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# Information Technology and Managing Quality Education

9th IFIP WG 3.7 Conference  
on Information Technology  
in Educational Management, ITEM 2010  
Kasane, Botswana, July 2010  
Revised Selected Papers

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- Open conferences;
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Arthur Tatnall  
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Adrie Visscher (Eds.)

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9th IFIP WG 3.7 Conference on Information Technology  
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Revised Selected Papers



Springer

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# Preface

## Information Technology and Managing Quality Education

As editors of this volume we are very happy to publish a selection of the papers that were presented at the 9th Conference of Working Group 3.7 of the International Federation for Information Processing, which was held in July 2010. The focus of Working Group 3.7 is on ITEM: Information Technology in Educational Management (for more information, please visit our website <http://item.wceruw.org/>), and the theme of its 2010 conference was: “Information Technology and Managing Quality Education.”

The conference was a very special occasion. Our Working Group started its activities in 1994 in Israel (officially we were not an IFIP Working Group at that time yet). As a Working Group we have since then organized two-yearly conferences in Asia (Hong Kong, Japan), the USA, Europe (Gran Canarias, Spain and Finland), New Zealand and in Australia. In 2010 our Working Group travelled to Kasane in northern Botswana. We were very happy to have been given the opportunity by the local Botswana organizers to visit the African continent and to hold our Working Group 3.7 conference there. The event was successful in terms of the quality and number of papers presented and included delegates from Africa (Botswana, Uganda), Australia, UK, Spain, Finland, and Switzerland.

The conference had the same structure as the previous conferences of our Working Group: the presentation and discussion of research findings in combination with discussion groups in which a specific topic was discussed in greater depth several times during the conference. The results of both activities are included in this conference book. Although the contributions to the conference varied considerably both in terms of the level of education at which ICT is utilized (the whole range from primary education to higher education) and the information technology topic addressed (e.g., identifying and satisfying learning needs, strategical management, school management information systems, open source software, the relationship between ICT and organizational performance) they all focused on answering the same question: how can ICT be utilized for improving the quality and output of educational activities?

All papers in this book have been peer reviewed. Papers were selected from those presented at the conference and the authors were given an opportunity to improve them, based on conference feedback, before publication.

We hope you will enjoy reading the various chapters of this book, which reflects the way in which ICT is being used around the world in order to improve the management of educational institutions and via that the performance of these organizations and their students.

October 2010

Arthur Tatnall  
Omponye C. Kereteletswe  
Adrie Visscher



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# Managing Quality Education – Identifying the Learning Needs of the Individual, Then Satisfying Them

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**Abstract.** Do teachers have access yet to the forms of data that will allow them to meet the needs of different learners? School head teachers and managers, when seeking to manage quality education, are challenged by the dilemmas of balancing quality of provision through classroom interactions with quality of provision that meets the needs of the individual learner. A number of processes and technologies are now available that support schools in managing those balances: availability of data; access to different forms of data; and technologies that support areas of learning and different learning approaches. Although there is continued development of systems to support schools in each of these areas, this paper will argue that there is need to consider further development in all of these areas, and to link up critical elements and features more. This paper will look at, in a United Kingdom (UK) context: the forms of data normally accessible to schools; an example of the ways that some forms of technology are supporting the learning needs of the individual; and an indication of the limitations for consequential quality management arising from lack of ‘learning-to-data-to-learning’ links.

**Keywords:** Managing quality education, individual learning needs, data management systems, formative assessment, social and emotional aspects of learning.

## 1 Introduction

A teacher recently shared a concern with me: she said that there are some students in her classes who really do not understand algebra, and she does not know why. To help them, she wants to know why they do not understand algebra, and what learning approaches or pedagogic practices she might use to help them, rather than being told from test and data records that they do not understand algebra. In essence, the issues at the heart of this concern are those considered in this paper.

School head teachers and managers seek to manage quality education in a range of ways; they seek to manage the quality of school environments for learning, of teacher interactions to support learning, and of interactions that support the needs and interests of the individual learner. It is clear that school head teachers and managers, as well as teachers themselves, when seeking to manage quality education through these domains, are challenged by the needs to balance quality of provision offered through classroom interactions with quality of provision that meets the needs of the

individual learner. In the context of the United Kingdom (UK), an increasing emphasis has been placed on the importance of engaging in a personalisation of learning, discussed in the Report of the Teaching and Learning in 2020 Review Group (2006). This influential report emphasised the need to consider ways that schools and learning might be transformed, as well as a review of the integration of assessment and data management to support those goals. It stressed that personalising learning should be learner-centred, knowledge-centred, and assessment-centred; some of the characteristics associated with personalising learning that were stated in the report included ‘close attention ... paid to learners’ knowledge, skills, understanding and attitudes’, learning ‘connected to what they already know (including from outside the classroom)’, teaching that engages pupil ‘interest in learning, ... identifies, explores and corrects misconceptions’, learners being active so that they ‘create their own hypotheses, ask their own questions, coach one another, set goals for themselves, monitor their progress, ... knowing that mistakes and ‘being stuck’ are part of learning’, with assessment being both formative and summative, supporting learning, and identifying next steps.

A number of facilities and technologies to help schools manage the balances and approaches concerned with personalising learning are becoming increasingly available. Data relating to individual learners is increasingly accessible online, through systems that provide access over the period of their school careers, there is increasing access to different forms of data (so that statutory test and examination data can be supplemented by data relating to attitudes, behaviour, and learning access outside school), and how technologies can support areas of learning, pedagogies and different learning approaches are being detailed and understood to greater extents.

In this paper I will consider a current ‘data dilemma’. I will explore the current forms of data that are accessible to teachers in schools in the UK, and the (sometimes limited) ways that those data can be accessed and associated with individual learner characteristics. I will indicate evidence from research reports that shows that technologies are supporting some learners with specific social or emotional characteristics, but that the data accessible to a teacher neither allows attainment or achievement to be easily viewed through those learner groupings, nor allows access to information and advice to offer alternative ways to support a personalisation of learning for those learner groups.

## **2 Data Accessible to Schools**

Schools in the UK have access to a wide range of data, and in many cases schools record and use data that is additional to statutory test and examination results. Data normally accessible to schools includes background results (prior national attainment or non-statutory test results in subjects at the end of a period of schooling referred to as a Key Stage), estimated likely outcomes (estimated future results based on previous performance, statistically produced and validated), targets (future targets generated by statistical engines, or by pupils, teachers or school leaders, so that they can be used as an aspirational focus), teacher assessments (subject attainment results entered by teachers to show achievement at specific points in time, and in some cases also records made regularly by teachers about homework completion, attendance, effort in

class, or behaviour in school), added value measures (indicating the value added at the end of a particular period of time, usually at the end of a Key Stage, generated and presented in the form of either raw score added value, or contextual added value moderated according to individual or school context, or within school variation value moderated according to previous school performance or school subject comparison). The forms of data listed here are widely used, but generally offer ideas about subject content or attainment, rather than ideas of pedagogic practice.

Some schools select to gather other data, including data from specific tests that provide measures other than subject attainment outcomes. For example, the GL Assessment (2009) Cognitive Abilities Tests (CATs) provide perspectives about learning potential; these are not subject focused (they indicate standardised scores for quantitative, qualitative and non-quantitative reasoning). Some online resource facilities monitor and report individual learner access levels outside as well as inside school, with access rates and outcome measures reported back to schools (SamLearning, n.d., for example). Some schools record details concerned with social and emotional attitudes to learning (SEAL), discussed in government education department guidance (DfES, 2005), and in this context, while many schools record details of attendance and behaviour, fewer maintain specific records of self-awareness, the managing of feelings, motivation, empathy, and social skills. Some of these social and emotional features are regularly tested in some schools using tests that measure attitudes of learners to aspects of readiness for and confidence in learning, feelings about school, perceived learning capability, self-regard, attitudes to teachers, to work, and to attendance, using a system such as the Pupil Attitude to Self and School (P.A.S.S.), for example (W3 Insights, n.d.). For those schools that gather these records, the data tend to offer insights into the contexts of learner engagement, however, rather than giving ideas directly about content or pedagogic preference (except in the case of CATs).

### **3 Access to Data in Schools**

Schools can access these data in a number of ways, through a number of different access points, many through online portals, and some in hardcopy form (these are discussed in more depth in Passey, 2009). The tracking of data through the individual child, however, a need that teachers have desired for many years and highlighted by work of the author in 2002 with the government department in England, and summarised in a later paper (Passey, 2007), is now beginning to become more easily available to local authorities (LAs) and schools through the work and development of the Fischer Family Trust with its Student Explorer system (2009), and through facilities offered in management information systems.

While data that is linked to the individual child enables LAs and schools to look at background data and estimated likely outcomes (and often attendance data), links to other forms of data such as attitude are not currently so easily accessible, for either comparative or selection purposes. However, data that allows filtering to highlight similarities or differences with specific groups of pupils are becoming increasingly accessible. Filtering factors such as ethnicity, gender, special educational needs, additional language needs, and socio-economic indicators are being built into systems

such as Student Explorer. Whilst uses of these forms of group filter data have been in place for some time (see DfES, 2002, for example), there has been increased interest in use of these data to explore impacts of background circumstances as well as specifically targeted interventions. A key question still remains however – if certain mechanisms or interventions are recognised to support personalised learning in certain ways, are appropriate and relevant data routinely collected and made available to teachers and managers so that they can set up and support quality interventions (where quality can be judged by shifts in attainment or achievement at individual as well as at group level)? In the next section, an example will show that systems in place do not yet allow for this need.

## 4 How Technologies Are Supporting Some Individual Learners

Many learning support interventions have been introduced into schools in the UK over the past 20 years. A range of these have involved and continue to involve technologies. Evidence presented in this section will indicate that a certain range of technologies and associated interventions can support a certain group of learners (evidenced by reports from learners themselves and from teachers).

Government education policy in England, initially defined in a report by the government education department (DfES, 2005), and later described within an implementation plan from the government agency for e-strategy (Becta, 2007), highlighted the need for schools and LAs to focus on effective implementation of certain specific learning and teaching practices. These practices included the personalisation of learning, the harnessing of technologies to enhance learning opportunity and effectiveness, the eliciting and integration of student voice, and the widening of home access and support. To this end, schools were (and still are) encouraged to implement e-learning practices, including approaches that use learning platforms, virtual learning environments (VLEs) and e-mentoring systems. A range of VLEs is accessible to schools across the UK. In this paper, learning outcomes from uses of two VLEs will be considered. The first, *Virtual Workspace*, was introduced into two LAs for use by all secondary schools and their learners aged 14 to 19 years. Findings from this implementation (Passey, 2007b) are included here, and are supplemented with findings from a second study that explored aspects of the implementation of a second VLE, *LP+* (Learning Possibilities, 2009), introduced into one of these two LAs for use initially by all primary schools and all learners aged 4 to 11 years, and extending into use into secondary schools at a slightly later stage.

The two VLEs both provided similar ranges of facilities, although different facilities were accessible for different users (teachers, school managers, LA consultants, pupils, parents and governors). However, there were some differences between the two VLEs. In the case of *Virtual Workspace*, facilities included: a range of communication channels, including messaging, discussion forums and chat rooms; online assignment management and storage of work and interest materials; online communities, offering collaboration between learners and teachers across schools; a mentoring service, involving live mentoring between 8am and 8pm on weekdays; a bank of interactive learning materials supporting the curriculum for 14 to 19 year old learners; an incentive or reward scheme for learners; and a continuing professional



development (CPD) programme for teachers and support staff, run by the commercial providers. In the case of *LP+*, facilities included the integration of: messages in the forms of notices from head teachers and in the form of news items; document handling and storage, for weekly as well as longer-term plans, organised by year groups, and able to accept online feedback from school managers; a calendar, and reporting of events, with online meeting spaces; an area to report technical faults (picked up locally by LA consultants) and access to support and training resources; discussion areas; surveys; subject areas within each school site; facilities for inclusion of school television or radio broadcasts; resources to support specific aspects of subject learning; a CPD programme for teachers and support staff run by LA consultants with training from *LP+*; networking tools in the forms of blogs and wikis; online spaces to share profiles and successes, task setting and tracking tools; assignment management tools; content repositories; an online text editor; paint and draw applications; an early years media player; search tools; and mobile compatibility and synchronisation.

To date, much of the evidence of benefit and outcomes arising from VLEs has been identified from uses within the higher education (HE) and further education (FE) sectors. As Condie et al. (2007) stated: “Specific benefits observed in the HE/FE sector ... included improved motivation and engagement, flexibility of access, learning gains in ICT, in writing, understanding and presentation, enhanced communication and interaction, plus the adoption of new approaches to learning”. Since 2005, research findings have increasingly pointed to learning benefits arising where learning environments and VLEs have been adopted in some schools. Condie et al. (2007) stated that Becta found that: “... learners benefited from them in that they could extend their learning experiences beyond the confines of the classroom, submit and track electronic activities for assessment and manage aspects of their personalised learning”.

The studies of the two VLEs reported in this paper gathered evidence that allowed perceptions and outcomes of implementation and uses to be viewed from different perspectives. Evidence was gathered in the first case (*Virtual Workspace*) through visits to 10 schools (selected on the basis of their different levels of learner and teacher use and different approaches to implementation of the system). Interviews with head teachers, senior managers, information and technology (ICT) co-ordinators, teachers, and learners gathered views about practices involved from management, teacher and learner perspectives, the recognition of positive and negative aspects arising, unique features identified, the roles of mentors, how uses matched approaches to learning, the recognition of pedagogies to complement online and personalised learning, aspects of change management that were considered to be of importance, and evidence of learning outcomes arising (in total, from 11 head teachers and senior managers, 7 ICT co-ordinators, 23 teachers and a teaching assistant, and 61 learners). Subsequently, further evidence was gathered through discussion and feedback with key personnel, including mentors in the management company, discussions with key project personnel through face-to-face, email and telephone means (16 in total), and completion of online questionnaires by a wide sample of learners across all schools (1,486 learners in total). Web-based materials, project documents and statistical evidence were also examined as a part of the study. Evidence was gathered in the second case (*LP+*, where implementation was more recent), from LA consultants

(who completed a grid of features, providing implementation details at a school level for all 63 schools initially involved), from 5 key personnel in the LA (through discussion), and from key personnel in 22 schools (who identified key features for the implementation through discussions).

From all forms of evidence gathered it was clear that not all learners had necessarily benefited to the same extents (or in the same ways). When learners used the *Virtual Workspace* system, the evidence suggested that those benefiting were often reported to be gaining through the nature and focus of social interaction, rather than gaining through forms of direct information transfer. In terms of those who were reported to benefit through these forms of social learning provision, it was not necessarily those who talked most in classrooms. These learners were likely to be those within classrooms that teachers would regard as being 'shy' or 'quiet' (perhaps not wishing to make their thoughts public, or not wanting to be seen by others to be actively participating). By comparing the responses of 'shy' boys (179 in total) with self-reported 'non-shy' boys (354 in total), the percentage of responses from 'shy' boys was higher in their reports about being more involved in learning than might have been the case otherwise (24% difference,  $\chi^2 = 34.17$ ,  $p < 0.0001$ ), discussion of work outside the classroom (21% difference,  $\chi^2 = 21.19$ ,  $p < 0.0001$ ), allowing ideas to be expressed when this might not happen in class (20% difference,  $\chi^2 = 18.31$ ,  $p < 0.0001$ ), helping to understand teachers more (13% difference,  $\chi^2 = 12.11$ ,  $p < 0.0005$ ), helping with coursework or assignments (13% difference,  $\chi^2 = 8.68$ ,  $p < 0.0032$ ), mentors helping personally (13% difference,  $\chi^2 = 10.43$ ,  $p < 0.0012$ ), and wanting to see more use of the system (12% difference,  $\chi^2 = 9.02$ ,  $p < 0.0027$ ). By comparing the responses of 'shy' girls (412 in total) with 'non-shy' girls (541 in total), the percentage of responses from 'shy' girls was higher in their reports about allowing ideas to be expressed when this might not happen in class (16% difference,  $\chi^2 = 23.58$ ,  $p < 0.0001$ ), and being more involved in learning than might have been the case otherwise (14% difference,  $\chi^2 = 25.01$ ,  $p < 0.0001$ ). In all the instances highlighted, statistically significant differences were shown between the 'shy' group and the 'non-shy' group of learners. It is clear from these data that the 'communities' area of the VLE was felt by more 'shy' or 'quiet' learners through their questionnaire responses (and this was supported by individual discussions with learners and by teacher responses) to support to a greater extent an engagement with learning.

Evidence from teachers using the other VLE system supported these conclusions, and offered further evidence about the nature of interactions that were occurring. In one of the schools involved in using the *LP+* system, the teacher set up a discussion about a poem, *The Highwayman and Bess*. The activity related to a unit of work that had been covered 3 weeks beforehand in class, so the discussion replicated some of this work. The lead teacher found that the online discussion that learners could contribute to at home as well as at school engaged pupils, and that it continued for many months (at least 7 months of discussion were recorded). On occasions the time intervals between pupil responses were short; pupils were involved as they would be in a conversation. From the contributions to the discussion, the lead teacher could see individual pupil opinions and their interests, and these she could access in textual

form (which she found to be particularly valuable, since previously she had found that an assessment of verbal opinions could lead to rather general indicators being identified only). She found that a textual discussion was giving her more detailed evidence, and she could go back to it whenever she wanted to gather further detail to inform her assessments. She found that comments came from some pupils who might not have been expected to comment; one deaf child used the facility a lot, and his confidence in responding was supported by opportunities to discuss his ideas with someone at home before he wrote his responses. The teacher found that the online discussions were particularly valuable, as pupils could: write an opinion; handle different opinions more easily; reason in a more measured way even when they were challenged; be less aggressive than they might be in face-to-face discussions (which would tend to be taken more personally); respond more easily to written (rather than verbal) material; accept written comments more objectively and less emotionally; take time in reading, thinking, and then responding; take more time to think about a reference to another idea or another text; and respond in their own way, rather than backing down as they might in class. The online discussion was reported to engage the pupils; it appeared to gain their attention so that they remembered it and the poem as a consequence; the teacher found that pupils could still quote lines from the poem some 7 months after encountering the poem in class. Evidence from another school using the same system indicated that online discussion was engaging learners in writing and completing homework, those who were in class situations 'shy' with regard to both writing and communication (and the teacher suggested some 6 learners within a class of 30 would have had these characteristics).

In all of the cases above, teachers are noticing impacts of a technology-based facility on specific groups of pupils. However, there was no indication that prior recorded data was being used to identify these pupils, or that the findings of these teachers were being used to link potentially useful learning opportunities for the benefits of others with similar characteristics or for teachers with learners of similar characteristics in their classes. The personalisation of learning for these individuals happened through fortunate opportunity rather than through guided advice, planning or design. The facilities did not enable these opportunities to be highlighted for other teachers and other learners who might benefit from them. Yet it was clear that outcomes for these learners when using these facilities was important to them and to the teachers; having data facilities to support the 'learning-to-data-to-learning' link could be important for other learners where these experiences have not been 'tried and tested'. This is an example of a pedagogic practice being explored that, if highlighted in some way for other teachers and classes, might well support a wider number of learners.

## 5 Conclusions

The previous section identifies a specific example, but highlights a key issue. 'Shy' or 'quiet' learners are increasingly being recognised by teachers across a range of age groups as being learners who should be supported more. Evidence from practice shows that some of these learners can be supported by e-mentoring and online support

systems, potentially providing schools and teachers with useful approaches to enhance learning. But how can a widening of experiences be managed within a school or classroom environment? Does data allow school managers and teachers to consider how to support these individual pupils best?

Does the standard data provision help? Prior national attainment or non-statutory test results, estimated future results based on previous performance, subject attainment targets, teacher subject attainment assessments, and added value indicators are all measures focused on subject content, rather than pedagogic or learning process (although some of these data might allow teachers to pick up on low levels of pupil writing, pointing to or suggesting support through appropriate uses of a VLE). Indicators of attendance, effort, or behaviour in school might highlight when contextual issues are arising, but do not offer any direct indication of potential actions in terms of pedagogic or learning process (although indicators of low homework completion might suggest to a teacher that this issue could be supported through appropriate uses of a VLE).

Does SEAL data help? Attendance and behaviour records are likely to offer indicators of the time periods when disengagement issues might be arising, while specific records about self-awareness, the managing of feelings, motivation, empathy, and social skills could provide indicators that could point towards the potential for certain pedagogic or learning processes. However, teachers might well need to be offered specific ideas of pedagogic or learning processes that they might use when indicators highlight a need for intervention or support. A link between data indicators and pedagogic alternatives (which might be called 'data-driven pedagogic intelligence') can be made by those who are already aware of what the indicators might tell them, what processes might be suggested as alternatives, and which processes have worked for some learners in those categories on previous occasions. This form of 'learning-to-data-to-learning' link is supported by some data systems; the GL Assessment CATs data system offers measures of qualitative, quantitative, and non-quantitative reasoning, and pedagogic and learning processes are suggested through accompanying materials.

