poor examples by skilled and low skilled students

(\*\* =  $p < 0.01$ ; \* =  $p < 0.05$ ; n.s. = not significant)

Generally speaking, skilled students evaluate good as well as poor examples of ICT use better than low skilled students; inter-group differences are (highly) significant on all items for the good examples.

This study focused on training in ICT use in teacher education and what could be identified as good or poor examples of ICT practices in training in ICT use.



Despite the empirical researches on ICT and the numerous initiatives in fostering ICT use in teacher education in Africa, there is limited research on how teachers are being trained to use these technologies. This study aimed at contributing to the knowledge base concerning what is known about ICT use in teacher education in African universities or institutions and which we hope will provide a foundation for further investigations in this field.

## 9. Conclusion

ICTs are spreading rapidly in the world. In order to stop brain-drain, new African education paradigms need to be constructed. Multipliers in the education sector need to be trained within a scientific-theoretical framework, enabling the implementation of best practice models, which are tested in African online-communities of best practice (CoPs). Such online communities make it possible to analyse and evaluate the explicit and implicit knowledge being effective in the ICT training of teachers. The identification and transmission of best practice elements take place in a larger community of practice. The organization of a CoP is characterised by the fact that all participants share the key concepts, i.e. the core of the paradigm.

The education at school in Africa should be in reference to the surrounding community. The aim of the ICT education in Africa should be the creation of CoPs, which constitutes an on-going teacher training. On a macro-structural level the deficit on the teachers' side can be explained by a non-existence, lack of influence or the current ineffective operating CoPs in this area. It is assumed that the production of paradigms in the area of teaching and learning can be achieved effectively by the formation and activity of African working groups.

CoPs help to accomplish controlled and evolutionary development of the African educational systems, which would permit phases of revolutionary radical changes. African education researchers need to realize that the education paradigms, which come from the industrial nations in their raw form, are incommensurable with the new, African education paradigms. Foreign aid in the ICT teacher-training should be regarded as a collection of best practice models which can be implemented in the education sector effectively, if they are weighted, tuned and controlled within African CoPs.



Institutions of learning are reforming their systems to accommodate new media of learning. While many of these are global organisations involved in all sectors of global development, there are also programmes initiated specifically for the development of ICTs in African teacher education on the continent. There is a need for a deeper comprehensive framework to train teachers in the appropriate use of ICTs and yet there are no standard references or methodologies to evaluate ICT in education programmes. The development of an ICT curriculum requires extra infrastructure (like CoPs), construction of teacher-trainer ICT skills and production of ICT training materials. This can help bring research and development closer to practical implementation programmes.

PEA as a network, developed for such programmes and institutions, allows the sharing of training facilities and experience. Responsibilities of the institute include the providing of a forum for the sharing of both positive and negative experiences. Using the project's website as a platform, a network of "contacts" or "experts" in departments of education in the selected universities was developed. PEA fosters the ICT use in education through establishing a CoP within African universities. This project aims at reducing the enormous digital divide with the help of an internet platform. In this network African "experts" can create successful learning environments, which could then act as examples of good pedagogical practice, checked and tuned by African CoPs, and can be transferred to other educational institutions. It is important that the examples of good pedagogical practise come from African institutions. PEA brings the participating teachers into contact with existing CoPs. Within the PEA framework, the results of the dissertation study show that the development of ICT use in selected African universities is still at a very low level. Teachers are the key agent in respect to educational change and innovation and, therefore, a foundation for any new strategy to establish CoPs for the successful implementation of teacher-training programmes in Africa.

## 10. References

- Allemann-Ghionda, C. 2004: *Einführung in die Vergleichende Erziehungswissenschaft*. Weinheim & Basel: Beltz.
- Angeli, C. & N. Valanides 2004: "The Effect of Electronic Scaffolding for Technology Integration on Perceived Task Effort and Confidence of Primary Student Teachers University of Cyprus." In: *Journal of Research on Computing in Education*, 37, 1.



