Perceptions of Information and Communications Technology (ICT) for Instructional Delivery at a University: From Technophobic to Technologically Savvy

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ABSTRACT (REQUIRED)

Changing academics' perceptions of information and communications technology (ICT) in developing countries has always been a challenge. A university in Zimbabwe has witnessed an about-turn in lecturers' perceptions and beliefs about technology, from being negative (technophobic) to positive (technologically savvy) for users of technology. This paper reports on the interplay of factors that resulted in lecturers' buy-in to the use of e-learning as a mode of instructional delivery. The study employed the Actor-Network Theory (ANT) as both a methodological and analytical framework to trace the trajectory of the e-learning program at this university. The conspicuous actors were followed using questionnaires, participant observation, and document analysis as well as tracing them through the trails they left on the e-learning platform. The results show that there are heterogeneous actants which influence lecturers through multiple associations created during implementation of the e-learning program. These resulted in the lecturers' change in perceptions from being technophobic to becoming technologically savvy. This article contributes to the growing body of literature that uses the ANT to understand e-learning as a socio-technical process. The ANT's contribution to explaining the change in lecturers' perceptions lies in its symmetrical power to consider technological developments and human capacity development as equal actants that can exert similar levels of influence on each other to bring about required change.

Keywords (Required)

e-learning, perceptions of lecturers, technophobic, technologically savvy, ICT integration

INTRODUCTION

Information communication technology (ICT) is generally accepted as a modern instructional tool that enables educators to modify the teaching methods they use in order to improve student learning. The use of ICT in education aims to improve the quality of teaching and learning as well as to democratize access to education. For any university to remain globally competitive it is essential for it to change the traditional way of delivering education in order to respond to the rapidly changing conditions in technology and society (Lee and Yeap, 2009). As a result of the fast developing internet and ICT technologies, universities around the world are under pressure to adopt e-learning systems to assist in their instruction. E-learning is generally accepted as a modern instructional process that enables educators to modify the teaching methods they use in order to increase student learning.

For the purpose of this paper, the term 'e-learning' is used to describe technology enhanced learning, whereby appropriate and relevant use of technology is used to augment the learning process. This may also be referred to as 'blended learning' which is often described as 'the mix of traditional methods of teaching, such as face-to-face teaching with online teaching'. Due to its simplicity, this is perhaps the most common meaning of blended learning used in a higher education context (Wong, 2012).

Florence Martin and Michele A Parker (cited in Masego, Nkomazana and Haverkamp, 2014) explored the adoption of synchronous online classrooms at a university in a developing country, using Roger's model of diffusion of innovation. They found that availability and ease of use, and efficiency and reliability of the system were key extrinsic motivators, although the faculty were wary of using particular tools if they lacked confidence. Beyond making technology available and acquiring the relevant support for projects, there is a need to provide training and support for faculty and learners to maximize the adoption and integration of technology effectively. Training ensures they have the requisite skills to take full advantage of the technology and minimize frustration. Moreover, faculty and students are important stakeholders to engage around developing a shared vision and receiving feedback since e-learning integration is implemented for the benefit of their teaching and learning (Masego, Kkomazana and Haverkamp, 2014).

In another study, perceptions of academic staff towards the adoption of blended learning in the Faculty of Education at a developing university in South Africa, the Technology Acceptance Model (TAM) was selected because it is robust and useful for determining how work-related information technology (IT) innovations are adopted by employees for their work (Tshabalala, 2014). It was found that the following challenges hindering the implementation of e-learning are:

- the University lacks comprehensive institutional and organizational mechanisms for facilitating the development and growth of e-learning;

- lack of a policy that promotes e-learning within teaching and learning;

- lack of quality management processes to enhance e-learning;

- limited initiatives for the professional development of staff to integrate e-learning within existing curricula;

- no structures in place for technical and system support;

- lack of support from leadership for change management; and

- considerable funding is needed to implement a successful e-learning program.

Higher education in developing countries will not continue to progress at a pace in keeping with the developed world without taking ICT and e-learning in particular, into consideration. Zimbabwe's ICT Policy (2005) places a premium on the importance of ICTs in education and human resource development, and emphasizes the promotion of equal access to ICT to enable education and training in all parts of the country, including in disadvantaged communities. The policy highlights the need to build skills in the sector, promoting software development, e-learning and embedding of ICT literacy in the pedagogy of schools, colleges and universities. Before the national ICT policy the Nziramasanga Education Commission Report (1999) had recommended the introduction and mainstreaming of computer- based teaching and learning in the pedagogy of schools, colleges and institutions of higher learning. It is clear from these observations that e-learning is destined to become part of the process of teaching and learning at schools and universities in Zimbabwe.

