

# An Investigation into the Effectiveness of ICT Supported Learning System Usage in South African Tertiary Institutions

P. Mkhize & S. Lubbe

[mkhizepl@ukzn.ac.za](mailto:mkhizepl@ukzn.ac.za)

Department of Information Systems and Technology, University of KwaZulu-Natal

## ABSTRACT

Tertiary institutions in the Sub-Saharan region of Africa are still struggling to acquire ICT tools in order to implement ICT supported learning systems let alone setting up and running of an effective and appropriate ICT supported learning systems. (Darkwa and Mazibuko, 2003). South African tertiary institutions are no exception, owing the frustration to the globalization of the economy.

South African tertiary institutions, though they have shown some degree of success in the implementation of ICT supported systems are likewise struggling with identifying and implementing an ICT supported learning system that will best suit the learning and budget requirements of the institution. This research examined whether the tertiary institutions that are claiming to implement ICT supported learning systems, are in fact doing so.

An ICT supported learning system can not be regarded as one size fit all, and a tertiary institution will therefore need to choose carefully, in line with its budget and learning requirements, which of the seven ICT supported learning systems it intends to implement: u-Learning, m-Learning, e-Learning, LMS, Distributed Learning System, Computer-Based Training and Distance Learning Systems. Based on the findings of the research, a framework has been developed that will assist all stakeholders in the setting up of an effective and efficient ICT learning system for the institution.

## INTRODUCTION

The utilisation of technology in the education process has been low in the Sub-Saharan region of Africa, compared to United Kingdom and United States schools and tertiary institutions (Darkwa & Mazibuko, 2003). However, Hoffman (2002) asserts that the application of

technology in the workplace has revolutionised productivity and has been accepted in the administration of the business function and in education.

The acceptance and effectiveness of telecommuting and virtual offices that enable employees to do work anywhere they can access internet, can also be adopted by the education sector to improve the quality of education or learning material delivered to students. Tertiary institutions are not only offering tuition to undergraduate students, but they also offer post-graduate degrees which are more likely to be utilised by people who work and have families to look after. Attending lectures is not always possible for a person who is working or looking after a family.

The ability to access learning material in the comfort of one's home is no longer a dream because it is already possible in the business sector. The sparseness of e-Learning and Information and Communication Technologies (ICT) supported learning systems literature proves that this subject has barely been investigated in South Africa, with the aim of understanding and acquiring the necessary information on alternative ICT supported learning systems that are available and can be used in tertiary institutions. This study will investigate the problems facing South African tertiary institutions in developing a model that will be a guide to implementation of ICT supported systems, by developing a framework for an ICT supported learning system set-up. The researcher identified two problems, namely the availability of resources including hardware, software and networking infrastructure, and the conceptual problem that involves knowledge of developing a model to guide implementation and set-up of an ICT supported learning system. In this study, the conceptual problem will be investigated by conducting empirical research, while the availability of resources will be investigated in the follow up study.

## **RESEARCH QUESTIONS**

The researchers identified the following questions:

- At which stage of ICT supported learning system implementation are the tertiary institutions in South Africa?
- What will the financial implications be?

- What needs to be done to ensure a smooth delivery of learning material to the students?
- Can this be used to create a framework to determine the application of the digital media?

## **RESEARCH METHODOLOGY**

The basis of this study is empirical research. A literature survey of e-Learning and relevant issues was completed and became the basis of the research that was to be validated.

