Paper, BAMAKO 2010 – Challenges in Using ICT in Ensuring Quality in Open and Distance Education in Africa, with Focus on Connectivity and Free/Libre and Open Source Software

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In developed countries, the use of ICT in education is a given, and with the growing interest in e-learning and distance education for which it is a prerequisite, ICT is needed in developing countries, too. However, there are a number of challenges to be addressed in order to make full use of ICT in education in developing countries.

Although data collection methods are a little uncertain as they're based on national statistics and may not be homogenous, samples from 17 randomly selected countries show that on average 46.58 out of 1,000 Africans use the internet[1]. Only 20 % of African students have access to a computer regardless of internet connectivity[2], and as few as one in a hundred people have access to a computer on average. In most African countries, learning how to use a computer isn't compulsory in primary and secondary education, but require an additional payment of tuition fees of as much as the amount that the normal classes costs.

These figure are interesting because computer literacy and especially internet literacy is a prerequisite for taking in knowledge in an e-learning environment as well as utilising the many free, online offers of educational software. They are also interesting because the lack of an internet based learning and information seeking culture in itself prevents IT personnel from being supported by the available online information and in consequence impairs expansion and improvement of internet connections and knowledge bases as a culture of internet based learning and information seeking is a prerequisite for that. Without the ability to navigate the internet, access information and use the tools and options available, students are unable to avail themselves of the resources available, either from their learning institution or on the internet as such. And the same is true for teachers, without the basic knowledge of uploading and maintaining course websites, they're unable to make the full course content available to students.

Learning Content Management Systems

The most widespread learning content management system is Moodle, which is a web based application designed to hold courseware, lecture notes, messages and test results. The idea is simple

and could potentially provide a much needed platform for standardising and disseminating course information, but though it is installed in a lot of universities across Africa, the actual use of it varies a lot.

Several NGO's and universities such as the NOUN (National Open University of Nigeria) offer sending specialists to other African universities to train the academic staff in using Moodle, but even after receiving the training, the use of the application dwindles after a year or two in many cases. Not much research has been conducted into finding the reasons why this tool is often not used, but judging from my experience as a lecturer at the Open University of Tanzania as well as conversations with colleagues form other Institutions of learning, the reasons are among others:

- Not enough "awareness creation" has been conducted. It is a classical problem of any effort to introduce new ideas or new material that the explanations of why this is attractive are omitted, leaving the future users without a sense of ownership and motivation to continue using the proffered materials or programmes when left to themselves.

- The students' accounts are not created on registration at the university. This means that even if the lecturers upload course material, it doesn't reach the students because they can't log in to the web site. This discourages lecturers from uploading course material, and students do not develop a culture of using Moodle, so that when eventually their accounts are created (which may very well be into their second year of studying, or even later), they do not use Moodle because they have learned to make do without it.

- There's no or very little control of the academic content, and for some courses there's no material uploaded at all. Some of the material actually uploaded is of a standard so poor that it doesn't really assist students in their learning. This is another factor which discourages students from using the course portal.

- Students are not familiar with the idea of using internet based portals and they do not have sufficient internet access to really make full use of it.

- No courses on how to use Moodle or how to seek information on the internet are provided for the students in their first weeks after registration, or if they are, they're not obligatory but are offered at an extra cost, causing many students to decide against taking them.

- Students are not taken seriously when they complain about not being able to use Moodle. The attitude on the part of teachers and administrative personnel is that the students are too lacy to learn how to use it, and it takes some persuasion to make them consider that not being able to log in might be the reason why the students complain that they can't use Moodle.

As the Moodle accounts had not been created for my ICT students, I made a website for the courses I teach on my personal website, but I was continuously asked questions about issues which were described in great detail on the website and I found out that most of the students had never accessed it. A survey conducted in class during the last face-to-face session[3] revealed that only 20 % of them had accessed the course website and downloaded any of the course material. This resulted in a

great loss of information and in consequence impaired the students' understanding of the syllabi, as the lecture notes, the comments and elaborative notes from their assignments, the solved problems and exams and extra material I saw fit to write because of commonly asked questions, never reached around 80 % of them.

