

Technology for teaching and learning in higher education contexts: Activity theory and actor network theory analytical perspectives

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ABSTRACT

There is a growing body of literature which argues that technology enhances teaching and learning processes in higher education. The adoption of teaching and learning technology such as elearning and the learning management systems (LMSs) is also on the rise among higher education institutions. The patterns of this growing trend are also incoherent and inconsistent. In addition, there is no general agreement on the meaning of concepts of adoption and use within academia. In the midst of the existing conceptual stampede it remains difficult to adequately explain emerging patterns. This paper explores a possible framework for the analysis of objective (goal)-directed applications of technology in a teaching and learning environments, and implications thereof. The work of Miettinen, of Rajkumar, and as well as Miettinen and Hasu encourages the use of Activity Theory (AT) for this purpose. The paper draws on three case studies from technology usability studies to explore a possible AT analytical framework. AT is found to be helpful for analysis of practical applications of technology, but not without shortcomings. AT tends to advocate an instrumentalist view of technology as a neutral tool. Both AT and Actor Network Theory (ANT) subscribe to the contextual embedded nature of technology but differ on implications and the status of technology in a socio-technical process. ANT supports the critical view of technology as value-laden, thus encouraging the critical engagement with a technology in social environments. Its symmetrical assumptions however, limit its scope in accounting for differences between human cognitive capabilities and the non-cognitive nature of artefacts. Additional studies towards an AT and ANT framework of contextualising e-learning and LMSs are recommended

INTRODUCTION

Technological innovation has changed the social, political, economic, and cultural fabric of life since the end of the Cold War (Taylor, 2001). Information and communication technology (ICT) has been instrumental in social transformations – from the industrial society of the 20th century to the ‘network society’ of the new age of ‘Informationalism’ - where even intercontinental neighbours are now one button-push away (Castells, 1996).

Higher education has not been left untouched, and predictions are that in just a few decades time the pressure of the changing times will have reduced big university campuses into relics. Universities as we know them, according to Drucker (1997), just won't survive. In the context of higher education there is a shift from the pursuit of knowledge for its own sake, to a more pragmatic economically-oriented paradigm (Gibbons, 1998). Information, awareness, and the ability to use information are key features of knowledge. Knowledge production and dissemination, research and teaching are no longer self-contained but involve interactions with a greater variety of knowledge producers than in the past. Universities worldwide are improving their competitiveness in the new and challenging distributed knowledge production system (Mlitwa, 2005). In this quest, they are making extensive use of new kinds of ICTs - to attract and teach new students, and to improve co-operation with different stakeholders (Gutlig, 1999; Middlehurst, 2003). The reaction in South Africa has been a move by the more established higher

education institutions from cultural conservatism to a more entrepreneurial university (Gutlig, 1999; van der Merwe, 2004).

Such traditional universities are dealing with the pressures of globalisation, the technology revolution, new kinds of competition, and the global push for an information society. Survival however, will depend on how universities re-position themselves in distributed knowledge production systems, the type of partnerships they forge (Gibbons, 1998; van der Merwe, 2004), and how they use available tools and resources such as ICT to improve their activities (Mlitwa, 2005). ICT for teaching and learning should be conceptually and operationally clarified if it is to have a positive impact. The purpose of this paper therefore, is to find a theoretical framework within which eLearning practices in teaching and learning at higher education institutions can be contextualised.

The paper opens with a survey of literature about the role of technology in a changing higher education sector. Drawing on a recent investigation into the meanings and implications of ICT for teaching and learning by educators, practitioners and researchers working in higher education institutions in South Africa (Cerniewicz, et al., 2005), it shows the incoherence in existing concepts and held views on technology in education. Andrew Feenberg's (2003) perspectives on technology and social contexts are used to categorise dominant assumptions concerning technology in teaching and learning. Activity theory (AT) is then outlined and motivated as an analytical framework. The author acknowledges dominant arguments that call for effective, innovative or appropriate uses of technology in the literature, and draws on case studies from the technology usability discipline to investigate the meaning and implications of technology usability. The paper investigates these meanings can contribute towards the development of an analytical framework for eLearning applications.

DIVERSE MEANINGS OF EDUCATIONAL ICT

ICTs may play a key role in effective responses by universities to the challenges posed by changing global, local, and technology related forces. However this requires the addressing of a pervasive lack of conceptual clarity concerning the nature and uses of ICT.