Although there are glowing statistics and success stories of e-learning adoption elsewhere in the world, the Zimbabwean situation remains below expectation and many key players, including lecturers in the education sector, are still apprehensive about technology adoption (Chiome, 2013). Issues pertaining to e-learning are still a new phenomenon in the Zimbabwean education system. E-learning has not yet been developed to its full potential. Universities in Zimbabwe are still grappling with the new technological developments, trying to see how they might be used to create a powerful learning environment.

Many universities in Zimbabwe have taken a keen interest in e-learning, and most universities are putting in place the relevant ICT infrastructure and emphasis on developing e-learning platforms (Chitanana, Makaza and Madzima, 2008). Recently, the Zimbabwe Research and Education Network (ZimREN) was established to put in place a robust fiber-optic backbone dedicated to academic and research activities in institutions of higher learning. In addition, ZimREN is expected to use its collective bargaining power advantage to negotiate improved bandwidth at a more affordable cost and to coordinate development of national network infrastructures (Harle, 2010).

It cannot however, be assumed that the provision of technical infrastructure will somehow cause lecturers to use it successfully to enhance their teaching and student learning. It does not also suit that the mere definition of policy in this area will bring about the desired results, as the new ideas have to be adopted first by all those involved. Many factors act to determine how e-learning is accepted by key players at institutions. This paper seeks to examine the factors that led to the positive perceptions of e-learning and ICT adoption at a university in Zimbabwe. This is achieved by tracing the trajectory that is described by the lecturers during their transition from being technophobic to becoming technologically savvy.

The approach used in this paper involves the Actor Network Theory (ANT) because of the combinations of both human and non-human actors involved in e-learning. In this paper the main actors are identified, as well as the role they play in changing the lecturers' views and use of e-learning, and the way they have attempted to convince others to join them in the use of e-learning as a mode of instructional delivery.

PURPOSE OF THE STUDY

The aim of the study was to explore the e-learning dynamics that have resulted in the change in perceptions of lecturers at this university. The study addressed the following research question: what are

the factors that are at play in the implementation of e-learning at this university? The focus of the study was to explore the linkages between the social, technical and natural factors that resulted in the change in lecturers' perceptions and their use of e-learning, from previously being technophobic to now being technologically savvy.

THEORETICAL FRAMEWORK
In this section we put forward the argument as to how the ANT can offer a unique lens for understanding how universities can organize and implement successful e-learning programs. The ANT provides a path in terms of a research methodology and theoretical framework that can be used to study complex phenomena such as the adoption and sustainable use of e-learning in universities. The ANT has a unique vocabulary that distinguishes it from other science and technology theoretical foundations which may be used to study e-learning. Most relevant are its ideas of heterogeneous networks, actants and the sociology of translation. In this section we give a brief introduction of these concepts and show their relevance to the study of e-learning.

Actor Network Theory
The ANT was developed within science and technology studies by Michel Callon, Bruno Latour and John Law during the course of the 1980s as a recognition that actors build networks combining technical and social elements, and that the elements of these networks (including those entrepreneurs who have engineered the network) are simultaneously both constituted and shaped within those networks (Callon, 1987). Unlike many other science and technology studies theories, the ANT assumes that social practice involves networks that consist of things working together, and argues that successful social practice is the result of "a process of 'heterogeneous engineering' in which bits and pieces from the social, the technical, the conceptual, and the textual are fitted together" (Law, 1992, p. 380). The idea of heterogeneity refers to the bits and pieces that make the network, which might include people, technologies, materials, and processes, all being referred to as actants.

As a theoretical framework the ANT is committed to symmetrical analysis, a principle which holds that the material and non-human elements of any network should be treated analytically in the same way as the social and human elements (Latour, 1992). The ANT provides a set of tools, sensibilities and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the web of relations within which they are located. It assumes that nothing has reality or form outside the enactment of those relations (Fenwick and Edwards, 2010; Law, 2007a).

