The Applications of Information and Communication Technologies in Higher Education, in Less Developed Countries

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Abstract

Surveys have been carried out by the International Association of Universities (IAU) and have shown that 70% of its member institutions have (an) expert(s) for Information and Communication Technologies (ICTs) in teaching and learning of which Africa, Latin America and Oceania have very low percentages. At the same time there is indeed not only a high demand for ICT in developing countries but in particular a demand for education that will help these countries to improve their socio-economic problems. This paper discusses and offers arguments for the growing possibilities of using ICTs as a training tool that can help Higher Education institutes in less developed countries to offer its students tremendous new possibilities in research and education, and open wider access to information as well as promoting active analytic thinking for purposes of solving socio-economic problems faced by these countries. A survey was carried out to find the level of connectivity and availability of experts for ICTs in teaching and learning in Universities in Zimbabwe. Questionnaires were administered to four of the six established state universities with more than ten departments each. The survey revealed that there is lack of experts of ICTs in teaching and learning and there are very few resources for this purpose. It is recommended that Higher education in less developed countries with the help of their governments be serious in developing and expanding the use of ICTs in teaching and learning.

1. INTRODUCTION:

Information and Communication Technologies (ICTs) can be considered as all the technology that facilitates the processing, transfer and exchange of information and communication services. Although ICTs can be dated back to the advent of the printing press, the rapid advances in technology witnessed in the late twentieth century, changed the traditional ways in which information was processed and communications conducted [1]. In this paper ICTs is referring more specifically to the networked computers (internet, chat sessions, video-conferencing), application packages, satellite viewing and all modern technologies that can be used for teaching/learning.

In response to the educational opportunities made available by dramatic technological innovations in the developed world, many initiatives are currently dedicated to improve the efficient use of the Web and other multimedia tools for education purposes even in the less developed countries. This is an exciting and challenging time for those in all sectors of education.

ICT will expand the possibility for cooperation between institutions of higher education, and give students and stuff members who are not able to travel extensively an opportunity to benefit from all that the partner institutions have to offer [4] A good example is that of UNISA which in addition to on-campus instruction, provides educational programs via internet and online classrooms, video and audio lectures and correspondence instructions. Students can also access UNISA's well-equipped library over the Internet. [12] African Virtual University (AVU) trains scientists, technicians, engineers, and students needed in many other professions for promoting economic and social development. Learning resources are directly provided by use of modern information and communication technologies to sub-Saharan African countries [13]. This is a case in Africa where the implementation of ICTs has been

successful in working to bridge the digital-divide.

Cost is the main constraint which has resulted in lack of resources and undesirable institutional environments. This is the time for Higher Education in less developed countries to take up the challenges if it has to produce inquisitive, creative, innovative and critical graduates as is going to be suggested in this paper. What is necessary is a willingness to make this part of the educational enterprise more vital and enriching.

With the Web and other multimedia tools, rich teaching/learning contexts will be created. Utilizing technology will increase the effectiveness and accessibility of learning to students who would otherwise have limited access to many new scientific, technological, and social developments. There is growing demand for lifelong, relevant, "just-in-time" and flexible learning opportunities for working adults. Also clientele for some universities in the present day consist largely of part-time students in full time employment. All these facts add to the external forces and factors that are driving universities and other higher education institutions to introduce and use ICT in the area of teaching and learning.

What we urgently need today are characteristics of rich teaching/learning contexts which today can be created by the efficient use of Information and Communication Technologies (ICTs). The use of ICTs can help those in higher education to improve their pedagogics. On issues of relevance of education the challenge faced by Higher Education is suggested by these questions:

1) If many undergraduates are afraid of controversy, and if they hesitate to participate in vigorous give and take intellectual exchange on any topic, how can the problem of absence of vigorous intellectual exchange be solved?
2) How can the dangers in rote learning facts and accepting principles be avoided?
3) How can learning which is not detached from the everyday world be promoted?
4) How can the problem of isolation between academic and social life be solved?