In research reports, government and higher education institutional policy documents as well as statements by academics and IT practitioners, technology is generally discussed in relation to its multiple uses (Mlitwa, 2005). The expanding range of technology uses leads to a proliferation of the meanings and implications attached to technology. In tertiary education reference is made to 'educational technologies' (UCT, 2003), 'learning and eLearning technologies' (Badenhorst and de Beer, 2004), 'online teaching and learning technologies' (Van der Merwe and Möller, 2004), 'digital library technologies' (Peters, 2002), and 'digital learning objects' (Smith, 2004), among others. Technology is further viewed within the context of communication, as a communication tool and or network. Relevant descriptions include 'IT networks and communication protocols' (University of Natal, 2003), 'electronic Information and Communication Technologies' (Van der Merwe and Pool, 2002), 'information agents' (Razek, et al. 2003), or just 'communication technology' (Blanchette and Kanuka, 1999). These terms are often used inconsistently, with minimal or no attempt to define them (Mlitwa, 2005).

Many definitions emphasise the links between technology and knowledge. As a tool for example, it can extend human capabilities to solve problems (McLuhan, 1994), and to assist students in the acquisition of knowledge (Sanbenito.tx, undated) or to empower teachers and administrators to stimulate learning more effectively. Technology is also conceptualised as a domain either of knowledge, for knowledge advancement (UCT Policy Document, 2003:1) or for underpinning

innovation (South African Research and Development Strategy 2002:13). Technology also includes the knowledge and skills necessary to use technology as a tool (Bergen.org, undated). For many practitioners in higher education according to Czerniewicz, et al., (2005) using ICT implies using the web. Hence, the term 'web-based' is equivalent to ICTs even when in reality, the two terms are not the same thing. As an example Muianga (2004:2) contends that many aspects of ICT relate to a web-based course management system. Uncritical reconciliation of the view of technology as knowledge in the earlier discussion and simultaneous acceptance of technology as the web can be confusing. It may be even be understood that since both knowledge and the web means ICT, that the web means knowledge. The following section investigates recent literature on the impacts of ICT.

PERSPECTIVES ON NEW TECHNOLOGIES IN TEACHING AND LEARNING

ICT is often considered part of a solution addressing the changing learning needs of societies (Garrison and Anderson, 2003). Beyond these positive perceptions there are fierce debates concerning the meanings and implications of ICT in teaching and learning. Technology may be viewed as neutral and autonomous (determinist) or neutral and human controlled (instrumentalist) (Feenberg, 2003). At the one extreme stands the view of technology as both autonomous and value-free (substantivist), while at the other technology is human controlled and value-laden (critical perspective). Where technology is seen as neutral and autonomous, the belief is that it is merely a tool and an indifferent instrument. This is the instrumentalist view of ICT (Feenberg, 2003).

For the constructivists, technology should be learner- centred. Arguments are made that when applied correctly, technology improves the quality of learning experiences (Tinio, 2002) or of education itself (Muianga, 2004). Its decentralized nature frees the learner from the educational provider (Khan, 2000). Elearning technologies should enable students to actively engage in the construction - rather than the passive receipt - of knowledge (Muianga, 2004). It could even help eliminate some debilitating factors in education, such as time, space, and pace (Sekgwelea, 2004). Authors such as Fox and Mills (1997) even expect web-technologies to totally change distance education. Technology such as eLearning for example, will inevitably transform all forms of teaching and learning in the twenty-first century (Brown, 2002). The implications of these perspectives on eLearning will be explored next.

INTERPRETATIONS OF ELEARNING

Elearning is also discussed within the contexts that mostly reflect 'whether or not distance education forms part of the meaning, whether the term relates to networked computers or stand-alone computers (or even computers at all) (Czerniewicz, et al., 2005)'. A computer is obviously presented as a significant part of eLearning. Most academics and IT practitioners in higher education institutions however, tend to emphasise a network and learning more than single computers (ibid.). Computer networks become significant environments in their own right since they allow the use of the Learning Management Systems (LMS) which are so fundamental to eLearning processes. A LMS can best be defined as a hardware and software environment for network-enabled learning programs and processes (Carliner, 2005) and in terms of its functionalities.

