ICT HUMAN DEVELOPMENT IN AN AFRICAN UNIVERSITY - THE CONCEPTION AND IMPLEMENTATION OF THE UNIVERSITY OF BOTSWANA SKILLS-BASED ICT EDUCATION AND TRAINING PROGRAMME

Sunday O Ojo

Abstract

This paper reports on the experience at the University of Botswana in the conception and implementation of an ICT human development programme. The programme goal is to equip students with necessary ICT knowledge and skills to enhance their capacity for e-learning adoption readiness for the digital world of work in future. The national and institutional context and needs for the programme are presented. The operational, contextual and strategic challenges being grappled with and how they are being addressed, are discussed. Various lessons learnt are presented. The paper stresses the indispensable role of the universities in ICT human development. It advocates the need to adopt an inclusive and holistic approach in playing this role.

Keywords: *computing and information skills, digital divide; ICT human development; operational, contextual and strategic challenges*

1. Introduction

In this information age, the significant role of Information and Communications Technology (ICT) in positive social transformation and economic development cannot be over-emphasized. However, in developing countries, there are operational, contextual and strategic challenges which impact on a society's ability to effectively utilize ICT for this purpose. Appropriate ICT human capacity building is central to overcoming these challenges [5].

Within the context of the United States of America (USA), Bailey [1] posits a link between the economic future and quality of life on one hand, and the ability of an individual to cross the digital divide on the other. According to her, as at the year 2000, it is estimated that 60% of all jobs in the United States will require skills with ICT, and 75% of all transactions between individuals and the government will take place electronically. The difference in pay for skilled and unskilled workers will continue to widen as companies compete for employees who can use new technologies, she opined. In developing economies, Botswana inclusive, the trend is in this same direction. It is now common to encounter in advertisement for positions, phrases such as "basic skills in computing is essential"; "working knowledge of … software package is a requirement", etc. Bridging the digital divide and transforming it into a digital dividend is one of the challenges that Africa is facing as we are entering the new millennium [6]

Generally, nations worldwide do recognize the key roles of the tertiary educational institutions in human capacity development. And so, each nation demands an appropriate response from their institutions to the challenges. Emphasizing this point, Bailey [1] sees tertiary institutions as having an important role to play in this regard. According to her, "*Technology is the new economic divider, and colleges and universities owe it to their students to provide them with the best skills at the most reasonable price, equal access to quality equipment and hands-on learning. In other words, educational institutions must be proactive in developing campus-wide technology programs that eliminate "have" and "have not" factors for students."*

Traditionally, the focus of ICT education and training in tertiary institutions is on ICT professional human development. The end-user computing paradigm shift has brought into focus additional emphasis on ICT human development. That is, in addition to ICT professional human development, there is the demand for ICT-user professional human development. There is also a demand for ICT-aware societal development. ICT-user professional human development deals with equipping other (non-ICT) professionals, such as teachers, accountants, scientists, etc., with necessary ICT knowledge and skills that enhances their capacity to function productively in a digital world. ICT-aware societal development deals with making society at large to be aware of the power, limitations, promises, and implications of ICT adoption in society [5]. It also has to do with empowering the society at large to beneficially interact with ICT in their daily life endeavour. Such inclusive holistic approach to ICT-human capacity development is necessary for minimizing digital divide while maximizing digital inclusion in a country.

According to [4], the "digital divide" is real and growing, and has profound implications. This divide is not just about access to computers or telephones; it is a deeper and more profound divide that reflects and reinforces more fundamental economic and social divides between and within countries. Bridging the digital divide is not simply about giving people access to tools. It is about creating policy and regulatory environments, institutional frameworks, and human capacities that foster information flows, innovation, and effective use of the world's knowledge resources. The context of such use includes sustainable development, health, agriculture, medicine, education, trade, economic development, and effective governance.

At the University of Botswana (UB) there is increasing dependence on ICTs for academic information sourcing and dissemination. It has long been recognized that both students and staff of the institution need to have ICT skills to effectively utilize the technologies which are readily available in the university. Meeting such needs has the potential to enhance students learning effectiveness and productivity. The UB has developed programmes that would equip graduates of other (non-ICT) disciplines with appropriate level of ICT knowledge and skills for beneficial exploitation of e-learning and ICT use in their future work life. There is also the programme to equip the university workforce with ICT knowledge and skills necessary to exploit the potential of ICT for a productive work life. This is in addition to academic programmes designed for education and training of ICT professionals. The academic programmes for ICT professional human development include a BSc Computer Science, a Bachelor of Information systems programme and an MSc in Computer Science and Computer Information Systems programme. The university also has a programme of ICT skills capacity development for its workforce which is being handled by the IT Services department of the university. The focus of this paper is on the skills-based ICT programme for students of non-ICT academic programmes, aimed at ICT-user capacity building.