Data from P.A.S.S. could also provide useful indicators for teachers, but the links between these indicators and pedagogic and learning alternatives are not provided through the current form of results as they are presented. Indeed, a research practitioner has recently undertaken a study to explore whether there is any correlational link between P.A.S.S. results and a lowering of results below those estimated from standard attainment tests in core subjects (English, mathematics and science). To undertake this work, the research practitioner had to manipulate the two sets of data to gain correlation results, had to interview learners to detail instances to greater extents, but then still needed to consider what pedagogic or learning alternatives might be available to her colleagues to address the issues.

So what is needed? The emphasis on personalisation of learning is clearly laudible; placing a learning provision that is learner-centred, knowledge-centred and assessment-centred offers potentially enhanced individual commitment, focus and ownership. However, managing quality educational experiences in this context, where data management can support a personalisation of learning (meeting the needs of individuals as well as specific groups) requires: the identification of learning and

pedagogic practices that support specifically identified groups of learners (and in the current context this needs to be the first, rather than the last, step); an identification of those learner features that indicate which learners might be within these groups; a means to capture shifts in levels of these features and to make these shifts known to managers and teachers; and a subsequent provision that highlights for managers and teachers possible pedagogic and learning alternatives that might be adopted at times when these shifts emerge, perhaps through links to vignettes of practice, such as those in guidance documents or in video format (including teachers.tv, n.d.). School managers are increasingly using data management systems to help them manage some quality educational experiences, but using ‘learning-to-data-to-learning’ links (data highlighting those who might benefit from pedagogic and learning processes), are only now beginning to be created. There is clearly wide potential to develop resources in this area, to support desirable transformational development.

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# Value Chain of Technology in Higher Education Institutions: From IT Resources to Technological Performance

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**Abstract.** Different studies confirm that the presence of IT in firms, together with human and other organizational resources, has a positive influence on the performance of organizations. However, the details of the process through which that influence is produced have not been clarified. This study is based on an extensive IT data base corresponding to a sample of universities and presents an IT-technological performance value chain and confirms the hypotheses about its functioning. The result is a value chain that begins with the IT planning, passes through different components related to technology in organizations and ends with the performance of the technology. We believe that this research is useful to higher education institutions managers by allowing them to have a clear path on how to improve the return of IT investments.

**Keywords:** IT performance, firm performance, IT resources, IT strategic planning, Value chain, resource-based view of the firm, universities, Spain.

## 1 Introduction

Today, almost every higher education institution uses IT. Still, we know that not all of them get the same value out of IT. This is, the organizational performance is not increased in higher education institutions as the investment in IT. Some obtain more, some obtain less.

Although a lot of different explanations can be given, starting by how we measure organizational performance in the case of higher education institutions, and passing by concepts such as complementary resources (Brynjolfsson, 2003), the effect of the learning curve deferring the performance and the sample size (Hitt and Brynjolfsson, 1996; Brynjolfsson, 1998; Schreyer, 1998; Kholi and Devaraj, 2003), we understand it would be very interesting for organizations to have a path, a value chain, that defines what to do with IT investments in order to improve organizational performance. Since not many works address this issue, this article aims to clarify this question, specifically in the context of higher education institutions.

To that end, we first explain our proposed model and the data base we used to test it. This is followed by the methodology used, the results obtained and, finally, the conclusions and limitations of the work.

## 2 Preparation of the Model and Work Hypotheses

According to Barney (1991), a firm’s resources can be classified into resources of physical, human and organizational capital. Thus, as drivers of the process, those resources must appear in the initial phase of the process of IT value creation.

In a first design of our proposal, the three types of resources constitute the starting point of the chain through which IT begins to add value. Like Bharadwaj (2000), we consider that an organization’s IT capability consists of organizing those three classes of resources in a way that is effective for their performance: IT strategic planning (ITPLAN), IT area human resources (ITHR) and infrastructure IT resources (ITINFR) and we understand that ITPLAN is the guiding structure that defines what to do with the other two categories, ITHR and ITINFR.

With these categories organizations are able to create IT applications (ITAPPS), guarantee system reliability (ITRELIAB) and define a series of norms for IT use (ITPROCS).

After these three items we understand we arrive to the part of the chain dealing with performance. Its position is in the final part, which is where the cited works also place it. Thus, in the analyses, we show that many of the data that we have refer to the output of the IT processes or tasks, in other words, they constitute what we finally called technological performance.

We believe there are really two kinds of technological performance: performance referring to the technology’s contribution to the management of the organization (ITPERFORG) and performance related to the use of the technology by users who are not IT personnel (ITPERFUSER). Those two dimensions match the possibilities that Sambamurthy and Zmud (1994) consider for the IT impact.

So we derive a model that is presented in Figure 1.

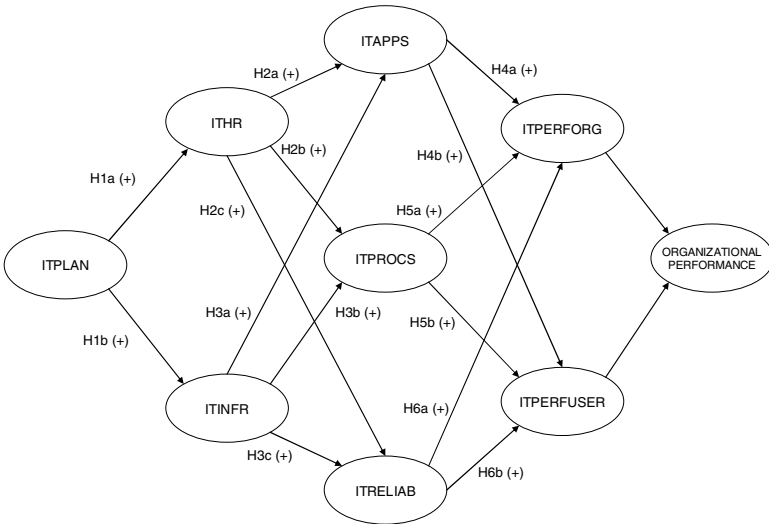


Fig. 1. Proposed model



In this article, we are not going to test the final part of the model, but, like Sambamurthy and Zmud (1994) and Soh and Markus (1995), we propose that organizational performance will be influenced by the technological performance.

To end this section, we break down the functioning of the proposed model into hypotheses. There are many authors who indicate the need to plan the development of IT (i.e. Boar, 2001). In light of the above, our first hypothesis is the following:

**H1.** ITPLAN has a positive influence on the level of (a) ITHR and (b) ITINFR.

The importance of human resources to IT performance has been confirmed in various studies (Powell and Dent-Micallef, 1997; Francalanci and Galal, 1998, Bharadwaj, 2000). Therefore, we propose that the greater the deployment of IT human resources, the higher the performance in the three IT processes identified from our data base. Thus:

**H2.** ITHR has a positive influence on (a) ITAPPS, (b) ITPROCS and (c) ITRELIAB.

It is also logical that it is necessary to have a basic IT infrastructure in order to perform well in IT (Ross *et al.*, 1996; Bharadwaj, 2000; Broadbent *et al.*, 1999; Bhatt and Grover, 2005). Thus, as in the case of human resources, we consider that the physical IT resources exercise a positive influence on the three established IT processes.

**H3.** ITINFR has a positive influence on (a) ITAPPS, (b) ITPROCS and (c) ITRELIAB.

Moving onto the final part of the model, Cooper *et al.* (2000) indicate that the presence of certain management applications (e.g., datawarehouses, work flows, content and news managers) in organizations favors organizational performance. Therefore:

**H4.** ITAPPS has a positive influence on (a) ITPERFORG and (b) ITPERFUSER.

Secondly, Broadbent and Weill (1992) indicate that the standardization and formalization of the IT in organizations is a positive value that helps improve the organization's technological performance. Therefore, we propose that:

**H5.** ITPROCS has a positive influence on (a) ITPERFORG and (b) ITPERFUSER.

Finally, authors such as Teo and Ang (1999) indicate that the fact that the IT services are efficient and reliable constitutes one of the factors critical to the alignment of IT:

**H6.** ITRELIAB has a positive influence on (a) ITPERFORG and (b) ITPERFUSER.

### 3 Description of the IT Data Base

In order to test the model, we had access to a data base of IT data of Spanish universities that was created by the universities themselves through their Rectors Conference (CRUE), specifically the group dedicated to IT.

The data base in question contains a vast amount of information related to IT in university institutions and has a total of 118 indicators. Table 1 shows examples of data for each of the six strategic axes in which that work group organized the information. It also includes some additional data about each institution in a specific area.

**Table 1.** Structure and content of the data base

Axes	Indicators	Examples of data
1. Teaching-learning	16	Students per computer in classrooms, classrooms with Wi-Fi coverage, institutional plan for the development of on-line teaching.
2. Research	19	Scientific calculation capability, application for research management, research groups with web page.
3. Management processes	12	Computerized management processes, backup system to activate the services that suffer availability problems, e-administration technologies being exploited.
4. Management of institutional information	21	Procedures available in the records management, departments that use the content manager to publish on the web, existence of a contingency plan in case of emergencies.
5. IT training and culture	21	Individuals on the management staff who have received training in IT competencies, average budget for specialized training of IT personnel, users who access the intranet through a VPN.
6. Organization of IT	16	Existence of a strategic plan for IT, IT personnel in relation to number of students, incidents successfully resolved by IT department in relation to number of users.
Context data	13	Administrative personnel, faculty staff, classrooms, research groups, subjects, budget, staff budget.

Source: CRUE-TIC group

In turn, each of those six axes comprises up to a total of twenty-eight objectives. Some examples of these were:

- Axe 1, Objective 1 – To incorporate IT in the classrooms (computer and non-computer) – 9 indicators.
- Axe 2, objective 4 – To promote the expansion of research activity by means of IT tools – 4 indicators.
- Axe 4, objective 2 – To be prepared to manage institutional knowledge on the basis of statistics, indicators, balanced scorecards and data analysis – 2 indicators.
- Axe 5, objective 2 – To ensure specific training for IT personnel – 3 indicators.
- Axe 6, objective 1 – To have strategic IT planning – 3 indicators.

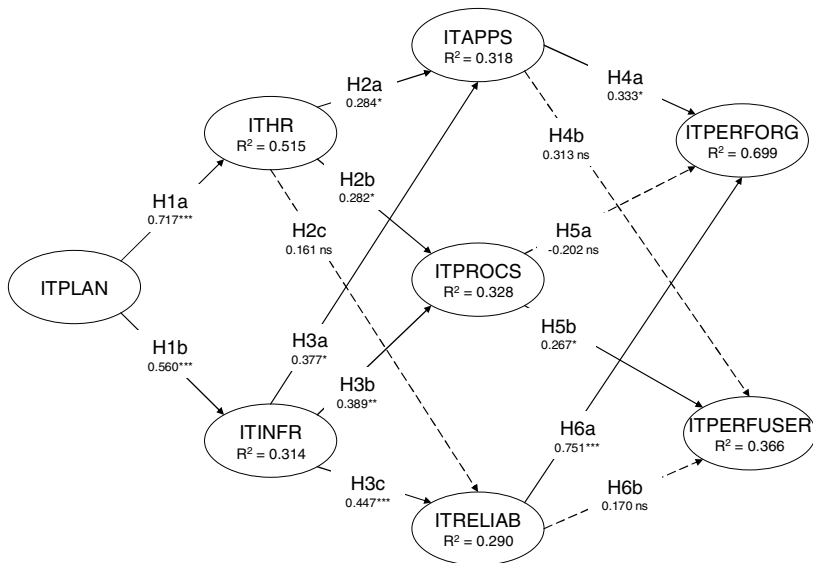
## 4 Methodology, Data Analysis and Results

The population of our study comprises all 73 Spanish universities, 50 of which are state universities and 23 private. Data was collected by the Rectors Conference in 2006 and 2007 through a questionnaire completed by the CIO. A total of 59 completed questionnaires were received, of which three were eliminated because they were not properly completed, giving a response rate of 76.7%. The chosen method of data analysis was structural equations using the Partial Least Squares technique (PLS), specifically, we use SmartPLS 3.0 build M3 (Ringle *et al.*, 2005).

Our model has eight constructs, three of which have formative indicators and the other five reflective indicators. In our case, the indicators of the constructs ITHR, ITINFR, ITAPPS, ITPROCS and ITRELIAB are reflective and, therefore, should display high levels of correlation. However, the indicators of the variables ITPLAN, ITPERFORG and ITPERFUSER do not have that property, thus this constructs are considered as formative.

To test the hypotheses, it is necessary to begin by analyzing the measurement model (in other words, the relationships between the constructs and their indicators) and then the structural model (that is, the relationships between constructs). All the test were sufficiently passed by the model: individual item reliability of reflective constructs, construct reliability (Cronbach's alpha coefficient and for composite reliability), average variance extracted (AVE) and discriminant validity. Formative constructs also passed the non-multicollinearity test.

We now analyze the structural model, summarized in Figure 2. That figure shows the explained variance of the constructs ( $R^2$ ) and the standardized coefficients ( $\beta$ ). Other tests such as the  $Q^2$  test for predictive relevance and the test for the stability of the estimations were all exceeded comfortably by the model.



**Fig. 2.** Estimated causal relationships in the structural model

As can be seen, out of the 14 proposed hypotheses, 10 were confirmed and 4 were not (H2c, H5a, H4b and H6b). With regard to the explained variance ( $R^2$ ) of the constructs the structural model displays adequate predictive power. The constructs obtain  $R^2$  values that are never below 0.290, the explained variance of the variable ITPERFORG is 69.9% and that of the variable ITPERFUSER is 36.6%.

Apart from examining the  $R^2$ , the model is evaluated by observing the predictive power  $Q^2$  of the constructs of the model (Geisser, 1974; Stone, 1974). The model passed the test of the  $Q^2$  being greater than 0 for the seven constructs.

As figure 2 shows, the model predicts 51.5% of the variance of the variable ITHR, regarding the deployment of HR in the IT area, and 31.4% of the variance of ITINFR, referring to the deployment of IT resources.

## 5 Discussion

It can be seen that the deployment of IT human resources (ITHR) helps explain the 12.8% variation in the existence of computer solutions to improve management (ITAPPS) and 12.8% in the existence of norms and procedures for the use of IT in organizations. However, it only explains 5.8% of the variation in systems to ensure the functioning of the IT, this last prediction being non-significant. We consider that the first two results are quite logical since an adequate deployment of human resources in the IT area enables the implementation of the automation processes. In other words, to be able to progress in the automation processes, it is not enough to purchase technology, it is also necessary to have the human resources required for the technology to function and be correctly applied. It is also logical that the deployment of human resources also helps and contributes to the development of norms and procedures for the use of IT in organizations, since it is a type of job that is usually associated with the technicians of the area. It is later shown that the existence of norms and procedures improves the users' perception and use of the technologies.

However, it is somewhat surprising that adequate deployment of human resources does not have a positive influence on the guarantee of reliability (i.e., high availability, back-up copies). This may indicate that it is more a question of having sufficient economic resources (and ultimately, technological resources) than anything else. In other words, the non-confirmation of the hypothesis may point to the fact that the need for reliability in the IT area is something already present in organizations and is also a service offered by numerous suppliers.

The basic IT infrastructure (ITINFR) explains 19.0% of ITAPPS, 20.0% of ITINFR and 23.2% of ITRELIAB. Thus, an appropriate level of physical resources in the IT area influences the existence of computer solutions to improve management, the existence of norms and procedures, and the systems to ensure reliable IT functioning. It is interesting to see that all those values are higher than those of the variable ITHR. This means that, although some authors, including Marchand *et al.* (2000), have indicated that in the implementation of technologies, people must be taken more into consideration than has traditionally been the case, our study indicates that machines and finance are still relevant.

Another interesting result is the extent to which organizations progress in the existence of computer solutions to improve management (ITAPPS); in other words, whether they have applications for the most common tasks, such as publication on the web, workflow management, datawarehouse, single login, etc. We confirm that this variable explains 18.9% of the technological performance in the organization's activities (ITPERFORG) but is non-significant in the case of technological performance related to users (ITPERFUSER). This indicates that the technological

output in the organization is explained by the development of automation processes but that, in the case of users, this type of issue is not so important. It should be borne in mind that a good part of the university communities comprises faculty staff and students and that such users do not normally have direct contact with management procedures. Therefore, issues related to the reliable functioning of the technology are more important to them than automation.

With regard to the existence of norms for the use of the technology (ITPROCS), we find that this variable has no significant relationship with performance referring to the technology's contribution to the management of the organization (ITPERFORG). However, it has a significant relationship with, and explains 13.2% of, the use of the technology by users that are not IT personnel (ITPERFUSER). The non-significance of the first relationship indicates that the use of technology in the organization's management area is not explained by the existence of norms. That finding is logical since the norms for the use of technology are, above all, oriented to the use of technologies on campus, especially by faculty staff (e.g., on the web, and related to respect for intellectual property) and students (e.g., in the use of classrooms, mail and related to respect for intellectual property). Therefore, the significant predictive capability of ITPROCS over ITPERFUSER is logical.

Finally, we analyze the predictive capability of ITRELIAB. We find that it is able to explain 58.4% of the variance of ITPERFORG but displays no significant relationship with ITPERFUSER. In other words, the implementation of technology in organizations must be accompanied by guarantees that it all functions correctly and that any problems are rapidly resolved. Thus, the continuity of the business is a fundamental issue in the internal use of technology. However, the non-significance of the relationship between ITRELIAB and ITPERFUSER indicates that such reliability is very important and decisive from the management point of view but much less so from the perspective of the use of technology by users.

## 6 Conclusions and Implications

The objective of this study was to expand knowledge of the process of how IT contributes to the performance of higher education institutions. We believe that this work sheds light on the space left by most works between the technological and organizational variables, on the one hand, and organizational performance, on the other. Although our model only goes as far as the phase immediately prior to organizational performance, logic and the opinion of other authors (Sambamurthy and Zmud, 1994; Soh and Markus 1995) suggest that organizational performance is the step that follows technological performance. Thus, we have been able to show a path, based on the results and arguments found in previous literature, of how IT acts to increase technological performance. Moreover, the elements of that value chain are specific links that generate less ambiguity than statements such as *a suitable combination of human and technological resources* or *organizational structures that support the IT tasks*. In that respect and except for the work of Bhatt and Grover (2005), the rest of the studies neither generate nor test specific hypotheses regarding the IT-performance process. However, it would be naïve to aim for high specificity about how all the elements of the value chain are managed since that would be too specific to be able to be generalized and applied to different organizations.

A result of the above is that an overall analysis of the value chain enables university managers to draw many interesting conclusions about how to orient their IT management policies. Thus, this work has shown the importance of planning in the context of technology in higher education. This is the variable that organizes and guides all IT activity and has a direct influence on the two types of resources most studied in the IT-performance literature. Hence, the human resources and the basic IT infrastructure constitute the basis for the development of IT activities. With regard to those activities, our sample contains three that have different effects on technological performance. On the one hand, the existence of computer solutions to improve management, and systems to ensure the reliable functioning of IT (this is determined only by the basic IT resources) that influence the extent to which IT contribute to and support the organization's activities and processes and, on the other, the generation of norms and procedures for the use of technology, which influences the use of technology by non IT-personnel users.

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## Appendix I. Constructs and Short Description

- ITPLAN (Formative construct, 5 indicators). IT planning process.
- ITHR (Reflective, 4). Deployment of HR in the IT area.
- ITINFR (Reflective, 10). Basic IT infrastructure.
- ITAPPS (Reflective, 8). Development of IT applications to automate management.
- ITPROCS (Reflective, 4). Proceduralization of tasks related to norms and procedures.
- ITRELIAB (Reflective, 2). Systems to ensure the IT functioning.
- ITPERFORG (Formative, 6). Performance referring to the contribution of technology to the management of the organization.
- ITPERFUSER (Formative, 6). Performance referring to the use of the technology by non IT-personnel users.

# Using Information Technology to Promote Thinking

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**Abstract.** The goal of this research study was to investigate the implementation and evaluation of a variety of digital media and web-based solutions and their effect and contribution on the learning environment in relation to the promotion of students' thinking skills. In particular, the objectives of the study included: an assessment of the educational value of a variety of multimedia and web-based solutions using different evaluation approaches; an investigation of the contribution of digital media in the development of an inquiry-oriented learning environment; an examination of the enhancement of students' skills in the use of digital media, and the examination of an inquiry-oriented multimedia and web-based solution while the students, the computer and the teacher interacted to create a social constructivist learning environment. In particular, the research described in this study involved an investigation of the implementation of digital media – utilising Macromedia multimedia and web-based solutions for school project work – in a Year 9/10 Information and Software Technology (IST) elective course: *Internet and Web Design*. It concentrated on the subsequent assessment and impact that the software had on creating an inquiry-based situation to promote higher-order thinking skills among students completing multimedia projects for publication on the World Wide Web within a secondary classroom.