A LMS as a 'seamless link to eLearning' (Carliner, 2005) offers an inclusive approach to defining the system. It positions the purpose within education. As a web-based training platform (Clark, 1996), it is largely described as a constructivist and collaborative knowledge environment on the World Wide Web (Relthe and Gillami, 1997) to advance guided independent learning (Rich, et al.,

1999). Note the alignment of LMSs in much of the literature with constructivist learning! It is said to enable 'flexible', 'participative' and 'contribution oriented' learning (Collis and Moonen, 2001). It can be used to incorporate multiple media elements (Henke, 1997; McManus, 1995) that further enable effective and flexible interaction. These perspectives reflect various understandings of what eLearning does, rather than how and why it happens.

The following section discusses insights on eLearning technologies in a higher education context, from the perspective of academic and IT practitioner interviews.

Practitioner and policy conceptions of eLearning

In a recent investigation of conceptions and meanings of ICT, education and change in higher education among academics, policy makers, and IT practitioners across South African universities, one interviewee described eLearning as the process where a lecturer with and sometimes without students creates a learning environment on the World Wide Web (www) and where learning in collaboration takes place (Czerniewicz, et al., 2005). Central to this definition is not only the presence, but also the significance of a network which requires access to computers and the skill to use these tools.

The University of Pretoria Strategic Plan, 2002-2005 (2002) describes eLearning as the process where education technology is used in a virtual campus to enhance both distance and residential education processes. In this case the purpose of eLearning is strictly to enhance the quality of teaching and learning. Special mention of a virtual campus and related implications is noted. Universal access to eLearning including adequate literacy is an obvious prerequisite. The quality enhancement aspect however, suggests that the availability should be supplemented by purposeful and effective usage (Broere, et al., 2002). Purposeful usage implies a process where technology is specifically applied to achieve predefined human goals.

In the quest for a useful contextual framework, and in acknowledging dominant arguments for appropriate application/usage, the author applies the activity theory (AT) approach to technology-usability case studies by Bjoko (2006); Sheng-Cheng Huang (2006); and Kreitzeberg (2006) to explore the appropriateness of AT and usability arguments in the understanding of eLearning and LMSs.

Activity theory and technology usability

Activity Theory (AT) can best be explained in terms of its key terms: internalization, mediation, subject, object, tool, transformation (process), rules, community, division of labour, and outcome (Engestrom, 1987). The subject is an individual, the object is the motive for action, the tool is an artefact while the community represents social groups, as well as rules and arrangements such as the division of labour. All these factors are jointly called the activity system (Rajkumar, 2005; Miettinen, 1997). AT originates from Vygotsky's concepts of mediated action, where he argued that human action is more than a function of internal biological processes. It is also mediated by culture and artefacts (including signs and tools). Leont'ev (1978) added that human activity is also socially mediated. Too often though, focus is placed on human action: hence the activity theory (and system). Activity theory is a concept and a theoretical approach or perspective (Sandars, 2005) that has been used and interpreted by many theorists and researchers across disciplines. It is used in most cases, to analyse the actual conditions of human activity from a means-ends, user-needs perspective (Rajkumar, 2005; Miettinen, 1997; 2002). Since the purpose of this paper is to improve the analytical framework for goal-specific uses of technology in social settings, the author finds AT useful.

The relationship between subjects (humans) and objects (motives) is mediated by the rest of the factors: tools, rules, community and the division of labour, among others. The mediation process is regarded as transformation that results into the outcome or motive (Miettinen, 1997). While a list of artefacts may be indefinite, the relationship between them and humans is purely that of a tool that merely serves to advance activities for the purpose of furthering motives. Subjects (humans) are mediated by culture, tools, rules and contexts (Rajkumar, 2005; Miettinen, 1997). They create artefacts on a continuous basis in the activity system to better enable transformation processes towards outcomes. An equivalent version of this perspective with a similar line of argument to describe the use of ICTs for local benefits (Erwin and Taylor, 2004), is made in Community Informatics (CI) literature.

This paper presents the use of an LMS within eLearning as an activity system in AT. The activity systems recognize interactions between subjects (humans) – mediated by artefacts, tools, symbols, rules, cultures, communities, among other non-human things (Miettinen, 1997; Rajkumar, 2005). The relationship is that of a human and tool, with other influences. This relationship within the activity system is compatible with the instrumentalist view of technology, where the neutral tool only serves to achieve human goals or to mediate between humans and their objectives. This is how the theory has been used in recent projects. Miettinen et al. (2002) used AT to articulate the needs of the user of a high technology product. Similarly, Rajkumar (2005) cites and supports this work.

