

## **Technological Change in Learning Environments: The Case of the University of Botswana**

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### **Abstract:**

This paper seeks to establish the extent to which educational technologies have impacted on Teaching and learning at the University of Botswana. The paper describes and analyses technological developments at the University of Botswana since 2000.

The University of Botswana recognises the importance of the effective use of educational technologies for enhancing teaching and learning. This recognition is directly linked to the vision of the institution being: "developing a student centred, intellectually stimulating and technologically advanced teaching, learning and research environment." Various obstacles that are typical of higher education in developing environments however have militated against the rapid implementation of this vision.

The process of technological change has been accelerated since 2001 and the emerging strategies for effective infusion are discussed. What strategic steps have been taken to guide the infusion of educational technologies in teaching and learning? What developments both in terms of human resources and infrastructure have been undertaken to help achieve the objective of establishing a technologically advanced teaching and learning environment?

The process of technological change is complex and systemic in nature and leadership is therefore key to this process. The LASO Model was found to be helpful and can act as a guiding heuristic for technological change in learning environments. The University of Botswana is experiencing positive progress in realising its vision for establishing a technologically advanced teaching and learning environment, despite various obstacles that are systematically being addressed.

## **1. Introduction**

This paper describes and analyses technological change in the learning environments at the University of Botswana since 2000 and establish the extent to which these developments have impacted on teaching and learning.

In 1966 when Botswana gained Independence, it was regarded as the poorest country in Africa. The discovery of diamonds in 1967 and the sensible management of the income derived from it have spurred consistent economic development and expectations of increasingly sophisticated educational systems. Botswana has recently been classified as a middle-income country with a vision of building an educated, productive, innovative and informed nation [1]. The use of learning technologies in higher education however developed much slower than the use of relevant information and communication technologies (ICTs) in other sectors of Botswana society [2].

There are numerous challenges that are encountered in the introduction of educational technologies in teaching and learning environments in developing settings. These challenges cover a wide range of issues such as limited infrastructure, access and bandwidth, levels of human resources capability and resultant training needs, working within a framework of limited resources, and the unfamiliarity with learning technologies that are often in common use in developed environments

The University of Botswana undertook to infuse educational technologies in the delivery of its programmes to enhance its learning environments and thereby increasing effective learning. This is tied to the nation's vision 2016, which also has as one of its objectives to have an informed nation by the year 2016 [1]. To achieve the above objective, it was imperative to make an objective assessment of the situation and come up with some key strategies and directions that the institution should take to achieve the said objectives.

## **2. A snapshot of educational technology use at the University of Botswana in 2000**

The analysis of the technological situation of the University of Botswana was conducted at the end of 1999 with the report [3] handed to management in early 2000. It became clear that there were a few areas within the University such as Information Technology (IT) that were moving forward to embrace educational technologies mostly for purposes of administration. Outside these specific areas, the status of information technology in the institution required quite a great deal of improvement. In particular there was need to improve in the areas of academic staff and student development in basic computer training, physical infrastructure, student support, and general instructional support services for the infusion of educ

- An assessment of the current technology infrastructure plan, including the viability of the current network to deliver and receive data for effective teaching, learning and research throughout the campus.

The findings of the consultant were based on the prevailing situation on the ground at the university as it relates to the use of information technology in teaching and learning. The above points indicate the challenges the University had to contend with in its effort to infuse educational technologies in the delivery of its programmes and becoming leader in the use of technologies for enhancing teaching and learning.

The use of educational technologies in learning environments at the University of Botswana up to 2000 was to say the least very limited. Most classrooms as Madigan puts it were bare of any technology. Due to the increasing intake, most classrooms were configured to take the largest number of students possible and in most of these classrooms there was hardly any educational technologies to help the situation. This situation needed to be changed in order to transform the prevailing environment and change the paradigm and create new and powerful contexts for learning and teaching.