This paper reports on the experience at the University of Botswana in the conception and implementation of its programme of equipping students with necessary ICT knowledge and skills. The goal is to enhance their capacity for e-learning adoption as well as for their readiness for the digital world of work in future. The operational, contextual and strategic challenges and how these challenges are being addressed, are discussed. Various lessons learnt are presented.

2. The Context and Needs

2.1 The National Context and Needs

Over the years, there has been a huge investment in the ICTs in Botswana. In the government sector alone, the National Development Programme 8 projected investment in this area is between 230-300 million pula. According to World Bank 2000 Report, in 1998 Botswana ranked third in Africa after Mauritius and South Africa as the country with the most personal computers per one

thousand people. As Botswana slowly moves into heavy dependence on ICTs, it cannot be spared from pressures brought about by the continuing development in the area of ICTs. Also, with Botswana having one of the fastest growing economies in the world, at a GDP growing at around 8% per annum for some years, this relative economic wealth has triggered desires to modernise the socio-economic infrastructure in the country, with ICTs as facilitating tools. Further, the Botswana's Vision 2016 [3] recognises ICT as an enabler and a catalyst to the social development and economic growth of the country. Appropriate levels of human capacity development are indispensable to turning this vision into a reality. Therefore, in addition to producing ICT professionals, there is a need for a calibre of human resources, who are professionals in other areas, with appropriate level of competencies in the use of the technologies. The goal is to enhance their productivity in their different areas of professional callings.

As far back as 1994, the revised national policy on Education [2] established the need for computer literacy at the secondary school level throughout the country. In pursuit of this, the computer in school programme was embarked on. A computer awareness programme was introduced in junior secondary schools and computer studies in senior secondary schools. The junior secondary school computer awareness programme is not examinable. Senior secondary schools currently offering computer studies adopt the Cambridge Syllabus. Due to lack of adequate human resources capacity in particular, not all schools offer computer awareness/computer studies to the students.

Botswana's economy needs graduates in various disciplines with computing and information skills, which are currently in short supply in the country. As a result, over the years, the Botswana government has been sponsoring its workforce on computer and information skills acquisition programmes. In recent times a number of departments from the university have assisted the government in this regard. Also, government looks up to the University to equip the students with necessary ICT knowledge and skills in preparation for future work life in an information age.

2.2 Institutional Context and Needs

There is a worldwide agreement among the various stakeholders of educational institutions that students need to be "computer literate". The stakeholders of the University of Botswana (UB) are not exceptions. The UB National Development Programme (NDP) 8 envisaged the introduction of computer literacy programme for all students during the plan period. Prior to this, the Faculty of Science had been running a computer literacy course for all BSc Year 1 students. During the NDP 8, all other Faculties in the University introduced computer literacy courses for their students too. Each faculty (except the Science faculty) employed its own Computer Awareness lecturer and provided computer laboratory facilities for running the course. The Computer Science department took care of running the course for the Faculty of Science. The computer literacy courses introduced by each Faculty varied widely in content, delivery, assessment, and quality. The obvious implication of this was that students from the same university had varied levels of computer literacy and consequently preparedness, to face the challenges of being productive role players in the information age to which they all belong. Further, it is only one faculty that included information skills as part of its computer literacy programme for the students. This situation created a class community of UB graduates with some being more computer literate than others. This was a recipe for digital divide which needed to be corrected.

In addition to the full-time students the university caters for distance education and other part-time students through its Centre for Continuing Education outfit. This category of students received their tuition through various non-traditional modes and is serviced at centres located at various locations in the country. There is a computer awareness course for the students too. Given the inability of the university to provide laboratory facilities in majority of the locations where these students are serviced, the course offering is mostly theoretical with little or no hands-on laboratory exercises.

In the university, there is increasing dependence on the ICTs for academic and administrative information sourcing and dissemination. The adoption of the e-learning technology and the encouragement to integrate ICT into the teaching and learning process increased the need for students in the university to have computing and information skills. So also do the students have to receive some of the university services through ICT mediation. The University was therefore faced with the challenge of producing graduates in all non-computing disciplines, with requisite computing and information skills and competencies that will enable them to be productive role players in the digital world of work.