The objective of the analysis is to explore the clarity of the key terms used in technology-usability research, as well as related implications.

Usability case studies

In order to contextualise what researchers and technology users consider as important for technology usability I have highlighted key terms and attributed meanings in table 1. This will be used to establish the meaning of 'technology-usability' as implied by researchers, and to develop an AT based analytical framework that supports arguments for the usability (user-friendly) of LMSs.

In the first case study Bjoko (2006) used an eye-tracking method to compare the user-friendliness of the American Society of Oncology's two web designs in 2005. The Clinical Oncology Society had initiated a new improved website, and the objective of Bjoko's study was to test and compare the usability of the original against the usability enhanced website. The study findings confirm the usability of the new website as superior to the original website (in terms of the given criteria in table 1).

Table 1: Selected Technology Usability Studies

Author	Case Study + Technology Type	Purpose of Case Study	Criteria per Case Study	Meanings/Implications
Bojko, 2006	Using eye-tracking to compare web page designs	Comparing user-friendliness of two web designs	enable goal achievement enable efficiency - ease of use - meet user needs/ expectations	- Determinant of success or failure - Improves processes to the final goal - Does not add unnecessary physical strain - Does not force unnecessary user-adjustments
Sheng-Cheng Huang, 2006	Empirical evaluation of a popular cellular phone's menu system: theory meets practice	Determine effectiveness, efficiency, & user satisfaction of a cell-phone's menu system	- effectiveness - efficiency - user satisfaction - accuracy -clear labelling & descriptions -meet user expectations -compatible with intended task	- Enable successful goal achievement - Saves time, works fast, reliable - Users say it satisfy needs (user choices show) - Do only what it is intended to do, reliably - Should not be confusing - Relevant. No unnecessary user-adjustments
Kreitzberg, 2006	Can collaboration help redefine usability?	Opening debate for platforms that combine related information with easy access, reference & use	-collaborated knowledge bases -single entry-points to knowledge	- Info. fragmentation complicates usability - Info. Collaboration improves cross-discipline interaction

Reconstructed to reflect the findings of the case studies: Bjoko (2006); Sheng-Cheng Huang (2006); and Kreitzberg (2006).

In the second case study, Sheng-Cheng Huang (2006) evaluated a Nokia Cell-phone menu system to compare the convergence between the theoretical and practical aspects of cell-phone menu usability in 2005. The findings offer an insight into what should be more usable cell-phone menu functionalities. Though a cell phone is not exactly the same thing as a website, usability criteria do support those of Sheng-Cheng. From a slightly different angle, Kreitzberg (2006) introduces content provision as a significant aspect of website usability. The focus of this paper is not on the details of methodologies and findings of respective studies, but to draw lessons concerning the objectives and the key terms used for inferences into the usability of LMSs. The AT framework can also be used to analyse the terms and emergent meanings attributed to technology usability in three case studies. For example, the central AT term: subject (which implies the individual), is central to technology usability considerations in all three case studies. Evident in all three case studies is that good (highly usable) technology applications should enable the 'satisfaction of the subject (the individual user) interests, goals, and meet their expectations – with ease'.

Just as Bjoko (2006) is concerned with the user friendliness of the webpage, Sheng-Cheng Huang (2006) is concerned with the user-satisfaction of cell-phone menu systems. Kreitzberg (2006) is also concerned with the improvement of information provision methods in websites, thus suggesting a collaboration of different information platforms and sources to improve user access.

Terms used in all case studies tend to present an instrumentalist perspective of technology as a somewhat neutral tool (Feenberg, 2003) whose purpose is to adequately satisfy user-ends. Technology usability in the case of web pages for example, is high if technology functionalities enable goal achievement, enable efficiency, ease of use, and meet user needs/expectations (Bjoko, 2006). Sheng-Cheng Huang (2006) uses the terms of effectiveness, efficiency, user satisfaction, accuracy, clear labelling and descriptions, meet user expectations, and compatibility with intended tasks to make a similar point about the usability of cell-phone screen menus.

Keitzberg (2006) discusses the content delivery aspect of information technologies. The argument is strictly that of enhancing usability by improving the process towards access to information (motive for using a web-page). Collaboration rather than disintegration of information sources according to Keitzberg (2006) enhances information access processes.