Thus the ANT aims at exploring how humans sustain (or fail to sustain) social processes. Its object of analysis is not to explain the size of any network, but rather to elucidate how any network grows in influence and/or contracts. The analytical interest is to illuminate the processes rather than explain end results, such as the size of a network at any point in time (Callon and Latour, 1981). Hence the ANT provides a promising perspective to holistic studies that focus on complex networks of heterogeneous actors, including people, ideals, symbolic constructions and material elements, which are seen as equally important during analysis.

Moments of Translation
Translation is the central process through which any network expands or contracts. The notion of translation is therefore an important tool that can be used to describe and analyze how an actor network grows, changes and stabilizes (or not) during the process of e-learning implementation. Translation suggests that the effectiveness of deployment of the technology is dependent on how the actor network

comprising both the human and nonhuman actants is created and strengthened over time (Callon, 1986; Latour, 1999). In every network there are continuous chains of translations which take place along its links to align and keep the actors involved and to create and stabilize the actor networks (Latour, 1987).

Translation leads to the alignment of the different actors and gradual institutionalization or routinization of information systems such as e-learning programs, which ultimately leads to development of durable networks (Braa, Monteiro and Sahay, 2004). Callon (1986) identifies four moments of translation, namely problematization, interessement, enrolment, and mobilization, which are critical to the development of networked processes like e-learning. The unfolding of these moments of translation is driven by principal actors in the network; every actor network has such actors who are crucial for the creation and development of the network.

During the problematization moment the principal actors in a network strive to make themselves indispensable to the other entities by defining the nature of the problem, and forcing or persuading other actors to accept the meaning which they have attached to the problem at hand. At the second stage, interessement, the principal actors lock other actors into place by imposing themselves and defining the linkages between others. Enrolment involves the principal actors in defining the roles that other actors in the network are supposed to play, as well as defining how actors will relate to one another within the network. The final moment, mobilization, involves the principal actors using the power of their passive agent allies in the network to make themselves the representatives or spokespeople for the network. Table 1 summarizes the four moments of translation.

Problematization	The primary actor defines the problem, the solution, and identifies the relevant actors.
Interessement	The primary actor convinces other actors that its solution is better than other solutions.
Enrolment	Roles are assigned to the actors accepting the solution.
Mobilizsation	Actors become spokespersons.

Table 1: Summary of the four moments of translation

In a successful actor network, the actants manage to reach agreement and associate through translations to join forces and are able to reach a common definition of the problem. The network aligns its actors, who otherwise have different initial agendas. Conversely, unsuccessful processes of translation weaken the actor network (Callon, 1991).

Callon (1986) introduces convergence and irreversibility as critical elements of successful networks. According to Callon (1986, p. 144) "Convergence measures the extent to which the process of translation and its circulation of intermediaries leads to agreement". This involves alignment, or the extent to which translation "generates a shared space, equivalence and commensurability" (Callon, 1986, p. 145). Even though there are some developments which may in principle be contingent and reversible, most successful translations reach a moment of irreversibility (Callon, 1991, p. 150) where it becomes

impossible to go back to a point where that translation needs to start afresh. This argument is relevant to the introduction and sustenance of educational programs such as e-learning in university education, where the continued use and development of the program are expected. The black-boxed (closed) e-learning program will only need to be reopened to see how the parts that it is made out of can be further strengthened.

A Brief Literature Review on E-Learning Implementation

There is a lack of research in Zimbabwean universities on the adoption of e-learning from a socio-technical perspective. There is very little literature that addresses the technical aspects of e-learning from a socio-technical agency basis. Instead, technological determinist and social determinist accounts dominate debates and adoption decisions (Mlitwa, 2005). These approaches maintain asymmetry between technology and the human actors in their analysis. For example, a study by Chitanana (2008) tried to shed light on the state of e-learning at universities in Zimbabwe from lecturers' perspectives. The study, which assessed the adoption of e-learning at a university in Zimbabwe, shows that e-learning had started at a very slow pace. Lack of a critical mass of early users who understand the value of e-learning in higher education institutions (HEIs) was identified as a major challenge to adoption of e-learning. This study argues that perceptions of lecturers and the speed at which they embrace e-learning depend on their level of understanding of e-learning technology. However, for lecturers' perceptions to be fully understood, their interaction with all the other critical players in e-learning need to be explored using the same lens of analysis.