3. The Conception of the Skills-Based ICT Programme

3.1 The Programme Concept

As part of the semesterisation programme which took off in August 2002, the concept of General Education Courses (GEC) was introduced. Among the seven areas of GEC is Area 2, which deals with "Computing and Information Skills" (CIS). This was aimed at improving on and consolidating, the earlier efforts in the various faculties. This was envisaged as a university-wide programme that is well harmonised and appropriately standardised in content, quality, delivery, and assessment, and well pitched at appropriate levels for the present and future needs of the students. It was also expected to enhance optimal resource utilisation in the execution of the computer and information literacy programme of the university.

The university decided that: (a) the Computing and Information Skills (CIS) courses should be developed within the framework of the General Education programme; (b) appropriate course modules should be developed for each level – i.e. Levels 100, 200, 300, 400, …, - so that students proceeding from a lower level can build upon their computer and information skills at a higher level; and (c) the programme should cater for students from the various faculties in the University, as well as distance education students..

To obtain baseline information necessary for the conception of the CIS programme, a university-wide students computing and information skills needs assessment was carried out. Also, a review of the existing faculty-based computer awareness programmes was conducted. In addition, global electronic consultations with institutions and individuals dealing with similar programme were made.

3.2 The CIS Programme Objectives

Key objectives of the CIS programme include: (a) to equip students with computer and information skills that will enable them to effectively utilise the computer technology in their academic works and in their future professional endeavour; (b) to promote and encourage computer and information literacy for all students; (c) to raise the level of knowledge about computing and information technologies and the level of competence in using personal computers and common computer applications for all students; (d) to provide students with a level of computing and information literacy that would enable them understand best practices and the advantages of using a personal computer; (e) to increase the productivity of all students who need to use computers in their academic work and their future professional work; (f) to enable better returns from investments in ICT in the university, as well as in the students' future place of work; and (g) to provide a basic-to-advanced computing and information competence which will allow students, regardless of their background, to be a productive part of the information society.

3.3 Programme Design Principles

A principle that guided the thinking in the CIS programme design is the universality and particularity of CIS programme. CIS, just like any other technology-based academic programme, is both universal and particular. It is universal in the sense that there is fundamental knowledge and skills required by all students, regardless of what faculty they belong to and what professional calling they will go into after graduation. Its particularity derives from the fact that there are peculiarities (or variations) in the context of the students using the knowledge and skills both during their studies and in their future world of work. This apparent paradox of CIS universality and particularity demands that the universal and particular aspects be distinguished, and both aspects be adequately accounted for in the programme development and implementation. While to some extent, elements of the universal aspects can be borrowed from similar programmes elsewhere, crafting the particular aspects demanded innovativeness and creativity so that the programme is well contextualized.

Another principle is the no “laundry lists” approach to CIS programme design. A worthwhile CIS curriculum must be more than “laundry lists” of isolated skills, such as: knowing the parts of the computer, writing drafts and final products with a word processor, searching for information using a CD-ROM database, etc. While these specific skills are certainly important for students to learn, the “laundry list” approach does not provide an adequate model for students to transfer and apply skills from situation to situation. Such computer literacy curricula address the “how” of computer use, but rarely the “when” or “why.” Students may learn isolated skills and tools, but they will still lack an understanding of how those various skills fit together to solve problems and complete tasks. Students need to be able to use computers flexibly, creatively and purposefully. Any meaningful CIS curriculum should therefore enable students to (a) recognize what they need to accomplish; (b) determine whether a computer will help them to do so, and then (c) be able to use the computer as part of the process of accomplishing their task. Individual computing and information skills take on a new meaning when they are integrated within this type of information problem-solving process, and students develop true “computer literacy” because they have genuinely applied various computer skills as part of the learning process.

The computer-information skills integration is yet another principle enjoined. There are two distinct but related skills required in the programme. That is, the computing skills and the information skills. The CIS programme recognized the need to integrate information skills with the computing skills such that the combined skills can be used in practical problem-solving using the ICT. In this regard, three requirements for an effective integration of the two skills are recognized in the programme design viz: (a) the skills must directly relate to the target application domains; (b) the skills themselves need to be tied together in a logical and systematic information process model; and (c) practical hands-on problem-solving experience with the technologies is critical to acquiring the skills in the learning process.