- Champagne, D.W. & M.A. Saltman 1964: "Science curricula and the needs of Africa." *West African Journal of Education* , 8,(3), 148-150.
- Cobern, W. 2000: *Alternative Constructions of Science and Science Education*. A plenary presentation for the second annual Southern Africa Association for Mathematics and Science Education Research, University of Durban-Westville, Durban, South Africa, 27-30 January 1994, 25 Jun 2000. <http://www.wmich.edu/slcsp/SLCSP122/SLCSP122.pdf>.
- Education for All 1999: *A Framework for Action in Sub-Saharan Africa: Education for African Renaissance in the Twenty-first Century Adopted by the Regional Conference on Education for All for Sub-Saharan Africa Johannesburg, South Africa, 6-10 December 1999*. [http://www.unesco.org/education/efa/wef\\_2000/regional\\_frameworks/frame\\_africa.shtml](http://www.unesco.org/education/efa/wef_2000/regional_frameworks/frame_africa.shtml). Access on January 10<sup>th</sup>, 2005.
- European Commission 1997: *ESPRIT ESD Best Practice. Technologies for Components and Subsystems (TCS). "Broadening the Use of Design Technologies."* Brüssel, Sept.1997 <http://www.cordis.lu/esprit/src/esd-best.htm>. Access on March 15<sup>th</sup>, 2003.
- European Commission 2005: Mobilising Experience – Transferring Best Practice in Learning in Europe. Conference in Cardiff 29-30 November 2005. Access on August 1<sup>st</sup>, 2006. [http://ec.europa.eu/dgs/education\\_culture/valorisation/doc/cardiff.pdf](http://ec.europa.eu/dgs/education_culture/valorisation/doc/cardiff.pdf)
- Higgins, S. 2003: Does ICT improve learning and teaching in Schools. Newcastle University. A Professional User Review of UK research undertaken for the British Educational Research Association. <http://www.bera.ac.uk/publications/pdfs/ICT%20PUR%20MB%20r-f-p%201Aug03.pdf>
- infoDev 2005: Knowledge Maps: ICTs in Education. *infoDev: the Information for Development Program*. <http://www.infodiv.org/en/Publication.8.html>
- Keuth, H. 2005: *The philosophy of Carl Popper*. Cambridge: University Press.
- Kuhn, T.S. 1962: *The Structure of Scientific Revolutions*. Chicago: University Press.
- Lakatos, I. 1977: *The Methodology of Scientific Research Programmes: Philosophical Papers Volume 1*. Cambridge: University Press.
- Lewien, K. 1990: "International perspectives on the development of science education: Food for Thought." *Studies in Science education*, 18,15ff.



