

# Digital Delivery. E-learning in Rural Secondary Schools in Tanzania.

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## Introduction

This paper is a presentation of results from a study within a research project for e-learning in rural Tanzania running at the University of Dar es Salaam and the prospective College of Engineering and Technology, and concerns specifically the platform and content of the e-learning project in Tanzania. This particular study is also part of SPIDER; the Swedish Program for ICT in Developing Regions, from which funding has been received.

The work done in this e-learning project has explicit links to a parallel project conducted by colleagues at Technical Faculty of Makerere University, Uganda, and situated at Arua district just by the border to Democratic Republic of Congo. Valuable comparisons can be made and the importance of situated, context sensitive approaches be explored.

## Background

In Tanzania, secondary schools face a shortage of educated teachers, especially in the rural areas, as educated teachers tend to move to the urban areas. The problem is particularly severe in the science subjects as teachers in science find alternative, more profitable employment.

At the University of Dar es Salaam (UDSM) and the prospective College of Engineering and Technology (pCET), a research project has been developed where ICTs will be tried as a tool to support rural secondary schools with teaching materials for the science subjects. The research group consists of senior researchers in computer science, telecommunication, electric and mechanical engineering (pCET) and the Faculty of Education (UDSM). Three doctoral students are also involved in the project, which will be finalised in 2007.

The University of Dar es Salaam has a strong demand to focus research and education on areas of benefit to the wider society (Trojer, 2004). The e-learning project lies well in line with this ambition.

In this paper, the e-learning project for rural secondary schools in Tanzania will be placed in the wider context of postcolonial ICT development. Particularly, the use of open source software (OSS) for the platform and the participatory content development and use will be discussed.

During the research process, we have developed a more complex understanding of the participatory aspects of e-learning.

- First, secondary school teachers are potential participants, when the material is developed.
- Second, the e-learning material can allow for more or less participation among the students in the schools, depending on the structure of the platform and the content.

- Third, the actual participation in the schools will depend on the preparedness among teachers and students to change the education context towards a more interactive mood when the e-learning material is introduced.

## Theoretical framework

A number of institutions in African countries have taken up the challenge to address the Digital Divide. At the Regional Workshop on Engineering and Technology in Bagamoyo, Tanzania<sup>1</sup>, researchers from East African countries identified common interests to find ways to develop ICT for use in rural areas in the different countries. The argument was that urban ICT has advanced much easier. Appropriate applications that have been identified for rural citizens include e-learning, medical advice, agricultural advice, promotion of the farmers' agricultural products and education through local computer centres in rural areas. This would reduce costs for travels and increase the accessibility for rural citizens to expertise located in urban or distant rural areas. Also, e-learning can address practical and local knowledge sharing outside the formal education system.

At the WSIS Africa Regional Conference<sup>2</sup>, the participants identified a number of technical aspects that are of specific relevance for the use of ICT in African countries. These include African languages and voice/touch screen applications, free software and development of content suited to local needs.

At the same time as the postcolonial universities take on a role to develop ICT systems in their respective nations, the conception of the postcolonial has been problematised. Although legally, the nations have become free, the international relations still remain the same in many ways. Many people and institutions feel that they continue to be in the position of receivers of financial and technological resources as well as development plans and knowledge (Trojer, 2004). Therefore, the situation of ICT introduction and development in a postcolonial context needs to be discussed in terms of postcolonial theory, if ICTs are ever going to be (come) tools in and for the development of independent postcolonial societies (see Rydghagen, 2004).

The theories of postcolonialism have been criticised for not worrying about the material (see e.g. Kapoor, 2002). However, technologies producing realities will need to be included in the postcolonial theory, as the technologies interact with the human beings and societies in the determination of direction for future development (Anderson, 2002 and Mejias, 2001). In previous research, a number of issues relating to ICTs in postcolonial contexts have been discussed (Rydghagen, 2004). In short, it can be said that the introduction of a specific ICT in a specific location has very specific meanings and consequences. In societies where oral communication and/or collective identities dominate, computers and the Internet have very different connotations than they have in the literal and individual societies where they were developed. Computers can be regarded as taking time from social interaction, thus being a negative thing. Similar, the language barrier to the Internet for people with other first languages than English is both real and symbolic (Leonardi, 2003). Some information systems are successful in one aspect, but regarded as negative or failed in other aspects. The employees might for example find the system useful for informal (but still work) purposes,

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<sup>1</sup> Regional Meeting, Engineering and Technology for Sustainable Development in Africa, Bagamoyo, October 17 – 21, 2001, UDSM, UEM, MU, UZ, Sida/SAREC, [www.nusesa.org/Newsletter/Highlights.html](http://www.nusesa.org/Newsletter/Highlights.html) [read 20040310].