In recent years, there has been is a growing body of literature that uses the ANT to reconcile conflicting perspectives on the position of learning technologies in social processes (Mlitwa and Van Belle, 2010; Trusler and Van Belle, 2005). The ultimate position should be that e-learning should be conceptualized and treated as socio-technical networks. This view will enable coherent engagements between humans (educators, students, administrators), structures (learning groups, educator groups, institutions, policies), technology (computers, e-learning platforms), and the learning processes in the network. Such an approach will contribute significantly towards the understanding of how lecturers can effectively implement e-learning within the varying contexts in which they are found.

Nevertheless, a snap view of the literature has shown that in many cases the adoption of e-learning at universities is mainly the result of decisions taken by top management and imposed on educators. This compulsory uptake will result in very minimal engagement with the system by academics (Van der Merwe, 2004). Mlitwa (2005) notes that at some institutions there are no policies or forums among the community of users to engage the choice of e-learning systems.

The trend in Southern Africa has been that e-learning and adoption of learning management systems (LMS) is largely driven and championed by directors of Information Communication Services. These approaches privilege technology and its affordances, which are taken as a given (Mlitwa and Van Belle, 2010). There is no full interactive engagement between the social and technical actors in such e-learning environments. There is minimal literature giving a satisfactory account of the interwoven relationship between technology and organizational transformations in e-learning (Mlitwa and Van Belle, 2010).

Due to the ever-changing nature of information and communication technologies, there is a constant demand and expectation for universities to incorporate increasing levels of technology into the design and delivery of their curriculum. This has placed academic staff sometimes in a difficult situation with

expectations of significant change within a very short and often unrealistic time-frame. One of the challenges of teaching with technology, according to (Wong, (2012, p 14)is: 'You cannot possibly keep up with the technology. The paradox of technology enhanced education is that technology changes very rapidly and human beings change very slowly".

Our study, however, will show that faculty did move from what we call "technophobic" (fear of technology) to "technologically savvy" (operating with ease).

RESEARCH METHODOLOGY

As stated previously, the methodology employed in this study is based on the ANT framework (Latour, 2004; Latour and Woolgar, 1986; Law, 2007b). The ANT is a theoretical framework which describes the world as a network or hybrid of both the social and technological actants. The ANT's postulation that the social and technological should be studied on an equal footing is most productive when applied to cases in which the social and technological are embedded in each other (Elbanna, 2009), as in e-learning programs. The ANT allows researchers to study both people and technologies using the same tools.

Data collection methods used in the research were meant to follow the actors (Latour, 2005). These included semi-structured interviews with lecturers, chairpersons of departments, university administration, ICT directors and technicians, review of documentation such as university strategic plans, senate meeting minutes and reports, university websites, discussion forums and blog posts and participatory observation. Google analytics was also used to trace users as they interacted with e-learning resources of various types, including e-journals and e-books. Actors were also followed through the trails they left on the discussion forms of the e-learning portal. This cluster of methods was used because large amounts of data were needed to assemble the e-learning system.

The ANT analysis in this study is based on the careful reading of textual documents such as transcripts of interviews, university strategic plans, senate meeting minutes and reports, as well as university websites, discussion forums and blog posts, academic articles, and various other reports. The texts were analyzed for references to associations that were formed among the actants in the e-learning network. Following several iterations of analysis, one complex network was drawn (see Figure 1). Due to the large number of actors and possible relationships, a two-dimensional matrix was used to explore all possible relationships between each pair of actants. The results are presented in the next section.

RESEARCH FINDINGS

In this section the findings of the study are presented. The use of the ANT as both methodological and analytical lens shows that e-learning is seen as a socio-technical network that comprises both human and nonhuman actors. Hence the focus of data analysis was to identify the principal actors and to map out the assemblage of the associations and ties they created which influenced the change of lecturers' perceptions of e-learning at this university.