- Moon, B., J. Leach & T. Powner 2002: *Building teachers' professional knowledge through ICT: experience and analysis across the 'digital divide'*. Paper presented to the European Conference on Educational Research, University of Lisbon.
- Moon, B. 2004a: *Open Learning And Icts: A Radical Solution To Preparing Teachers To Meet The Universal Basic Education (UBE)*. The Open University, United Kingdom. [http://www.col.org/pcf3/Papers/PDFs/Moon\\_Bob.pdf](http://www.col.org/pcf3/Papers/PDFs/Moon_Bob.pdf). Access on July 13<sup>th</sup>, 2006.
- Moon, B. 2004b: "'Open and Distance Learning for Teacher Education in Africa: Innovation and Change', A Toolkit for Education Policy Makers, Planners and Teacher Educators in Sub-Saharan Africa." In: *Region Human Development Working Paper Series, 5*. Washington: The World Bank.
- NEPAD 2001a: *New Partnership for Africa's Development*. Access on March 12<sup>th</sup>, 2006. <http://www.nepad.org/2005/files/inbrief.php>
- NEPAD 2001b: <http://www.nepad.org/2005/files/documents/41.pdf>. Access on August 1<sup>st</sup>, 2006.
- Nicolai, A. & A. Kieser 2002: "Trotz eklatanter Erfolglosigkeit: Die Erfolgsfaktorenforschung weiter auf Erfolgskurs." In: *DBW*, 62, 580ff.
- Colle, R.D. 2005: "Building ICT4D Capacity in and by African universities." In: *International Journal of Education and Development using ICT*, 1, 1.
- Pippa Norris 2001: *Digital Divide*. Cambridge: University Press
- Popper K.R. 1959: *The Logic of Scientific Discovery*. London: Hutchinson.
- Renkel A. 1996: "Träges Wissen: Wenn erlerntes nicht genutzt wird." In: *Psychologische Rundschau*, 47, 78-92.
- Resta, P. (Hg.) 2002: *Information and Communication Technologies in Teacher Education: A Planning Guide*. Paris: UNESCO.
- SARPN (Southern African Regional Poverty Network) 2006 AS THE YEAR OF AFRICAN LANGUAGES. African Union Summit 2006 Khartoum, Sudan. Access on July 10<sup>th</sup>, 2006. <http://www.sarpn.org.za/documents/d0001850/index.php>  
[http://portal.unesco.org/education/en/ev.php-URL\\_ID=30401&URL\\_DO=DO\\_TOPIC&URL\\_SECTION=201.html](http://portal.unesco.org/education/en/ev.php-URL_ID=30401&URL_DO=DO_TOPIC&URL_SECTION=201.html)
- SchoolNet Africa 2004: *Towards a Strategy on Developing African Teacher Capabilities in the Use of Information and Communication Technology (ICT)*. Access on December 4<sup>th</sup>, 2005.



[http://www.schoolnet africa.net/fileadmin/resources/Towards\\_a\\_Strategy\\_on\\_Developing\\_African\\_Teacher\\_Capabilit.01.pdf](http://www.schoolnet africa.net/fileadmin/resources/Towards_a_Strategy_on_Developing_African_Teacher_Capabilit.01.pdf)

UN 2000: *MDG (Millennium Development Goal)*. <http://www.un.org/millenniumgoals/#> Access on June 11<sup>th</sup>, 2006.

UNESCO 2000: *Dakar Framework for Action. Education for All: Meeting our Collective Commitments*.

UNESCO 2002: *Information and Communication Technology in Education: A Curriculum for Schools and Programme Teacher Development*. <http://www.unesco.org/index.php?id=782>. Access on June 10<sup>th</sup>, 2006.

UNESCO 2005: *Global Education Digest 2005: Comparing Education Statistics Across the World*. <http://www.uis.unesco.org/template/pdf/ged/2005/ged2005en.pdf> Access on August 14<sup>th</sup>, 2005.

UNESCO-Bangkok 2003: *Developing and Using Indicators of ICT Use in Education*.

UNESCO-IICBA 2000: *Utilisation of Information and Communications Technology for Education in Africa*. Addis Ababa: Ethiopia.

Unwin, T. 2004. *Towards a framework for use of ICT in Teacher Training in Africa*. <http://www.gg.rhul.ac.uk/ict4d/ICT%20TT%20Africa.pdf> Access on June 10<sup>th</sup>, 2006.

Wenger, E. 1999: "Communities of practice: the key to a knowledge strategy." In: *Knowledge Directions*, 1, 2, 48-63. (Reprinted in Lesser, E., M. Fontaine & J. Slusher 2000: *Knowledge and Communities*. Boston: Butterworth-Heinemann.

Wengler, E. 1998. *Communities of Practice*. Cambridge: University Press.

Williams, D. 1997: *Teachers' ICT skills and knowledge needs: Final Report to SOIED*. The Robert Gordon University.

Zindi, F. & R. Aucoin 2006: *Information and Communication Technology (ICT): A Compulsory Subject for all Students in Teacher-Training Institutions*.

<http://www.developmentgateway.org/e-learning/highlights/viewHighlight.do~activeHighlightId=109021> Access on May 27<sup>th</sup>, 2006.