Individual researchers and university scientists may be motivated to do research for one set of reasons, whereas society usually supports research for a special set of reasons. The societal philosophy is that it needs people today who can understand both technology and its social implications, who understand their machines and also have an awareness of their place in the human spectrum. A graduate who cannot weave his technology into the fabric of society cannot claim to be a good technologist. What it means is that bridges between knowledge produced by university and society's problems must be built. This could be achieved by producing competent and adequately trained graduates. As will be presented in this paper, there are three major aspects, which ICTs bring to the teaching, and learning process, which are very useful for educationists in producing competent and adequately trained graduates. Firstly ICTs link learning to contemporary issues. Secondly, ICTs provide problem posing and thought provoking situations that promote an active orientation to learning a task. Thirdly, ICTs provide learning and teaching that allow students to solve problems in the classroom similar to those they will encounter in life. Like it has been done in the area of agriculture in Europe and North America by creating online extension services that include support systems for local problems, expert system for diagnostics of crop, animal and production system problems, and for providing information on new technologies, processes, products and markets. [10]

2. LITERATURE SEARCH

Literature search revealed that ICTs can influence research through the sharing of information and knowledge, and the creation of new collaborations and partnerships for research. The north, comprising of developed countries of Europe and North America, has a highly developed ICT infrastructure that influences its agricultural research through the sharing of information and knowledge,

and the creation of new collaboration and partnerships [10].

Success stories in developed countries demonstrate the importance of ICTs in Higher education and yet the Digital-Divide between the developed countries and less developed countries signal challenges which the later has to face. Costs, lack of resources and infrastructure being some of the major constraints. On the availability of ICTs in teaching and learning in IAU member institutions and on connectivity and access to the internet, the following statistics can be worked out from the Paris June 2002 report [6]. (Out of 120 responses, which were received and is claimed to be one-fifth of IAU institutional constituency, which can be interpreted to mean its member institutions, are 600). The results are presented in Table 2.1 below.

Table 2. 1. Access to Internet & availability of expert(s) for ICTs in IAU member institutions

Access To Internet Network & with expert(s) for ICT (2001)	%
Latin America	10
Central & Eastern Europe	11
Western Europe	43
North America	11
Africa	5
Asia	15
Oceania	6
Arab countries	22

2.1 Summary and interpretation
Out of 84% of the IAU member institutions Africa seems to have the lowest percentage of experts for ICTs for teaching and learning and is the list connected.

A similar survey on connectivity and access has been conducted by Diocaretz and Kloet and has revealed that African countries are the least connected [4].

3. The Zimbabwean Situation
A survey in Zimbabwe which is one of the African countries, revealed patterns that confirm the findings of the surveys carried out by the IAU. In Zimbabwe a collection of quantitative data on the availability of resources and experts for ICTs in teaching and learning have been done by the researcher. Table 3.2 below presents the results.

Table 3. 2 Availability of ICTs experts & resources in Zimbabwe's universities

University	ICTs Experts	ICTs/ lecturer ratio	Internet/ students
ZOU	Nil	11 to 20 per ICT tool	Nil
BUSE	Nil	5 to 11 per ICT tool	60 per computer with internet
MSU	Nil	5-10 per ICT tool	50 per computer with internet
UZ	1 per 100	2 to 5 (Sciences) 95 to 10 (Arts) per ICT tool	100 per computer with internet.

3.2 Findings.
Findings revealed that there is lack of experts for ICTs for teaching and learning in most universities in Zimbabwe, ICT resources are not sufficient and in some cases there is lack of these resources to the extend that 7 to 12 lecturers share an ICT tool e.g. internet. For students on average 70 share a computer connected to the internet and in some cases students have no access to the internet.

4. Constraints.
While it is plausible that Information and Communication Technologies affect education and training positively by bringing a better system of teaching and learning, a more realistic critique of the situation is that which realizes that in some countries the desired improvements are difficult to achieve.

It is very easy to talk about doing marvelous things with ICTs, but it is important to take into account situations in some countries and build upon these in a realistic manner.

There are barriers to the successful realization of the argued wide-ranging opportunities for teaching and learning that can be provided by ICTs. Costs are a barrier in many less developed countries as revealed by Diocaretz and Kloet in their study. The impact is reflected in speed, power supply, subscription fee and telephone costs. [4] Costs have to do with infrastructure which has to do with connectivity, access and services. The problem of costs results in lack of resources. This barrier is compounded by the fact that there are inequalities among the world's regions. For example Internet access as has been shown is extremely

unevenly spread over countries and regions and this digital divide seems to be on the increase.