When asked about why they neglected to use the course website, the students gave the following reasons:

- No internet access at work and at home
- Too few available computers in the computer rooms on campus
- Internet connections are so poor and so expensive that we had to give up downloading the material because the money ran out[4] or there were so many interruptions that the download never finished
- Frequent power cuts are making downloads impossible
- Being unfamiliar with using websites
- Software compatibility issues. It is not possible to open a PDF document directly from a website on the Solaris platforms the university used, and this made a lot of the students conclude that the documents must be corrupted (and then they didn't try opening them on another computer running a different operating system)

Another effect of the poor and expensive connections, other than just preventing dissemination of already existing and targeted information, is that it discourages developing a culture of using internet based learning tools. In my experience, the students are more than happy to use any internet based resource which they're explained how to use, but very few of them have the initiative to seek resources on their own because they have never learned how. I made them look up formulas for derivation and integration on Wikipedia[5] during class once, and was pleasantly surprised to learn that ever since, most of them are using Wikipedia as their main information source on the internet. Unfortunately, I had not introduced them to using the course website in the same manner.

A number of counter-measures to unstable power grids causing frequent power cuts and poor internet connections exist, such as download managers, which pick up the downloads from the point where they were disrupted instead of starting over, making downloads possible even on very poor connections, but using them requires a level of computer literacy which most students do not possess, so instead they give up getting the material.

Online Laboratories

Multilateral networks around online laboratories, most noticeable the Open iLab[6], which derived from the Massachusetts Institute of Technology (MIT) iLab, have developed, allowing students to use an internet based platform to programme and perform experiments in chemistry, biology, physics and electrical engineering without being physically present in the lab, which might be located thousands of miles away.

The Open iLab is presently spread over several parts of the world, with labs equipped to perform different experiments placed in different universities in countries like Sweden, Tanzania, Nigeria, Singapore, Taiwan, Uganda, Greece, United Kingdom and the USA. A student in Ethiopia may be performing experiments in labs located in Massachusetts, Greece or Tanzania, either by using a mirror site at her own university or logging in directly at the remote location.

It's still in it's early days, but research suggest that the "computer game like" approach to performing experiments doesn't aversely affect the learning of the students in comparison with traditional hands-on experiments. Another positive effect of the virtual labs is the creation of a growing educational community that shares teaching approaches and lab designs. As universities around the world use the framework to create their own labs, they have generated new ideas that have benefited all participating universities. Virtual labs are not completely free of cost as they require some hardware at the institutions that wish to use them, but the software platform itself is freely available.

Other Educational FLOSS Programmes

A multitude of educational FLOSS programmes exist. They range from visualisation tools such as GeoGebra and Greenfoot, highly specialised scientific software such as R (a statistics package) and LaTeX (a scientific typesetting package capable of dealing with any sort of formulas and diagrams), and innumerable more or less home grown applications which have been developed as the needs arose around the faculties in various universities and then made publicly available.

These programs are widely used in education in the developed world, and the role they have to play in quality assurance is that they facilitate the deepening and broadening of the students' understanding of a subject matter, as well as familiarising students with the use of ICT in working with their fields of study. When used in the developed world, special classes with tutorial/technical assistants are held to assist the students in learning how to use the programmes, and all evidence points to the necessity of using a similar approach in the developing world, as resistance to using unfamiliar software is ubiquitous.

This poses a special challenge in open and distance education, as the time in which students and lecturers or instructive personnel meet face-to-face is very limited, if time for face to face sessions is allocated at all. Strategies invoked in order to counter this lack are many, but the most successful ones are allowing as much off-line functionality as possible[7]. In this regard, it would be making support databases locally available as well as ensuring that local ICT staff have some knowledge of the programmes in use.

The benefits of using FLOSS programmes are many:

- Low cost. Many of the packages are free in the sense that they only expenses incurred are the cost of bandwidth when downloading them, and the cost in man-hours of installing and supporting them, and other FLOSS programmes are available for the price of CD and transport.

- Stable, powerful and flexible programmes. Most FLOSS programmes have been developed with focus on functionality, which means that they facilitate a lot of operations not always supported by commercial software.