Identification of Actants

The first task of an ANT analysis is to identify the actors and the problem they are trying to solve. Analysis of the data revealed that the e-learning network at this university comprised various conspicuous actors ants, which included the human actors (lecturers, students, ICT staff, university administrators), structures (departments, senate, library, institutional policies) and technology

(computers, internet connectivity, computers networks, e-learning systems). These actors through their agency are involved in multiple associations that have resulted in a fairly stabilized and hence contributed to successful e-learning programs that has turned lecturers from their initial technophobic tendencies into being technologically savvy. Figure 1 shows an assembly of the web of ties and associations that the actors created during their interaction in implementation of the university's e-learning program.
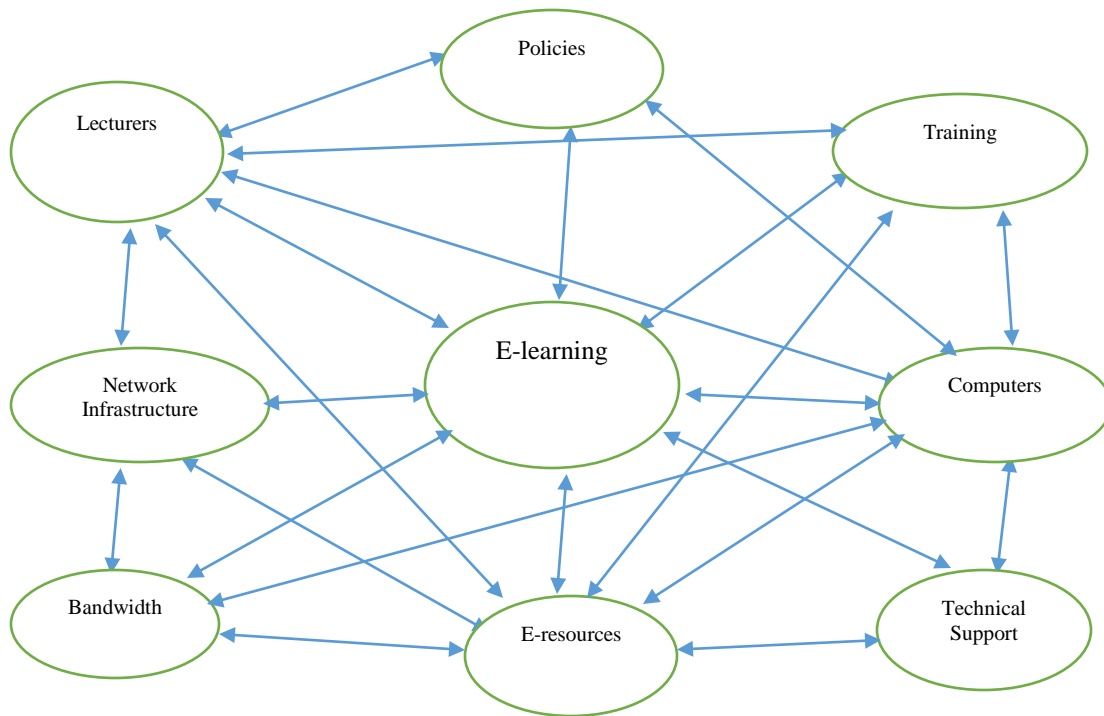
Figure 1: University e-learning actor network associations

Mapping the Essential Factors

ICT Network Infrastructure

The university started off with a wired Local Area Network (LAN) which has been upgraded to provide a robust fiber-optic network backbone with Wi-Fi connectivity. From 2009 to 2014, the university has also increased its bandwidth from a mere 1 Mbs to the current 380 Mbs. This internet connectivity was improved from a simple dial-up connectivity through dedicated lines, radio link, satellite and the current optic-fiber connectivity. This has resulted in faster internet connectivity that gives users easy access to internet services and access to electronic resources. The lecturers interviewed registered their satisfaction with the speed of the internet and the quality service they received.

Provision of Computers

The university started with two computer laboratories of 40 computers each. One of the laboratories was used for staff and student training in basic ICT skills, and the other was available for use by both

students and staff outside learning time. Since 2009 the university has had a phenomenal increase in the number of computers for student use. Furthermore, the university has adopted the bring-your-own-device (BYOD) concept to improve on students' access to computers. BYOD has resulted in large numbers of computing devices, including laptops, tablet computers and smart phones, being added to the university campus-wide network by both lecturers and students for teaching and learning. University technicians help students and staff with hardware and connectivity problems that they face, especially those who bring their own devices. This has seen the student to computer ratio improving from 10: 1 to almost 1:1.

E-learning Portal
The university e-learning portal was developed and launched in 2005, with an average of 20 lecturers. To date, out of the 492 lecturers 393 are active users of the platform. This portal functions as an LMS for learning content and assessment feedback. Lecturers upload lecturer materials such as presentations, lecture notes, handouts and links to online resources. The portal allows lecturers to link up with their students through discussion forms, instant messaging and live chats. In addition to learning content and materials, students also obtain their semester results and fee statements from the portal.