Those in countries with situations where there are low speed telephone connections have had to accept the fact that they are stuck with an analogue telephone dial up Internet connection or with low speed connections to the Internet and in some cases with power cuts.

Institutional environment is another major constraint. This has to do with infrastructure together with the reality of the heavy workload of academics in light of the time factor. Heavy workload of academics in the scenario of lack of resources brings boredom and kills the enthusiasm for the use of ICTs in teaching. The author's observations in a work- based situation and from speaking with other lecturers in universities in Zimbabwe would appear to suggest that sharing slow Internet connected computers makes one to find information after many hours and this consumes precious time. As revealed by Diocaretz and Kloet's study in Africa, Asia and Latin America, given the heavy workload of academics, in particular due to the increasing burden on teaching, using the Internet is considered too time consuming by many [4].

On the issue of relevance one major obstacle is limited amount of local content with a scenario of heavy external content which brings in the problem of suitability and relevance to the problems at home for less developed countries. Diocarets and Kloet's study has also revealed that these constraints rank high in the African countries [4].

Despite the highlighted constraints, the fact still remains that the growing possibilities of using ICTs as a training tool can help Higher Education institutes in less developed countries to offer its students tremendous new possibilities in research and education, and open wider access to information as well as promoting active analytic thinking for purposes of solving socio-economic problems faced by their countries. The realization of ICTs'

potential and its impact now depends foremost on the commitments that governments of these countries make to the funding of promotion of the use of ICTs and on how these institutions see the importance of prioritizing this need.

5. THE ARGUMENT FOR THE NEED OF COMPETENT AND ADEQUATELY TRAINED PERSONNEL

In preparing this paper, survey questionnaires and interviews yielded important information about faculty and student's views and feelings on the considered central issue "how knowledge can be applied to human problems in useful and creative ways." (Because universities and students that participated were promised anonymity, their names are not mentioned in this paper.) In the site visits, all the visited universities in Zimbabwe agree that the purpose of these institutions is to produce knowledge essential for transforming the nation and for solving the present problems of its people.

And yet, Zimbabwean universities have been more successful in credentialing than in assessing the effectiveness of produced graduates to the problems of this nation. Closely related is the problem that many undergraduates find it difficult to see patterns in their courses and to relate what they learn to life In the survey, when undergraduates were asked how they felt about the overall contribution of university education to the problems of the nation and to its development, about three fourths of them are confused about values on which the vitality of both higher education and society depends. A freshman said: "This semester six difficult courses have been introduced, which I must complete I really do not see their relevance and I wish I could concentrate on what I really need to get a job." Many students are geared toward job training, complete courses, but university education is not seen as an opportunity to gain perspective.

One professor, who has been teaching since 1978, summarized his view of the problem this way: "Today' graduates are not very useful for solving societal problems, many undergraduates are afraid of controversy,

they hesitate to participate in vigorous give and take intellectual exchange on any topic. .My students tell me what they are here for is to get a few ideas that will serve them in the working world."

While students are pulled by demands of career and private concerns, universities should be troubled by the diminishing student's perception of the importance and purpose of their education to society. Bridges between knowledge produced by the universities and society's problems must be built, and the core program must be seen ultimately as relating the curriculum consequentially to life.

One wonder why when you move around in shops and flea markets almost all toys for kids have been imported from China or some other country and pencils too from Taiwan. It is not being suggested here that it is wrong for us importing things from other countries but when you import everything and you are not able to produce anything, then you have a very serious problem. Though the problem has been presented here by employing some kind of hyperbole, the reality about the challenges facing educational systems in less industrialized countries like Zimbabwe remain clear and distinct. Kanhukamwe has argued for the need to have quality personnel as one way of equipping less developed nations with relevant education.
It is therefore clear that if we are to compete successfully in various sectors of our economies with other nations we need to have quality personnel and in the engineering sectors competent and adequately trained personnel [7].

This marks the crucials, though in his article he concentrates on relationships between industry and universities.