**Keywords:** Technology, thinking, interactive multimedia, constructivism.

## 1 Introduction

*“Technology is really a way of thinking”.*

(Australian Academy of Technological Sciences and Engineering, 2004, p.1)

This study emerged from interest in and experience with the use of digital media in the secondary Information and Communication Technology (ICT) classroom. The research focused particularly on how technology is used as a tool in the teaching and learning process. Special attention was paid to the theory of constructivism and the emphasis that a constructivist perspective has on students' evolving knowledge; that is, the critical role that social negotiation plays in helping students interpret their experiences, and the promotion of thinking skills when using technology. Much of the literature suggests that the primary responsibility of the instructional expert is to



create and maintain the constructivist notion of a collaborative problem-solving environment (Dick, 1992; Crick, 1994). Hackbarth (1996) supports this view by noting that constructivism has become a dominant force in society. The essential principle of this theory is that each person assembles the bits and pieces of experience in ways that are unique. This study examines how students use technology to assist with their personal construction of knowledge, along with the development of thinking skills utilised to complete the practical tasks. Drawing upon prior conceptions and feelings, people actively interact with their surroundings in an ongoing effort to make the diversity of experiences all sensible and coherent. The essential challenge of constructivism has been in its shifting the locus of control over learning from the teacher to the student. Educational technologists, with their roots in behavioural psychology, have long sought to design programs in such a way that students would be enticed to achieve pre-specified objectives. Constructivists have claimed that this violates both what is now known about the nature of learning (situated, interactive), and about the nature of knowledge (perspectival, conventional, tentative, evolutionary). They have maintained that objectives should be negotiated with students based on their felt needs; that planned activities should emerge from within the contexts of their lived worlds; that students should collaborate with peers in the social construction of personally significant meaning, and that evaluation should be a personalised, ongoing, shared analysis of progress.

The influences of constructivism on educational technology can be seen in many areas. Models of communication can portray the process as interactive, with the message as much determined by the selective perception of the recipient as by the style of the author. Mediated programs are seen now more in terms of providing students with opportunities to expand their range of interests, knowledge and/or experiences. Interactive multimedia (IMM) presentations are seen to provide students with insights into the thinking of experts, and the “scaffolding” needed to enable their own uniquely coloured construction of disciplined knowledge. Romiszowski (1992), defines interactive instruction as a process in which the learner is involved in overtly responding to material by making selections or giving answers to questions. Interactivity in the instructional process operates by setting tasks for the learner to deal with, but its value and its nature are best described by the “depth of processing” or the quality of thinking that is demanded from the student. IMM comes in various forms and has the potential to enhance education, though there has been little opportunity for educators to gain experience in how to effectively use and critically evaluate this new media (Wiburg, 1995). IMM products have the capacity to shift the locus of ‘ownership’ and ‘control’ in learning. Learning has traditionally been ‘controlled’ by the teacher, the instructor or the computer-based instructional system. The end-users of IMM courseware can be empowered to own and control their own learning (Latchem, Williamson & Henderson-Lancett, 1993). IMM is a particularly effective medium for providing such search-through problem environments. Another central issue in IMM instructional design is the design philosophy of increasing learner control over the ‘what’ and the ‘how’ of learning. Latchem et.al. (1993) highlight that it is important for designers of IMM products to provide the end-user with “a handful of simple ways to travel from one object to another (by keyword, object search, text type or random choice) which lets people create many paths through a rich territory without getting lost or hitting a dead-end”.

The three issues in optimising IMM design are *linking*, meaning making connections and allowing alternative ways for the attainment of information; *human interface*, meaning the point of interconnection between a computer and the person using it and involves ease-of-use, depth of structure (that is, will the product be useful to advanced/expert users?) and navigational features (for example, buttons, graphic hot spots) and *content*, meaning information made available by an electronic medium or product. Each of these issues relate to the practical project work observed during this case study in which students engaged as they planned and developed the digital media into an accessible and user-friendly website.

## 2 Aims of the Study

The goals of this study involved the amalgamation of two aims, namely, an investigation into the evaluation and implementation of digital media which includes multimedia and web-based solutions, and an examination of their effect on and contribution to the learning environment in relation to the promotion of thinking skills among students. These may be expressed in terms of the following objectives:

1. To evaluate the educational value of a variety of digital media.
2. To investigate the contribution of digital media in the development of an inquiry-oriented learning environment.
3. To enhance students' skills in the use of digital media.
4. To develop, implement and evaluate the use of inquiry-based learning with digital media through a social constructivist environment.

## 3 Research Questions

In order to provide a focus for these objectives, the following research questions were formulated:

1. Can digital media contribute to and enhance inquiry-based learning within the secondary classroom?
2. What is the impact of using digital media on students' abilities in the classroom learning environment?
3. How does digital media enable the student to develop higher-order thinking skills?
4. How can constructivist strategies be promoted through the development and use of digital media?

The implications of this study for teaching and learning via a digital media approach to promote thinking skills within students were considered in light of the results.

## 4 Key Concepts in the Study

The concepts discussed in this section were identified as being important in establishing the theoretical framework for this study.

- Thinking skills
- Critical and creative thinking
- Higher-order thinking (HOT) skills
- Information and Communication Technology (ICT)
- Interactive Multimedia (IMM)
- Constructivism and social constructivism
- Project-based multimedia learning and digital media

Research has shown that today's generation of student is comfortable using computers and digital media as forms of communication (Scherer, 2005-2006). As educators, we are seeking to support this contention by seeking new ways to integrate technology across the curriculum and to provide engaging, relevant projects for students that build valuable digital skills. The Year 9/10 IST class observed aimed to engage students actively in project work that was related to real-world experiences and that allowed them to utilise different types of thinking skills.

Simkins, Cole, Tavalin and Means (2002) examined the effect of increasing student learning through multimedia projects. They defined *project-based multimedia learning* as "a method of teaching in which students acquire new knowledge and skills in the course of designing, planning, and producing a multimedia product (p. 2)". Students involved in this research study developed multimedia products that were technology-based and utilised digital media to create websites. *Digital media* refers to any form of information that has been "digitised" or "converted" for storage or use on a computer (Crothers, 1997). It encompasses digital audio, digital video, the World Wide Web (Internet) and other technologies that can be used to create and distribute digital "content" (Wales & Sanger, 2001b).

*Constructivism* refers to a learning theory that views learning as a process where the learner actively constructs or builds new ideas or concepts based upon current and past knowledge (Duffy & Jonassen, 1992). This perspective is beneficial to students in terms of social processes and the change in an individual's understanding as well as, promoting a student's free exploration within a given framework or structure. As educators, we need to recognise that education is centred on themes and concepts and the connections between them, rather than isolated information. Students learn best when they gain knowledge through exploration and active learning. The use of hands on materials and the encouragement of students to think and explain their reasoning instead of memorising and reciting facts is an example of constructivism in action.

Krause et. al. (2003, p. 157) assert that constructivism takes several different forms, two of which include "psychological constructivism" and "social constructivism". While both are identified as sharing a focus on individuals constructing their own learning, it is clear that each also has a different emphasis: one on the individual, the other on the social context. *Social constructivism* draws heavily on Vygotsky's belief that social processes are integral to learning (Krause et. al., 2003, p. 157). This approach rejects the view that the locus of knowledge lies within the individual. Rather, the social constructivist view is that social interaction shapes cognitive development and is an essential component of the learning process (Cobb & Yackel, 1996; Prawat, 1996). In addition, Doolittle (1999) refers to social constructivism as knowledge which is the result of social interaction and language

usage, and thus is a shared, rather than an individual, experience. He continues by referring to it as being a type of constructivism that is concerned more with meaning rather than structure. In the classroom, observers see a combination of the various forms of constructivism at work as students focus on the learning and teaching process. In the class observed for this research study, students were able to select their own topic area of interest for the minor and major projects. They were required to find information and design layouts, then to construct a final product that clearly conveyed information about their topic. The role of social and cultural factors in shaping learning experiences was emphasised during each lesson and was clearly evident through examples such as: student-student and student-teacher engagement and interactions, the use and increase of language by students with one another, the variety of selected topics that indicated an individuals interest and involvement in the wider community.

## 5 Definitions of Key Terms in the Study

There are several terms used throughout the study that were identified as being important and need to be defined in order to establish a common understanding.

- Web authoring and web authoring tools
- Computer Assisted Learning (CAL)
- Inquiry-based learning activities
- Tools for inquiry
- Effective learning
- Effective teaching
- Assessment: formative, summative, authentic

## 6 Research Methodology

### 6.1 The Case Study Approach

The fieldwork for the research carried out in this study was implemented using a *case study approach*. Rather than using large samples and following rigid protocols to examine a limited number of variables, the case study method was selected as it allowed me to establish an in-depth longitudinal examination, over a period of 18 months, of set focus areas within the secondary ICT classroom. In particular, I was able to investigate authentic student and teacher activity. Whilst the experience was unpredictable and complex, it provided a systematic way for me to examine what was happening, collect data in different forms, analyse the information and then report the results.

### 6.2 The Sample

For this study, one secondary ICT class was selected from a school located in the Sydney metropolitan area. Participating students were enrolled in the Year 9/10 IST elective course: *Internet and Web Design*. The area of Computing Studies was

selected for the study because of the requirements from the New South Wales Board of Studies that students be familiar with the use of database design, digital media, Internet and website development and multimedia programs. The teacher involved in the study became my collaborative colleague to discuss the class, issues that arose and progress being made.

### 6.3 The Software

For this study, students used digital media with an emphasis on the Macromedia multimedia and web-based solutions suite. In particular, the structure of the Year 9/10 IST elective course encouraged students to develop knowledge and technical skills in the use of *Flash*, *Fireworks* and *Dreamweaver*. Initial projects were developed using Microsoft Notepad to enable students to develop skills and an appreciation for HTML code prior to using a customised package for the development of higher-end project work that demanded more variations in the completed product.

### 6.4 Instrumentation

The primary quantitative data gathering tool used for this study was the '*What is Happening in this Class (WIHIC)*' classroom environment instrument (Aldridge, Fraser, & Huang, 1999). The WIHIC was used to examine how the teacher and students perceived the classroom environment to be with relation to the use of technology. It was used to gather data on both the preferred and actual perceptions of the staff and students involved. The WIHIC instrument was administered to both the teacher and students with a five-month interval between the examination of each group's preferred and actual perceptions. A computer background survey was implemented with the class to obtain information from the fifteen students about their access to computer technology, use of computers both at home and at school, interest and personal assessment of the ease with which they use technology, and regularity of use of the Internet and multimedia programs.

### 6.5 Data Collection

The 18 month long study was conducted to investigate whether the use of digital media can facilitate higher-order thinking within the learning of secondary ICT students. As part of this investigation, a 20-week intensive classroom-based field observation was implemented and involved both qualitative and quantitative approaches. Johnson and Onwuegbuzie (2004) refer to the combination of the methods represented by these two forms of data gathering as a *mixed methodology approach*. During the observation period, 30 lessons of 75 minutes duration were formally visited to view students engaged with the classroom technology. Specifically, the data collection methods implemented included: a pre-questionnaire; field notes (descriptive; observations); informal student and teacher discussions; formal student and teacher interviews; student work samples; computer-based student answer files, and a post-questionnaire. Staff and students responded to a classroom environment inventory prior to using the digital media and again after three months. The qualitative methods involved in the study included observations and extensive field note recording. For the purposes of this study, I assumed the role of a

participant-observer (Maor & Taylor, 1995) in the classroom of one secondary ICT teacher. This role enabled me to monitor selected students' application to task, and the thinking they utilised and/or displayed through the completion of the set activities. Field notes were recorded to document observations of both the teacher and students during each lesson. These notes recorded the learning taking place, whole-class discussions, individual interactions, student-student interactions and teacher-student interactions. During the second half of the school semester, classroom observations and field notes were further supported by access to entries made at the end of each lesson by students in an online diary of classwork.

## 6.6 Quality Controls

Johnson and Onwuegbuzie (2004, p. 22) discuss the mixed methods research process with reference to Onwuegbuzie and Teddlie's (2003) seven-stage conceptualisation of the mixed methods data analysis process which involves data reduction, data display, data transformation, data correlation, data consolidation, data comparison, and data integration. The research methodology was broadly ethnographic, and used data collection techniques of participant-observation, interviewing and verification techniques of triangulation and respondent validation (Jaworski, 1998). As Jaworski (1998, p. 112) describes, the methodology of this research study was conducted from a researcher as instrument position, meaning that an important instrument in both data collection and analysis was the researcher. During this study, I was aware of the need for quality controls, particularly for the qualitative research approaches implemented. These controls refer to the recommendations of Guba and Lincoln (1989) and other factors considered by Denzin and Lincoln (1994).

## 6.7 Data Analysis

During the implementation phase of this study, analysis of the data was an ongoing process. This process involved the review of detailed field notes taken during observations of the selected class and students, transcribed interviews by students and teaching and executive staff, the review of online diary entries and the analysis of student work samples that were in both electronic and paper-based format. It was necessary to examine the data and to triangulate the various data sources gathered.

## 7 Significance of the Study

It was anticipated that this research would contribute to future investigations related to the teaching and learning of secondary students within technology-orientated classrooms. In particular, the research study is significant for a number of reasons, as discussed briefly below.

First, it is likely to provide new information about the extent to which students can develop higher-level thinking skills using web authoring tools that utilise digital media. Second, it is likely to provide information related to the contribution that these tools have on changing the learning environment to be inquiry-oriented. This would support the research conducted by Coulter (2000) who investigated the role that technology has played in the provision for and enhancement of an inquiry

environment. The third area to which the study is likely to contribute is in facilitating comparisons with the work of Cooper and Maor (1998) who utilised multimedia to create a student-centred learning environment to examine the implementation of computer software whilst encouraging its use with students' in order to observe the presence of higher-level thinking skills. Cooper and Maor (1998) based some of their research investigations on the work of Grabinger (1996, p. 688) who posed questions including:

- How can we design machines to help people learn and think?
- Does this mean machines need to replicate human processes or that machines support processes?
- Can we use machines to help make the learning processes visible and more accessible?

Further comparative information can be gathered and considered from the studies conducted by Maor and Taylor (1995) who examined student achievements related to higher-level thinking skills, and the investigation of the mediation role of teachers' epistemologies in high school computerised classes. In addition, studies by Maor and Fraser (1996) concentrating on how the use of a classroom environment instrument can monitor perceptions in evaluating inquiry-based CAL are relevant to the investigations conducted within this study. These investigations may provide comparative results related to the analysis of a technology content-based classroom, its environment and the actual and preferred perceptions of the students and teachers.

The study is likely to contribute to investigations related to constructivism within the secondary ICT classroom. Jonassen (2002) and a number of researchers have conducted various investigations in relation to technology. In particular, he has examined constructivist perspectives for learning with technology, computers as mindtools for engaging learners as critical thinkers, and using computers as cognitive tools. The findings from this study will refer to the literature produced from these studies and highlight particular findings of significance that support and add to the identified areas of investigation. Denning, Fisher, Higgins, Loveless and Tweats (2003, p. 31) state that there "remains a daunting gap between that which is most often measured as a contribution to 'standards' and the acquisition and use of higher-order and metacognitive skills that may also go hand in hand with the use of ICT in the classroom". They refer to McGuiness (1999) who provided an informed and concise account of the present state of our engagement and understanding of thinking skills. It is hoped that this research study can look at the 'gap' referred to and work towards a better understanding of the impact that ICT can have on learning and thinking. Reeves (1992, p. 185) believes that research in the area of multimedia, learning and the links between them "has never been more important". He indicated that multimedia does not automatically guarantee higher-order learning and refers to Hawking (1988, p. 186) who states that "the difficulty of researching how people learn via IMM can be compared to the difficulty involved in measuring the development of black holes in space". The research conducted in this study aimed to examine some of these concepts. The study also aimed to contribute to an area that has been clearly identified as one that demands further investigation.

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# Age, Gender and Culture as Correlates of Use of Knowledge Management Systems in Makerere University

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**Abstract.** The purpose of the study was to establish which of (i) age (ii) gender and (iii) organizational culture is a correlate of use of knowledge management systems (KMS) among teachers, senior administrators and postgraduate students in Makerere University. The study was a co-relational and cross-sectional survey biased to the quantitative approach, involving 444 respondents from the University, from whom primary data were collected using a self-administered questionnaire, and analysed using summary statistics (e.g. means, standard deviations), t-test, Correlation and Multiple Regression Analyses. The study found that while age and gender were unimportant, organizational culture significantly correlated with KMS use among teachers, senior administrators and postgraduate students in the University. The study thus concluded that organizational culture must be improved if KMS use in Makerere University is to improve, leading to the recommendation that all stakeholders look into the possibility of improving organizational culture in the respective units in the University as a measure of enhancing KMS use.

**Keywords:** Knowledge management, innovation, gender, organizational culture.

## 1 Introduction

Turban, Aronson, Liang & Sharda (2007) define Knowledge Management (KM) as the systematic and active management of ideas, information, and knowledge residing in an organisation's employees, defining a Knowledge Management System (KMS) as Information and Communication Technology (ICT) that makes KM available throughout an organization. In other words, KMS are ICT tools that facilitate the creation, storage, transfer and application of organizational knowledge. Turban et al (2007) stress this definition by observing that a KMS is the use of modern ICT (e.g. the Internet, Intranets and extranets) to systematize, enhance, and expedite intra- and inter- firm knowledge management. Turban et al. (2007) observe however that: "encouraging employees to use a KMS, both for contributing knowledge and for seeking knowledge, can be difficult" (p. 487). This is particularly so in Africa, as is observed by Sebandeke (personal communication, June 23, 2009) to the effect that "whereas knowledge management and all associated best practices have been well received and embraced by the Western World, Africa seems to have a long way to go".

This observation happens to be true of Makerere University where use of computers and/ or ICT and other KMS tools, has consistently been reported to be low (e.g. Agaba, 2003; Makerere University, 2000; Niwe, 2000; Nsobya, 2002). For example, Makerere University (2000) observes that most departments in the University, both academic and administrative, depending on manual systems, with little use being made of computers in admission and registration, examinations, students' records, finance and accounting, estates, library management, personnel, office systems and so on. In addition, e-mail use and Internet access are minimal. Moreover, most sections of the University are using ageing PCs with old versions of software. Failure to use these KMS tools, implies that Makerere teachers, administrators and students are missing the opportunity afforded by KMS namely "to help an organization cope with turn over, rapid change, and down sizing by making the expertise of the organization's human capital widely accessible" (Turban et al., 2007: 484).

As suggested by Sebandeke (personal communication, June 23, 2009), "it is therefore... appropriate enough to set off" by trying to isolate the reasons why African institutions such as Makerere University are slow to embrace use of KMSs. The theoretical basis for this study is Turban et al. (2007) who note that several past studies (e.g. Riege, 2005) have identified a number of possible reasons why people do not like to share knowledge, including differences in terms of age, gender and organizational culture. Hence this study appraising the role of the three independent variables on KMS use by teachers, senior administrators and postgraduate students in Makerere University. The following section relates each of the three independent variables in the study, to use of innovations, basing on the fact that KMSs are an innovation, in conformity with the assertion that "knowledge management... is a ... new form of collaborative computing" (Turban et al., 2007: 480). It is still in line with Turban et al (2007)'s observation that KMS, that is the "application of ICT tools to facilitate the creation, storage, transfer and application of... organizational knowledge is a new and major initiative in organizations" (p. 481).

## **2 Related Literature**

### **2.1 Age and Use of Innovations**

Schiffman & Kanuk (2004) observe that it is reasonable to assume that age of the consumer innovator is related to the specific product category in which the consumer innovates, with consumer innovators tending to be younger than either late adopters or innovators because many of the products selected for research attention (e.g. fashion, automobiles) are particularly attractive to young consumers. Age is also theorized to be important in adoption of health and/or demographic innovations such as family planning (Bonabana, 2000), contraception (Karugaba, nd) and health service utilization (Mayanja, 2001). Age is also theorized to be important in the adoption of agricultural innovations, although there are two conflicting explanations for this: For example Basisa (1999) points out that while older farmers may have more experience, education and farm resources which factors can be an incentive to try out a

technology, young farmers tend to have more schooling and exposure to new ideas that may help to adopt a technology, which suggests an inconclusive debate and hence gap on this issue.

A few past studies on age and innovation adoption are now given. Natukunda (1998) found age to be negatively associated with knowledge and ever-use of contraception in both Central and Northern Uganda, while Turyaheebwa (2000), found that in Kampala District, women's attitudes towards family planning became more favourable with age. Byarugaba (1998) reported finding age as a factor with a significant relationship with modern contraceptive use in his study of selected socio-economic and demographic determinants of modern contraceptive use in Western Uganda. Ehikhamenor (1999) found age as having no influence on the level of ICT cognition or knowledge among 116 newly admitted postgraduates in information related programmes (i.e. information science; communication and language arts; and library archival and information studies in Nigeria). Thus while many of the above studies (e.g. Naturinda, 1998) showed a negative correlation between age and innovation adoption, others found a positive relationship (e.g. Turyaheebwa, 2000) yet others (e.g. Ehikhamenor, 1999) did not find any relationship. Such contradicting findings call for more studies to establish the truth. Further, of all the studies reviewed, only one (Ehikhamenor, 1999) was on the context of an academic institution, but not Makerere. Thus the empirical question remained for this study to answer; What effect did age have on KMS use in Makerere University if at all, explaining why age was hypothesized as a negative correlate of KMS use in Makerere University in this study, given that no earlier study had addressed itself to the issue.