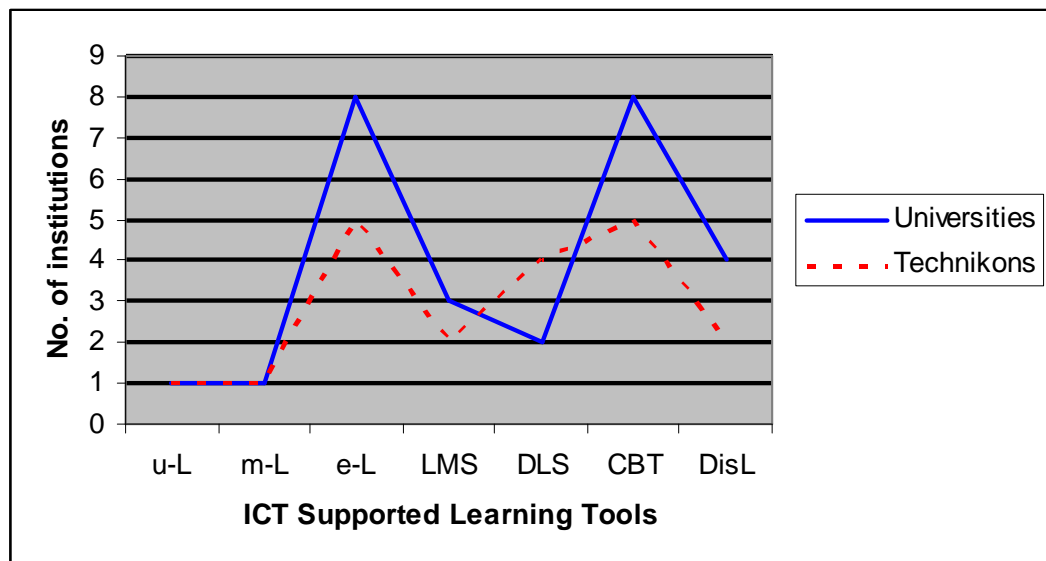
As the focus of the study is to understand the *how* and *why* of e-Learning and its evaluation within the organizational context, the researchers decided to conduct a series of case studies which will be used to develop a model concerning the formulation, adaptation and implementation of e-Learning and its benefits. In summary the research project consisted of three phases: case study, data analysis, and a presentation of the results.

The researcher will use case studies to analyse data collected from a sample made up of respondents from different tertiary institutions in South Africa. Based on the case studies, a framework will be developed for assisting tertiary institutions setting up an ICT supported learning system appropriate for the institution.

## **DISCUSSION OF THE RESULTS**

This section presents a classification of the respondents as well the case studies that were utilised for the gathering of data. A discussion of the research findings is also presented and the current state of affairs in some South African tertiary institutions is examined.

## CLASSIFICATION OF RESPONDENTS



**Figure 1** Types of ICT supported learning systems used by S.A. tertiary institutions

When one looks at Figure 1, it should be quite clear that both technikons and universities view and think of their teaching activities as mainly e-Learning and CBT. Figure 1 also shows that many of the tertiary institutions that are using e-Learning and CBT, have indicated that they are implementing only CBT but are in fact in possession of tools that can be used for the implementation of other ICT supported learning system.

u-Learning, m-Learning and Distance Learning Systems are rated as the lowest because some of the institutions do not know whether to rate themselves as u-Learning practitioners either because they do not know what u-Learning actually is, or they do not have permission from the Department of Education to practice Distance Learning..

## MINI CASE STUDIES

In this section the tertiary institutions under discussion are characterised generically and not identified by name.

## UNIVERSITY OF TECHNOLOGY A

This University of Technology is situated in the heart of South Africa's economic sector in Gauteng (one of nine provinces). More than half of the student population do not have access to computers outside the institution, while more than 80% of the student population have either access to a Telkom phone or own a cellular phone.

It is estimated by respondents that delivering a lecture electronically may cost between R151 and R200 per student. The majority of the student population comes from disadvantaged backgrounds, and increasing tuition fees are not an option. It is therefore up to the institution to prioritise on employing technology (electronics) in their learning system, making it worth the effort. Williamson (2000) emphasises the importance of affordance and perceived affordance that are made available through a computer system interface. This will be an initial high cost to start with but cost will decrease over 2-3 years (until the hardware's next upgrade). Both lecturers and students have limited access after hours. This reduces the option of delivering lectures electronically thereby limiting ICT supported learning systems that can be employed by the institution..

## UNIVERSITY A

This University is one of the two universities situated in the Eastern Cape Province of South Africa. It is one of the universities that is regarded as a traditionally black University because its student population is 100% African. Less than 21% of the student population have access to computers after their computer practical session. More than 80% of the student population have access to or own a cellular phone. This makes mobile learning the most feasible option for the University to implement in order to support contact time with students.