<sup>2</sup> Bamako, Mali 28-30 May 2002. Summary at [http://www.geneva2003.org/bamako2002/docs\\_word/Dec\\_bko2002\\_en.doc](http://www.geneva2003.org/bamako2002/docs_word/Dec_bko2002_en.doc) [read 20030312].

while the usefulness is not reflected in increased income and thus not successful on management level (or the opposite). Gender and other social relations are affected by ICTs, but not necessarily in a way that resembles previous experiences in other parts of the world (see e.g. Apffel-Marglin and Sanchez, 2002). Technologies as such, as well as the way they are introduced and by whom will have effects on the impact ICTs will have in a postcolonial context. Old computers can be regarded both as ‘good enough to start with’ and ‘something the rich countries want to get rid of anyway’. In what ways this is going to be taken into account in the closing of the Digital Divide is still to be explored more extensively.

Feminist technoscience studies suggest that knowledges are situated (e.g. Haraway, 1997 and Trojer, 2002), and the spread of ICT on a global scale places the question of local appropriateness and usefulness in the centre of the proposed project. Relating to digital ICTs, Mejias (2001) warns that “although communication is conducive to the creation of communities, it is not necessarily conducive to *ethically sound* or *sustainable* communities” (p. 214).

In addressing appropriateness and usefulness, the postcolonial and feminist arguments point towards the concept of distributed knowledge systems and knowledge production within what Nowotny et.al. (2003) names Mode 2. In this perspective, robust and appropriate knowledge in today’s society is produced in the context of application in collaboration between scientists, users, governmental bodies and other stakeholders. This in turn places new requirements on the scientists as well as technological specialists, who will need to reframe their working tasks to include the learning and reflection together with the users (c.f. Schön, 1983).

## **What is the potential of ICT for e-learning and distance education in Tanzania?**

We have found little academic writing on the issue of postcolonial aspects of ICT in Africa or e-learning in general in the postcolonial context. According to Maria Fernandez<sup>3</sup>, the postcolonial theorists have traditionally been working mostly within literature, with issues of identity, agency, migration etc, and not with (electronic) media. This does not mean that the use of ICT and e-learning does not exist in Sub-Saharan Africa. In searching for relevant e-learning web material, we have found websites promoting the use of F/OSS among women, in Africa and in general. We have also found websites providing e-learning courses in different subjects and different levels (primary, secondary school, university level, vocational, specific issues for business and computer use etc.) for African users. It would be interesting to follow these websites (see *Table 1* for examples) – their origins and user groups to create a better picture of what is available to the African internet user. What course contents are provided – basic, higher, vocational, informal learning in what areas? Who is the supposed course participant – rural/urban, previous education, employment etc.? Who is covering the costs for the courses – participants, commercial companies, governments, aid organisations or learning institutions? How many participants enter the courses? However, this would be a research project in itself and is not done in this project.

Maria Fernandez (ibid.) argues that “many [electronic media] theorists were knowingly or unknowingly doing the public relations work for the corporations. This often involved the representation of electronic technologies – particularly the computer – as either value-free or as inherently liberatory”. So, can we manage researching and discussing ICT initiatives in

<sup>3</sup> <http://www.medialounge.net/lounge/workspace/nettime/DOCS/zkp5/pdf/art.pdf> pp. 220-223 [read 20050512].

African communities without promoting the commercial interests of computer companies that provide the hardware, the software and the content?

**Table 1.** Examples of web sites related to e-learning/distance education, gender and/or development and/or (East) Africa.