## **2.2 Gender and Use of Innovations**

Gender comprises a range of differences between men and women extending from the biological to the social practical roles a woman has to play like caring for the children, cooking, fetching water and firewood, in addition to cultivation may hinder her from easily adopting to technology use. According to Kato (2000), the marginalization of women in regard to technology adoption and transfer is reinforced by the African cultural system which requires women to remain at home while husbands attend seminars, yet they do not always teach women what they have learnt in extension meetings. Women do not have access to the key productive resources such as capital, as well as being underprivileged in education and knowledge. Mwebesa (1997) observes that technological changes are not usually aimed at women at all, and that large scale development projects and their attendant technology rarely include policy regarding women; that sexist bias was the most important factor explaining the inability of women to take advantage of new technology offered; that appropriate technology programmes reveal that many projects do not achieve positive results for women's lives; that in many projects, even technology introduced for the benefit of women has been co-opted by men for their own use.

Any past studies on gender and innovation adoption? Mbabazi (2002) found sex as one of the variables significantly associated with reasons against condom use among adolescents in Central and Eastern Uganda, while Lubanga-Kiwanuka (1998) found gender as one of the factors influencing the adoption of new technologies in her study

of the factors influencing the adoption of new technologies of integrating and utilizing fruit trees in the farming system of Mukono District, Uganda. Another study (Sseguya, 2000) reports empirically finding gender as one of the factors significantly related to the adoption of soil fertility management technologies in banana-based agriculture of Lake Victoria Basin. Lewis (1995 cited in Obbo, 2001) is reported as empirically finding that internet content design, use, and so on are predominantly male, which finding was corroborated by Mburu, Massimo and Mutua (2000) who reported a similarly gender biased empirical finding in their study on Internet use in Gaborone City, Botswana.

However, Luwedde (1997) found that gender of farmer was not a significant factor in adoption of improved post-harvest technologies of tomatoes among small-scale farmers in Mukono District, Uganda. Another similar negative finding was by another study (Nakiganda, 2004) which concluded that gender (or sex) was not an important factor affecting use of agro-chemicals in Buikwe County, Mukono District, Uganda. Also, Ehikhamenor, (1999) found sex as having no influence on the level of ICT cognition or knowledge among 116 newly admitted postgraduates in information related programmes (i.e. information science; communication and language arts; and library archival and information studies) in Nigeria. Thus while many studies showed gender as an important factor in innovation adoption, others (Ehikhamenor, 1999; Nakiganda, 2004) did not show any, suggesting that the correlation between these two variables is far from certain, hence the need for this study to test the correlation between gender and use of KMSs.

### **2.3 Organisational Culture and Use of Innovations**

An organisation's ability to learn, develop memory, and share knowledge is dependent on its culture (Turban et al, 2007). Kizza (2003) argues that organisational culture is key to understanding why some firms succeed in implementing their strategies while others fail. Culture, a concept developed from anthropology is difficult to define or explain precisely (Mullins, 2002; Ndibalekera, 2002; Ssentamu, 2001). Nevertheless quite a few suggestions have come up. It has variously been conceptualized as; "how things are done around here" (Mullins, 2002: 802; Ndibalekera, 2002: 14); as the "underlying assumptions about the way work is performed"; "what is acceptable and not acceptable"; "what behaviour and actions are encouraged and discouraged" (Mullins, 2002: 802); as the "collective programming of the mind which distinguishes the members of one organisation from another" (Ndibalekera, 2002: 14-15); as a "pattern of shared basic assumptions" (Turban et al, 2007: 487). Kizza (2003) observes that if change is to succeed in an organisation, one needs to understand the culture that is to be changed. If the proposed changes contradict cultural biases and traditions, the changes will be difficult to embed in the organisation.

Since cultures are difficult to change, organizational culture is among the sources of resistance to change (Kizza, 2003; Rogers, 2003). Turban et al (2007) seem to concur with the above observations when they make an assertion of much significance in the current study to the effect that "an organizational culture that does

not foster sharing can severely cripple a KM effort” (p. 487). Any empirical studies on organizational culture and innovation adoption? Korpella (1996) set out to test the hypothesis of traditional culture as the key explanatory factor for organisational obstacles to ICT in developing countries. Using the case of the Yoruba ethnic group in Nigeria with a fairly uniform and distinct culture, he showed that that hypothesis was false, naïve, arrogant and led to dubious recommendations to developing countries, hence concluding that the differences in ICT adoption were not due to culture (indeed, according to him, there was no “culture of developing countries”) - but of political economy, a legacy of colonialism. Sentamu (2001) was a study on why the introduction of ICT in National Water & Sewage Corporation, NWSC in Uganda had not yielded significant changes in performance, which revealed a strong significant relationship between organizational culture prevalent in an organization and ICT adoption and hence called for the need to harmonize organizational culture and ICT adoption to enhance performance.

Mugweri (2000) in his assessment of the opportunities and challenges of exploiting ICT networks to improve efficiency and effectiveness in government operations using the case of the Ministry of Finance, Planning & Economic Development (MFPED), Uganda, established organisational culture to be one of the factors curtailing ICT adoption, when he, for example reported finding that the cultural context in MFPED was inimical to optimal exploitation of ICT networks. Dawa (2004) reported an empirical case of where faculty culture impeded ICT adoption when he reported that in 1998 the Faculty of Law, Makerere University sought to have its academic and administrative functions computerized by employing a technology consultant. However according to the Report of the Dean of Law Faculty of April 2000, the Computer Management Committee resolved to terminate the technologist’s contract because he had not developed any system. In response the technologist reportedly described the environment or culture in the Faculty of Law as having been hostile and hence deterring his ability to fulfill his terms of reference, thus suggesting that the culture of a major Faculty in Makerere was deterring adoption of ICT. From the above empirical cases this study still had major questions to answer; (i) Was the consultant used by the Faculty of Law sincere in blaming the Faculty’s poor ICT culture for the ICT venture failure? (ii) If he was, was the same true in the other units in Makerere University? That explains why organizational culture was used as a probable explanation of KMS use in Makerere University in this study.

### 3 Hypotheses

This section will seek validity of the following hypotheses:

- (i) Age negatively affects KMS use by teachers, senior administrators and postgraduate students in Makerere University.
- (ii) Gender affects KMS use by teachers, senior administrators and postgraduate students in Makerere University, with male performing better than females.
- (iii) Organisational culture enhances KMS use by teachers, senior administrators and postgraduate students in Makerere University.

## 4 Method

Using a quantitative correlational survey design, data were collected using a self-administered questionnaire with four background questions of relevance in this Paper, namely age, gender and income level. It had five items on organizational culture ( $\alpha = .8828$ ); and another 12 items on KMS use ( $\alpha = .8918$ ). According to Cronbach's Alpha Coefficient Test (Cronbach, 1971), the questionnaire was reliable for the study as both alpha coefficients were above 0.5. Using the said questionnaire, data were collected from a sample of 145 teachers, 124 senior administrators and 175 postgraduate students in Makerere University: other details about respondents are given in Table 1, which suggests that the typical respondent was aged between 30 and 40 years (39%), a male (66%), postgraduate student (39%) and of medium income (64%). The data were analysed using summary statistics (e.g. means, standard deviations), t-test, Correlation and Multiple Regression Analyses.

**Table 1.** Descriptive statistics on respondents' background

Description	Category	Frequency	Percentage
Age group in years	Up to 30	148	35.8
	30 but below 40	161	39.0
	40 and above	104	25.2
Gender	Female	147	33.9
	Male	287	66.1
Category of respondent	Teaching	145	32.7
	Senior administrator	124	27.9
	Postgraduate student	175	39.4
Income level	Low	132	31.1
	Medium	271	63.8
	High	22	5.2

## 5 Description of Dependent Variable: KMS Use

Knowledge management systems (KMS) use was a multi-dimensional variable made of twelve questions or items, each scaled 1 = Very rarely or never, including never heard of it; 2 = Rarely use; 3 = Neither rarely nor regularly; 4 = Regularly; and 5 = Very regularly. Pertinent descriptive statistics are given in Table 2:

According to Table 2, e-mail use had the highest sample mean, of over 4, followed by surfing use, suggesting regular use of these KMSs by respondents. African Virtual University (AVU) and video conferencing had the lowest sample means slightly above 1 (i.e. 1.56 and 1.48), suggesting that they were very rarely or never used by the majority of respondents. To get an overall picture of how respondents rated themselves on KMS use, an average index "KMS" was computed from the 12

**Table 2.** Descriptive statistics on KMS use

Indicator of KMS use	Mean	Standard deviation
LAN in your school, faculty or department	3.14	1.57
WAN in Makerere University	3.03	1.56
Africa Virtual University	1.56	1.07
Email	4.21	1.89
Web surfing	4.00	1.27
Bulletin board, mailing lists, discussion groups	2.49	1.46
Computer conferencing systems	1.67	1.06
Video conferencing systems	1.48	0.90
Electronic journals, newsletters (e.g. in Main Lib)	2.43	1.41
Electronic databases	2.23	1.35
On-line library catalogs	2.17	1.33
Other e-facilities	1.68	1.19

questions or items in Table 2 and found to have a mean = 2.38, which as per the used scale was suggesting that overall, the majority of respondents rarely use KMS facilities.

**6 Bivarite Analysis**

In this Section, bivariate or two-variable analyses are used to perform a preliminary test of hypotheses in the study:

**6.1 Age and KMS Use**

The first hypothesis in the study was that age was inversely related to KMS use among teachers, senior administrators and postgraduate students in Makerere University. Respondents were thus prompted to state their ages in years, which turned out to have a mean of 36 and median of 35 suggesting that respondents were above youthful age of 35 generally because only postgraduate students, administrators and lecturers were involved. The fact that the mean and median are almost same implies normality of distribution, despite slight skew ( $Sk = .769$ ). The ages ranged from a minimum of 22 to a maximum of 69. Pearson’s Linear Co-relation Coefficient was used to co-relate age with KMS use, yielding  $r = - 0.083$ ,  $p = 0.411$ , leading to acceptance of the null hypothesis to the effect that age was not significantly inversely related with KMS use among teachers, senior administrators and postgraduate students in Makerere University at the five percent level of significance ( $p > 0.05$ ).

**6.2 Gender and KMS Use**

The second objective in the study intended to establish the effect of gender on KMS use by teachers, senior administrators and postgraduate students in Makerere University from which it was hypothesized that gender affects KMS use, with males



being better. Given that the study wished to relate a numerical dependent variable (KMS use) with a binary categorical independent variable (gender), a t-test was suitable to test the null hypothesis. Table 3 gives the pertinent results:

**Table 3.** Descriptive and t-test results on KMS use by gender

Gender	Count	Mean	Standard deviation	t value	Sig. or p value
Female	37	2.54	.82	1.504	.136
Male	67	2.27	.87		

Means in Table 3 suggest that females (mean = 2.54) were better than males (Mean = 2.27) at KMS use. However the pertinent t value (1.504) is small because its p value (0.136) exceeds the benchmark sig.  $\alpha = 0.05$ . Thus at the five percent, we accept the null hypothesis to the effect that gender did not affect KMS use by teachers, senior administrators and postgraduate students in Makerere University.

### 6.3 Organisational Culture and KMS Use

The study wanted to see the influence of organizational culture on KMS use in Makerere, conceptualizing organizational culture as the extent to which the respondent agreed that their unit is change-oriented, innovative, progressive, ensures participation of all, and ensures organisational learning (five items), using a scale ranging from a minimum of one for strongly disagree, to a maximum of five for strongly agree. Table 4 gives resulting descriptive statistics:

**Table 4.** Descriptive statistics on organisational culture

Indicator of organizational culture	Arithmetic mean	Standard deviation
Unit is change-oriented	3.12	1.29
Unit is innovative	3.30	1.22
Unit is progressive	3.44	1.20
Unit ensures participation of all	2.92	1.24
Unit ensures organizational learning	2.91	1.29

It is noteworthy from Table 4 that all the five cultural constructs or items recorded means around three (i.e. median score), which suggests that as far as these items are concerned, cultures in the respective units in Makerere were viewed fairly by respondents. To get an overall picture of how respondents rated organizational culture in their respective units in Makerere University, an average index “Culture” was computed from the five questions or items in Table 4 and found to have a mean = 3.13, which as per the used scale was suggesting that overall, the majority of respondents rated their respective cultures as fair. When this index was correlated with the aggregate KMS use index, it yielded a significantly positive correlation,

$r = 0.313^{**}$  ( $p = 0.002$ ), suggesting that the better the organisational culture of the unit in Makerere University a respondent is in, the higher the expected level of KMS use of that respondent, at the one per cent of significance ( $p < 0.01$ ).

7 Multivariate Analysis

Bivariate analyses in Section 6.0 suggested that of the three independent variables (age, gender and organizational culture) only organizational culture seemed a potential correlate of KMS use among lecturers, administrators and postgraduates in Makerere University. However to rank order the three variables as correlates of KMS use, a more powerful multivariate tool, Multiple Regression Analysis, which takes into account simultaneous relationships of the many variables thus documenting collective effects and accounting for potentially spurious factors (Sweet & Grace-Martin, 2003) was employed. But before fitting the multiple regression model, independent variables were treated as follows: Being a continuous variable, age was used in the model as given by the respondents with no modification; because of its categorical nature, a dummy was created from Table 3 for gender (0 = female; 1 = male); organizational culture being a continuous variable, was used in the model as given by the respondents with no modification. Hence a multiple regression analysis of the aggregate KMS use index (KMS) on the three independent variables, yielded the results in Table 5:

Table 5. Regression results on KMS use on age, gender & organizational culture

(a) ANOVA table

F statistic	Significance level	Adjusted R square
4.71	.004	0.109

(b) Coefficients

Independent variable	Beta, $\beta$	Sig. or p value
Age	- 0.136	0.188
Gender dummy (0 = Female; 1 = Male)	- 0.066	0.520
Organisational culture	0.352	0.001

Part (a) of Table 5 suggests that the three independent variables considered, were collectively good explanatory variables of KMS use among lecturers, administrators and postgraduates in Makerere University ( $F = 4.71$ ;  $p = 0.004 < 0.01$ ), although accounting for less than 11% of the variation in the aggregate KMS use index (Adjusted R square = 0.109). Table 5 (part b) further suggests that of the three independent variables, only organizational culture was a significant correlate of KMS use at the one percent level of significance (its  $p = 0.001 < 0.01$ ).

## **8 Discussion, Conclusions and Recommendations**

The study has suggested that KMS use among lecturers, administrators and postgraduates in Makerere University is low, corroborating earlier researchers who came to similar findings about Makerere in the areas of utilization of computers in the management of students' information such as admissions (Nakaye, 1998; Zziwa, 2001); Internet utilisation by teaching staff as source of information (Agaba, 2003; Niwe, 2000); student participation in ICT usage and management (Nassanga, 2001), and teaching (Nyakoojo, 2002). Now the discussion, conclusions and recommendations turn to the influence of each independent variable on KMS use.

### **8.1 Age and KMS Use**

The study findings disagreed with the initial hypothesis that age is negatively related to KMS use among teachers, senior administrators and postgraduate students in Makerere University, inconsistent with several past studies (e.g. Byarugaba, 1998; Natukunda, 1998; Turyaheebwa, 2000) but consistent with others (e.g. Ehikhamenor, 1999). The finding dismisses theoretical assertions such as that by Schiffman and Kanuk (2004) to the effect that age is an important correlate of innovation adoption, with consumer innovators tending to be younger than late adopters or innovators. In conclusion, age proved an unimportant correlate of KMS use among teachers, senior administrators and postgraduate students in Makerere University. It is thus recommended that to improve KMS use in the University, stakeholders such as University Management should give equal training, exposure and encouragement with respect to KMS use to all teachers, senior administrators and postgraduate students without regard to age.

### **8.2 Gender and KMS Use**

While the study set out on the premise that females were at a disadvantage as far as KMS use is concerned, the study findings proved otherwise, a finding similar to that of Ehikhamenor (1999), but disagreeing with others (e.g. Mburu, Massimo & Mutua, 2000). The possible explanation for the study finding is that levels of KMS use are so low among teachers, senior administrators and postgraduate students in Makerere University that they cut across the gender divide. In other words, both males and females in the University are equally poor at KMS use. The study thus concludes that males are not better at KMS use among teachers, senior administrators and postgraduate students in Makerere University: hence the recommendation that both male and female teachers, senior administrators and postgraduate students in the University be given equal training, exposure and/ or encouragement with respect to KMS.

### **8.3 Organisational Culture and KMS Use**

The study set out to test the relevance of good organizational culture in enhancing KMS use in Makerere University, which hypothesis was supported by the findings.

This finding, while inconsistent with some past studies (e.g. Korpella, 1996), it was at par with a host of others (Dawa, 2004; Mugweri, 2000; Ssentamu, 2001). The finding thus strengthens the theoretical assertion that organizational culture is that does not foster sharing can severely cripple a knowledge effort (Kizza, 2003; Turban, et al., 2007). The findings thus lead to the conclusion that organizational culture is a positive correlate of KMS use and hence the recommendation that if KMS use is to take root in Makerere University, then the respective units in the University should enhance their organizational cultures.

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# Managing the Online Student Experience: An Ecological Model

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**Abstract.** The move towards providing fully online and blended courses for university students is becoming almost universal. To maximize the benefit to students and organisations we need to develop a robust model that allows us to identify the needs of students. We propose that an ecological model, already found to be useful in complex educational settings, can be used to make sense of data gathered regarding the behaviour of online students. Using an example involving three courses at a large Australian University we show this model yields useful pointers to investigating these issues.

**Keywords:** Online university education, blended courses, management of e-learning, ecological model.

## 1 Introduction

When university courses are taken online, or significant support is provided through the Web for blended learning, a difficult complication arises for the educational manager. In an asynchronous online environment feedback usually available through physical contact with students is replaced by parametric information available through the educational server. It is possible to interpret this information in many ways. If improvements are to be made in the content and delivery of online and blended courses then we need to have a model that allows us to measure the effects of changes we make and relate them to intended outcomes.

## 2 Modelling Student Use of the Internet

The literature contains a wide range of studies based upon models of student behaviour. When these models are studied in detail many of the assumptions we make about the way in which young people interact with the Internet are found to be unsupported by fact. For instance (Spennemann, 2007) looked at the assumption that students are choosing online courses because of the flexibility it gives them in study times. This study found that the overwhelming majority of students studied during normal working hours. Another study by (Kennedy, 2009), look for evidence of a

generation gap between students and their teachers. This study found that there was no evidence of a generation gap in terms of using technology, that assumptions about be preference by students for particular learning technologies were in error and it is critical that pedagogical technical and administrative issues be aligned. So much of our thinking on how to use the Internet to deliver education is based upon these poor models of students that studies often find no advantage to the student in having materials delivered online. For instance studies by found that there are many small numbers of students who felt that the Internet support provided helped them understand material being studied (Anagnostopoulou, 2009) (Franklin & Van Harmelen, 2007). A recent study (Wong and Tatnall 2009) found that the initial improvements in education supported by the Internet drop off quickly or students became less motivated by be novelty of a system that they used. This study hints at the possibility that it is not the materials, the way they are presented, or the technology used to present them, but be interaction between students and their environment that must be modelled if we are to effectively administer the use of the Internet to deliver educational services.

### 3 Ecological Models

The world abounds with situations of great complexity. One of these situations that has been studied for a long period of time is the natural environment. The science of Ecology has developed many different ways of investigating nature. Ecology is concerned with interrelationships between different living things, and between living things and their environment (Tatnall and Davey 2004). In addition to dealing with the natural environment however, the principles of Ecology have been used to deal in many other areas to deal with the complexity of those areas (Star and Griessemer 1989; Richards and Sanford 1992; Podolny and Stuart 1995; Nagarajan and Mitchell 1998; Simon 1998; Barnett, Mischke et al. 2000; Grzywacz and Fuqua 2000; Havelka, Koh et al. 2001; Sutcliffe, Chang et al. 2003; Johnston 2006).

These techniques have also been used in education and curriculum development to produce worthwhile results (Tatnall 1997; Tatnall and Davey 2002; Tatnall and Davey 2002; Tatnall and Davey 2002; Tatnall and Davey 2003; Tatnall and Davey 2004; Tatnall and Davey 2005; Tatnall, Singh et al. 2008; Tatnall and Davey 2009).

Ecological models can be simple or complex and can incorporate some or most of the techniques used in ecology and environmental science. Two key biological principles exemplify the concepts of ecology (Townsend, Harper et al. 2000):

- Organisms behave in ways that optimise the balance between their energy expenditure and the satisfaction they obtain.
- Organisms operate within a competitive environment that ensures only the most efficient of them will survive.