3.4 The Programme Structure

The CIS programme brings together as an integrated whole, the identified computer and information skills requirements of students from the various faculties of the university. The CIS programme has 6 course modules as shown in Table 1.1 on the next page:

Course Code	Course Title	Credits
GEC 121	Computing and Information Skills Fundamentals I	2
GEC 122	Computing and Information Skills Fundamentals II	2
GEC 221	Information Management Skills	2
GEC 222	Problem-Solving with Spreadsheet	2
GEC 223	Web Application Skills	2
GEC 321	Multimedia Information Presentation Skills	2

The two 100-level courses (GEC121 and GEC122) are compulsory for all Level 100 students throughout the University. Those at higher levels are optional.

4. Programme Implementation

The implementation of the CIS programme took off in August 2002. Hitherto, only the two compulsory modules (GEC121 and GEC122) are being offered. This is due mainly to lack of adequate computer laboratory resources. Though the original proposal recommended the setting up of a fully fledged unit (Computing & Information Skills Unit) for the running of the programme, this has not materialized. Instead, the group of computer awareness lecturers who were formerly employed by different faculties were redeployed to the Computer Science department to constitute a team for the delivery of the programme. One of them was appointed as programme coordinator. The lecturers are assigned one each to handle students from the same faculty. This team works together with another team of librarians for the university library who handle the information skills component of the course. The team operates under the management of the Head of Computer Science. At the beginning of each year a team of teaching/laboratory assistants is employed to assist lecturers in laboratory works. In respect of the distance education students, the Centre for Continuing Education handles the implementation of the programme using part-time lecturers.

The existing faculty-based computer laboratories formerly used for the defunct computer awareness courses are the only laboratory resources currently available for the programme. Some 200 PCs are currently installed in the university library for open students use. This is the first phase of 800 PCs planned to be installed in the library for students' use. In respect of the distance education students, the CCE commonly arrange for borrowed computer laboratories at different locations in the country where such are available.

A teaching material module for GEC121 has been developed, while another for the GEC122 is in preparation. A pilot implementation of a web-based version of he GEC121 using WebCT has been done for students in one of the faculties. Work is on-going to extend this facility to students in the rest of the faculties. Over 400 students register for each of the two courses each semester. Generally, the CIS programme is at present under-resourced in terms of computer laboratory facilities. Hence, its current implementation mode is not quite as envisioned.

5. Challenges

There are three dimensions of challenges associated with the implementation of the CIS programme. That is, the Operational, Contextual and Strategic challenge. Operational challenges deal with those that are resource-related. Contextual challenges have to do with those associated with particularities of the programme implementation environment. Strategic challenges derive from the implementation strategy adopted.

5.1 Operational Challenge.

The resources required for the implementation of the CIS programme include human, computer laboratory facilities, teaching aid and teaching material resources. The human resources include lecturers, laboratory/teaching assistants and laboratory support technicians. Teaching aids include multimedia projector e-learning facility. The main challenge is running the programme with inadequate computer laboratory facilities while at the same time pursuing quality delivery. Ensuring equity in students' access to available computer facilities is a challenge too. However, in addition to scheduled computer laboratories, the university provided PCs in the library for open access to the ICT facilities in the university. It is up to students to avail themselves of this facility. The programme at present is generally under-resourced with implication for the quality of teaching and learning.

One consequence of the under-resourcing of the CIS programme is that, since its take-off in August 2002, the offering of its programme has been limited to the two compulsory 100 level modules – GEC121 and GEC122. This situation has limited students to the basic computing and information skills being offered in these two course modules. The implication is that students who have been graduating from the university since August 2002 have been denied the opportunity to benefit from the higher level CIS courses. Thus limiting their preparedness for the digital world of work. This is in addition to the limit on the quality of the basic computing and information skills received from GEC121 and GEC122 due to under-resourcing.

5.2 Contextual Challenges

There are contextual challenges in the running of the programme. Notable among the contextual challenges is resistance to change. This manifests in the form of some stakeholders not cooperating with the management of the programme. The designed CIS programme was taken through faculties for comments and approval. The conception of the programme was generally well-received across faculties. However, when it came to the stage of implementation, an element of resistance to change was experience. The faculty computer awareness lecturers who used to operate autonomously now have to work within a team. Some demonstrated elements of perceived resistance to this change. Managing resistance to change is a challenge. Evolving appropriate mechanism for contextualization of the programme offering to students with diverse backgrounds and need pose another challenge. This challenge overlaps with the challenge of managing pedagogy discussed under strategic challenges below.

5.3 Strategic Challenges

There are challenges arising from the strategy adopted in the implementation of the programme. The non-implementation of the recommendation to set up a fully-fledged unit with full compliment of resources necessary for effective running of the programme lies at the core of the challenges. The strategic challenges revolve around those associated with a) managing the pedagogy, b) managing the operational logistics, c) managing the interface with other stakeholding components of the university, and, d) managing development in the area of CIS.