<p><a href="http://africa.rights.apc.org/">http://africa.rights.apc.org/</a> APC - Association for progressive communications. Internet and ICTs for social justice and development. Africa ICT policy monitor.</p> <p><a href="http://www.apcafricanwomen.org/">http://www.apcafricanwomen.org/</a> Women's organisation, connected to APC (above).</p> <p><a href="http://bridges.org/">http://bridges.org/</a> in South Africa. Spanning the international digital divide. Providing Real Access – physical access, appropriate technology, affordability, capacity, relevant content, integration, socio-cultural factors, trust, legal and regulatory framework, local economic environment, macro-economic environment, political will.</p> <p><a href="http://www.bytesforall.net/info">http://www.bytesforall.net/info</a> - Computers and the internet for the majority of the world. India, Bangladesh, Pakistan base.</p> <p><a href="http://www.cipesa.org/">http://www.cipesa.org/</a> Collaboration for international ICT policy/east and southern Africa. Providing a provocative discussion about ICT in Africa. Related to Bridges.org</p> <p><a href="http://www.comminit.com/events_calendar/2004-events/events-3142.html">http://www.comminit.com/events_calendar/2004-events/events-3142.html</a> Communication initiative, provocative essays and reports from media and events, Canada based.</p> <p><a href="http://cyberdiva.typepad.com/postcolonialaoir/">http://cyberdiva.typepad.com/postcolonialaoir/</a> Postcolonial feminists meet internet research. Discussion forum.</p> <p><a href="http://www.digitafrica.com">http://www.digitafrica.com</a> DigITAfrica commercial web site producer in Accra.</p> <p><a href="http://lists.sn.apc.org/mailman/listinfo/arise-governance">http://lists.sn.apc.org/mailman/listinfo/arise-governance</a> with a number of discussion forums</p> <p><a href="http://lists.sn.apc.org/mailman/listinfo/arise-rural">http://lists.sn.apc.org/mailman/listinfo/arise-rural</a> - Simunet discussion forum.</p> <p><a href="http://mithrandr.moria.org/blog/category_africasource.html">http://mithrandr.moria.org/blog/category_africasource.html</a> with information on different activities, African free and open software movement. Examples of Norwegian Linux for schools introduced in Uganda with “thin client support”.</p> <p><a href="http://rdvp.org/">http://rdvp.org/</a> Digital Vision Program at Stanford University. Free e-learning courses provided by researchers on “sabbatical fellowships”.</p> <p><a href="http://sangonet.org.za/snsite/">http://sangonet.org.za/snsite/</a> - Southern Africa NGO network, offers e.g. free ICT courses.</p> <p><a href="http://www.schoolnet africa.net/286.0.html">http://www.schoolnet africa.net/286.0.html</a> Networking for better e-learning for schools. Research reports.</p> <p><a href="http://www.sul.stanford.edu/depts/ssrg/africa/elecnet.html">http://www.sul.stanford.edu/depts/ssrg/africa/elecnet.html</a> with discussion forums</p> <p><a href="http://www.swopnet.or.tz/">http://www.swopnet.or.tz/</a> SWOPNet - Share with other people net, based in Tanzania, including articles and free software programs.</p> <p><a href="http://topics.developmentgateway.org/elearning">http://topics.developmentgateway.org/elearning</a> From the World Bank and James Wolfson, providing e-learning, computer systems etc. to the developing world.</p> <p><a href="http://womensnet.org.za/about/about.htm">http://womensnet.org.za/about/about.htm</a> for women in South Africa.</p> <p><a href="http://www.wowem.org/about.htm">http://www.wowem.org/about.htm</a> - Women open world empowerment movement for F/OSS (free or open source software).</p>
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The free or open source software (F/OSS) movement is obviously an actor in this sense. The development of freely accessible software is a technological achievement for those working with it and for the end users. The free access provides cheaper software and facilitates the adjustment to different applications and user groups. It is also a political action opposing the IPR (individual property rights) dominating global relations (see e.g. *The Roadmap for TAFOSSA*, 2005<sup>4</sup>). In Africa, the network *Free and Open Source Software for Foundation for Africa* ([www.fossfa.net](http://www.fossfa.net)) provides leadership and guidance to all F/OSS promoting organisations on the continent. In Tanzania, TAFOSSA is the national member of FOSSFA.

<sup>4</sup> [http://www.ethinktanz.org/eseecretariat/DocArchive/TAFOSSA%20RoadMap%20\(v2.0\).pdf](http://www.ethinktanz.org/eseecretariat/DocArchive/TAFOSSA%20RoadMap%20(v2.0).pdf) [read 20050308].