By technology usability therefore, the case studies suggest the capacity of a technology to improve processes towards achieving the final goal of the user (in respective contexts and purposes). It should not be confusing. It should meet user needs, expectations, and should be easy to use (Bjoko, 2006). Keitzberg (2006) adds efficiency, effectiveness, and accuracy to concur with other two studies. The focus is clearly on subject activities and processes towards the outcome.

The reasoning in the three case studies supports the activity system paradigm of AT. Human-technology interaction according to this model of thinking is equivalent to a social network joined together by the use of tools where a negotiated relationship is limited to subjects (humans) who interact by manipulating artefacts. Following this thinking, a framework for understanding the LMS within AT paradigm is constructed in Figure 1.

An LMS in this framework would represent the activity system where learners are the subjects with activity taking place in their interaction with the hardware, software, content, and other learning applications. It is the usability of the LMS applications and the entire learning environment that mediates and transforms the object (learning) through the activity of learning – into the final outcome: enhanced learning and learning experiences. While this thinking seems fairly logical in many instances, it tends to carry simplistic implications that leave numerous questions unanswered. When technology is highly usable then the individual user will simply apply the rules in the activity system to easily achieve intended goals. In practice, the relationship between technology use and outcomes may be far more problematic since socio-technical interactions are not simply determined by the technology. Given the AT bias towards technology-neutrality perspectives, the question arises whether this framework is adequate to contextualise eLearning through LMSs. The application of the neutral technology thesis in eLearning processes is critiqued in the following section.

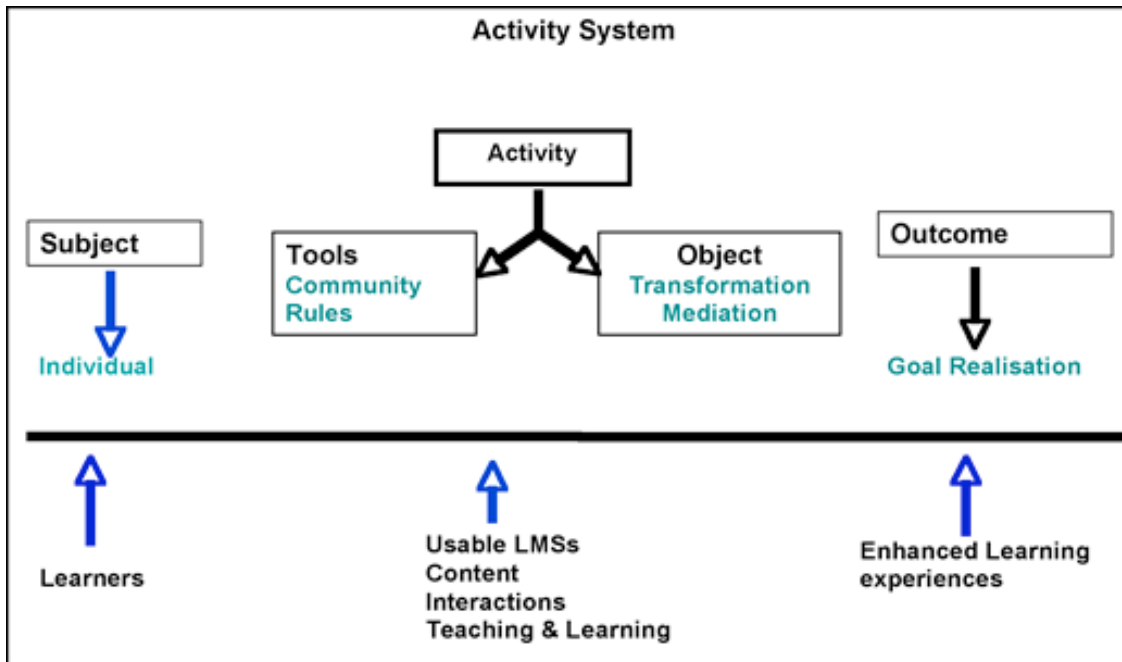


Figure 1: AT, Technology Usability Studies & LMS

Elearning and the neutral technology thesis

The neutral technology thesis is common in instrumentalist vocabularies that tend to see technology as the indifferent tool that merely stands to serve user purposes (Henrickson, 2000; Feenberg, 2003). This thinking is based on assumptions of essentialism and the social abstraction (Kellner, 1998) of technology as a means to the end. The neutral-technology thesis tends to limit the socio-technical interaction debate to issues of resistance or adoption, reducing the problem into a mere technical literacy challenge where all that matters is for humans to know how to use a technology for goal realisation. Our identities according to this perspective are uniquely pre-given, fixed, and rationally independent (Henrickson, 2000). The role of technology in shaping human action (and identities) is non-existent (or rather, neutral) in instrumentalist accounts. So, we shape technology for our purposes and not the other-way round.