The vital mission for educationists as shown in the above premises is to produce competent and adequately trained graduates. What it means for those in education is that, tension between conformity and creativity must be resolved. Teaching must encourage creativity and critique. It should be shown that traditions can be challenged and new ideas can be produce, tested and found useful. We find

then on the debate about the purposes and goals of Science/Technology education, that for less industrialized countries to try and keep a pace with the global trends crucial is that they must produce well-informed, inquisitive, creative, innovative, open- minded young people who are both productive and reflective, seeking answers to life's most important problems/questions.

Looking at the current situation in Zimbabwe and in similar less industrialized countries, ways in which science/ technology education can be strengthened to be the needed education for transforming those nations calls for thoughtful examination of pedagogical issues. Firstly good teachers/lecturers are these who link learning to contemporary issues. This way the strength of Kanhukamwe's desired approach becomes realizable. Secondly the philosophy must be that which demonstrates how education benefits society and how knowledge can be applied to human problems in creative and useful ways. A good example is that of the International Health and Medical Education Centre (IHMEC) at University College London, which runs an electives programme with emphasis on development issues and building links with universities and students in developing countries [11]. Another good example is that of Europe and North America's institutions, which connect farmers to innovations in agriculture through farm organization and public sector agencies and undertake activities to link agricultural research to farmers through the use of ICT [10]. ICT is one teaching/learning tool as is going to be argued in the next section which is very helpful for teachers/lecturers in producing creative, innovative, and productive personnel, capable of competing with competence.

6. **HOW ARE INFORMATION AND COMMUNICATION TECHNOLOGIES AFFECTING AND IMPROVING EDUCATION AND TRAINING?**

The pedagogical question we should consider is "how are information and communication technologies affecting and

improving education and training?" Too often the focus becomes the technology and not education. We must draw our attention to education and curriculum with ICT as a supportive tool. Our focus must be on learning and content as central with the technology itself as a foundation and tool. Although the new learning environment can be created without the use of technology it is clear that some ICTs can provide powerful tools to help learners access vast knowledge resources, collaborate with others, consult with experts, share knowledge and solve complex problems using cognitive tool. Critical thinking, problem "authentic" learning experiences, and collaboration pedagogical methods are argued from modern constructivist educational theory to be the new pedagogical methods. If ICT is used for right intention is capable of supporting new pedagogical efforts since it enable student learning by doing and by affording students learning in which they are encouraged to work in rich environment of information and experience to build their own understanding. It is necessary to modify the traditional model of education towards what J. Dewey and many progressive scholars have recommended. More exciting is the tremendous progress made in integrating technology into teaching and learning, which is a realization of J Dewey's dream of learning which is experiential and contextualised. John Dewey' writings are so extensive, given here is nothing more than just a hint at his views on education. Dewey as noted in Entwistle emphasizes the utility of concrete reality in stimulating abstract thought and active analytic thinking which is necessary for solving both practical and theoretical problems [5]. In a similar vein, scholars like Biggs describe rich learning contexts and conditions for good learning, and among the key principles of knowledge construction is learner activity and interaction [3].

Marton and Saljo distinguished between deep and surface approaches to reading an academic article. . The surface approach was characterized by a tendency to memorize discrete facts or ideas, to be anxiously aware of the need to reproduce information at a later time and to view a particular task in isolation both from the academic subject as a whole and from real life [8]. Such an approach is characterized by extrinsic motivation. Philosophy raises the question "why?" If we look at history, the impression is that the traditional methods of teaching and learning make students' work to store the deposits entrusted to them, which results in minimizing their creative power and critical consciousness. Secondly the absence of original contributions by students' results in intellectual frustration and inability to see the relevance of what they learn. A deep approach refers to an active orientation to learning a task characterized by a search for meaning, a focus on the content as a whole' and attempts to see the interrelationship between different parts [8],[3]. Digital content and networked applications are helping in transforming teaching and learning by providing more challenging learning situations. They provide contemporary, thought-provoking, life-related ideas that promote higher-order learning experiences for students, which are necessary for building intrinsic motivation in the student when learning. Students who adopt a deep approach to learning have an intrinsic motivation to learn a subject. Learning and teaching that allow students to solve problems in the classroom similar to those they will encounter outside of the schoolhouse is progressive. Also teaching which arouse curiosity yields positive results. Of significance here is the fact that people learn best from what they consider most relevant to their lives and are stimulated by thought-provoking methods of teaching and learning situations. This is where those who invest in technology for education reap the benefits of powerful teaching and learning applications.