The respondents indicated that this institution implements e-Learning, Distributed Learning Systems, and Computer Based Training. The respondents from this University rated the following ICT tools to ensure that their student population get the course material used at this University: CD-ROM courses, multimedia tools, LAN based systems, wireless network, web-based learning, cellular phones, portals, data projectors, intelligent classrooms, tracking and reporting systems, interactive delivery mode, asynchronous delivery mode, library delivery mode and lecture mode. Delivering a lecture electronically is estimated to cost

between R101 and R150 per student. The availability of cellular phones makes m-Learning a cost-effective option for the University rather than trying to stretch its budget.

#### **UNIVERSITY B**

South African academic institutions are slowly adopting the use of ICT in delivering lectures, such as this University situated in the Northern Province of South Africa. The race composition of the student population is 90% African, 5% coloured and 5% white students.

The respondents indicated that the University is implementing e-Learning tools but their main focus is CBT. CBT is practised in a limited form because of limited funding. They rarely use data projectors (mostly overhead projectors) and students do not have access electronically to any teaching material. The limited access to software and hardware that is needed to implement any ICT supported learning system limit this institution to CBT while it can take advantage of other ICT supported learning systems.

This University is not implementing any ICT supported learning systems. The estimated cost of delivering a lecture is estimated at more than R250 per student because of the initial cost of investing in new technology. Buying the most needed tools will be a significant expense on the University's budget.

#### **UNIVERSITY OF TECHNOLOGY B**

This is a newly merged institution consisting of the technikons from the North West and Northern Gauteng. This institution offers technical degrees to students. The majority of the students are African students (97%) and they come from disadvantaged backgrounds. Less than 80% of the student population has access to a personal computer. Getting access to internet would therefore be a quite difficult mission for students. According to the respondents they are implementing e-Learning, LMS, DLS and Computer-Based Training.

In ensuring quality electronic learning, institutions need to invest in ICT tools requirements, as indicated by the respondent. Implementing electronic learning will cost the institution between R201-R250 per student. Initial investment is very costly for the institution, which is why it has analysed its needs and probability to implement a decent learning system.

## UNIVERSITY C

Universities in Southern Africa are now engaging themselves in e-Learning research and the actual implementation of e-Learning. This University in the Western Cape is one of the universities that are actually implementing e-Learning. The students' racial composition is dominated by white students (80%), with African students at 14%. More than 80% of the student population have access to a computer at home.

According to the respondents this University is implementing segments of e-Learning, Distributed Learning Systems, Computer Based Training and Distance Learning Systems, They use the following tools in their teaching process: e-mail, data projector, transparencies, internet, telephone and cellular phones. The cost of delivering lectures electronically is not expensive because the University owns many ICT tools. According to the respondents, the cost of delivering a lecture online or electronically is less than R50 per student. The ability to implement any ICT supported learning system allows both lecturers and students to enhance the learning and teaching experience, and transformation of the learning process from the traditional brick wall classroom to a virtual learning environment.

## UNIVERSITY D

e-Learning is known for extending borders of institutions to anywhere in the world if they are connected via networks. This University is a major correspondence learning institution in South Africa offering degrees through distance education. The Distributed Learning System sounds like an obvious choice although one should not simply assume that this is the system to be used by the institution without examining the needs and financial capabilities of the University.

Computer hardware and software are easily accessible to both lecturers and students for learning purposes. They use any software that is relevant to teaching and learning online. According to the respondents, all students have access to either a telephone or cellular phone, enabling students to participate in m-Learning support programmes without further investing in new tools. This University utilises the following support tools when delivering learning material to students: e-mail, discussion boards, Internet, and telephone. In accordance with the principle of accessibility of online Distributed Learning Systems, Williamson, 2003, all the above-mentioned tools are appropriate for Distributed Learning Systems (DLS).

The University is specializing in distance education and concentrates all of its IT investment effort on enhancing its educational output for the University. According to the respondents, the costs of delivering a lecture electronically is low, because the initial investment has been recovered throughout the years of employing ICT for the delivery of learning material.

#### **UNIVERSITY E**

This University, situated in the Western Cape, celebrated its 40th anniversary in the year 2000, and is one of the young and dynamic institutions of higher learning in South Africa. Coloured students presently constitute 50% of the student population followed by Africans (40%), Asian (5%), and white students (5%).