In view of the above, the university was prompted to action to address the issue of absence of educational technologies in the teaching and learning environment. Some of the issues that had to be addressed to redress the situation included among others;

- Having one place responsible for space allocation, to solve the problem of inappropriate use of space on campus. This aspect was left to the department of Campus Services to come up with a catalogue of all teaching spaces on Campus. The project is still in progress.
- Provision and installation of overhead projectors in classrooms so as to bring basic educational technologies closer to the teaching environment. A decision was taken to have all lecture halls with a carry capacity of 100 and above be installed with overhead projectors. By the end of financial year 2000/2001, a total of (95) such classrooms were affected.
- Installation of data projectors in some large lecture halls: As an experimental project, six large lecture halls were identified and installed with data projectors and public address systems for use by academic staff. This project was aimed at creating connected classrooms to increase the potential to change the learning environment. As Berenfeld [4] puts it, "Connected classrooms potentially offer open-ended, dynamic, discovery-oriented learning experiences. The more advanced the classroom use of telecommunications is, the greater the potential to change the learning environment...". In addition to the above identified lecture halls, the University undertook to increase the capacity of the resource centre where an assortment of teaching equipment were acquired and kept for loaning out to academic staff for use on short term basis. This arrangement further ensured that educational technologies are made available to the teaching staff.

The University has taken a position that the use of information technologies can so enhance classroom delivery and when properly used and applied, could improve teaching and learning in general.

### **3. Technological change in learning environments at the University of Botswana since 2001**

The University of Botswana has embarked aggressively on a programme of technological change of its learning environments since 2001.

The Educational Technology Unit (EduTech) carries out the training of academics in the effective and appropriate use of educational technologies at the University of Botswana. EduTech has been charged with the responsibility of technological change at the University of Botswana. A major undertaking oed

in 2001. UBel has been phased in with consideration to constraints such as the tremendous training needs among staff and students, funding constraints, limited infrastructure and bandwidth, and the unfamiliarity with learning technologies in common use in developed environments. Gibson [5] for instance observed, "...the adoption of a novel technology requires new labour skills that are usually not found in Less Developed Countries."

The University of Botswana has however been fortunate in many respects regarding the application and implementation of educational technology into the curriculum and using such technology to expand access. Every staff member has a Pentium computer, printer or access to a printer, access to the Internet and e-mail with minimal power failures and network shutdowns. A new library addition has recently been completed and will in the future make available 800 new student workstations to contribute to a technology rich learning environment.

A state-of-the-art eLearning Support Centre has been implemented as the first wireless network application at the University of Botswana. Semi-embedded computers are used to facilitate eye contact among group participants. The computers are laid out in clusters to support collaborative work. A Mimio-board is used to display, via a data-projector, what is written or drawn on the white-board. Microsoft-Netmeeting is used to project the white-board or any other aspect of the instructor's screen on the screens of all the participants, or the screen of any participant to all other participants.

The eLearning Support Centre has been used to train more than 30% of the academic community of 680 staff in various educational technologies using more than 60 targeted workshops. A new eLearning Certificate, issued by the Centre for Academic Development, has been designed by EduTech and is on offer from 2003.

WebCT, an online learning management system was acquired in 2002 after a rigorous evaluation process. At present more than 20 courses are online with approximately 2000 (of the 12 000) students involved. More than 4000 additional students will be studying part of their courses online from August 2003 in the courses currently being developed for online-delivery. WebCT 3.8 offers a full suite of online learning tools including chat facilities, bulletin boards, online calendar, assessment tools, student tracking, email, content uploading and student administration.

A video-conferencing system, POLYCOM was installed in 2003 for synchronous teaching and learning. The system links the main campus in Gaborone with Maun and Francistown via ISDN and leased lines. The University of Botswana can also conduct video-conferencing internationally through this system using IP addressing or ISDN.

The Internet and particularly the Web is playing an increasingly important role as eLearning is expanding. Student use of the Web has increased exponentially and so has the demand for more computers and faster access.

EduTech has an equipment outlet and has seen a dramatic increase in the demand and use of laptops and mobile data projectors by academic staff. A satellite model is planned whereby each Faculty will have its own eCentre providing customised support, training and equipment services.

Equipment at the central educational technology outlet now uses computerised issuing on a bar-code system. In the future academic staff will be able to both check availability of equipment via the network and also reserve desired equipment online.