In AT's own terminology however, the activity system emphasises the process of mediation and transformation of activities into end goals. Where the end-goal is learning which includes cognitive, cultural and shaping, assumptions of technology-impact neutrality on the 'learning outcome' becomes questionable.

Czerniewicz, et al., (2005) reports numerous interview statements that subscribe to this thesis. Most respondents presented teaching and learning ICT (including the web) as the neutral means to furthering user-ends. Instructivists claim that technology is merely a tool for use by teachers to instruct (transfer knowledge). In this case, eLearning is successfully or unsuccessfully used to transfer content. Because technology is seen as neutral, instructivists would focus attention on how it is used (Czerniewicz, et al., 2005). The limitations in the instructivist focus on tools, uses, resistances to use, and adoptions, tend to overlook the interaction of technology with cognitive

processes (as propagated by Vygotsky, 1978), failing to take account of the socio-technical discourse.

The determinists on the other hand see technology as both neutral and autonomous. Determinism is aligned with descriptions of technology as a determinant of progress and change (Feenberg, 2003) in higher education (Czerniewicz, et al., 2005). A number of uncritical constructivists who accept technology at face value as the agent for change also fall into this trap. In this view technology automatically enhances education. This is related to claims that ICT enables 'independent learning, it influences or drives the theory of learning, it breaches many walls created by distance and times zones; it unites people and creates powerful and synergistic partnerships at local, regional and global scales; it motivates students and energises classrooms' (Czerniewicz, et al., 2005; Mlitwa, 2005). Most constructivist commentators interviewed by Czerniewicz, et al., (2005) however, saw the impact of eLearning as the enabling of user engagement with learning, where a learner becomes the active participant in the construction of knowledge.

Collaborative learning was also emphasized. One interviewee even explained why the term eLearning is written with a small 'e' – followed by a capital 'L': 'I think the whole issue is clearer when I write it, I always try to be consistent and make the 'e' small and the 'L' large to emphasize the learning and the 'e' as the small or abbreviation type of thing but the learning is the most important thing ... (II)' (Czerniewicz, et al., 2005). Implications were however, largely aligned to the neutral thesis that as long as eLearning is designed as a user-friendly tool for the learner, and is applied to further constructivist principles, it should enable the unproblematic construction of knowledge. The reader should note that divergent understanding of technology is evident even within a single 'neutral thesis' school of thought, which in turn opposes the value-laden perspective of technology.

Technology as value-laden

At the other extreme, technology can be autonomous and value laden, but not human controlled. Feenberg (2003) calls this view the 'substantivist' perspective of technology. In other words both the means and ends are linked in a system. Technology therefore, influence academic processes and change, but is also influenced by those processes. It can also be human controlled and value-laden. Feenberg (2003) calls this perspective, the critical theory of technology. In this case technology is used as a value-laden tool that carries with it the context of its design, the language and cultural connotations of its location, to influence its destinations (Vygotsky, 1978). It is never neutral but value-laden (Feenberg, 2003) and has a potential to shape (transform) social inter/action and social identities. The embedding of American English in most computer applications for example, means that the Mongolians, the Chinese, and the Russians should now adopt the foreign language in order to effectively interact with the Western technology. Therefore, it is because of this value-laden nature of technology that critical theorists interrogate the possible connotations of its use.

In summary, the focus of the neutral technology thesis is clearly on human activity where the interaction of human and technology is that of improving user-interests. Actor Network Theory (ANT) offers an alternative value-laden perspective of technology which gives more credit to the social and contextual embedded aspects of technology. Technology is seen as a tool that interacts, shapes, and is in turn shaped by contexts. ANT and eLearning contextual framework is discussed in the following section.