It can be argued that ICTs provide a promising alternative to on site education, since it reduces costs for buildings, travelling and accommodation etc. Teachers can be located in one place while students can stay in their home environments and attend to courses in local learning centres. The teachers might be gathered in a campus, in e.g. tertiary education courses but also in secondary school courses. Support professionals with specific knowledge are easier to engage in central locations (capitals, national institutes and universities) if their need to travel to remote areas is minimised through the use of ICTs.

Mackintosh (2005) argues that sub-Saharan Africa (SSA) has the potential to take a lead in the development of e-learning, due to the great need for a massive expansion at low cost of education at all levels. The lack of university campuses and the lack of an existing technical infrastructure might, according to him, encourage the fast development of innovative e-learning in a Mode 2 sense of distributed knowledge production (Nowotny et. al., 2003). The risk of international commercial e-learning for the elite needs to be countered by national open access e-learning in the countries of SSA.

However, Zemsky and Massy (2005, p. 244-247) also warn that there are some exaggerated assumptions concerning the potential of e-learning to change and improve the situation for the students;

1. *“If we build it they will come”*. This is not self-evident. Mostly course developers are active in discussions, and the course participants are sometimes fewer than the teachers.
2. *“The kids will take to e-learning like ducks to water”*. This, however, depends on the structure of the course. Access to support will be necessary and not all students find it easy to use computer based courses.
3. *“E-learning will force a change in how we teach”*. Implicit is the idea that a teacher monologue replaced by a guide in self-learning processes is positive and supported by ICT. This requires rather extensive course development efforts, while most often, teacher’s notes are simply typed and distributed, together with exam questions to be replied by e-mail.

Uys et.al. (2004) develops the strategies for appropriate e-learning in African higher education. They point to the third issue above, namely that the pedagogical aspects of e-learning need to be addressed before any technological decisions can take place. Teachers need to have ownership over the technological transformation from classroom learning to computer-based learning, as the role of the teachers (and students) change from lecturing towards facilitation and discussion. The courses are best developed in teams with both content/pedagogic and technical specialists involved. A student representative in the team is also valuable (ibid.).

#### ***Additional experiences from the Uganda project***

The researchers in the Tanzanian e-learning project work together with colleagues at Faculty of Technology at Makerere University in Uganda. They jointly constitute a complementary East Africa team with great potentials for the development of appropriate, robust and flexible e-learning systems.

In short the Uganda project includes the following<sup>5</sup>. The topic is *The Effects of Hybrid E-learning Application in Rural A-level Secondary Education in Uganda on Performance of Female Students in Mathematics and Physics*.

In the context of the actual R&D project a rural secondary school is a school without either grid electricity and/or landline telephone connectivity. As such, they present a separate set of challenges and cost structures. In Uganda, in primary education, all subjects are compulsory. In secondary school Ordinary Level, subjects are optional and some students do not opt for sciences. They drop them. Those who take them perform poor, especially in Physics, Chemistry and Mathematics. In Advanced Level very few students take the Physics, Chemistry and Mathematics (PCM) combination, especially female students from rural schools. The few female students who take the PCM combination in rural schools perform poorest and very few get admitted into Faculty of Technology (FOT) for engineering courses. Overall, enrolment of female students is about 20% in FOT and very few of those are from rural schools. Rural A-level secondary schools do not have the basic infrastructure for science subjects especially PCM yet 88% of Ugandans live in rural areas (2002 census report). There are no equipped laboratories, libraries, furniture, qualified teachers, infrastructure like grid electricity and telephone landlines. Hybrid e-learning could be used as a tool for solving the problem.

The above scenario presents a research question that needs to be addressed as regards rural secondary education in Uganda: *Will application of hybrid e-learning in A-level Physics and Mathematics training result in improved performance of female students in rural secondary schools in Uganda?* The specific objectives with the project are

- to develop an online *local content course material* according to the current curriculum for PCM combination,
- to source and apply an online, web based software environment, or in short, e-learning environment or the *course platform* in the delivery of the courseware,
- to develop the relevant *Tools and applications* for managing the platform and the course material,
- to create a digital library for use by the secondary students as a source of reference materials.
- to develop a Hierarchical Linear Modeling (HLM) model for longitudinal data
- to use the HLM model to analyze the performance of students in Mathematics and Physics after application of e-learning in rural secondary education.