- “Light” OS packages specially designed for developing countries enables recycling of old computers.

- The use of FLOSS packages facilitates a culture of knowledge sharing and open learning as people learn from each other and the online support for most FLOSS applications are literally world wide networks.

- ”Localisation”, i.e. being able to change the software to match language spoken, functionality needs, etc, is a special feature of the FLOSS software paradigm which allows and encourages adaptations and redistribution of the software once it’s been downloaded.

- Development of local ICT capacity as a consequence of learning to use, adapt and further develop the FLOSS programmes.

- Allows free or low cost access to highly specialised and well documented scientific programmes.

- Less vendor dependency allows legal local business initiatives as the redistribution of this software is legal. One obstacle to introducing FLOSS is that cheap, pirated copies of MS Windows programmes flourish and the users are often not aware that what they’re doing is illegal.

However, South Africa is the only country to have passed a bill on the use of FLOSS, encouraging it as much as possible. In the rest of African universities and institutions of higher learning, the use of FLOSS is generally limited to operating systems and web servers, i.e. programmes running in the background. As learning how to use computers isn’t compulsory in primary and secondary school, and courses aiming on teaching ICT skills tend to focus on MS packages, there is a strong reluctance to migrating to new software systems, and any project with any amount of success have had to invest in “awareness creation” and user support[8].

Migrating to FLOSS is often driven by local enthusiasts or starts with programmes introduced by visiting researchers. Most of Africa outside of South Africa is not considered a market for software developers, and in consequence the exposure and availability is low. In addition to reading reports, I asked a number of ICT stakeholders in higher learning about their experiences with introducing FLOSS, and the following obstacles were mentioned:

- A lack of FOSS advocates and a lack of a culture of volunteering, as well as a lack of development capital hinders the upstarts of FLOSS projects[9].

-The international FOSS community needs to understand and take an interest in the special needs of users in developing contexts, e.g. encountering problems that others might consider basic, there is a different network situation, widespread power instability, etc.

- Development issues such as hunger, conflict, natural disasters, diseases, lack of clean drinking water and sanitation, illiteracy, unemployment, lack of skilled staff and investment in academia as well as brain drain take higher priority in a lot of developing contexts

- The shortage of people trained in logical, mathematical thinking, programming skills and software development hinders the development and adaptation of FLOSS packages, and if somebody develops skills there is a high risk of brain drain. The best ICT minds are migrating to the developed world in search of higher salaries and better opportunities, and then the companies they go to work for are selling back already developed software, leaving the rest of the continent without the knowledge to adapt the software locally.

- The frequent power cuts cause a special need for "power cut friendly" software, which is in short supply as the low quality power grids are not as much of a problem elsewhere

- The large distribution of proprietary software in other spheres of society (as well as used by lecturers) along with the compatibility issues discourages the use of FLOSS

- When the software isn't localised, a number of language issues arise, and (computer) literacy issues also hinder the spread of FLOSS applications

- Reluctance to start using the new software on the part of students and lecturers. Many expressed a belief that the FLOSS software is inferior because it is free.

- The costs incurred for training teachers and instructors in using FLOSS software

- Cheap pirated software is widely circulated and removes any motivation to learning how to use new software

- Low internet penetration means limited communication between FLOSS communities

- Internet connections (and power grids) are often so poor that downloading anything without a download-manager is hopeless

- ICT infrastructure is generally only available in big cities, which makes the use and expansion of ICT based learning resources to more rural areas difficult.

These answers are interesting because they are repeated again and again whenever you ask about

the use of FLOSS application in Africa. A survey conducted by the ICT University of Copenhagen identified the following obstacles to using FLOSS in education as the most important:

1. Power cuts or unstable power grids
2. Lack of skills in using the software and assisting others in using it
3. The budgetary implications of migrating to a different software system, both in terms of identifying the relevant software and in terms of training personnel in using the new applications

Open Content or Open Courseware

A lot of internationally acclaimed universities post lecture notes, overheads, study plans, assignments, problems and exercises (with or without solutions) for all or some of their courses on the internet. This is known as open courseware or open content. In trying to achieve international standards for higher education in Africa, this courseware can be used as a help, an inspiration or a guide to syllabi, course content, relevant problems and additional notes, and if students are encouraged to seek information on the internet, they may deepen and broaden their grasp of subjects matters by reading other lecturers' notes on the same issues. It is freely available and ready to be used.