Various research projects in eLearning have commenced. A study was done in 2002 to encourage open discussion, information-sharing and entry-level counselling on HIV/AIDS by all staff and students. The study involved the use of public Web-based threaded message boards as an anonymous Q&A forum where an expert answered questions [6].

In the Faculty of Humanities a project is in progress to establish the eLearning readiness of the secondary schools from which the university draws its students. In the Faculty of Education a current study seeks to establish the degree to which eLearning is practiced in the private sector in Botswana in order to align eLearning projects and practices at the University to that of the graduates' future work place. A study is also underway that will result in a relevant and effective model for development of new eLearning materials at the University of Botswana.

An eLearning Smart Classroom has been co-designed with visiting consultants[7] and constructed for technology-based, collaborative learning. This classroom is laid out in a similar fashion to the eLearning Support Centre, with semi-embedded computers using a clustered arrangement. The Smart Classroom also features a video-conferencing system and a number of motorized screens for maximum flexibility in sharing information.

#### **4. Strategies and steps for effective technological change in learning environments**

##### **4.1 Vision, leadership and dedication**

An inspiring vision for the use of new learning technologies has proved to be critical at the University of Botswana. The process of technological change is complex and systemic in nature and leadership is therefore key to this process.

The critical importance of visionary leadership correlates with a central finding of Uys's doctorate research [8] that Rogers' diffusion of innovation theory [9], when the innovation emerges from outside of senior management, needs to be augmented with a top-down component that includes both senior and middle management in order to accomplish effective diffusion of technology-based education.

At the University of Botswana the UBel programme links to Botswana's Vision 2016 [1] goals of being an educated, productive, innovative and informed nation as it aims to provide wider access and increase the quality and relevance of tertiary education in an emerging global information society.

The vision of the University of Botswana to transform its academic processes towards an increasingly technological base has strongly influenced technological change in learning environments at the University. The stated vision of the University is further to strive for excellence in the provision of education to the nation and in particular to use ICTs in the teaching and learning process.

The Educational Technology Unit (EduTech) in the Centre for Academic Development, which is spearheading the UBel programme, has as its vision, "to be a well-rounded, highly skilled and well equipped unit, respected in Africa and beyond in research, teaching and the provision of an extensive and evolving range of services in educational technology", and this vision is indeed realised.

Vision without leadership, however, is at best a fantasy, and at worse a farce. Strong leadership for the use of eLearning, however, has been provided on various levels at the University of Botswana and confirms the view of Berge and Schrum [10] that the key to success of campus initiatives in technology-enhanced learning and distance education is the support of campus leaders. This further correlates with Drucker's [11] assertion that a successful innovation should aim at leadership from the beginning in order to be innovative enough and capable of establishing itself.

In this regard, both writers have provided direct leadership through EduTech, as champions of the use of new learning technologies at the University of Botswana and as chair and alternate chair of the UBel Committee. The respective faculty representatives on the UBel Committee have been providing leadership within their respective faculties.

Dedication and committed work from within EduTech and the UBel Committee is making the vision for a technologically advanced learning environment a reality at the University of Botswana.

#### **4.2 Clarity on the strategic imperatives for educational technology use**

In any situation involving technological change in higher education, commitment will be lacking however, unless both academic staff and students appreciate and take ownership for the rationale and benefits of technology-based education. A vision needs to be translated within a strategic framework towards a clear, long-term rationale for the use of eLearning.

Tertiary education, similar to other sectors of society, has often responded to new ICT applications on the basis of efficiencies rather than using more strategic considerations. Technological innovations therefore have experienced difficulty in education because of this problem that Michael Porter calls “metrics” [12].

Porter [12] describes this problem as follows:

The traditional criteria by which IT applications have been chosen have been ones of operational effectiveness—How many people can we save? How much faster can we process the paper?—rather than by more strategic measures, such as how much have quality or service levels gone up.

David [13] similarly calls for strategic approaches to ICT use in schools of the United States, which seems apt for what has been occurring in tertiary education regarding technological innovation:

The primary reason technology has failed to live up to its promise is that it has been viewed as an answer to the wrong question. Decisions about purchases and uses of technology are typically driven by the question of how to improve the effectiveness of what schools are already doing—not how to transform what schools do”.