## **Aims and methods**

In relation and close connection with the on-going e-learning project at pCET, we have developed research questions concerning the platform and the content development of the project. Our frame of understanding is that the introduction of ICTs in a postcolonial society places specific requirements on the system (Rydhagen, 2004).

The overarching research questions are:

- What is the rhetoric concerning the need for the particular project of rural e-learning?
- What kind of issues are in focus – technological, financial, social, cultural etc.?

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<sup>5</sup> Presented at seminar at Makerere University in March 31th, 2005.

- In what ways do the suggested platforms and content of the e-learning project in focus address the questions posed by the postcolonial situation, i.e. contextualised knowledge and information, oral and collective communities etc.?
- Who are the different stakeholders in the e-learning project, and how can their perspectives be understood in light of feminist and postcolonial theory?
- What roles are the beneficiaries expected to take?
- In what ways does this project relate to the global discourse on the digital divide?

Qualitative, semi-structured interviews were conducted with five of the researchers in the group at UDSM and pCET. Study visits to two secondary schools in the semi-rural area of Kibaha were done, and the respective headmasters and responsible staff members (two persons at each school) were interviewed about their potential participation in the e-learning project. The two schools were a well established, governmental school for boys, which has a good reputation nationwide, and a new, Islamic seminar for girls and (recently) boys, consciously recruiting students from disadvantaged households. The aim is not primarily to examine individual (possibly conflicting) views of the project, but rather to create a picture of the process of the e-learning project. References to individual interview participants will therefore only be done occasionally. All interviews were done in April, 2005.

The interviews with the researchers included questions like

- What is the primary purpose with the e-learning project?
- Who are supposed to gain from the project?
- What platforms are being used?
- What kind of support will be available at the secondary schools?
- In what ways is e-learning supposed to influence the secondary school learning activities?
- How is this going to be evaluated?
- In what ways will the experiences be reported, given that this is a research project AND a development project?
- In what ways does this project benefit Tanzania in a broader perspective?

In the secondary schools, questions were asked about the major benefits of the suggested project, and their possibility to contribute with their teaching materials into the digital learning material.

## **The project of e-learning for rural secondary schools**

### ***Motives***

The major aim with the e-learning project was, according to the interviewed researchers, to increase the quality of science education in secondary schools, especially in the rural areas where there is a severe lack of educated teachers and accurate books. With e-learning material, the students can access and use quality material that should be self explanatory. The aim is to increase the number of students who continue to A-level<sup>6</sup> in science in the secondary schools, and who succeed in their studies. In the next step, the research group hopes to recruit more qualified students to the engineering programs at pCET. “Research directed towards the people is what we want to do”<sup>7</sup>.

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<sup>6</sup> The secondary school is divided into four years at O-level and 2 years at A-level. To enter A-level, certain grades from O-level are required. Different combinations of subjects are offered for the students to choose from.

<sup>7</sup> Interview with Ki.

E-learning material and digital learning material are proposed to complement irregular and low quality teaching and a lack of up-to-date school books for the pupils and thus make secondary school teaching nationally more equal and of a higher quality. Especially in the private schools, which dominate in the rural areas, the lack of educated teachers is pressing.

The major goal with this particular project is thus not to raise the number of secondary school students in general, but to improve the standards for those already in the schools and to motivate more students to take an A-level in science. One of the interviewed researchers mentioned e-learning as a possible solution to meet the recent Governmental plan for “Complementary secondary schools” for those who cannot come to secondary schools<sup>8</sup>.

The secondary schools seem to regard the computers and computer literacy as a goal in itself to start with<sup>9</sup>. Specific computer literacy classes are therefore the first plans, to teach the students to switch on the computer and use the basic programs like word processing. In a second stage, the school representatives were interested in computers and the Internet as a way to find more, and more accurate teaching materials that are (supposed to be) available on the Internet. At one of the schools, which was recruiting students from disadvantaged families, the representative gave voice to a dream to open up the school for adult computer courses, on-line diploma courses and teachers developing themselves by getting diplomas through e-learning. E-learning was also seen as supporting weak students to find new motivation and to be able to learn in their own pace. In other words, many different benefits are expected from the introduction of computers and e-learning.