7. OBSERVATIONS AND RECOMMENDATIONS.

Historical-facts of ongoing integration of technology into teaching and learning show that those who employ technology for teaching and learning yield positive results. The success is best explained by the philosophy of progressivism. ICT brings the opportunity to enhance teaching and learning by providing more challenging and higher learning experiences for students.

We can actually list the advantages as follows:

1) Access to the Internet will help end the isolation of teachers. ICTs provide and expand the resources for teaching and learning- teachers are able to expose students to many new scientific, technological, and social developments.

2) ICTs link learning to contemporary issues and teachers can directly demonstrate how education benefits society, and how knowledge can be applied to human problems in useful and creative ways. ICTs promote learning and teaching that allows students to solve problems in the classroom similar to those they will encounter in life.

3) ICTs provide problem-posing skills and thought- provoking situations that promote an active orientation to learning a task (deep approach). This way teaching and learning encourage creativity and critique in students so that education produces well-informed, inquisitive, open-minded young people who are both productive and reflective, who seek answers to life's most important questions.

4) Online education for example, brings collaborative learning to the forefront Students are encouraged to interact with one another and to develop social virtues such as cooperation and tolerance for different points of views. UK medical students share ICT skills while on elective in developing countries. Assessment of the effect of sharing skills is incomplete as yet, but benefits in terms of friendship and improved awareness of resources available were immediately appreciated [11]

It is interesting and important to note that education based on experiential and contextualised learning is live learning which links learning to reality and life situations necessary for solving problems of mankind.

For Higher Education to reap the benefits of integrating technology into teaching, above considering the constraints mentioned in this paper, it should also address issues related to: teacher training, the new role of the teacher, methods of assessment, and acceptable use policies.

7.1   Teacher/Lecturer training

The introduction of ICTs in education challenges teachers in relation to their technical ability, knowledge and expertise in the use of ICTs. Inadequate operational knowledge as is a practical reality in especially many developing nations is one of the major problems. If the teachers/lecturers are to use technology effectively in helping students achieve high academic standards they must possess the technical ability, knowledge and expertise in the use of ICTs. Secondly attitudes and degrees of ability and willingness to adapt to and use ICTs should be addressed.

7.2 The new role of the teacher/lecturer

The teacher/lecturer acts more as learning guide. The teacher/lecturer becomes someone who stimulates the learner by creating materials and situations for active learning. The student who is an inexperienced problem solver needs assistance from the teacher (who in the ICTs learning setting is coach, assessor and consultant) in locating and defining the problems in learning as well as suggesting the direction to be taken. His role as the "knowledge Authority" is not jeopardized in an ICTs learning setting, he remains the subject matter expert who facilitates relevant learning activities by updating the content. His new role is that of a tutor who supports the learning process.

7.3 Curriculum:
When determining the appropriateness and the validity of the subject matter, online courses need faculty approval. They must go through a similar approval process just like any other course in order to meet the same standards and expectations. The advantage of especially online curriculum is that it focuses on application of knowledge to real life and to foster critical thinking skills.

7.4 Assessment

Assessment methods must then move from measurement of learning to emphasize assessment for learning.

8.   SUMMARY

To summarize, in judging how information and communication technologies are affecting and improving education and training, we more comfortably embrace the notion that they appropriately and meaningfully foster quality-learning experiences necessary for producing the desired outcomes. Most less developed countries have the lowest percentage of experts for ICTs for teaching and learning, as well as being the least connected and with insufficient ICT resources. As has been shown, costs, lack of resources and institutional infrastructure are the major constraints. It then becomes a sound argument that the less developed countries should face the challenges and make a serious effort to develop and expand the use of ICTs in teaching and learning especially the internet since these have a potential of offering tremendous new possibilities in research as well as promoting active analytic thinking for purposes of solving socio-economic problems faced by these countries.

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