Lecturer Training
The university introduced lecturer training in both technology and pedagogical skills through the Postgraduate Diploma in Tertiary Education. This course is meant for all lecturers who are teaching without a teaching qualification. In addition to the foundations of education and teaching principles, the course offers training in instructional technology where issues of e-learning and technology integration, instructional design, sound teaching and learning practice are dealt with. Interviews with graduates from this program revealed that this course has helped to build capacity and confidence among lecturers to use technology in their teaching. The level of confidence, commitment and motivation among lecturers has been increased, and they are now committed to continuous improvement in the use of technology in their teaching. During interviews lecturers would not hide their feelings of ownership, pride and competence towards their use of technology in their teaching. In addition, the university offers tailor-made workshops to deal with capacity building, accessing e-learning resources, internet searching, presentation packages and Turnitin, among others.

Library Support
The university library is one of the key actors in the e-learning network at this university. The library has an electronic resources section that allows both students and lecturers to access internet-based teaching and learning resources. Through the electronic library section the university subscribes to 19 e-book collections and 52 e-journal databases. In addition, the library has an institutional repository which is a collection of all research output by lecturers and students at the university. The library also offers training on internet surfing and how to access e-resources. The training supports the link between lecturers and e-learning materials. Lecturers noted that through this training they were able to gain confidence in using the electronic resources that are available. During the two year period the actors were followed, a Google analytic report shows that there were 393 users and that of these 252 were returning users (Table 2). These users were interacting with e-journals and e-books collections, as shown in Tables 3 and 4 below.

No.	User type	Acquisition			Behavior		
		Sessions	% New section	New users	Bounce rate	Pages/ session	Average session duration
		1038	**62.14**	**393**	**25.63**	**8.04**	**00:07:36**
1	New visitors	393	100	393	22.95	8.44	00:07:25
2	Returning visitors	252	0 00	0	30.03	7.39	00:07:53

Table 2: Type of e-learning users

No.	E-JOURNAL DATABASE	Total events	Unique events
		6717 (44.51%)	**3842 (51.81%)**
1	Emerald Insight	1409 (20.98%)	1047 (19.54%)
2	Jstor Journal Storage	913 (13.59%)	737 (13.76%)
3	Ebscohost	749 (11.15%)	583 (10.88%)
4	Proquest Central	315 (4.69%)	229 (4.27%)
5	Sage Journals Online	285 (4.24%)	225 (4.20%)
6	Taylor And Francis Online	279 (4.15%)	219 (4.09%)
7	Wiley Online Library	216 (3.22%)	165 (3.08%)
8	Agora	107 (1.59%)	61 (1.14%)
9	Oxford Journals	101 (1.50%)	75 (1.40%)
10	Sabinet African Online Journals	83 (1.24%)	69 (1.29%)

Table 3: Rate of use of e-journals

No.	E-BOOK DATABASE	Total events	Unique events
		6451 47.50%	**3142 47.53%**
1	E-Brary	**2012 (31.19%)**	1389 (29.95%)
2	Ebscohorst	959 (14.87%)	611 (13.17%)
3	E-Book Library	806 (12.49%)	603 (13.00%)
4	Emerald Business Management and Economics Collection	638 (9.89%)	367 (7.91%)
5	Safari Business Books Online	454 (7.04%)	331 (7.14%)
6	Dowsomera	413 (6.40%)	323 (6.96%)
7	Proquest Central	150 (2.33%)	131 (2.82%)
8	African Digital Library	135 (2.09%)	113 (2.44%)
9	Project Muse e-Books	108 (1.67%)	81 (1.75%)
10	Google Books	56 (0.87%)	49 (1.06%)

Table 4: Rate of use of e-book collections

Institutional Policies

Polices usually create awareness amongst staff and students about the need to adopt e-learning. The university senate has passed a number of policies that guide the use of various ICT resources, such as a University ICT Policy, Open Access Policy and Institutional Repository Policy. The Institutional Repository Policy has improved the link between lecturers and electronic resources, with lecturers not

only acting as consumers of information but as information producers who are able to upload their conference and research papers. The Institutional Repository Policy together with the Intellectual Property Policy addressed lecturers' concerns about intellectual property rights, and these policies have persuaded lecturers to upload their research output without fear of losing their intellectual property rights.