A complete ecological model of educational change would consider the **Environment** in which the innovation under consideration was occurring; the **Organisms** (actors) involved; possible **Competition** or **Cooperation** between these organisms; maximisation of return for the **Least Expenditure of Energy**; and the possibility of finding a **Niche Environment** that is free from competition from other organisms



(Tatnall and Davey 2004). In this study we have used a simplified model involving just Competition and Cooperation between entities and ecological concept of greatest return for the organism for the Least Expenditure of Energy, in order to explain the complex datasets.

## **4 The Ecology of Online Courses**

Ecological models require us to identify the Organisms which will interact with each other and the Environment they live in. The process of identifying organisms and environments is similar to that used in actor-network theory to identify actors. We see organisms as being those ‘actors’ who have the ability to respond to their environment independently. Those organisms that remain constant throughout a significant time, for instance a semester, are identified as being part of the environment. In an online course the principal actors who can respond are students, the resources and tools delivered through the Web, and the academics controlling the delivery of the course. The environment will include the facilities available to the student, including time, the software to be used in the course including the software that forms the University delivery system, and the details defining the course such as assessment and due dates. Our simplified ecological model asks us to look for potential competitive and cooperative behaviours between the organisms.

### **4.1 Least Energy Expenditure**

A principle often found in ecology is that organisms will behave in a way that maximises the amount of return they get from a small amount of energy expended. This principle will lead us to look for behaviours in the online experience where organisms (probably students or academics) are attempting to get maximum response for minimum energy expenditure. For instance, if there are two alternative methods available for an academic to communicate with students, we would look to find which of these this academic saw as requiring the least effort (energy expenditure). Similarly students might choose a path through the materials to return the greatest assessment results for the minimum effort on their part. Using this part of the model we would first of all look for communication facilities that enable students and teachers to communicate easily and efficiently. We would look for patterns of behaviour among students which improve their educational outcomes because communication was easy. We will also look for ways in which the student was missing out on educational experiences because they are attempting to minimize energy expenditure.

### **4.2 Co-operation**

In ecology we find successful organisms are often those that cooperate with other organisms to derive maximum benefit from their environment. This principle would let us look for behaviours in the online setting where organisms are attempting to cooperate. For instance an academic might find that cooperation with the tools available in the delivery system (even if they are not quite what they want) gave a better outcome than inventing a new tool. Another important aspect of cooperation is the idea or of coordinating the structure of the course with the tools available on the

Internet. Courses that give credit for students using tools seem to be important to the educational experience would be using the idea of cooperation to increase use of those tools.

### 4.3 Competition

In ecology scarce resources can lead to competition between organisms, with the most competitive organisms being successful. This would lead us to look for behaviours where the organisms compete with each other to obtain advantage. For instance a student might wish to communicate privately with the lecturer rather than using a bulletin board where all other students obtain the same information. Competition can be seen in more subtle interactions between the components of the environment. For instance use of Internet tools are require specific browser can lead to competition between those tools in the operating system favoured by the student.

## 5 The Cases: Courses at RMIT

All courses at RMIT are supported by the Learning Hub. This is connected to the Student Records System and comes online one week before the commencement of semester. Semesters have twelve teaching weeks and a mid-semester break, before a week of exam preparation (that we call “swat week”) and two weeks of examinations. This is followed by the publication of results. We will now investigate three RMIT courses that we will call: Face-to-Face-1, Face-to-Face-2 and Online Course.

“**Face-to-Face-1**” is a compulsory subject for all business students and has no prerequisites. It has a very large student cohort for each of the three semesters in a year. All teaching materials are provided to the Learning Hub and students are required to communicate with the teaching team either at tutorials or using the discussion board within the Learning Hub. “**Face-to-Face-2**” is an elective course with no prerequisites and is open to all students in the University. In this course all the teaching materials are available both on the Learning Hub and on a network drive available to all students. The teaching team uses the Learning Hub mostly for dissemination of assessment results. “**Online Course**” was changed to a fully online course during 2008. It is an elective course with no prerequisites and is available to all students in the University. In the first of the three semesters studied the Learning Hub was used for all teaching materials and students were encouraged to communicate with the teaching team using individual academic e-mail addresses. Assignments were all uploaded to each student’s individual server account, and assessed by the team from that account. Results were then transferred to the Learning Hub and feedback provided by e-mail.

## 6 Results

It is often assumed that students will take advantage of online resources by studying at different times that suit them. Spennemann (2007) examined server traffic statistics over a number of Australian universities and found that the overwhelming majority of use of University servers took place Monday to Thursday and during office hours, principally before two o’clock in the afternoon. We looked at two aspects of the use

of the Internet-based facility available to students in the three courses: firstly days and hours when students accessed educational materials. Table 1 below shows these results.

**Table 1.** Percentage of hits during working hours

Hit Times	Courses		
	Face to Face-1	Face to Face-2	Online Course
# hits	25481	18377	3733
% 9-5	57.9%	76.19%	68.77%
% outside office hours	42.1%	23.8%	31.23%
% 11-4	43.82%	58.02%	55.16%
Mon-Fri	84.82%	87.61%	89%

This table confirms the results from Spennemann (2007) and shows that regardless of the principal delivery method students mostly study during office hours. In our case this is surprising in that a significant proportion of the students undertaking these three courses are working full time and are studying part time.

Next we looked at each of the courses to see if there is any pattern in students logging into the Learning Hub. Logins are powerful in that they are direct evidence of student behaviour. They are also a broad measure as we only know that a student's computer is connected to a particular part of the learning hub and not what there are looking at there. We have only counted logins where the student navigated to some page other than the course homepage. These figures have been aggregated to give totals for each week. This means that a total of 600 logins may be one student logging in 600 times, or 600 students logging in once, or any combination of these scenarios. Careful study of the individual figures shows that students log in about three times a week. This means that the bars in the following graphs represent one student for each three logins. Figure 1 shows the pattern of logins for Face-to-Face-1. There were no logins for the week prior to semester when the Learning Hub was available because students generally are given instructions on how the course is delivered only during the first lecture. This chart is vaguely bimodal. There are two major assignments in the course due in week six and twelve. Students encountering a problem with their assignments are required to report that problem on the Learning Hub discussion board so that answers to problems are distributed to all students. This process was put in place mostly to make it possible for the teaching team to provide answers to a very large cohort of students. Inspection of the detailed access in this course shows that 22% of all access was to the discussion board and 61% was to the announcements page (where summaries of answers were kept.) Inspection of access to the discussion board shows zero posting for the board by students for other students. All postings on the discussion board are intended for the lecturer in charge of the subject or that lecturer making a reply.

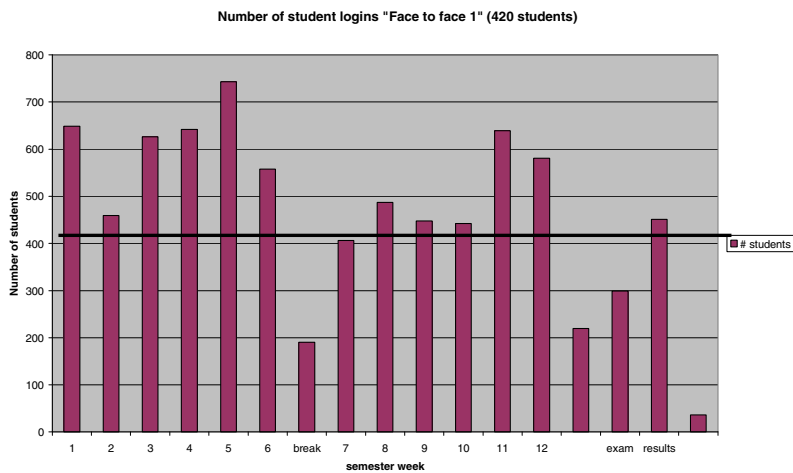


Fig. 1. Large face-to-face subject showing number of students logging in each week

“Face-to-face-2” has assignments every few weeks, with the major assessment during week 12. The chart below should be interpreted in the context of this course making electronic copies of materials available in several forms. In this course 21% of accesses were to the page showing results of assessment, and 53% to the page showing announcements. The announcements page was mostly used to clarify any issues about assessment and the course. In this course, although a discussion board was provided, there were no postings to the discussion whatsoever.

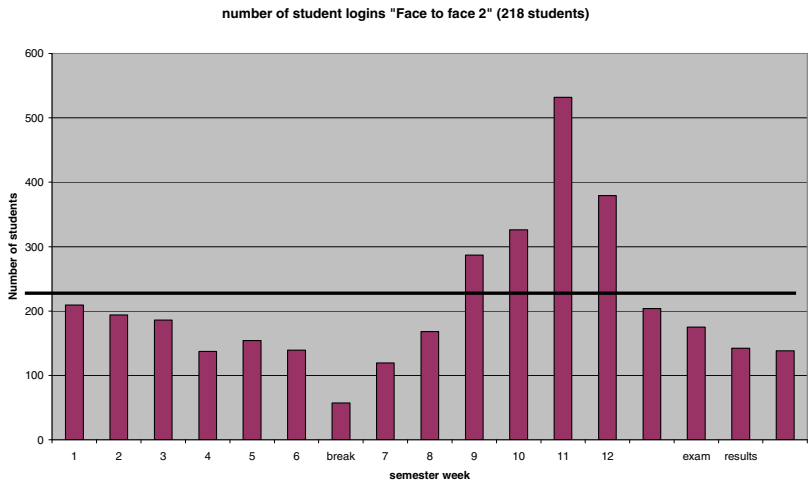
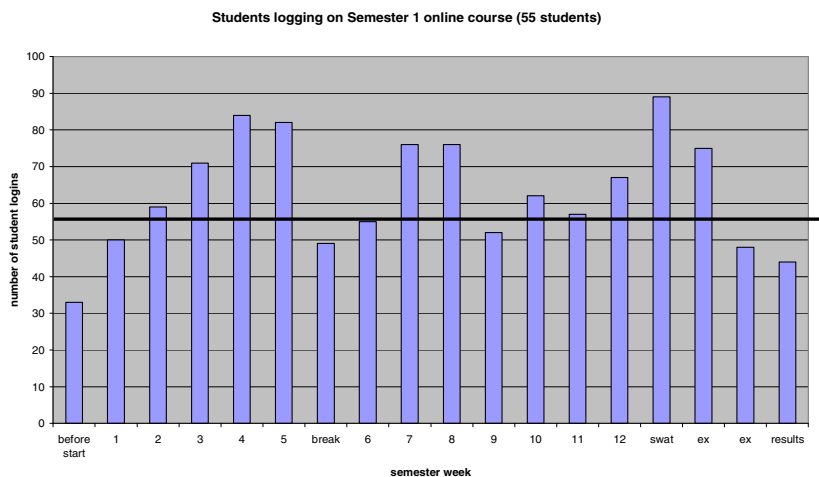


Fig. 2. Face-to-Face-2 subject showing number of students logging in each week

The third subject in a study was delivered completely online. In this case the figures show three peaks, again coinciding with the assessment task. This course requires all students to communicate directly by e-mail with an e-mail account separate from the learning hub. 80% of all hits on the learning hub were to the pages containing content, either lecture material or tutorials or assessment. Again the discussion board with provided in the subject was not used by the students.



**Fig. 3.** Students logging on Semester 1

## 7 Conclusion

The courses presented in this case study cover some of the range that must be administered in the University. There are consistent outcomes across the three diverse courses that would indicate the need for action. Students appear to be only using the Internet materials at the last moment before assessments. They are also ignoring any of the richer facilities available to them that are not directly related to assessment. There is no evidence of student using social interaction within the courses, such as discussion boards and groups, unless they are forced.

The extensive use of office hours access the study materials by students is consistent with our model in that students are using the online subject and materials to avoid personal appearance rather than to gain flexibility. This choice is clearly a way of minimizing energy expenditure.

The evident rush of hits immediately prior to assessment task being due is both an indication of minimizing energy and cooperating with the structure of the course.

What we do about this consistency of student behaviour depends upon whether we see it as being positive or negative. The University was not concerned with students using the Internet facilities during office hours. It does, however, give us insights into the reason for students choosing to use the Internet facilities provided. These reasons

have little to do with flexibility of study and more to do with the way in which students prefer to have their materials delivered. The lack of social interaction between students using the discussion boards and the apparent lack of interest in the course except immediately prior to assessment times is concerning.

The model would indicate that we can change student behaviour by looking for opportunities to give students least energy, cooperation with our course and competition with the other aspects of their life that interfere with maximizing the education. If we are concerned mostly with smoothing out student effort throughout the semester then our model suggests we did try some strategies:

- Smaller and more regular assessment spread through the semester.
- Use of push technologies with time release material.
- Covert monitoring of student interactions.

The ecological model was found to be useful in both predicting student behaviour and suggesting strategies for improving the outcomes of Internet delivered materials.

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# Using Open Source Software for Improving Dialog in Computer Science Education – Case Mozambique University

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**Abstract.** This paper highlights the essential matters in adopting technology as an aid to delivering education in higher education institutes in Africa. The key idea of the paper is how to use open source software for teaching and hence for improving interactivity between content, teachers and students i.e. how a well-selected open source software can foster learning processes. The paper also includes a case study in a Mozambican University to reveal a practical example on how technology has been used as an aid to education delivery. Availability of computer infrastructure, computer literacy, competent information technology staff, leadership support and collaboration and sharing culture are some of the identified issues important in using learning management systems (LMS) in African higher education institutes. The paper concludes by noting the need to fit the local environment and circumstances in adopting the use of technology in Africa.

**Keywords:** Learning Management Systems, Open Source Software, Higher Education Institutes, Africa.

## 1 Introduction

When IFIP Technical Committee 3 on Education had its first conference in a developing country in 1997 in Harare, Zimbabwe it was stated: "... while per capita income may be the dividing line separating "developed" from "developing" countries, the search for solutions to a host of common problems unites IT users around the globe. For example, IT adds a new level of complexity - acquiring equipment, training users and reconceptualising past practices - that places extraordinary demands on the IT community and, at the same time, creates dislocation in day-to-day life, whether in village or the megalopolis."(Marshall & Ruohonen, 1998) The use of technology is of immense importance to the education sector. It is one of UNESCO's aims to ensure that both developing and developed countries have the best educational facilities essential to prepare youths to actively participate in modern society and add value to a knowledgeable society (Anderson et al., 2002). Information technology (IT) plays a very important role in this endeavor. However, Watson (1998) states, that "more attention is needed to consistent and appropriate pedagogies with an



infrastructure for support that includes ease of access and time to incorporate IT into a well-established curriculum. Time for teachers to reflect professionally is essential. Strategies targeting professional capacity building will have a greater chance of success. They need to be focused not on the technology but on pedagogy and on the delivery mechanisms to be contexted within, rather than superimposed on, the real professional environment of the teacher."

Furthermore Visscher (2001) noted the general lag behind in use of computerized information systems in developing countries due to constraints for example in skills, expertise, finance and computer infrastructure. Nissilä and Puhakainen (2009) highlighted problems of technology related projects as including using expensive methods, ignoring local wishes, undermining local capacity and distorting priorities. The key idea of this paper is how to use open source software for dialogic teaching and hence for improving interactivity between content, teachers and students.

In addition the purpose of this paper is to highlight practical issues in educational management and systems in an African context. IT can be used to aid administration of a university i.e. to, for example, keep records of teachers and students. Another educational management perspective is classroom/teaching management which is handled by the teacher and is the focus of this paper. This educational management system has several names in the academic literature such as course management systems and learning management systems. While a significant number of tertiary education institutes in Africa have administrative educational management systems, there is even more room for improvement pertaining to systems that could be used for classroom. Moreover, seemingly the teachers' use of IT in their daily work is still a challenge (both in developed and developing countries). Beauchamp and Kennewell (2008) stated that "Most teachers adopting ICT use it for relatively authoritative teaching approaches, and our results suggest that they should identify how it can help achieve a more dialogic approach to whole-class teaching."

Furthermore, it has been noted that IS in the African educational sector are used mainly for administrative purposes with no direct impact on the main stakeholders in education i.e. students. Therefore, this research aims at motivating IT use in African universities in directly and positively impacting on learning methodologies. In addition, this research includes a case study from an African setting which will aid in providing experience in practical solutions on how to incorporate IT in enhancing education deliverance at tertiary level.

In this paragraph, we introduce potential learning management systems (LMS) which could be used for classroom management. This is important for awareness of existing platforms; some of them are part of free and open source software (FOSS) which African tertiary education institutes could use and benefit. The main advantage of using FOSS is the reduction of costs. It is important to highlight that the aim of this is to simply bring to light the possible LMSs. There is neither detailed discussion of these systems nor review of the systems in this paper. The first system KEWL ([http://www.opensourceafrica.org/view\\_article.php?type=case\\_study&id=16](http://www.opensourceafrica.org/view_article.php?type=case_study&id=16)) is an African initiative and the second system Moodle (<http://moodle.org/>) is free, open source software and was used in the case study as elaborated in section 3. Other FOSS systems evaluated in the case study below (Section 3) are Dokeos ([www.dokeos.com](http://www.dokeos.com)), Sakai (<http://sakaiproject.org/portal>) and ILIAS ([www.ilias.de](http://www.ilias.de)).

The rest of this paper is structured as follows. Section 2 covers key issues in practical application of LMS taking into consideration the African setting. Next, the case study of the application of LMS in a Mozambican university is covered in section 3. Finally, the discussion in section 4 then highlights the key issues when implementing an LMS in Africa.

## **2 Key Issues in Practical Application of LMS**

Kumar (2008) noted that technology incorporation in education is better than methods without IT use. However, there are several essential aspects that have to be taken into consideration for successful use of IT in education. This section discusses these aspects from an African perspective and in the tertiary education sector. These issues could be termed key issues in practical application of LMSs in African tertiary institutes. The issues that are discussed include computer literacy, computer infrastructure, collaboration/sharing culture, human resource (IT staff) and leadership support.

### **2.1 Computer Infrastructure in Developing Countries**

The first requirement in using LMSs is the computer infrastructure. Kumar (2008) noted that the main challenge for IT-enhanced education in developing countries is availability of computer infrastructure. Wright (2006) highlighted that IT has long been recognized as having a key role to play in emerging markets but questioned the effort of African countries in promoting ICT for development. There is need for African countries to actively support and make initiatives to avail computer infrastructure to the education sector. Wright (2006) also notes that “the difficulty faced by Africa is one of access and in a global society increasingly driven by access to information Africa lags behind because its population does not have access to the technologies that are facilitating information access and dissemination.”

### **2.2 Computer Literacy**

Lecturers and students should be computer literate to be able to use LMSs. Kumar (2008) argued that this is a problem in use of IT in education in developing countries. There is need to incorporate IT literacy classes at teacher training institutions. There is also need to organize workshops to train in the use of IT. Students should also have compulsory computer literacy classes and be encouraged to make use of the computer in different aspects such as entertainment, research and assignments.

### **2.3 Human Resource – IT Staff**

Anderson et al. (2002) suggested that countries must be able to benefit from technological development and to do so there is need for professionals with sound IT background. This IT background should not be computer hardware or software specific but general which enable learning and keeping in touch with technological advances. Different players in the tertiary education sector in Africa needs tailor-made IT training which suits their job requirements. For instance there is need for

trained IT staff who can manage the network on which the LMS runs. They should also have the essential skills to administer the LMSs. Different platforms such as Moodle and KEWL offer support to users which is an important aid in using the LMSs. The essential IT skills for running LMSs include basic knowledge on databases, network administration, web servers, system administration and server-side HTML embedded scripting language like PHP.

## **2.4 Learning and Knowledge Sharing Culture**

The success of a LMS depends to a great extent on the need for collaboration at different levels. There are many benefits if there is collaboration from students, lecturers, departments, facilities and even between different universities. For instance in Finland a student can take courses from any university in the country. Libraries are open to both university personnel and other residents. This sharing culture and collaboration is essential especially to get the best out of limited resources. The power or usefulness of any LMS for example increases with the increase of users. And user value increases with the increase of input into the system. Hence the need for collaboration and sharing culture to effectively use LMS.

## **2.5 Leadership Support**

The use of LMSs in Africa could be regarded as a change effort (Kumar, 2008) and change initiatives require the support of leaders. This support has to be substantial and in some instances is recognized by resources put in support of these initiatives. A simple example is the inclusion of funds for IT in education in national budgets. Support at high levels such as in government should be cemented by policies which promote the use of IT in education. For instance computer literacy course could be mandatory at teacher training institutes.

# **3 Case Study: Mozambican University Experience**

## **3.1 Initial Findings**

The first intake in the Information Technology Department did a Database course in their third year of study. The Database course was done in two semesters. The first semester was taught using the “Traditional” face-to-face teaching methodology. There were many problems in the first semester, which are noted below.

At the end of the first semester, interviews were done with students to enquire about their Database course experience and below are some of their responses. From the interviews:

- “There was inadequate time to use the Module Resources.”
- “It was difficult to communicate problems (academic and administrative) to the Lecturer.”
- “It was difficult to seek help from other students.”

- “Sometimes we did not hear the deadlines set or forgot them when told long time before the date.”
- “There was not enough time and space for discussions and debates.”
- “We have inadequate or no practical experience with the use of Database especially in a System.”