More than 50% of the student population have access to computers, which means that students can access learning material posted on the network by lecturers. This University uses e-mail, discussion boards, data projectors, transparencies, and the internet to deliver material to students. Both students and lecturers have access to computer software and hardware, which enables them to use different learning systems. According to the respondents, this University is implementing the following ICT supported learning systems: u-Learning, e-Learning, LMS, Computer Based Training, and the Distance Learning System which was approved by the national Department of Education..

The cost of delivering a lecture electronically is high because the University only started to invest in ICT tools for lecturing purpose in the new millennium. Most of the equipment used for lectures is new. They estimate the cost for delivering learning material electronically as more than R250 per student.

#### **UNIVERSITY F**

This University is situated in the Eastern Cape. The student population composition is White (50%), African (35%), and Asian (15%). More than 60% of the student population has access to computers after hours, which would make implementing any ICT supported learning systems successful. According to the respondents, all students have access or own cellular phones that will help facilitate the implementation of m-Learning. However, the respondents indicated that this University is not implementing any kind of ICT supported learning systems.

## **UNIVERSITY OF TECHNOLOGY C**

This University of Technology is situated in Bloemfontein in the Free State, and it has branches in Welkom and Kimberley. The institution offers technical degrees to its students. The student population composition is African (60%) and White (40%). All the students have access to telephones and cellular phones. More than 40% of the student population has access to a personal computer after school hours.

This institution is using data projectors and transparencies to deliver teaching material during a lecture. However, according to the respondents, the institution is implementing u-Learning, e-Learning, LMS, Distributed Learning Systems Computer Based Training and Distance Learning Systems. This institution is undergoing a merger process, which may affect the financial position of this institution. However, the institution is expected to spend less than R50 per student using ICT supported learning tools. m-Learning is the cheapest option for this institution, because all the students have access to cellular phone.

## **UNIVERSITY G**

Allsop (2001) argues that students should learn in their preferred learning style that can be achieved by using more than one of the learning processes. Some institutions in South Africa such as the University of Stellenbosch and the University of Cape Town pioneered the adoption of learning technologies while other institutions are often avoiding technology in their learning process, hoping that ICT supported learning system is a hype that will eventually fade away.

According to the respondents, more than 80% of the student population have access to cellular phones, which are used mainly for m-Learning to report and give notices to students using SMS. The University is implementing e-Learning, LMS and Computer Based Training. However, some of the respondents, when asked what learning aid they use to deliver learning material, responded that they are using data projectors only.

## **UNIVERSITY H**

This is the biggest University in KwaZulu-Natal. The student racial component is 60% African students, 25% Asia, White 10% and 5% Coloured students. This is a new University that has just merged and consists of 5 campuses. Less than 41% of the student population in this University have access to computers after formal practical sessions. Administra-

tion of the University in the transition period is a daunting task for support staff and academic staff of this institution, and optimizing the work processes would require an enterprise-class system that would enable staff members to report, track and administer the operations of this institution.

It will be naïve to measure the cost of delivering a lecture only on the price of the equipment, without considering the time invested, and maintenance of the system. However, the respondents could only measure cost of delivering a lecture electronically by assigning a price value per student of R51 – R100. It is imperative that a formula for calculating the cost of implementing of ICT supported learning systems and developing a model that will enable the tertiary institutions to trace their point of existence in the development of robust ICT supported learning system that would satisfy the needs and situation of the University better any other system.

#### **GUIDELINES TO THE NEED FOR A MODEL**

The Table below shows the components of the model of that each tertiary institution can use to verify which system to implement, and determine the trade-offs a tertiary institution would have to make in order to implement its preferred ICT supported learning system. Some of the ICT supported learning systems may be cost higher than others, but it may save a lot of time in maintaining and preparation of the system to execute an intended task. It also facilitates a comparison of the learning system against the ICT tools, money and time available to each tertiary institution.

Some of these learning systems utilise common ICT tools in their operation. They are different in the way they are setup and in delivery methods. Some tertiary institutions assume that they are implementing e-Learning because they have computer or a LAN to provide learning material. If they are doing e-Learning, a student should be able access learning material everywhere at anywhere time (Williamson, 2003). The Lotus Corporation (1997) point out that the traditional instructor-centric method of teaching is now giving way to a student-centric model of learning, where information is interpreted by a student rather than being merely received by the student from the lecturer; in that way new knowledge is created, and learning has occurred.