### *Technical details, platform and content*

The construction of the project is that the schools will provide the computers while the research project will provide cables and system for access to the internet and to the learning material provided at a server. The University will develop the material – platform and content, but will use teaching material from secondary schools teachers that will be involved in the project.

At present, many secondary schools lack computers. The national Department of Education has started to provide computers to the governmental schools, but this process takes time. Some schools, especially the private, depend on donations. At both of the schools that we visited, computers were available, but were still to be installed. Some of the staff was computer literate at these schools. Sustainability after the end of the specific project is important, but the researchers also expect to remain in charge of update and support. Secondary school staff that is trained might not remain in the schools, and therefore, lack of technical support is likely to remain for some time.

The connectivity between schools and pCET is regarded as a major issue<sup>10</sup>. The e-learning material is supposed to be supplied via the internet, but it will be transmitted during low frequency hours at night, and will thus not be instantly interactive on distance, but will include material to be used on site, once it is downloaded. The security level on the connectivity will be adjusted to the needs for both secure transfer (for e.g. exam results) and open access (for e.g. ordinary e-mail and downloading of material).

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<sup>8</sup> Interview with Nd.

<sup>9</sup> Interviews at secondary schools.

<sup>10</sup> Interview with Ki.

The e-learning material will be developed in open source software (OSS). The OSS platform where the content will be placed will be developed in the research group. OSS is chosen not primarily to reduce costs, but to increase the flexibility to modify and test and develop appropriate materials<sup>11</sup>. The flexibility also makes it possible to adjust to small bandwidth. At the UDSM, a Linux group has developed SwahiliLinux, Swahili word processor and SwahiliExcel, which can be used in this e-learning project<sup>12</sup>.

The content of the e-learning material will be provided by qualified and experienced teachers at the secondary schools in the project. It is supposed to be presented in a way that the students can access without a skilled teacher to explain further. A supervisor for the computer facilities and more general questions will be present in the learning situation. Experiences from previous projects at the Faculty of Education show the importance of adjusting the material to the learning style. The language is the main difference, and the teachers will need to restructure their material. Easily understood language, a lot of self exercise, practical examples and interactivity are important characteristics of e-learning platform and content. "One should feel like one is talking to someone"<sup>13</sup> As far as we understand, the planning of the content development is yet to be started, as the platform development has also not yet begun.

### *The role of stakeholders*

The PhD student who is going to develop the platform, places the identification of the stakeholders and their requirements on the system as her primary research question. She regards the research process as spiral learning, as the system has to be modifiable. Implementation will lead to new requirements and adjustments in the system, according to her<sup>14</sup>.

The initial plan was to address rural areas with poor performing schools. During the first phase of the project, the research group has done a thorough survey of secondary schools in different districts in Tanzania to find a suitable cluster of schools that could be connected to each other and to pCET. In the process of selecting districts and schools, the researchers realised that they would need to include better performing secondary schools too, in order to engage teachers from these schools in the development of the e-learning content. The involvement of the teachers in the early phases is expected to increase the sense of ownership of the material and the acquaintance with the teaching material (the content) among the teachers<sup>15</sup>. Also, teaching material in different subtopics can be achieved from different teachers who have specialised in these different subtopics (e.g. cell biology, zoology, organic chemistry)<sup>16</sup>. The choice finally fell on a district close to Dar es Salaam, where connectivity is rather unproblematic to arrange, and where at least one school have teachers who will be able to provide content to the e-learning material. The secondary schools already collaborate concerning other issues (administration, examinations etc.), and they do not hesitate to share their learning material with other schools through the e-learning project if asked for<sup>17</sup>.

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<sup>11</sup> Interviews with Ki and Mv.

<sup>12</sup> Interview with Mj.

<sup>13</sup> Interview with Nd.

<sup>14</sup> Interview with Ka.

<sup>15</sup> Interview with Mj.

<sup>16</sup> Interview with Mv.

<sup>17</sup> Interviews at secondary schools.

“Those who have internet connection, they think it is enough to surf. Now, what can you do *more*, given that you are a secondary school and are teaching?”<sup>18</sup> At one of the schools, the headmaster was also interested in facilitated communication, both with other schools and students, and with the Ministry of Education for example. The researchers were interested in developing their own teaching materials rather than to find it on the Internet. It is likely that the teachers in the secondary schools see it as beyond their capacity and time constraints to develop their own material, especially if qualified teachers are lacking. This discrepancy in primary aims with computers and connectivity in the schools could thus rather be seen as a difference in ability than principal perceptions, and is not likely to cause conflicts when the project is implemented.