After the interviews an analysis of the problems was carried out and a review of the problems was done. This motivated research on how to improve class administration and the learning methodology.

### **3.2 Problem Identification**

There was rampant shortage of study material for the database Module. Eighteen students and the lecturer relied on three main textbooks only. This made access to textbooks quite a problem and had adverse effects in the class performance and motivation. In addition, communication barriers were encountered in the first semester. There were no sufficient and efficient communication channels among the students themselves and between them and the lecturer. This made expression of problem areas and information dissemination quite difficult for the two parties. Furthermore, there were insufficient learning resources to carry out vivid discussions on the database concepts. This meant that the time each individual student had on the course material was limited. A conducive learning environment was difficult to create and this demotivated the students. And finally, there was lack of ICT hands-on-tools to improve the computer literacy of the pioneer class.

### **3.3 Solution; Facilitating Learning by Blended Learning Approach**

After the problem analysis, the use of technology was recommended to aid face-to-face learning and also help in the class administration. This led to consider blended learning approach (Colis & Moonen 2001, see further discussion Kim 2007) which is used to describe learning that mixes event-based activities, including face-to-face classrooms, live e-learning, and self-paced learning. Research on how to incorporate technology was carried out and technology use was initiated to add to face-to-face learning methodology in the second semester. There were several possible FOSS alternatives that could be incorporated as described previously. However, there were several reasons that led to selection of Moodle such as stability, for it had a stable software platform at the time of the research, user support with well documented and free online support from users community, user-friendliness and personnel's expertise on its administrative and network requirements. Blended Learning was a combination of face-to-face learning and use of Moodle course management system (CMS) in the second semester. The following objectives were set for using a Blended Learning Approach in the second semester of the Database Modules:

- make Module materials available every time students need them
- improve communication between students and lecturer and among the students themselves

- create space or platform for discussions and offer students alternatives in helping each other.
- improve computer literacy of the students.

The Database Module chapter materials were prepared and uploaded on the Moodle CMS before the chapter commences. The students then downloaded the materials for use. The materials were available on the university's local area network for the students to use. Face-to-face sessions were carried out using the materials downloaded. With Moodle CMS forums were utilised to discuss Database course concepts. Students uploaded their thoughts to Moodle CMS and debates were carried out which were accessible by students anytime of the day. This offered space for discussions and debates. Students also utilized this feature to highlight problem areas, difficulties and/or misunderstandings they had in the face-to-face sessions.

During face-to-face sessions students were informed about deadlines of tests, exercises and other activities. These deadlines were highlighted on the calendar, which was one of the features of Moodle CMS. Students were reminded every time they use Moodle CMS as the calendar is on the index page. Students also carried out case studies such as "The use of database systems in local Companies." These case studies were presented during face-to-face sessions. These Case Studies were carried out in group research settings and then uploaded on the Moodle CMS for further use.

### **3.4 Evaluation of the Intervention**

The use of technology to improve the dialogic learning and interactivity effects had several outcomes. These outcomes can be described as technical, performance and social outcomes. In this section we will elaborate each of these outcomes.

#### **3.4.1 Technical Outcome; Diffusing New Technology**

Moodle CMS was the first information system to be used by the Information Technology Department Faculty of Tourism Management and Information Technology. It was an outstanding technical step for the Department as a whole. The Pioneer students participated in Moodle CMS set up. This enhanced their technology appreciation and knowledge. They also had the opportunity to practically learn MySQL database, PHP language, Apache web server and EasyPHP. In the first semester the students did not have any practical experience of Database use in a System. This made the grasp of Database Concepts difficult and this demotivated the students. In the second semester, Moodle CMS offered a platform to learn database (MySQL Database) use in a system. This motivated students to understand better the Database concepts.

#### **3.4.2 Performance Outcomes; Improving Overall Grades**

Figure 1 below shows the Database Module class performance in first semester and second semester respectively in the same student population. The graph shows the number of students in each mark range for the two semesters.

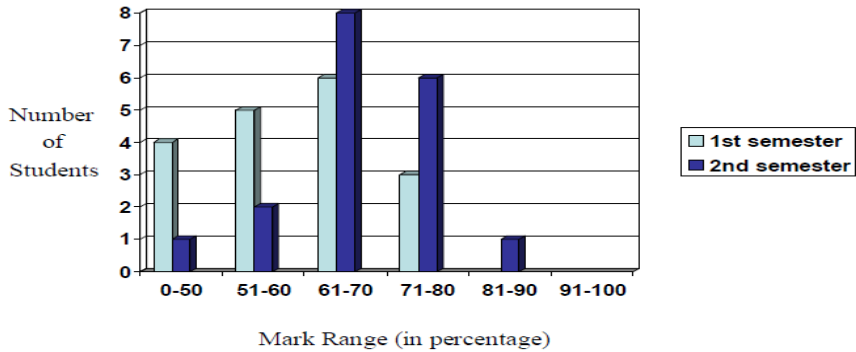


Fig. 1. Class performance in first and second semester

Four students failed in the first semester as compared to one in the second semester. Mark range 51-60 had three more students in first semester as compared to second semester. There were two more students in the mark range 61-70 in the second semester than in the first semester. This shows a positive shift from a lower range to an upper range, which is an improvement in performance of “average students”. In the second semester there were six students in the mark range 71-80 and three students in the first semester (half of second semester). There was no student in the percentage range 81-90 in the first semester and one student in the second semester. This shows a better class performance in terms of both quality and quantity in the second semester.

3.4.3 Social Outcomes; Increasing Motivation and Attendance

Figure 2 below shows database course class attendance in first and second semester.

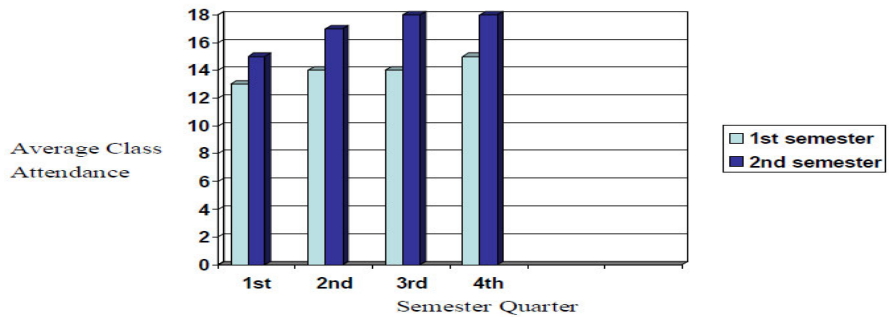


Fig. 2. Average class attendance in first and second semester

In the first quarter of the semester there was an increase in average class attendance by three students. The increase continued in the second quarter - we had an average class attendance of fourteen in the first semester and seventeen in the second semester. In the third and fourth quarters, there was full average class attendance in the second semester rising by four students in the third quarter and three students in

the fourth quarter from the first semester. Moodle CMS shows statistics of usage by each user showing time logged on and out, last time accessed and frequency. The statistics revealed increased usage by the students each quarter from the first semester quarter to the last semester quarter. It also revealed high participation in discussion forums. This showed high interaction among the students and also with the lecturer. Students discussed socio-academic problems in forums and this motivated the students.

### 3.4.4 Feedback from Interviews

At the end of the second semester, interviews were done again with students to enquire about the impact of technological intervention to their learning experience and below are some of their responses.

- “Learning was fun with lots of material available that could be downloaded from the system.”
- “There were lots of interaction through Moodle, which made problems be quickly addressed and from different perspectives of other students and the lecturer.”
- “Studying with access to material (from Moodle) helped me understand better and improved my performance.”
- “Technology use brought a new thinking in my life. It was like opening a window to a whole new world with possibilities.”
- “Help as well as communication from other students and the lecturer improved significantly because of the new channel technology brought.”
- “The system offered adequate space for discussions and debates.”

We can state that the blended learning approach has had a great impact on student’s learning skills, improved dialogic approach, increased motivation and better commitment to the use of educational management technology.

## 3.5 Lessons Learned

There was a significant improvement in performances as shown previously. This was attributed to a large extent, to the use of a blended learning approach. Hence the use of technology improved the performance of the Database course. There was improvement in computer literacy. Students maneuvered through the course management system, which was the first system they used. This triggered and encouraged students to start carrying out research in technology use in education. The use of Moodle CMS was an “eye-opener” and motivated students to study more.

The increase in class attendance shown was a result of the motivation and enthusiasm in use of technology by the class. Interaction among students increased significantly as noted by the number of emails they wrote each other. Discussion forums (on Moodle CMS) on academic, class administration and social issues were well participated by the students. Hence technology use had a positive social impact.

There is need for proper and good orientation in time before the implementation of blended learning. This is necessary to avoid panic and discomfort among students in using new technology. In addition, there is need to allocate adequate time for students’ practice in using new technologies. For example, two students dismally

dropped in performance and these were slow learners who did not grasp and adapt to use of technology very well. Remedial work is therefore recommended for the benefit of slow learners.

The main drawback and disadvantage of Moodle CMS use is when electronic materials are not available due to unavailability of network, electricity blackouts, server problems and/or the computer laboratory security rules. Continuous Moodle CMS access problems will raise adverse effects to class administration, progress and motivation. It is recommended that the responsible authorities and policy makers do appreciate and have technology use knowledge so that they fully support technology use.

Computer literacy is a prerequisite to use blended learning. However related to this, Nissilä and Puhakainen (2009) noted that one of the reasons for project failure is too much emphasis on technology and little attention to user needs. In addition, they highlighted the importance of including the users from the starting phases of the project. The success of blended learning in this case was due to the fact that the database course class was a computer literate group. It is therefore recommended that there be a computer literacy test before blended learning methodology use.

## 4 Discussion

Technology use in the tertiary education sector is of immense importance for educational development in Africa. The use of technology by higher education institutes varies, however this research focused on the LMSs. The key issues of learning management systems identified from an African tertiary education perspective are need for increasing computer literacy in the sector, need for computer infrastructure, learning and knowledge sharing culture, human resource – IT staff and leadership support. This paper included a case study of how open source software was utilized to benefit students at a university in Mozambique. This case demonstrated that there is no defined way of technological adoption but there is need to adjust and adapt technology to suit the different local conditions and circumstances. Nevertheless the use of technology is very much encouraged to aid and improve the higher education institutes in Africa.

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# A Baseline for a School Management Information System

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**Abstract.** This paper examines previous studies and supplier recommendations for the requirements of Management Information Systems (MISs) in schools. Utilising the broad headings in the Becta (2006) document ‘functional requirements for information systems including MIS’ it expands on its recommendations as a baseline for a school’s MIS. It looks in brief at 34 different areas that may form part of a school’s system and considers the minimum features that each should encompass. It considers the need for more detailed examination of some of the categories and concludes that much has been achieved over the last 20 years or so. However it also notes that the areas of open standards, interoperability, transfer, functionality, cost effectiveness, statutory driven developments and usability are still major issues.

**Keywords:** MIS; Management; Information; System; Schools; Interoperability; Framework; Software.

## 1 Introduction

There have been many previous studies into the use of MISs in schools including; Strickley, 2009a & 2004; Baker et al, 2008; Fung et al, 1998; Ip Tsang & Lee, 1997; Fung & Ledesma, 2001a&b; Visscher & Bloemen, 2001; Nolan et al, 1996; Nolan & Lambert, 2001; Nolan & Ayres, 1996; Wild & Walker, 2001; Visscher, Wild & Smith, 2003; Selwood, 1995, 2004 & 2005; O’Mahony, 1998; Barta, Telem & Gev, 1995. Many of them have made recommendations as to the minimum and preferred requirements of a school MIS.

In addition the various school MIS suppliers provide information on the specifications and advantages of their own specific systems including Capita SIMS, (Capita, 2009), Serco CMIS, (SERCO, 2009), Wauton Samuel PASAPP, (Wauton Samuel, 2009), Bromcom, MIS, (Bromcom, 2009), Research Machines Integris, (Research Machines, 2009), ScholarPak (ScholarPak, 2009) and SchoolbacS (SchoolbacS, 2009).

This paper looks at previous research, the MIS suppliers’ information, The ‘Information Management Strategy Framework’ (Becta, 2008), The ‘School Management Information Systems and Value for Money’ report (Becta, 2005b) and ‘What to look for in a management information system’ (Becta, 2005a). Using the Becta (2006) framework as a template it expands on each of the categories contained within it adding new ones as appropriate.

The paper makes no assumption that the MIS is from a single supplier (although it could be) but that all of the modules should work in an interoperable way sharing common data with each other and under a single over-arching data management and security protocol. It considers the main users will be administrators, teachers, parents, pupils and the senior management team and that although the requirements of primary and secondary schools may be different this should not be assumed. Whilst most of the attributes described would be applicable to any school MIS many of the legal references apply to schools in England only.

The following sections follow those in the Becta (2006) report with extra sections added at the end. The order of the sections is not considered to have any significance to their importance.

## **2 Specification**

### **2.1 Access Remotely**

Multiple site access to the MIS is critical to its use and usefulness (section 2.2). As Strickley (2009a) found in his study of primary schools many teachers, parents and governors do not have electronic access to even the most basic data stored on the school MIS and often have to rely on, at best, hard copy.

In addition the availability of remote access outside of the school building is important for several reasons:

- Lack of non-contact time in school to use the system (particularly for primary schools where there is less non-contact time).
- Lack of access points within the school to accommodate all staff.
- Lack of access at point of source for data input.

In order to achieve this full availability the MIS must have the capability of being accessed from any suitable hardware, at any location, through the internet using an eportal or similar. As a result the transfer of data must be secure and the access point subject to strict password controls.

The use of secure wireless technology within the school should help alleviate some of the issues of school access points. However, there is still the need for hardware that can communicate wirelessly together with suitable work areas that comply with health and safety guidelines for computer workstations (HMSO, 1992).

It should not be assumed that internet connectivity is always available (or even at all) and the ability to work offline and upload when connected should be a feature of the system where appropriate.

In short the MIS should be available, with appropriate restrictions and security, at any place at any time accessible through a variety of hardware options.

### **2.2 Accessibility**

The system must be accessible through an intuitive Human Computer Interface (HCI; see section 2.30) and support those with disabilities through Disability Discrimination

Act (DDA) compliance (HMSO, 2005a) and the Web Accessibility Initiative (WAI, 2009). Screens should be customisable to individual requirements where possible e.g. text size, colour, language etc.

As Strickley (2009a) suggests many of the current MISs are not designed with the user in mind and many web-enabled options are identical in layout to the non-web version. The different requirements and modes of use of the different access channels must be part of the design.

## 2.3 Admissions

Admissions for first entry (reception), secondary transfer and in year or casual admissions are all important transfer stages for pupils (Strickley & Allen, 2008). It is therefore critical that the pupil profile is transferred when the pupil moves school. Whilst the Common Transfer File (CTF) (DCSF 2009a) and the more specific Admissions Transfer File (ATF) (DCSF, 2009b) achieve this to a limited extent they suffers from a lack of rich pupil data and a difficult transfer process through the s2s secure transfer site (DCSF 2009c).

The ability to seamlessly import new admissions data into an MIS is essential for the continued learning of the pupil with the added advantage of reducing data input into the system for administrative staff.

For the increasing number of schools that administer their own admissions policy (academies; voluntary aided and foundation schools) the MIS should be capable of importing the appropriate admissions application data (Admissions Data Transfer File; ADT) ranking the pupils as defined in the school's over-subscription criteria and sending the file back as an Admissions School List (ASL) file to the home Local Authority (LA) for processing (DCSF, 2009b). This again should reduce data input burdens for schools and LAs as well as ensuring that the admissions criteria of the school are being applied fairly and consistently (DCSF 2009d).

The above own admitting authority schools will also need to keep records of appeals by parents who have failed to secure a place at the school as part of the statutory reporting requirements for school census (DCSF 2009e). Also see section 2.29.

## 2.4 Assessment Management

Assessment is key to the school as a measure of its effectiveness, the performance of its pupils and the development and improvement of its learning and teaching.

The assessment software should provide all of the flexibility and usability of the teachers' traditional mark book with the added functionality of a software tool which will support analysis, predicting, standardisation and statistical modelling through an intuitive interface.

As the Becta (2006) document suggests all tests should be recorded in the system. However the results of these tests should be available on a need to see basis to ensure the confidence and support of the teaching staff entering them.

The process of recording should enable the administration of statutory, internal and external exams and tests. These results should also be accessible to parents, in the

appropriate format, as part of the online reporting process (section 2.34). This will also reduce data input burdens. The ability to add data at the point of creation whether online or offline is particularly important in this area.

Any Integrated Learning Systems (ILSs) and learning platform should integrate seamlessly with this module with assessment results being recorded automatically.

## **2.5 Attendance**

The collection and transfer of attendance data is a statutory requirement (DCSF, 2006) for schools and therefore a method of easily collecting this data and transferring it is an essential statutory element of a school's MIS. In addition the continued and regular attendance of pupils is critical to their educational achievement and the identification and intervention of poor attending pupils is a vital tool in school improvement.

Seamless capture here is the key, at source, via a PDA, laptop, swipe-card or similar. The ability to easily capture lesson by lesson attendance as well as am-pm registration is also an added advantage particularly for secondary schools. In this latter respect the module needs to work in tandem with the timetabling and options modules.

As Strickley (2009a) suggests attendance reporting should be real-time via an alerts system or reporting tool and not just used for statistical reports at the end of the day, week or term.

The software should enable the proactive monitoring of attendance patterns, alert appropriate staff to unusual activity and activate intervention when key critical points are reached.

## **2.6 Authentication**

A school's MIS will contain a large amount of sensitive data about children, parents, teachers and other associated personnel. Clearly such a database needs robust authentication before users can access any part of it and in addition strict business rules must be applied that control the exact data items that may be accessed.

Access to the system should be at a minimum through user ID and strong, frequently changed, password with additional use of biometrics an option if appropriate.

Wireless, intranet, internet and LAN authentication protocols must be in place and regularly monitored to ensure that only approved personnel are accessing the system.

## **2.7 Behaviour Management**

Both positive and negative aspects of behaviour should be recordable on the system. The system should allow the recording of action taken and outcomes. See section 2.31 for exclusions.

Reports should be available to all appropriate school staff in real-time and analysis tools should be capable of illustrating trends and variables as appropriate. Event

driven alerts should be used to inform staff of critical issues such as specific lesson/teacher issues, repeat occurrences, items for weekly newsletter etc.

It is important that the module is used for both positive and negative aspects and not just for negative incidents. Staff training will be required to make sure that the system is used in a consistent and equitable way.

## **2.8 Consistent Learner Information**

The system should ensure that there is minimal duplication of information and that processes should be automated to avoid errors and inconsistencies.

The use of consistent datasets will help to enable consistency and interoperability. All data should be validated against standard benchmarks such as BS7666 (Cabinet Office, 2009), Common Basic Data Set (CBDS), (DCSF, 2009f) etc. at source to ensure that consistency is maintained and that cross –system transfer is possible. The development of the Systems Interoperability Framework (SIFA, 2009) and the establishment of the Information Standards Board (ISB, 2009) may assist in this with a view to common data standards across all partners including health, social services, youth services etc.

## **2.9 Data Protection**

Compliance with the Data Protection Act (DPA, HMSO, 1998) is clearly essential. Fair Processing Notices (FPNs, DCSF, 2009g), also known as privacy notices, should encompass all data sharing activities and should be generated for all data collection processes such as data collection sheets, emails, web forms etc.

The modules within the MIS should comply with the security guidelines in the Becta (2009) report.

## **2.10 Information Access**

Edit, view and restricted access roles should be available and applied to all fields including User Defined Fields (UDFs). Predefined groups should not be assigned as a default. Access rights should be at field level.

These access rights should be reflected in the fields accessible in the reporting module (section 2.13).

## **2.11 Learner Information Exchange**

The system should comply with the statutory requirements of pupil data transfer as detailed in HMSO (2005b) using the CTF. It should comply with the data collections from the various statutory bodies such as DCSF, QCA etc.

This statutory baseline should be extendable for more rich data about the pupil for transfer to other systems (including those outside of the school system such as colleges) as detailed in (Strickley & Allen, 2007).

The system should also support the use of Unique Learner Numbers (ULNs, MIAP, 2009a) for the transfer of information through Managing Information Across Partners (MIAP) learner registration service.

## **2.12 Messaging**

The MIS should act as a conduit for the creation, transmission and receipt of all types of messages.

These may be telephone voice messages received via any telemetry system and captured by the system; emails from inside or outside of the school intranet; SMS texts sent to an approved school mobile number; emails sent via a web-based email system for parents; short messages sent via the web portal; instant messaging; digitised documents and any other approved method of contact.

Essentially the system should be inclusive to all messaging to and from the school making it unnecessary to move from application to application to access multi-channel information and thus reducing the risk of missing vital information.

Contact information needs to be prioritised to prevent what could amount to spamming and the creation of groups with similar profiles should be simple to achieve.

## **2.13 Reporting**

An MIS is only as good as the information that can be extracted from it. Ease of use and functionality are key. Simple reports should be menu-based and pre-defined for the users, whilst reports of intermediate complexity should be menu driven or use “wizards” enabling most users to utilise with minimal training. The development of complex reports should be available through a simple programming interface.