Related to policies the other actants which come into play in the e-learning actor network at the university are the various university committees, such as the Computer Committee, Website Committee and the Library Committee. For example, the Computer Committee has enacted a computer replacement policy which ensures that old computers are replaced at the rate of 300 computers per semester. This has seen new, state-of-the-art computer hardware being introduced at the university. The new computers have encouraged lecturers to use the internet since they no longer face challenges of delays due to slow processing speed.

Technological Support
The role of the Information Technology Services (ITS) department at the university is to maintain a robust network backbone and ensure that university computers are in good working order. In addition, the department offers technical and training support to both lecturers and students. Lecturers and students are given training in basic ICT skills to enable them to be able to use computers comfortably. Users are also assisted in troubleshooting and solving hardware problems on their personal computers. Basic ICT training is assumed in the training that is offered by the electronic resource library section.

University Administration
According to Shraim (2010) it does not matter whether the academic staff has the interest or that technology is in place – if there is no political will, nothing will change. The university administration becomes one of the conspicuous actors in the e-learning through their political will, by putting policies and committees in place to guide rolling out of the e-learning program. The university administration's commitment to e-learning is reflected by the Vice Chancellor's keen interest in ICT issues. The ITS directors report directly to the Vice Chancellor on issues of ICT development at the university; ICT is one of the university's key result areas which is monitored through the results-based management system. The ICT Purchasing Committee, which is responsible for buying computers and related hardware, is also under the Vice Chancellor's office; this has facilitated the purchasing of computers and related hardware such as data projectors, whiteboards and relevant e-learning software.

MOMENTS OF TRANSLATION AND CHANGING E-LEARNING PERCEPTIONS
This section is a collection of the traces that were left by the actors described above as they went through the university's e-learning trajectory. Collan's moments of translation provide a useful vocabulary that is used to describe how lecturers were translated by the associations and the other actors they interacted with in the e-learning program. The first stage of an ANT translation is problematization. At this stage the principal actors defines the problem to be solved by the network, which emerges from the association of the targeted actors. At this university, the primary actors included the university administration, faculty deans and departmental chairpersons. These are members of the senate, the highest decision-making board on academic issues. These actors enact policies that guide the rolling out of the e-learning program. The Strategic Plan of the university was presented to the senate, and through the senate departments were tasked to come up with action plans on how they were going to implement the university's vision of making e-learning the principal mode of instruction. A common understanding

of what constitutes e-learning at the university was reached, and each department produced a results-based management plan to guide the lecturers in implementing e-learning.

The acceptance of the goal of the university to embrace e-learning as a principal mode of instructional delivery and student learning was the Obligatory Passage Point (OPP) for entering the emerging network. The OPP is that point which each of the actors involved need to pass to satisfy their interests and the university's interests. In this case the OPP was related to the university policies, training and technology. It was necessary that the university drafted policies that would provide direction as to how the university wanted its e-learning program to progress. Training was required to build capacity and expertise among lecturers to implement the e-learning program. Technology infrastructure and internet connectivity was needed to facilitate the use of the internet for teaching and learning.

With the deans at faculty level and chairpersons at department level as principal actors, interessement of other lecturers was sought. In this second moment of e-learning translation the focus is on actor-network building and how actors seek alliances that share the same interests. The university Strategic Plan (1999–2005) provided some direction on the development of e-learning by stating the role of ICT in HEIs and learning. The Strategic Plan initiated the institutionalization process by defining the mandate for university lecturers to coordinate processes, and by recognizing the need to build capacity with regard to technology resources and training.

Lecturers' interessement was therefore carried out through efforts made by the Faculty of Education and the library to convince them that e-learning was the best option in as far as teaching and learning was concerned at HEIs. Hence the Faculty of Education and the university library played crucial roles in training and building e-learning awareness. These efforts helped to lock into place all the actors who had passed the OPP, so that their reciprocal relations are invested in some interest.

These targeted actors needed to be enrolled into the e-learning actor network. The enrolment started with approval of the university e-learning program by the senate. Through coordination and alignment of interests, common ground and multiple networks of alliances are produced, when actors accept the roles assigned to them by the principal actors. The actors identify themselves with the problem solution. This leads to the final stage of the translation, in which the network starts to speak as one and starts to operate as a recognizable actor. Departments now claim ownership of the program; this resulted in commitment from the policy maker and practitioner to work together for the program's success. Lecturers now feel engaged and are actively involved in the program as indicated by the Google Analytic report on their usage of electronic resources, as well as their participation in e-learning portal discussion forums.