It is also vital not to base the strategic rationale for technology-based education on first order changes, which relates to a misplaced focus on efficiencies. Fullan [14] distinguishes first order (or first level) changes from second order (or second level) changes. He believes that most changes in education in the twentieth century have been first order changes, which are aimed at improving efficiency and effectiveness of current practices. Fullan [14] states that “... second order reforms largely failed”, which are those changes that aim at fundamentally changing the ways that institutions are put together

The rationale for using advanced learning technologies at the University of Botswana includes

- increasing the quality of learning and the success rate of students
- creating and supporting new research opportunities
- alleviating increasing administrative and teaching pressures on academic staff
- supporting academic freedom and freedom of speech through free information flows and
- making teaching more rewarding and exciting for academics.

In the context of a dynamic workforce through large staff turnover in Botswana, as in other developing countries, and the effects of HIV/AIDS, learning technologies and eLearning in particular can be used to create repositories of the intellectual and human capital in nations and in particular within higher educational institutions.

New learning technologies can further provide

new levels of flexibility in learning and teaching with students studying at their own pace, place, time and preferred ways of navigation. Technology-based distance education can also be used to transcend geographical distances more effectively and it can be a key

strategy to counter the threat of national and international virtual institutes seizing traditional student markets.

Advanced learning technologies can also

increase access to education, but this contribution of technologies is dependent in developing environments on providing computer access and increasing basic computer literacy levels.

In developing environments in particular, the wide implementation of advanced learning technologies can be leveraged to create a demand for more sustainable and stable ICTs such as wide area and local area computer networks as well as adequate and affordable bandwidth. The provision of ICTs to these standards is a pre-requisite for user-acceptance and wider support by stakeholders.

Technologically based education is further seen by some as a way to address the increase in the world demand for higher education. In this regard Daniel [15] states that "one new university per week is required to keep pace with world population growth but the resources necessary are not available.

In view of growing globalisation and transnational exchanges in many fields, scholars like Marquardt, [16] and Evans and Nation [17] have indicated that in "... these circumstances politicians, policy-makers and citizens are making demands upon education systems to reform. Open learning and distance education are at the forefront of educational responses to the changes that are taking place locally, regionally, nationally and internationally"

Learning technologies can however, also provide efficiencies. Bates [18] concurs that using educational technologies for teaching at universities can serve the public more cost-effectively and in particular, can prepare students better for a technologically based society

#### **4.3 Using a map for technological change to guide the implementation and selection of strategies**

Once a clear vision and committed leadership have been established and there is adequate commitment to these, a map or model for the technological change process is required.

Such a model needs to be flexible and realistic as managing change in general and in higher education in particular has to deal with particular challenges related to the unique organisation of Universities. It is therefore necessary, as Fullan [14] suggests, "... that we explicitly think and worry about the change process" in educational reform.

There is however no neatly formulated theory of generic change. Cannon [19] further points to the absence of a general theory of educational development and notes that educational developers therefore draw on theories from other disciplines to inform their educational practice. The use of models for educational change therefore becomes vital.

At the University of Botswana the LASO (Leadership, Academic & Student Ownership and Readiness) Model for Technological Change in Tertiary Education [19] (see Figure 1) guided the implementation and selection of appropriate strategies.

*Figure 1: The LASO (Leadership, Academic & Student Ownership and Readiness) Model for Technological Change in Tertiary Education*

The LASO model was born out of the reality of implementing advanced learning technologies in higher education in various settings and includes the necessary top-down and bottom-up processes.

Gunn [21] has also proposed the integration of top-down and bottom-up initiatives:

An effective technology strategy works in both directions. From the top down, it is articulated through institutional objectives, sensitive to existing culture, constraints, strengths and weaknesses, and presented as a coherent, achievable set of goals with appropriate incentives and rewards. It must also move from the bottom-up where knowledge of teaching strategies, learning contexts and disciplinary expertise can be translated into action plans geared to achievement of institutional strategic objectives and so creating a sense of ownership at all levels of the institution

The LASO model emphasises the importance of integrated top-down, bottom-up and inside-out processes. This model suggests that technological change occurs when leadership is integrated with academic and student ownership and readiness. Leadership is achieved through mechanisms such as defining a clear vision for the required technological change, providing a reward structure for those engaging in the change process and the creation of a strategic framework to guide the change process.