However, African education largely is based on rote learning instead of encouraging logical, critical, creative and independent thinking, and this creates a special hindrance for the students in terms of seeking out their own information in addition to what they're given (e.g. from some of the many websites from other universities making their courseware available), and also in terms of learning how to apply, alter and re-apply the methods and facts they have learned. This is evident even in the way that exams in higher education are made: the focus is on ability to recite, not on examining the students' deeper understanding of the subject matter. And this is one of the reasons why African higher education doesn't compete well internationally. And it means that the open courseware isn't directly applicable without some adaptation, either in terms of the scope of problems posed or in terms of encouraging a different approach to learning in the students.

As open and distance learners, the students are relying heavily on self-studies, so any tools assisting them in improving their deeper understanding and in consequence the quality of the education they receive would greatly support the lift of open and distance learning onto a more internationally competitive level. In my experience, students are more than happy to use any information gathering tools and any software they're properly introduced to, but they lack the initiative to start looking for information on their own. More effort should be put into encouraging independent gathering of information and course material, and it cannot be stressed enough that introductory courses on using the internet to access information, circumvent the problems caused by poor connections and using web portals such as learning content management systems and online research facilities should be obligatory.

Challenges

The challenges to using educational FLOSS programmes and other open resources fall into two categories, though of course they influence each other:

1. Challenges in terms of hardware and system performance
2. Challenges in terms of learning cultures

The first kind of challenges are primarily in the form of poor and expensive internet connections which discourage students, teachers and IT personnel from using the available resources and from getting familiar with using the internet for knowledge acquisition in the first place. In consequence, many improvements to the systems performance are not made because knowledge of the possibility remains unavailable, and the continued low performance discourages acquiring the said knowledge as well.

It will be interesting to see how the new broadband and fibre optics initiatives in Africa will affect the poor and expensive internet connections and their averse effect on the internet based learning acquisition cultures. Having made the submarine connections available[10] isn't enough. As many developing projects have shown, it's the last mile delivery that makes or breaks the successfulness of an otherwise carefully planned project. If people are not enabled to use the new facilities because of lacking the funding for connecting remote or even urban areas, the new resources, whether it be new sours and water purification plants, hospitals, or internet connections, are likely to be left under-utilised and largely unknown by locals.

The other kind of challenge, in terms of learning cultures, is in part exacerbated by the poor connection performances with its averse effect on information seeking and developing a culture of searching the internet as such, and in part by the fact that students are not encouraged to think independently and question the teacher's version of things and find their own information.

As long as a student doesn't know about the existence of the many freely available resources, she is very unlikely to get the idea of using any of them, and as long as she's not told to regard what the teacher says as nothing more than one human being's possibly fallible interpretation of the theory, she doesn't know that it may be in her own interest to get second opinions and different points of view and angles of approach. She may not even know that there are different points of view and angles of approach.

One of the first things you're told as a university student in many developed countries is that if there's something you don't understand, it may as well be a fault by the lecturer or in the textbook as because you're not clever enough to grasp the theory. African education would benefit greatly from adopting the same approach, especially as the use of tutorial assistants and assistant lecturers is much more common here than in developed countries, making the difference in knowledge levels between teacher and student as well as the level of expertise on the part of the teacher much smaller than in developed contexts.

Yet another challenge is that even though all these options are freely available, it still takes an effort on the individual level to use any of them: The ICT personnel and the lecturers have to identify suitable educational FLOSS programmes or online options, install them and get so familiar with them that they can teach students how to use them, lecturers have to search the available courseware

for ideas for syllabi and problems to be solved, students have to search the internet for other sources of information, read them and use them. This of course is a problem for all people dealing with learning and education, but it is especially a challenge in under-resourced settings where the cultures of questioning and gathering alternative information are in their infancy.