As the program network grows, more resources will be needed. Through institutionalization the e-learning program is getting funding from the university's central budget to cover operational costs and infrastructural development. Policies such as computer replacement ensure that computer hardware is kept up to date. The BOYD principle has relieved the university of the pressure exerted by increased demand for computers from both lecturers and students. The university is now focusing on providing a robust network backbone and bandwidth to ensure unlimited access to internet and electronic resources.

At the initial stages of e-learning there were challenges which included problems with lecturers and students who had low skills in using computers and the e-learning platform. Most lecturers and students were using computers for the first time and had not had any formal training in the use of ICT for

teaching and learning respectively. To mitigate this challenge the university introduced ICT training for both lecturers and students. Special face-to-face training in basic ICT skills and pedagogical skills were conducted to help lecturers to build their confidence in the use of e-learning technology in their teaching.

MISSING RELATIONSHIPS

The scenario described above does not imply that everything is connected; some disconnections in the e-learning program were identified. The analysis revealed some missing links between assessment and evaluation as agents of improvement in the e-learning program. Assessment and evaluation should be viewed as actors which can be used to destabilize the black-boxed actor network so that new cycles of translation can be initiated to improve on the e-learning program. Furthermore, the e-learning program has basically remained transmissive rather than the recommended constructivist model of teaching. As opposed to the transmissive model, a constructivist model describes learning as the innovative and participative process that can be enhanced through e-learning platforms. The continued use of transmissive model instruction points to a mis-tier between the pedagogical training and the methods of teaching employed by lecturers. Training has focused a great deal on ICT skills, which together with other actants such as increased bandwidth and access to high-quality computers has significantly changed the perceptions of lecturers of the value of e-learning in their teaching.

DISCUSSION

To understand the implementation of e-learning by lecturers and how their perceptions can be positively changed, we need to think of e-learning as networks of heterogeneous actors. E-learning should be viewed as a socio-technical network that comprises computers, network applications, learning material, learners, and lecturers, among other actors. The significance of the ANT's concept of network is in its continually negotiated network processes, where both human and nonhuman actors have a mutual and causal influence (Toumi, 2001). According to Toumi (2001), each actor can only be viewed in relation to and not separate from other actors or parts of the network. These actors assume identities according to prevailing strategies of interaction (Hanseth and Monteiro, 1998) and should be mutually engaging and supportive of each other.

Looking at e-learning through an ANT lens therefore requires us to recognize the negotiating interplay between the human and nonhuman actors in the e-learning environment. We should focus our attention on exploring the actors' practices, and looking for the relations, associations or ties they make. Technology can no longer be taken for granted: we may not view technology as just a neutral, passive entity, but should see it as one of the principal actors which needs to be treated at the same analytical level as humans.

One major contribution of the ANT to explaining the change in lecturers' perceptions is symmetrical power that sees the technological developments and the human capacity development as actants which can exert similar levels of influence on each other to bring about the required change. The ANT description of the results of this study helps us to understand the multiplicity of influences throughout e-learning translation at this university:, that is, e-learning translation is an active collective creation process. The active e-learning actor network grows, enrolling actors and translating them into what is wanted and rectifying their translation in such a way that none of them can desire anything else.

When they are turned from being technophobic into being technologically savvy, the actors enter into a state of flow with regard to the use of e-learning. When actors get into a flow state, they become absorbed in their activities and might be unable to recognize changes in their surroundings. This will be time to open the black box with the aim of improving the system.

CONCLUSION

The change in lecturers' perceptions may be viewed as a result of the associations created by heterogeneous actors in a network of aligned interests which results in a stable network. Lecturers need to be e-enabled to take advantage of the use of technology, by creating an interactive environment including a clear policy for raising awareness, a training program and improving infrastructure. However, sustained use of e-learning issues of accessibility and connectivity and other technical issues should be treated as temporary, and emphasis should be placed on e-learning as a networked process rather than as a tool.

To ensure translation of lecturers from being technophobic to technologically savvy, the e-learning approach should be part of a systematic integration of technology into the learning processes of the university rather than an imposed project.

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