5.3.1 Managing the pedagogy

This is associated with the implementation of the three-fold guiding principles in the development of the CIS programme. That is the universality and particularity of the CIS, the no "laundry lists" approach, and the computing-information skills integration. These have pedagogical implications which have to be managed. It is required in the implementation of the course modules: a) that the delivery of the universal aspect of the programme be standardized; b) that the illustrative examples to be used during lectures and the practical classes be creatively and innovatively crafted to reflect the varying needs of students in the different faculties, for ease of skill transfer to the context of use; c) that an integrative approach be adopted in the teaching of the computer skills and information skills, with the information skills infused throughout the teaching of each course module; d) that the use of e-learning technology be adequately employed; and e) that practical hands-on problem-solving experience with the technologies is critical to acquiring the skills in the learning process.The production and use of common teaching materials and the use of the WebCT e–learning technology and the making of lecture and laboratory classes tailor-made to suit the needs of students from the same faculty have greatly enabled coping with the challenge of managing the pedagogy.

5.3.2 Managing the operational logistics

Given the enrolment of over 4000 students each semester for the courses, and the need to ensure effectiveness in the implementation of the programme, the enormity of the challenge of managing the operational logistics required in the running of this programme cannot be overemphasized. The core of the challenge here lies in ensuring across faculties, among others, a) programme delivery standardisation; b) students assessment standardisation; c) quality assurance mechanism standardisation; and d) optimal acquisition and utilisation of resources. The adoption of a team approach in the operational mode of running the programme enables better coping with this challenge.

5.3.3 Managing the interfaces with other stakeholders

The CIS courses are offered to full-time students from all the faculties and part-time/distance education students from the CCE. Experience in coordinating the programme in the past three academic sessions showed the daunting challenge of managing the interface with these constituents of the university. Charging individual lecturers assigned to each faculty with the responsibility of managing the interfaces has greatly enhanced our capacity to cope with this challenge. The decision to devolve the responsibility for handling the continuing education students to the CCE has also helped.

5.3.4 Managing development in the area of CIS.

The challenge here deals with the necessity to keep the programme content and delivery up-to-date in line with developments in the area and changing needs. Arrangement is on-going to subject the programme to external review exercise as part of the overall agenda for the review of all ICT-related academic programmes of the university. Hopefully, useful feedback will emerge to guide future direction.

6. Lessons learnt

- The level of resource availability constraints effectiveness in ICT programme delivery and the growth of the programme in responding to the changing needs;

- Effective management of such a programme requires appropriate management structure commensurate with the management challenges posed;

- Resistance to change should be anticipated and appropriate change management mechanism be put in place so as to minimise the extent of its negative impact;

- Effective mechanism for managing the interface with stakeholders is indispensable to achieve the objectives;

- If shortage of resources is inevitable, it is more helpful to cut one's coat according to one's cloth rather than one's size.

7. Conclusions

Universities have a leading role to play in the ICT human development programme of a nation. Having in place adequate resources provision to play this role is indispensable. It requires an inclusive holistic approach to ICT-human capacity development that recognizes the need for ICT-user education and training programme, in addition to the usual ICT professional development programmes. This is necessary for minimizing digital divide while maximizing digital inclusion in a developing economy.

8. References

[1] Bailey Judith, Students need help bridging digital divide. USA Today. September 15, (2000). http://www.usatoday.com/news/opinion/columnists/educate/ed2.htm

[2] Botswana Government, Revised National Policy for Education. Government Publication, 1994.

[3] Botswana Government: Vision 2016 – A Long Term Vision for Botswana – Towards Prosperity for All Government Publication, 1997.

[4]German Foundation for International Development (DSE), Digital Inclusion - Impact and Challenges of the Networked Economy for Developing Countries. Discussion Report. The Development Policy Forum of the January 23 2001 http://www.dse.de/ef/digital/rep0201e.htm

[5] Ojo Sunday, IT Human Resources (HR) Need in Developing Countries. In Proceedings, COMNET-IT International Symposium on Best Practice in Electronic Government, Kuala Lumpur, December 1998. http://www.comnet-it.org/news/malwk98r/ses5pap2.html

[6] Soltane Karima Bounemra Ben (2001) Africa and the Digital Inclusion- Personal Reflections http://www.dse.de/ef/digital/solta2-d.htm

[7] University of Botswana, GEC Area 2: Computer & Information Skills Programme, Internal Document, University of Botswana, 2001.