Ownership and readiness for change by both students and academic staff can be achieved by using strategies such as pilot projects, extensive training, establishing workgroups and learning communities in every faculty / school and using teams for courseware development.

The curve of technological change is indicated in the LASO model as a ragged line to signify the complexities and dilemmas with which technological change of learning environments in higher education is often associated.

The critical aspects of this model that proved to be very relevant in the University of Botswana environment are its emphasis on pedagogical imperatives and ownership by academic staff, effecting change through development teams, the Certificate of Development (The Diffusion Technology and distributed implementation and support structure.

A change model further needs to take cognisance of the systemic nature of technological change.

## Conclusion

There are numerous challenges that were encountered in infusing technological change in the learning environments at the University of Botswana. These challenges cover a wide range of issues such as limited infrastructure, levels of human resources capability, and working within a framework of limited resources.

The University of Botswana has embarked since 2001 aggressively on a programme of technological change of its learning environments, which is being spearheaded by EduTech [22]. The University is for instance using an online learning management system where courses are offered via WebCT, while a state-of-the-art eLearning Support Centre has been implemented using wireless computing. The University of Botswana has also acquired a video-conferencing system.

The process of technological change in learning environments is, however, complex and systemic in nature and leadership has been found to be key to the process of implementing the vision of the University towards a technologically advanced learning environment.

The LASO Model for technological change in learning environments has been a helpful map and can act as a guiding heuristic for technological change in learning environments.

The University of Botswana is experiencing positive progress in realising its vision for establishing a technologically advanced teaching and learning environment, despite various obstacles that are systematically being addressed.

## References

[1] Presidential Task Group, Long Term Vision for Botswana - Vision 2016, September 1997.

[2] Ministry of Commerce and Industry, Botswana Review of Commerce and Industry 2002/2003. 22nd edition, Gaborone, 2002.

[3] D. Madigan. Enhancements of teaching and learning environment through classroom improvement and instructional technology. Consultancy report to the University of Botswana, 2000, May 15.

[4] Berenfeld, E., Telecommunications in our Classroom: Boondoggle or a powerful Teaching Tool? Proceedings of INET'96. Sighted in Backer, P.R. and Saltmarch, M., Getting on board with multimedia and Internet training, p.1. in Hoffman, P. and Lemke, D. (Eds.), Teaching and learning in a networked world – TechEd 2000 Proceedings, IOS Press, Amsterdam, 2000.,

[5] R., Gibson, "Informatics Diffusion in South American Developing Economics", Journal of Global Information Management, Vol. 6, No. 2., 1998, p. 36.

[6] P.M. Uys. & M.K. Mphahlele. The use of Information Technology in Botswana Secondary Schools. Journal of Global Information Management, Vol. 6, No. 2., 1998, p. 36.

[18] Bates, A. W., *Strategies for the Future*, 1999. [Online]. Available:

<http://bates.cstudies.ubc.ca/strategies.html> [2003, February 15]

[19] Cannon, R.A., *Theoretical perspectives in changing tertiary education*. In Jones, J. & M. Horsburgh (eds), *Research and development in higher education*. HERDSA, Kensington, Australia, 1986.

[20] Uys, P.M., *LASO (Leadership, Academic & Student Ownership and Readiness) Model for Technological Transformation in Tertiary Education*, 2001. [Online]. Available

<http://www.globe-online.com/philip.uys/LASOmodel.htm> [2003, July 5].

[21] Gunn, C., *Virtual technologies in higher education: vision or reality?* pp. 134-145. In Peters, M. & P. Roberts (Eds.), *Virtual technologies and tertiary education*, Routledge, London, 1998.

[22] Educational Technology Unit, Centre for Academic Development. [Online]. Available:

[http://www.ub.bw/departments/centres/cad\\_et.html](http://www.ub.bw/departments/centres/cad_et.html) [2003, July 5]