The teachers at the chosen schools will be invited to training, both at pCET and their schools, in order to be able to use the computers and the programs in their schools. Previous experience of the introduction of computer systems in secondary schools show that the young male teachers were eager to learn, while many female teachers were afraid to touch the computer<sup>19</sup>.

When asked about the changing role of the teachers in the secondary schools, the main expectation among the researchers was that the teachers will be motivated by the increased quality of the material<sup>20</sup>. The political agenda, expressed in curricula reviews, supports more autonomous learning styles. However, there are experiences also at the University, of teachers who fear to lose importance and control once their teaching material is digitalised. Most teachers lack the competence for implementation of more autonomous learning, although the University now teach the epistemology of “constructivist learning”. There is therefore a need to train the teachers to become comfortable with the technology, and to prepare them psychologically for the change<sup>21</sup>.

The role of the students as stakeholders was rarely brought up, as they were supposed to be involved only at the implementation stage. One of the interviewed researchers brought up the question of trust – many children expect the presence in the classroom to be one of the requirements for learning. However, according to the researcher, the secondary school students like to interact, and if the e-learning material is successful, it will enhance interaction in the learning process and thus become more attractive to the students<sup>22</sup>. At one of the secondary schools, with students with learning difficulties, e-learning was expected to motivate the students.

Stakeholders such as other rural institutions, farmers, clinics, producers etc. were supposed to gain from the project at a later stage.

### ***Assessment and research questions***

The evaluation of the successfulness of the project was brought up in the interviews. The researchers were eager to show success by comparing exam results from before and after the implementation of the e-learning project. They were also aware that the performance of the students depends on different things, and might be difficult to evaluate after a limited pilot project. The relevance of the material, the eagerness of learning and the access to facilities

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<sup>18</sup> Interview with Ki.

<sup>19</sup> Interview with Fa.

<sup>20</sup> E.g. interview with Mv.

<sup>21</sup> Interviews with Nd and Mj.

<sup>22</sup> Interview with Nd.

will also be possible to evaluate through surveys among teachers and students<sup>23</sup>. The hope was that this e-learning project could serve as a model for spread to other, more remote districts in the future.

The assessment of the research process has not commenced so far, but will be included in the final evaluation. The major part of the evaluation will thus not be done during the process, but towards the end. Reflections and feedback loops that have led to changes in the project have not been particularly recorded.

### ***Postcolonialism and the digital divide***

The postcolonial situation was not discussed explicitly during the interviews. The more general benefits of ICT and e-learning in Tanzania were brought up in some of the interviews. One of the interview participants<sup>24</sup> articulated the wider benefit of rural areas to get access to communication without travelling, access for farmers and producers to current market prices in Dar es Salaam, access to medical services and a general awareness raising. This will help to develop attractive living conditions in the rural areas. (Economic) development in general also requires a “critical mass of educated people” who have the ability and desire to change the present conditions<sup>25</sup>. In one of the schools, as referred above, the vision of e-learning for the whole community was articulated. The representative at this school argued that not all girls need a University education, but without secondary school education, their future would be insecure.

## **Discussion**

### ***The rationale for the Swedish research collaboration***

In a complex research and development project like this e-learning project in Tanzania a number of different aspects are addressed and constitute areas of vital problems to be solved. A systematic study, documentation and analysis of all this has a knowledge quality in comprising

- a continuous feedback function in the project itself
- a tool for exchanging experiences, system solutions, knowledges of ‘how’ etc to others, who request this type of knowledge and experience. The results from this interdisciplinary R&D project will contribute to valuable insights and solutions needed both in South and North.

### ***Motive***

The e-learning project was clearly motivated by the need for raised quality in existing secondary schools. Another argument for e-learning can be to increase the access for those outside the school system, for whom neither classrooms, teachers nor books are available. This argument is motivated by the impossibility in meeting the needs with traditional schools at the speed of population growth (Mackintosh, 2005). It is our understanding that the motive in this particular e-learning project – to increase quality in existing schools – plays a role for the system structure and the assessment procedure in the e-learning project. If teachers and classrooms will be the basis for the learning even when e-learning material is used, this will affect the e-learning material.