Reporting should take place across modules employing the same back-end database and should also be able to report across different databases providing the appropriate keys are available.

Whilst some of the simpler pre-defined reports may be modular based an overarching reporting tool must be available for the more complex requirements. A third party tool may well be the most appropriate and effective solution.

Internal and statutory reports should emulate the same information access security protocols as for direct access to the MIS and should not enable access via stealth.

All types of report should be available from simple list reports to more complex mail merges, cross tab reports and graphs and should be available for publication in a variety of formats e.g. pdf; doc and rtf.

## **2.14 Special Educational Needs (SEN)**

The MIS must cover the statutory (DfES, 2001) administration and reporting functions that are required by the law. In addition it should enable the efficient and effective management of the education and well-being of SEN pupils by assisting practitioners to develop learning/education plans, assimilate progress and past achievements and monitor and report on progress at a micro level (section 2.34).

### **2.15 Data Returns**

The system must be capable of generating all of the central and local government returns/census in an efficient manner utilising data held on the system to the full . Error checking and validation should be intuitive and assist in cleaning the data held on the system to the advantage of the school. The format of reports should be in a variety of interoperable formats.

### **2.16 Support**

The system should be supported through online help, supplier helpdesk, email, telephone and local support unit. Help should be intuitive and available when required but unobtrusive. System upgrades should be accompanied by appropriate explanatory materials including changes log and at regular intervals without excessive software patches applied at a later date.

### **2.17 Timetable Management**

The timetable is a complex and significant process particularly for a large secondary school. The timetable module should support all of the modelling functionality required including rooms; times; locations; special needs access; travel time; non-standard timetable cycles etc. It should not be seen as an annual one-off event and should be accessible by staff, parents and pupils in a cut down format through the network and web portal for reference, cover and general information.

### **2.18 Workforce Management**

The system should enable the management of personnel records, job evaluation, pay scales, training and development, attendance, sickness etc. enabling the generation of statutory returns (DCSF, 2009h) and linking with financial management to enable a full business model of the school and its staff.

Such a sensitive area should have the highest security protocols in place.

### **2.19 Asset Management**

The MIS should be capable of recording and tracking all assets in the school including consumables. The normal reporting and alerting functions should be available to enable good stock management.

### **2.20 Coursework Management**

The system should support the storage, retrieval, classification and archiving of pupils' coursework materials. These may be those as submitted for examination or pupils' work as part of their day-to-day education or after-school activities. Digitisation of the materials together with metadata for identification must be available. Where appropriate the facility to transfer outside of the school system (sections 2.33 & 2.27) to external examiners, employers or other schools must be available and efficiently implemented.



### **2.21 Curriculum Planning**

The system must be capable of storing the overall school development plan in an appropriate format. It must cater for all levels from whole-school, through departmental to teacher lesson plans. It must also hold resources required and enable forecasting and modelling for future planning with appropriate links to finance, asset management and assessment etc.

### **2.22 Dinner Money**

The recording of dinner, trip, school fund etc. monies should be a feature of the MIS. The process should be linked to the school's financial system with full audit trails and authentication. The system should be linked to any cashless catering systems and i-payment facility and should be capable of printing receipts, remittances and cheques as appropriate.

### **2.23 Document Management**

The system needs to be capable of the storage, retrieval, classification and archiving of documents including full metadata. Digitisation may be through a variety of methods but the system should be capable of importing and exporting all standard formats.

### **2.24 Financial Management**

Full, partial or limited financial management, to industry standards, should be available capable of being dovetailed with existing over-arching systems from the Local Authority (LA) or other systems. The system should accept all payments including those via the internet and enable all forms of ordering across the school with appropriate access levels (section 2.9).

Full audit trails and security protocols must be in place.

### **2.25 Library**

The MIS should have the option to run a fully functional library system including reference, lending, borrowing, returns, reminders and fines system. It should also be available online and utilise electronic copies where appropriate. The system should be adaptable for all types of schools.

### **2.26 Options**

The facility to accommodate options, particularly for years 9 to 11, to facilitate curriculum planning and timetabling should be incorporated into the MIS with the additional functionality to handle diplomas and non-standard requirements.

### **2.27 Transition Portfolios**

An ePortfolio enables learners to have a record of their progress throughout their lifelong learning (Strickley, 2009b). The creation, maintenance, access and seamless transfer of ePortfolios should be a feature of the MIS (sections 2.11, 2.20 and 2.34).

## **2.28 Web Services**

The system should incorporate interoperability standards, such as SIF (2009) that enable seamless data exchange to occur between modules within the MIS and appropriate systems outside of it. This should be through the use of an Application Programming Interface (API) or other appropriate protocol e.g. xml (section 2.33).

## **2.29 Appeals**

The MIS should be capable of recording, administrating and reporting on appeals where the school undertakes this function as a foundation, voluntary aided school or academy (section 2.3).

## **2.30 Human Computer Interface (HCI)**

The MIS modules should all incorporate HCI best practice (COI, 2009) and should have a similar look and feel between each module using a consistent GUI and shortcut keys (section 2.2).

## **2.31 Exclusions**

The MIS should enable the recording, retrieval and internal and external statutory reporting of exclusions information (DCSF, 2009i). Alerts should be in place to warn when statutory limits are approaching and it should be capable of modification outside of the statutory framework for internal purposes.

## **2.32 Alerts**

Alerts are a critical part of an MIS. They must be easy to set up and flexible in terms of recipients, mode of receipt, activation levels and complexity of initiation thresholds. For example they should be able to alert a predefined group by email and SMS, if a mobile number is available, when a combination of criteria are reached.

## **2.33 Transfers**

As referred to in sections 2.3, 2.11 and 2.27 the ability to transfer the data between modules within a school, between schools, to the LA and other agencies such as DCSF and QCA is a critical feature of an MIS. This will require a more open standards approach such as that proposed by ISB and SIF (see section 2.8 and 2.28).

## **2.34 Reports to Parents**

The statutory requirement for secondary schools in 2010 and primary schools in 2012 (DCSF, 2009j) to enable electronic reporting of attendance and behaviour (both positive and challenging) progress and attainment and SEN information to parents is a critical mover to increase access and engagement for parents (Strickley, 2009). The ability to record and share this information will need to be embedded in all MISs by the dates above.

### 3 Conclusions

There is no doubt that school MISs have improved greatly over the last 20 years and most incorporate, to some extent, the functions described in this paper.

However there are still some major issues which need to be addressed:

- There is still a tendency for MISs to be marketed as a single complete solution. Whilst many of the major suppliers offer all or most of the functionality a school might need there is little opportunity to mix and match the modules between suppliers. This is as a result of the lack of open and interoperable standards being used by the suppliers as discussed in detail in Becta (2005).
- The lack of transfer between different schools (and LA) systems is highlighted in Strickley & Allen (2008). Transfer needs to be seamless and capable of transferring all pupil data as required.
- Support for school MISs needs to be flexible and cost effective particularly where different suppliers are involved (Becta 2005).
- Modules need to be more adaptable to the needs of the school be they secondary, primary, special, small or large.
- Whilst the requirements of statutory legislation are key functions of the MIS they must not be the drivers of the development of it.

Further work is under consideration to expand upon this paper to give more examples and details, with references to case studies. It will be interesting to see how systems compare against these criteria in five years from now.

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# Implementation of the Technological Plan for Education in Portugal, a School Perspective

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**Abstract.** The Portuguese Ministry of Education has intervened in the Technologies and Information Systems (TIS) of the educational system with a Technological Plan for Education (TPE). The TPE is the Portuguese initiative for ICT in education, and is an intervention in three axis - Technology axis, Contents and Training which cover in an integrated and transverse way all areas related to the modernization of the educational system in Portugal. The full impact generated by this action is of particular importance due to the high performance enabled by the integration of ICT in the management and quality of the educational system thus allowing for an increase in confidence, performance and competitiveness. In this paper we follow a model in the implementation of the TPE in secondary schools. It shows a solution we came up. A strategic plan and is iterative assessment, from the need to address this problem.

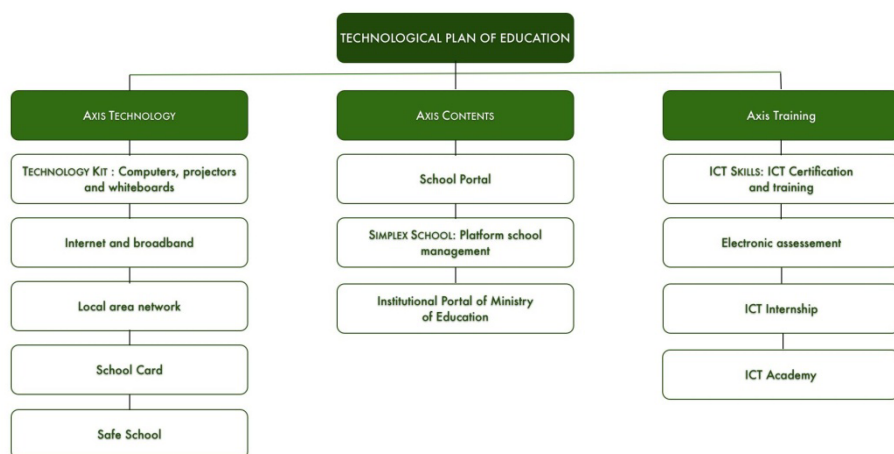
**Keywords:** Educational Information Systems, Strategic planning, training and professional development, educational management and information technologies.

## 1 Introduction

The Technological Plan for Education, a program for the technological modernization of the Portuguese school, is a decisive turning point towards what really matters in schools: teaching and learning. The TPE aims to make school a place for interactivity and the sharing of knowledge without barriers, to certify the ICT skills of teachers, students and staff and to prepare youngsters for the knowledge society. The aim of the TPE is to put Portugal among the five most advanced European countries in terms of technological modernization of schools by 2010 (Table 1).

**Table 1.** TPE Goals - Source: [www.pte.gov.pt](http://www.pte.gov.pt)

GOALS	2010
High-speed Broadband Internet connection	48Mbps
Number of students per PC with internet connection	2
Percentage of teachers with ICT certification	90%



**Fig. 1.** Technological Plan for Education Source: [www.pte.gov.pt](http://www.pte.gov.pt)

The Technological Plan for Education comprises three areas of action - Technology, Contents and Training, which act in an integrated and cross manner in the Portuguese education system. As shown in Figure 1, each axis has its own projects with objectives and participants.

*TECHNOLOGICAL KIT – Interactive whiteboards, computers connected to de Internet, and video projectors: Reinforce IT equipment in the classroom. Goals: 2 students per computer in 2010, to improve the ratio of students per computer connected to broadband Internet. To increase the amount of support equipment.*

*HIGH SPEED BROADBAND INTERNET: To increase the rate of broadband Internet access among schools to at least 48Mbps by 2010. Goals: To progressively increase the minimum speed of Internet connection in schools to 4 Mbps in 2007 and 48 Mbps by 2010. To ensure the ubiquity and safety of access.*

*LOCAL AREA NETWORKS: To ensure Internet access in all classroom and school spaces. Goals: To allow students and teachers to have Internet access in the classrooms. To enable computerisation of school management.*

*SCHOOL CARD PROJECT: Generalise to use the student's e-cards whit several functionalities such as, access control, attendance record and electronic purse. Goals: to increase efficiency and safety in schools.*

#### - CONTENT AXIS -

*SCHOOL PORTAL PROJECT: Create a school portal with a content sharing, distance learning and cooperative functions. Goals: to increase the production, distribution and use of digital contents ( for instance exercises, textbooks, electronic notebooks). To encourage the development of student's e-portfolio. To complement conventional teaching methods and increment interactive teaching and continuous learning practices.*

*SIMPLEX SCHOOL PROJECT: To create an electronic platform for school management. Goals: to increase efficiency in management and communication between the agents in scholar community. To improve access to school information.*



- TRAINING AXIS -

*ICT COMPETENCIES TRAINING AND CERTIFICATION PROJECT: To create programmes for modular and progressive certification in ICT competencies. ICT training programme for teachers and non-teaching staff aimed at the certification of competencies. Goals: generalise ICT skills training and certification. To promote the use of ICT in teaching and management.*

*ELECTRONIC ASSESSMENT PROJECT: To use the computers in student assessment (Diagnostic, Formative and summative assessment). Goals: Promote the educational use of ICT.*

*ICT INTERNSHIP PROJECT: Internship aiming at providing specific training at workplace for ICT vocational education students in reference national and international technological companies. Goals, to promote excellence and employment opportunities for ICT vocational students.*

### **Source: Technological Plan for Education**

The use of school information systems provides coordinating mechanisms for the central educational authorities, so they can monitor what schools are producing [1].

In what schools are concerned, at this stage of gradual implementation of the TPE in the field, a study that sought to clarify the existing conditions was developed, with the aim to provide information, for strategic decision making, in the monitoring of the implementation of the TPE in schools.

The problematic of the adequate use of technology in education cannot be answered only by introducing more technology in the educational system. Having technology at hand is not a good enough reason for schools to rely comfortably in its use. It was the need for an effective answer to this problem that promoted this work – “How should school pursue its mission with the implementation of the TPE?”

## **2 Research Design**

With the main goal of preparing and optimizing the new, richer and integrated technological environment that will be a reality in Portugal, the literature was revised references, aiming to identify the concepts to be used. The practices of six urban secondary schools were observed in their educational component as well as in terms of the administration and management of education supported by the technologies.

We tried to identify the positive and the negative factors that have conditioned the adoption of Technologies, in Portuguese educational system along the years, elaborated and validated a tool (the interview) to observe the best and the not so good practices locally, identified a sample of the universe urban to be studied, gathered the information and analyzed the results to product a solution.

### **2.1 Literature**

The object of study in the present work, the process of literature review was identified and the area of activity was defined. This was because there are many approaches

regarding technology in educational context perspectives. Aware of the importance of literature review in the influence of the final work – 3 important dimensions were identified to frame the guideline of the literature to this work.

- Identification of weaknesses and threats of technology implementation in an educational context.
- The impact generated by the introduction of TIS (Technology and Information System) in educational context.
- Guidelines by future care for international exchanges of information on the state of the art of research, development and implementation of scholar information system.

The resulting information collection process, provided information to the interviews design, the results interpretation, and the adopted solution. The information comes mainly from publications of three entities GEPE, BECTA and ITEM. (GEPE, Statistics office of Portuguese Ministry of Education – BECTA, British Educational Communications and Technology Agency – ITEM, Information Technology in Educational Management, the Workgroup 3.7 of Technical Committees 3:Education of International Federation for Information Processing).

## **2.2 Definition of the Sample**

Regarding the definition of the set of secondary schools selected for interview requests (sample), the number of schools within the city of Porto was, in the first place, defined. From this total number, 10, we selected 6. In this, 2 are TPE pilot schools, which in turn are from a total of four schools nationwide. They were chosen because they are schools with an educational background that is complementary to and covers the entire educational offer of the Portuguese education system. They also cover the entire urban area and across its social economic impact. The secondary schools Carolina Michaelis, Rodrigues de Freitas, Filipa de Vilhena, Artistic Soares dos Reis, Clara de Resende and Fontes Pereira de Melo were selected for the interviews.

## **2.3 The Information Locally Selection Tool – The Interview**

The local observation went from gathering qualitative information to consolidate or weaken the trust in the problems within the revised literature, for the practices to implement the technologies in the educational system. The collection of information was done with the help of face-to-face interviews to the leaderships with top responsibilities in schools – the Director or the responsible for the technologies. The interviews lasted for about 120 minutes, from March to May 2009 and were set to four Directors, all with over 20 years careers, of the schools involved and two responsible for the technologies with more than 15-year careers. They were asked to give their views on the school policies according to six parameters:

Q1- AWARENESS OF THE INTERVENTION OF THE TPE to the school environment and provide an initial approach to the intervention of TPE in schools and their awareness to this fact.

**Q2-RECRUITMENT AND MOBILITY OF THE TEACHERS/ TEACHING STAFF CAUSED BY THE TPE**, enquire whether the situation of having a better technologically equipped school makes it more difficult to recruit appropriately and also if the fact that moving to a technologically richer environment will involve the mobility of teaching staff.

**Q3- THE PROBLEMATICS OF COMMUNICATION**, seeking information about communications seen in the context of interpersonal verbal communication: The way the message is sent to all community, horizontally or vertically to the organization, whether at the level of broadcasting of news or in the transmission of information on a more or less urgent basis.

**Q4- THE MANAGEMENT OF THE LEARNING PROCESS**, trying to identify innovative areas in the management and fostering of practices. Gather information on innovative and differentiating practices.

**Q5- IF THERE IS RESTRUCTURING OF THE EDUCATIONAL PROJECT**, study the underlying reorganization of educational projects in richer technological contexts.

**Q6 - THE NEED FOR THE MANAGEMENT OF TIS** - look for information regarding the relation of community with technology, the concern with the integration of information, better analysis of information on the use of coordinated support for the learning process.

### **3 Results and Decision for a Strategic Plan**

#### **3.1 The Results**

The information gathered was dealt so as to retain, diagnose and give information in the areas selected and in the context of the literature review. Question 1 asked the interviewed about their awareness to the intervention of the TPE. The problematic identified transversally by all the interviewed was the resistance shown in all the processes of change [2], it was identified in all six schools the usual barriers to the process of implementing the TIS [3] developed so far as a concern of the implementation of the TPE. The following are, in short, the common barriers identified:

- All representatives reported personal resistances of various natures-knowledge, motivation, and empathy with the technologies.
- All representatives identified the access to technologies, such as technical factors and factors causing resistance, the availability of reliable and stable technologies, whether at the network level or at the level of equipment in the classroom.
- All representatives expressed concerns with the need for training and education in Information Technology to monitor the process.

On question 2 all the inquired admit altering the teams that have been working with technologies in the management of education at school level, however no school has provided yet, in a conceptual shape, the final solution for the teams.

On question 3 all schools identified the use of e-mail as a reality. However only one school has that service on adequate machines thus solving a problem identified by the other schools:

- All identified problems in communication, which should be monitored, in such a way as to ensure the efficiency in the two-way reception of communications. There must be proof data elements on this.

In what question 4 is concerned, managing the teaching-learning process, all schools have technology to support the process. All the inquired answered that:

- The use of information resources as an aid to administrative/pedagogic tasks is a reality. All have/use LMS (Learning Management System) Moodle, and student's management software, but none of the previous is integrated.
- Information technology is schools means, at the moment, unstructured informatics networks of support to user that range between the 600 and the 1900 users, they have LMS, access to the Internet providers that go from 1 to 3, they are at the Web and have several management applications (administrative/pedagogical) without any of them being integrated [3].

One realizes that computers are used more often as a helping tool for individual tasks than to offer support to promote teamwork. There are applications that gather information transversally to the work teams but fail in the connection and communication between them.

On question 5 the directors or the responsible for the technologies were asked to state their opinion, on the school intention to restructure the educational project, as a response to the intervention of the TPE.

- In all the schools there were different readings, sensitivities and perspectives of the problem.
- All the interviewed stated that the legislation demands a revision of the educational project of the school at the beginning of the four year cycle that follows the one about to end now.
- However no school suggested possible paths for the revision of the educational project.

Lastly question 6, which is considered to be the most important as it frames all the process of control coordination of the Technologies and Information Systems – the need for TIS management.

- All the interviewed answered in a superficial way, merely interpreting technical reasons, revealing lack of an integrated and leveraged of global indicators for the management of education.
- All refer to the difficulty in having the material usually operational.
- The schools state that they have specific and independent equipment/ software for the administrative processes. Hardware – PCs, informatics network and access to the Internet. Software - Applications for Human Resources, Inventory and Administrative Management.
- It was mentioned by all schools but one, that the administrative tools, are still being used by a reduced number of processes.

Based on the processed information, collected through the instruments used, we can state that using computing resources as an aid to pedagogical and administration tasks is a reality in the schools surveyed. However, computers are used more as a help to individual work than as a means to provide teamwork. There are thus applications that collect information transversally to the work teams but fail in the coordination and communication among them.

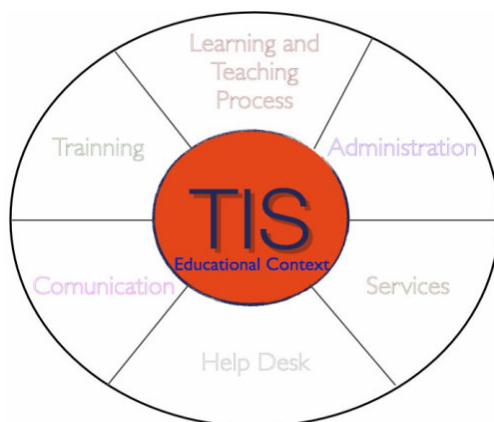
The existing TIS may be regarded as tailored to the needs of each individual. There is no standard model for the flow of information, hence resulting in a wide variety of representations of information and an inefficient communication. Schools are still in early stages of the route [4] to the schools information systems. It can also be seen that there isn't an overview of TIS in schools, which resort to ad hoc solution with no major concern for integration, such as the disintegration of information [5]. The lack of such a global vision has compromised the preparation of integrated development plans, whether for the purchase of hardware and software, or in the training of human resources. So in the new context, it's advisable to the schools, to keep up with planned to the process. There must be a strategic orientation.