ANT AND eLEARNING

Actor network theory places a semiotic emphasis on the human and the technical agents (Latour 1987; 1992 and Callon 1991) and enables specificity about the technology (Hanseth and Monteiro, 1998). It further suggests the elimination of all a priori distinctions between the technical and the social (Callon 1986) actants in what Law (1987) refers to as a heterogeneous network. Unlike the implications of activity theory where the activity system represents human actions that are mediated by neutral artefacts, ANT presents a network as a sum of interrelated and causal connectedness of all factors on any socio-technical account. The significance of a network is in its 'continually negotiated processes' where both human and artefact actors have a mutual and causal influence in network processes (Tuomi, 2001). There is no network without actors, and actors cannot act outside of a network. Each actor can only be viewed in relation to, and not separate from other actors or parts of the network (Tuomi, 2001). While a social network is merely a set of people, organizations, and perhaps their structures that are connected by a set of social relationships, a socio-technical network includes technologies that people construct and use in collaboration (Lamb and Davidson, 2002).

This paper takes the perspective that eLearning is a socio-technical network that comprises of humans (educators, students, administrators), structures (learning groups, educator groups, institutions, policies), technology (a LMS), environments (contexts), resultant learning processes, wanted and unwanted outcomes.

Technology in a network

ANT is built on the arguments that knowledge is embedded in social processes, conceptual systems, and material artefacts that are used in social practices (Callon, 1991; Latour, 1992). From an ANT perspective eLearning involves a negotiating interplay between the human and machines. Through a LMS, eLearning qualifies as a socio-technical network that incorporates a computer, network, applications, learning material, learners, educators and/or mediators. Just as human and non-human actors assume identities according to prevailing strategies of interaction in ANT (Hanseth, and Monteiro, 1998), the parties to the eLearning network should be mutually engaging, but also supportive. This view tends to streamline the arguments of this paper into the constructivist rather than instructivist pedagogical stream. As opposed to the 'instructional' view, constructivists describe learning as the innovative and participative process that can be enhanced through eLearning platforms. The question though, is whether ICT assumes such a meaningful role in technology assisted education practices and whether it is engaged as the active actor in the eLearning network.

The author of this paper shares the mutual shaping view of actors in a network, and that a network constitutes both human and material actors. This paper however, does not subscribe to the symmetrical notion of humans and non-human actors. Human actors have higher order cognitive capabilities (Vygotsky, 1983) and intentional action that are lacking in artefacts. Artefacts (and animals) also have other characteristics that humans lack. So, as much as the mutual shaping argument is accepted, it is not accepted that it follows a linear and equal negotiation pattern.

CONCLUSION

Literature about existing conceptions of ICT and education has shown that the meanings and perceptions of ICT in educational technologies are divergent. A recent investigation of the thoughts of academics, practitioners and managers have also shown that conceptual

disagreement is not only limited to the literature, but also to perceptions of practitioners in the field.

This paper opened with the argument that all higher academic institutions are either adopting open source software (OSS) or proprietary learning management system. In the midst of the existing conceptual stampede however, studies show discrepancies between the adoption of a technology in higher education by institutions and usage patterns by academic staff. In a quest to find a useful framework for understanding teaching and learning ICT, dominant calls for effective or appropriate usages of technology were acknowledged by a synopsis of the technology usability studies. An AT framework has been applied. It adopts the neutral instrumentalist view of technology as a means to achieving ends. This makes it useful only to analyzing better uses of technology to improve the satisfaction of human needs. Unfortunately AT neglects issues of power relations that stem from the social embedded nature of technology. This is where ANT comes in. ANT has been used to reconcile conflicting perspectives on the position of learning technologies in social processes. It supports the critical view of technology as a social and culturally embedded actor in a socio-technical network. It supports the view that technology shapes, and is shaped by contexts and environments.

ANT offers a helpful approach in encouraging the critical engagement of a technology in social environments such as eLearning, but it is not without shortcomings. The notion of a symmetrical relationship between technical and human actors just pushes the role of technology a bit too far. The problem as Vygotsky (1978) would put, it is that humans are graced with cognitive mental capacities which artefacts and animals do not have, and as such the symmetrical argument remains questionable. The final argument therefore, is that an AT's socio-technical activity system should be extended into a socio-technical network without the symmetry implications. The LMSs should not only be seen, but also conceptualized and treated as socio-technical networks. This will enable coherent engagements between humans (educators, students, administrators), structures (learning groups, educator groups, institutions, policies), technology (a LMS), and resultant learning processes in the network. In turn, it will contribute to the realization of intended benefits of eLearning – within varying contexts in which it is engaged.

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