Many educational institutions are experimenting with the use of new technology to enhance the existing learning material delivery methods to their students. However, not all tertiary institutions can afford experimental teaching by using ICT supporting tools because of the factors as outlined by Tracey (1992). He finds that a group's collaborative learning can result in higher level reasoning strategies, greater diversity of ideas, more critical thinking and increased creative responses, compared to individual learning. These barriers to collaborative learning were discussed in detail in chapter 2 and can be surmounted over duration of time, as outlined by Tracey, (1992):

### SUGGESTED MODEL FOR SETTING UP THE ICT SUPPORTED LEARNING SYSTEMS

Experimenting with an ICT supported learning system is an expensive exercise; hence technology tools are expensive. The model illustrated below is adopted from Lubbe (1997). The researcher will use this model to explain the process of choose and implementing an appropriate ICT supported learning system.

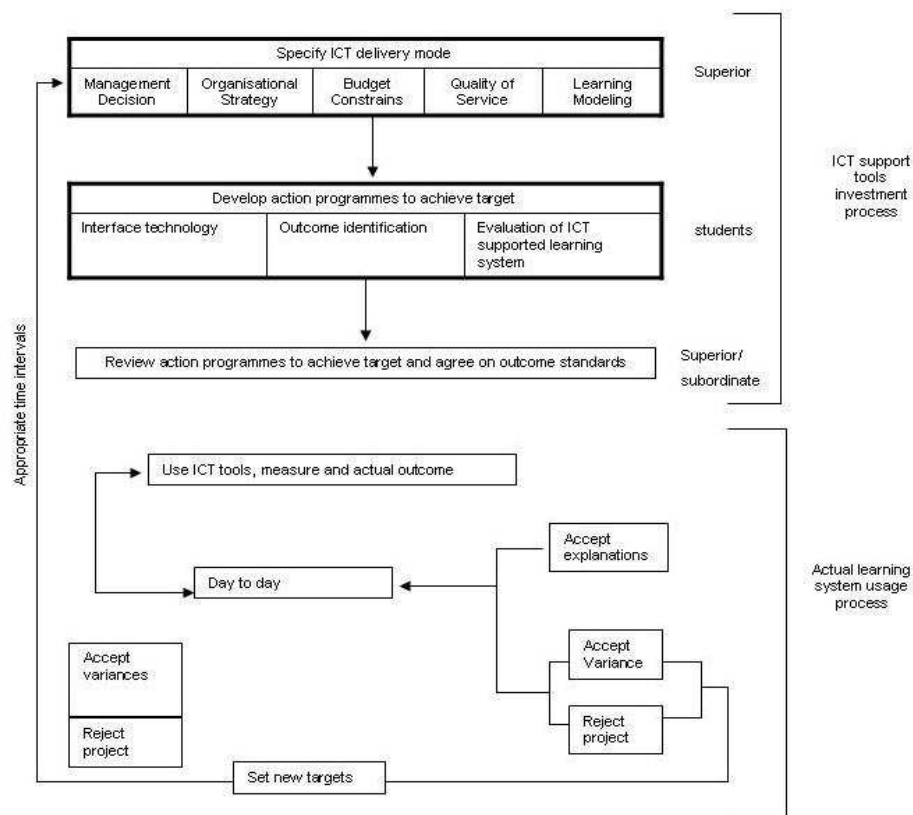
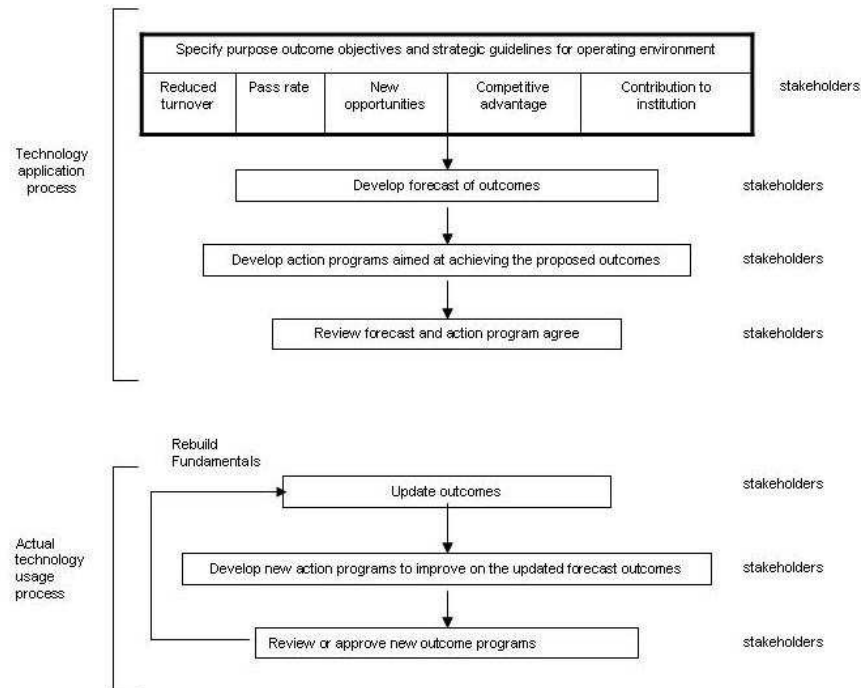