Recommendations

To sum up, many of the tools for improving the standards of higher education in Africa already exist, but the basic skills needed to make full use of them are lacking in both students and academic staff as a consequence of low priorities placed on those skills in primary and secondary education, as well as the general poor quality of internet connections and power grids. The following recommendations and issues to be redressed in order to further the use of FLOSS and open courseware were mentioned during my survey on the use of FLOSS:

-The international FOSS community needs to understand and take an interest in the special needs of people in developing contexts

- Conditions propagating brain drain need to be redressed so that the people capable of facilitating, emulating and developing the right platforms are staying in Africa, where they can pass on their skills and knowledge for the benefit of all users of ICT in higher education

- Achievement of the Millennium Development Goals, especially nr. 2 and nr. 8

- Increasing computerisation and internet penetration

- Introducing computer literacy in primary education

- Encouragement of logical, critical and independent thinking in all levels of education

- Governments should consider interoperability when acquiring new software for official use, passing laws to promote use of FLOSS in professional and learning environments and investment in IT infrastructure (possibly through private-public partnerships)

- Companies should migrate to FLOSS

- FLOSS user groups should be created and encouraged. User groups are known to exist in Burkina Faso, Ghana, Kenya, South Africa, Tanzania, Uganda, Zambia and Zanzibar

- Institutions of learning should encourage visiting researchers to share their FLOSS expertise. They need to invest in training instructors and teachers so that they can help and support students in using FOSS. Because of the myths surrounding FLOSS ”awareness creation” is needed

- The FLOSS community needs to recognise that novices encounter problems that are considered basic by super-users and work on the available online help so that even problems that are not considered ”challenging” are supported

-Successful FLOSS projects in Africa have a large amount of off-line, or LAN, functionality and support

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Software should include measures to counter data-loss caused by power cuts, and download managers should be installed in all ICT facilities

-Awareness creation is needed, i.e. introduction to the fact that various OS and software packages exist and that proprietary software isn’t necessarily the best option

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Courses in basic internet use for both teachers and students

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Train (student) instructors in the use of the chosen FLOSS application and have practical sessions for teachers and students

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Make use of others’ knowledge of FLOSS by inviting visiting researchers to share their FLOSS experiences, and engage in joint FLOSS projects with universities in developed countries

References:

IICD (International Institute for Communication and Development): Applying Open Source Software in a Developing Context, Case study of the Uganda Martyrs University, 2005.

IDRC (International Development research Centre), Good to Great FOSS, Learnings from Africa, 2008

Many of the facts used above are gained from answers to a list of questions on the use of FLOSS posed to African educational ICT stakeholders in preparation for a presentation on the use of FLOSS in education in Africa held at the eLearning Africa 2010 conference, Lusaka, Uganda.

The questions are: 1) Which experiences do you have with introducing FLOSS programmes? 2) What are the barriers to making people use them? 3) Do you feel there's any progress towards more extensive use of FLOSS programmes? 4) Do you think a culture of using FLOSS programmes could develop? 5) Are there areas in which people are more willing to use them than others? 6) What do you think should or could be done to further the use of FLOSS programmes? 7) Which good practices are in place where, and can they be implemented in other places? Why or why not?

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[1] InternetWorldStats.com, a website dedicated to publishing global statistics on the use of the internet

[2] ICT4D, ICT for Development, an NGO dedicated to using ICT in improving lives in developing countries

[3] The courses are mainly taught as distance learning courses, but there are four face-to-face sessions with classroom based teaching during the academic year, the first one lasting two weeks, the last three lasting one week each.

[4] Most private internet connections as well as internet cafés are pre-paid, just cutting off when the money runs out no matter whether the user has finished her work or not

[5] See http://www.wikipedia.org/, a free internet based encyclopaedia, the content of which is created, edited and corrected by the users

[6] See http://icampus.mit.edu/iLabs/ for more information about Open iLab

[7] IDRC, Good to Great FOSS, Learnings from Africa

[8] IICD, Applying Open Source Software in a Developing Context, Case study of the Uganda Martyrs University.

[9] IDRC, Good to Great FOSS, Learnings from Africa

[10] See http://manypossibilities.net/african-undersea-cables/ for a map of the submarine fibre optics cables around Africa