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<sup>23</sup> Interview with Mj.

<sup>24</sup> Interview with Mv.

<sup>25</sup> Interview with Mj.

### ***Technical details, platform and content***

There are many constraints to a fully interactive and open access to e-learning and e-communication. The connectivity is expensive whether it is wireless or linked through a cable. This means that when links are provided, the bandwidth will often be minimised and allow only for transfer of small files. Second hand computers, which will be used in for example the Islamic seminar included in this study, further reduces the possibility to use creative and interactive tools for e-learning. As mentioned in the background, the use of old computers can be regarded both positive and negative. It is our understanding that there is no possibility to await more powerful equipment, neither when it comes to computers nor bandwidth, but it is an urgent quest to the more affluent countries to take this issue seriously in their engagement in ICT for development.

In the similar project in Uganda, the use of CD ROMs to deliver material to schools without internet connection will be used. The researchers in Uganda call their form “hybrid e-learning”<sup>26</sup> which includes both on-line and off-line material (Okidi-Lating, 2004). This might be preferred to the sole use of internet downloaded material, even if transfer is done during low hours.

The development of a platform in OSS, with SwahiliLinux as a resource, and with locally provided content, has a potential to address precisely those particularities that relate to the situation of postcolonialism and the present situation in the rural secondary schools. The teachers and the researchers are free to experiment with the level of interactivity according to their own experience and comfort with the system.

We identify a need for a deeply integrated model for development of content and platform, where teachers, Faculty of Education (FoEd) and programmers work closely together. As one of the researchers stated, the language and structure of the content will differ from traditional teaching material, and the expertise in this field is available at the FoEd. The collaboration with the FoEd from the start of the project is therefore regarded as very valuable.

### ***The role of stakeholders***

The participation in societal development opens up for increased awareness of the advantages of distributed knowledge systems. The researchers pointed to the fact that they had realised the need to include secondary school teachers as participants in developing the e-learning system at all stages. This was necessary to achieve a robust and appropriate system. The teachers were thus regarded as providing relevant theoretical and practical knowledge and not only to receive a product.

The e-learning project, in this sense, addresses different dimensions of participation both in the development phase and in the implementation phase. In the implementation phase, participation will include

- interaction between schools
- interaction between teachers and pCET researchers
- interaction between teachers and students
- interaction between students

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<sup>26</sup> The hybrid E-learning project includes development of physics / chemistry / mathematics course out of local content materials and lecture notes, development of courseware for delivery through the Internet, making and delivering CD-ROMS to the schools.

- interaction with the platform (both teachers and students).

At all these levels, the participation will alter and reshape the e-learning platform and content. Awareness of this has grown among the researchers in the initial phase of the e-learning project. The use of OSS can be regarded as both a material and a symbolic part of the desire to increase stakeholder participation.

### ***Assessment and research questions***

We have a strong focus on the assessment and evaluation throughout the process. According to the interviewed researchers, the research process is sensitive to feedback and alterations, but these are not recorded as part of the research results. This is a common research procedure, not the least within the technical faculties globally. However, the close relation to the implementation and the stakeholders in the secondary schools, call for a conscious reflection-in-action (Schön, 1983) over the research process. This lies in line with our experiences of feminist research, but with the postcolonial theory as well. In the forthcoming doctoral research projects, the reflective practice will be possible to integrate.

### ***Postcolonialism and the digital divide***

The project of e-learning could be regarded on different levels in relation to the postcolonial situation. On a very overarching level, computers vs. school books and training of teachers or a completely different syllabus of more relevance to rural areas could be discussed. From an environmental perspective, the current development discourse has been questioned by both researchers and political activists (see e.g. Shiva, 1993). On the other hand, as long as the power to destroy the world lies in hands of people with access to advanced communication technologies, denying access for all can be regarded cynical and neo-colonial. These questions have not been raised by our interview participants, and will not be discussed here.

The UDSM and pCET express a strong commitment for education both in rural areas on secondary school level and in higher education. The possibility to examine PhD students at the University is a significant achievement, compared to having doctoral students registered and examined abroad<sup>27</sup>. The postcolonial University takes an active and explicit role in societal development, in contrast to the traditional academic custom in Western countries (Trojer, 2004 and Nsengiyumva, 2004). This perspective is shared by the researchers in the e-learning project.

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