Figure 2 General model for ICT supported learning system set-up, adapted from Lubbe (1997)

Lubbe's model was adapted to help guide tertiary institutions in the designing or choosing a learning system that will successfully satisfy each tertiary institution's requirements and ensure one that is affordable. The institution should assign a task team that will be in-charge of designing and implementing an ICT supported learning system that is desired by the institution which will meet the institution's goals. The team should take into consideration the fact that ICT supported learning systems vary in terms of resources requirements to implement each system. These variations could be ICT tools such as personal computer, data projector, internet etc., as well as time requirement to set-up the system as some of the systems would require the installation of computers in the labs. This model focuses on two main phases of investing in ICT development of the institution, namely the ICT supported tools investment process and the usage of the learning system.

Developing action programmes to achieve targets set by the institution's management to promote the quality of education delivered to their students, would involve deciding on the interface technology that will able the transfer of learning material from the lecturer's computer to the student's computer without being distorted. Outcomes identification is also incorporated into action programmes so that they can be used as targets to be achieved by the institution through the use of an ICT supported learning system.

The project team reviews its action programme to achieve targets and agrees on outcome standards in conjunction with the superior or management of the institution. This process verifies whether the outcomes expected by the user of the system are in-line with the vision of the institution's management, and that the institution's management and subordinates agree on outcome standards. The actual learning system usage process stage of the framework begins where there is a variation between the expected outcome and the actual outcomes; this should be explained by the task team. The variation can lead to two decisions: accepting the explanation and variance or reject the project; where the variance is accepted the system should be running on a day to day basis and measure the outcome again, and then set new targets and restart the process.



**Figure 3** Specific model for ICT supported learning model

The technology application process involves defining the specific purpose, objectives and strategic guidelines for the environment in which the system is expected to operate. The specific objective and strategic guidelines should elaborate the reduced turnover, pass rate, new opportunities to the academic departments and administrative department, as well as competitive advantage over the nearby or competing universities and thus contribute to the overall business functions of the university.

The forecasted outcomes are updated from time to time, during the actual technology usage process. The relevant stakeholders (depending on the institution’s lines of responsibilities) develop new action programmes to improve the updated forecast outcomes to suit new demands of learning styles and to keep up the evolution of technology over the years. New action programmes are then reviewed; if they are good they will be approved that will initiate the rebuilding of fundamentals of the system, so they are in line with the updated system.

## CONCLUSION

Many institutions who are said to be implementing e-Learning or any other ICT supported learning system assume that they are implementing such systems because they can

afford or acquire ICT tools from sponsors. Implementation of any ICT supported learning system goes beyond giving students' unlimited access to computers, and the instructional design and content should be developed to suit individual systems. The content that is designed for CBT will not be possible delivered through m-Learning ICT tools such as cellular phones.

The model presented in this study will assist institutions to develop appropriate ICT supported learning systems.

## **BIBLIOGRAPHY**

This can be supplied upon request.