### 3.2 The Adoption of a Strategic Model

The new technological environment brings structured networks with integrated transverse tools and offers collaborative work platforms. This whole new environment has brought important changes in the objectives of organizations, relationships with the community, and internal operations. These systems are called strategic systems [6]. With the implementation of the TPE there is a new reality for TIS in schools. A technological environment, richer and more structured, must be addressed by the community in a well thought out and planned manner with the weight and the strategic orientation that the process of change requires and needs. That is what happened in this case, based on the information collected, it was defined a strategy and aligned the school with its implementation. The best practices on information technologies in education, promote values of strong strategic planning [7].

The barriers to its use, which are the main weaknesses previously identified lead to decide for a strategic direction that could assure a stable, efficient and reliable technological infrastructure as a basis domain. Thereafter that strategy should operate in the 6 areas designated as strategic (Figure 2), namely;

- Dimension area of the teaching-learning process, in order to approach both sides (learning and teaching).
- **Administrative** dimension, an approach to seek the construction integrated reports of school indicators, so as to increase the efficiency and effectiveness of school and education management.
- An area **services** dimension capable of opening the school to the community and provide support for innovative activities, able to generate change from a support point of view to research and professional development practices.
- In **communications**, to be applied in a perspective of interpersonal verbal communication, with a disseminating or targeting nature.



**Fig. 2.** Strategic orientation to the school

- A **monitoring** field, with training concerns but with predominant training and monitoring activities of proximity.
- A **Technological** area with the establishment of a technical filed of global skills.

In order to approach this transversal dimension to the whole school it is advisable that the teams involved in the monitoring process in schools are themselves also restructured. This team works under the guidance of the strategic plan designed for that purpose and which is implemented through action (business) plans to be developed yearly with projects or measures for each area. The monitorization and evaluation of the process has the same framework and aims to make an evaluative and iterative monitoring [8] of the whole process of the implementation of the TPE in schools.

### 3.3 Monitoring and Assessment of the Solution

The assessment, which is the next stage, will determine whether the strategic direction is working or in need for adjustments since the objectives and strategies will be reviewed periodically to ensure their contemporaneity [9]. In this context, an evaluation of an Annual Action (business) Plan will be made in order to identify the strengths and weaknesses and to make adaptations and adjustments in two stages: in the middle of the semester and a final assessment at the end of the school year.

The factors that will be evaluated depend on the purpose of the evaluation itself. We are aware that this cannot focus exclusively on quantifiable results, as some will have resulted in the acquisition of non-measurable skills or knowledge. We will take into account factors that may influence the results, such as the inadequate means or methods, failures problems resulting from equipment and logistics. It is important to bear in mind that the assessment is not limited to the detection of differences between the expected objectives and the results achieved, but above all it is a reflexive process on the Plan itself. The following Instruments (table 2) of Evaluation & Assessment Objects were defined:

**Table 2.** Instruments of evaluation and evaluation objectives for the strategic plan

INSTRUMENTS	GOALS
- Formal and informal contacts with teachers, students and non-teaching staff	- To observe resulting materials;  - Observe management efficiency  - Development of ICT skills;  - Monitor New methods of work;
- Analysis of materials;	
- Measurement for quality of material produced ;	
- Questionnaires.	
- Evaluation Criteria and Indicators:	
- Usage statistics;	
- Usage rates;	

## 4 Conclusions

Later in this work we assume clearly to be facing the most important intervention in technologies and information systems of the educational system in Portugal.

To position school in this approach it was developed a model to go along with the implementation of the TPE in school which comprises a Strategic Plan, the definition of its implementation through the Annual Action (business) Plans (the make it happen), its monitoring and evaluation Tools. The adoption of a solid strategic plan for TIS is a demonstration from schools, through their leaders and the wide educational community, that the ICT efforts are real and sincere and that the strategy is the expression of a collective will [7]. It is also a clear indicator that the school is willing and capable of evolving its most complex features to levels and results that we are pursuing and hope to attain (Table 3):

Finally the results we will achieve will, undeniably be the teaching benefits, learning benefits and management benefits. This work requires continuity and endurance in its monitoring and readjustments, which is the path we will follow, working on the indicators and the iterative process of monitoring and evaluating.

With TPE technology was brought to school on a massive scale, not as a lifting product, but to improve the quality of what has always been done in schools: teaching and learning. However a new era means a new paradigm. Past is the industrial age in which the school provided the custody, the setting of behavioral rules, ensured cognitive development, socialization and selection for the era of knowledge where the shift is centered in the learning in a school aiming at the building of knowledge – of the practices (doing), of thought (as experience), community (belonging), identity (becoming) [10].

**Table 3.** Expected Results

EXPECTED SHORT-TERM RESULTS	EXPECTED HALF TERM RESULTS
Increased autonomy of the use of IT	Increased autonomy of the use of IST
Use of digital content in teaching	Production of materials and knowledge supported IT
Promotion of digital assessment	Collaborative work on digital platforms
Propagation of digital portfolios	Participation in projects outside the school
Improve levels of communication	Providing more and better school information
Encourage the acquisition of ICT skills	

The use of technology in education is generating change before which Portugal should not have the sole attitude of observer. One of the facts shown by this study is that TPE certainly wants to correct the existing technological gaps between schools. However, correcting these imbalances is not enough on the evolutionary path to work on the multiple displays [11]. It is necessary to develop a technological culture in Portuguese schools that sets schools free from the use of school bags filled with books, notebooks, assessment records and pencil cases; A culture that generates motivation with the support of technologies and develops self-esteem; A culture that conveys a collective will in the application of the potential use of technologies in education and in the education system. This is where the applicability of TPE should start on the ground, that is, in schools. Developing ‘the will’ to enable and create a good collective use. The will such began to as the attitude of the four phases of the Management Information Systems [12] - Willing, Thinking, Making, Using.

In an era where technology and education congregate and integrate, managing education is to have effective and efficient access to information to support the process of decision-making in due time. We need technology management and information systems for the production information process; it is necessary to introduce management information systems professionals [13] to have added value in information. The information provided by integrated tools support for the decision making process, the ability to obtain the production of reports and mapping of indicators of educational practices and related support. In the knowledge era, the quality of education is proportional to the quality of TIS. In the knowledge era, the quality of the educational process is structured and leveraged by the TIS.



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# In Search of a Conceptual Framework for the Capacities of University ITEM

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**Abstract.** The purpose of this paper is to conceptualize and illuminate the capacities of information technology for educational management (ITEM) as a regulative element in the managerial operations of universities. It is argued that the environment in which institutional management functions has become more unpredictable typified by numerous stakeholders with various demands. Moreover, the academic organization comprises disciplinary units that respond to the stakeholders differently. However, pressures for efficiency and effectiveness are calling for more integrated functioning. We envisage that ITEM has the capacity to support internal integration of the university and also link it to external constituencies. But understanding this capacity in terms of organizational theory has been largely elusive. It is this dimension that this article seeks to elucidate by applying the tenets of the organizational learning framework to illustrate the possibilities university ITEM in integrating the functions of middle management within a university.

**Keywords:** University ITEM systems, organizational learning, integration.

## 1 Introduction

Concerns for the efficiency and effectiveness of institutional management are not new. There are increasing demands for efficiency and effectiveness as the universities operate in their turbulent environments. It is perhaps no coincidence given the declining fiscal resources to higher education, the demands for accountability amidst granting autonomy to the institutions, and quality in the academic programmes. Yet at the same time, the commonest pattern within institutions as they respond to these external changes has been to transfer responsibilities to the academic units premised on the nature of the university as a loosely-coupled organization comprising several academic units based on disciplines (Becher & Trowler, 2001; Clark, 1983; Weick, 1976). Unsurprisingly, each of these subunits responds to the environment quite differently further perpetuating fragmentation. As a result, universities have sought to integrate the activities and functions of the academic units and also strengthen their links to the environment by using information technology as a key tool (Dill & Sporn, 1995). In fact, previous studies have shown the role and relevance of information and information systems in enhancing self-regulation and hence integrated functioning of institutional management as it responds to the changing requirements of government

(Hölttä & Nuotio, 1995 p.14; Hölttä, 1995 p.238-239). Undoubtedly, in some European countries, universities have provided management information to government agencies and synchronized feedback has been obtained in return (Frackmann, 1994 p.33-34). Evidently, most universities have acquired integrated information systems to contribute to integration of the disparate units with the overall objective of improving efficiency and effectiveness. However, despite their valuable role in coordinating and monitoring the responses their units make to the environment, research on how to regulate the operations of middle management based on their information needs is highly needed (Creswell & England, 1994 p.16). Moreover, most of the ITEM research in universities has focused on economic rationales of introducing ITEM, dealt with attitudinal issues concerning the users, without clear conceptual reflections (Gorr & Hossler, 2006; McCredie, 2003; Rodrigues & Govinda, 2003; Creswell & England, 1994; Masland, 1985). With a few exceptions (Hölttä, 1995; Hölttä & Karjalainen, 1997) ITEM in universities has been hardly explored in terms of organizational theory. It is this perspective that this paper presents by using the organizational learning framework to explore the question *how can the capacities of university ITEM in regulating the roles and functions of the academic deans with respect to academic and financial management practices be conceptualized?* The next sub-section of the paper outlines the information needs of the deans with respect to their roles. This is followed by the dilemmas surrounding the work of these deans as the university seeks to harness integrative operations. Thirdly, the organizational learning framework is examined. Fourthly, discussions and conclusions are made on the possible conceptualization of the capacities of university ITEM.

### 1.1 Information Needs of the Academic Deans

Although it is not uncommon for universities to acquire ITEM systems or even establish mechanisms to determine the relevant information, the "...beginning point for most ... deans would be to conceptualize the categories of information needed and used" (Creswell & England, 1994 p.10). Thus, it is first of all vital to explore the roles of the academic deans as a basis for understanding their information needs. Firstly, there is a faculty-oriented leadership role whose focus is on faculty morale, professional development, and promotion of university-wide faculty development activities. Essential information for this role can be found in personnel records, budget information, and policy documents and procedures. Secondly, it is possible for the dean to concentrate or emphasize the discipline or field of study. Such roles would entail keeping the discipline up-to-date by gathering information on the changing patterns in teaching, research and practice in the field. Thirdly, the dean functions as a manager. This role has a focus on support activities such as preparation of budgets, maintenance of departmental and faculty records, and assigning duties to faculty. Information required is basically on personnel records, budgeting and scheduling. Fourthly, the dean is an academic leader. In this, the strategic goals and vision are emphasized where interest is on ideas that can improve the processes within the academic unit. With regard to the hierarchical structures of the university, the deans receive information from the heads of departments, and then communicate to the central administration. Such information exchange could be related to various policies

and procedures, alumni, students and personnel. Fifthly, academic deans may be externally oriented. It is through this that the deans stress the need to scan for external changes that affect the operations of their units, partner with various stakeholders, explore new student markets, and source for new funding opportunities. The information requirements associated with this may be met by institutional research offices on campus or external stakeholder organizations (Creswell & England, 1994 p.13-14).

## **1.2 Constraints in the Role of the Academic Deans**

The information needs and roles of the academic deans illuminate the diffusion of institutional leadership at the middle level of the organization in order to enhance responsiveness. Whereas the deans may concentrate on such managerial roles by executing the mandate of the central administration, the same deans also pay attention to “the drives of disparate academic professional groups” (Clark, 1995 p.9). Undoubtedly, the dean operates in a state of role conflict (Bray, 2008 p.692-694; Wolverton, Wolverton, & Gmelch, 1999 p.82) and thus, to assume that deans are inclined to the managerial roles is to underestimate their disciplinary obligations of research and publishing within their parent academic units. Yet for the deans to pay exceeding attention to the academic profession is to discount the new “...image of the dean as an executive - politically astute and economically savvy” (Wolverton et al., 1999 p.81-82). The two conflicting roles certainly demand for different sets of information owing to the tensions elicited by the competing values. But still, the deans are confronted with role ambiguity. For instance, in hierarchical terms, the dean reports to the vice chancellor just as the dean receives directives from the vice chancellor or any other members of central administration. Apparently, the academic deans allocate or reallocate resources to the departments, activities and programmes within their units without any consideration of the allocation decisions of their counterparts in the same university. It is therefore certain, for example, that “...if deans receive no clear guidelines [from the central administration] about budget priorities, decisions made at the college level may seem capricious and indefensible” (Wolverton et al., 2001 p.21). Undoubtedly, vertical looseness is likely to occur in contexts where “adequate procedural safeguards” are non-existent or weak (El-Khawas, 2001 p.246; Rubin, 1979 p.213). In other words, information may not be delivered or gets distorted leaving room for multiple interpretations that are at times incongruent to acceptable standards. Certainly, the greatest challenge is how to maintain equilibrium in such contexts of conflict and ambiguities.

## **2 Theoretical Learning Framework**

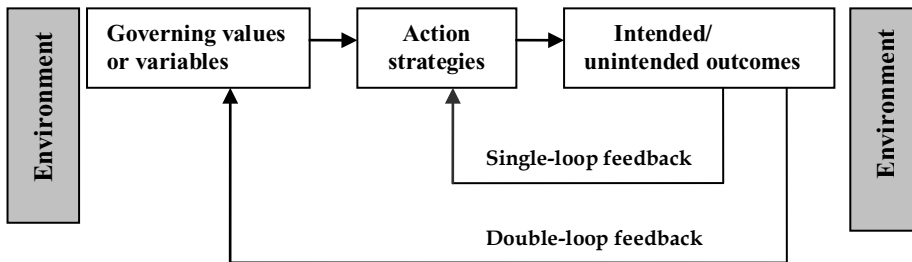
Organizations learn internally and also encounter internal threats to learning with implications for integrated responsiveness (Easterby-Smith & Araujo, 1999 p.8; Kezar, 2005 p.13). Most significant is that, “... an organization learns if any of its units acquires knowledge that it recognizes as potentially useful to the organization” and “an entity learns if, through its processing of information, the range of its potential behaviors is changed” (Huber, 1991 p.89). Information is an essential

element that enables the organization and its subunits to make responses to its external pressures in order to maintain or restore equilibrium. The disciplinary origins of organizational learning are in the Cybernetics theory. Cybernetics focuses "...on the selection of the limits that are to be placed on behavior as on the active pursuit of desired goals" (Morgan, 1997 p.99). Accordingly, the cybernetics framework suggests that "cybernetic control mechanisms" have to be in place to guide the actions of the basic units towards institutional goals and to enable the institution to respond and function as a whole as it deals with the external demands, for example, from government. The organization would establish mechanisms for self regulation on the basic assumption that "organizations [are] systems [functioning] as complexes which maintain certain essential constancies through cycles of action, error-detection, and error correction". In fact, system theorists have argued that organizational learning is evident in systems that have favorable conditions for self regulation and in instances where organizational stability is collectively pursued (Argyris & Schön, 1978 p.325-326).

In the organizational learning framework, responsiveness of an organization is dependent on gathering and processing information about itself both internally and externally (Easterby-Smith, 1997 p.1090; Easterby-Smith & Araujo, 1999 p.3). It is this information that provides impetus for the 'cycles of action' within the organization. These cycles of action comprise structural – social interactions through which gathering and processing information become the core processes and enablers for pursuing organizational learning. On the assumption that the environment is dynamic, and that the consequences of any interactions cannot be accurately predicted, it is necessary to establish parameters or *governing values/variables* within which outcomes can be ascertained or feedback on performance can be generated (Argyris & Schön, 1978 p.18-26; Morgan, 1997 p.100; Senge, 2006 p.74-75; Senge, 2000 p.277). Indeed, due to the likely differences in responses that the organizational subunits make to external contexts, parameters or controls within which the organization operates have to be established in order to sustain equilibrium. It is against these parameters that can be in form of output or behavior that appropriate action strategies are sought, identified and deployed with the aim of achieving a certain set of desired outcomes (Argyris & Schön, 1978). When deviations from the organizational norms occur, specifically when the actions elicit unintended or undesirable outcomes, they are detected and corrected.

As shown in Figure 1 below, following actions that may be either within or outside the limits of governing values or variables, feedback is generated. The single feedback loop "connects detected outcomes of action to organizational strategies and assumptions which are modified so as to keep organizational performance within the range set by organizational norms" (Argyris & Schön, 1978 p.14-15). Such corrective feedback (single loop) is triggered when outcomes show low performance e.g. through built-in controls of the information system or print-outs from the information system. On the other hand, transformative feedback (double loop) is when information is used to change the values or norms themselves. Certainly management information systems are mechanisms that an organization can use to support its internal regulation and integration (Argyris & Schön 1978 p.268-276; Easterby-Smith & Araujo 1999 p.4). In essence, 'limits' can be established or 'control systems'

designed or built in or installed to detect errors and take corrective actions within acceptable ranges for organizational effectiveness (Argyris and Schön 1978; Birnbaum, 1988 p.34-35; Easterby-Smith, 1997 p.1092; Hölttä, 1995 p.242-255). Obviously, deviations trigger feedback loops within the organizational processes and systems that become the basis for new actions for organizational improvement (Easterby-Smith, 1997 p.1090; Huber, 1991 p.91; Morgan, 1997 p.100). However, it has to be understood that subunits simply store new information on old information making retrieval of old information, when it is needed, difficult (Easterby-Smith, 1997 p.1093). This may constrain transformative feedback. Perhaps, it is information on external changes for instance; fiscal hardships or demands for quality or change in the interests of the stakeholders may elicit a form of information feedback that can challenge the existing values, systems and structures within the organization and its subunits (Easterby-Smith, 1997 p.1093; Hedberg et al., 1976 p.51; Hedberg, 1981 p.18-19).



**Fig. 1.** Organizational learning framework

Author's compilation on the basis of Argyris and Schön (1978); Senge (2006)

By way of illustration, we can argue that, information systems have the capacity to support the accomplishment of performance targets, for instance, where there is feedback on cost and output between the subunits and central administration (Hölttä, 1995 p.248-251; Hölttä & Nuotio, 1995 p.15). Such performance targets may be set by the central administration in terms of funds reallocation and new demands for internal accountability hence presenting new sets of information requirements for the deanship (Creswell & England, 1994 p.8-9). As a requirement, information may have to be presented in specific formats or with certain contents to authenticate whether the output or behavior of the academic unit conforms to acceptable standards. When such required information deviates from the expected, the decision to accept is withheld until the information is corrected. A good example is the use of minutes of meetings as a valuable measure to assure that the academic and financial practices are congruent to established standards. Incidentally, some of the information that is necessary for organizational effectiveness may be withheld or not availed to the deans with the consequence of deviations in work processes or low performance of the tasks (Wolverton et al., 1999 p.82; Wolverton et al., 2001 p.21). In the use of ITEM

systems, feedback can be generated when the limits are built into the information system or by analyzing outputs from the information system that may show significant anomalies that would elicit corrective action. All in all, the essence is to keep the organizational activities in equilibrium through self-regulative capacities of ITEM and/or using its outputs. As the external environment keeps changing, the governing values or variables may be altered in alignment with the environment. Obviously this will sanction new action strategies in form of mechanisms that will facilitate the realization of the new set targets.

### **3 Discussion and Conclusions**

In this section, an attempt is made to illustrate the applications of the tenets of the organizational learning framework as shown in Figure 1. This is based on previous analysis of the perceptions of faculty deans at a Ugandan public university concerning the utilization of university ITEM systems. The ITEM system was a relational database that was an integrated vendor product that had been procured from South Africa and comprised four modules namely; the academic records information system (ARIS), finance information system (FINIS), the human resource information system (HURIS) and the library information system (MakLIBIS). The modules discussed in this section are ARIS and FINIS. Because of the peculiarities of the context, this vendor product had been quite difficult to customize to the local institutional conditions. As a result, it was found out that in addition to the structural or output controls, there were several manual or behavioral controls that augmented the regulative capacities of the ITEM systems. In the same way, two dimensions of feedback were evident. The outputs from the ITEM system elicited corrective feedback e.g. if a large percentage of students who did an examination had their grades or test scores below acceptable ranges then such an anomaly would be detected by other means such as committees because the existing ITEM system did not have the capacity to detect the error but its print outs were the basis for the detection and rectification of the error by the committee members.

With respect to financial management, the main support activity of FINIS was in the allocation of finances to the academic units. It enabled the computation of the percentages of the tuition fees that would accrue to the academic units. Financial allocations to the faculties were based on the number of privately sponsored students who had paid their tuition fees and duly registered with the faculties they belonged to. Although the remittances to the units were computed using the ITEM system, actually the university bursar had to write a cheque to the unit that would be presented in the bank in order for funds to be transferred to the account of the faculty. During the expenditure of these finances now belonging to the faculty, the ITEM system was not very helpful. In other words, its impact was mainly seen in the governing value of deciding how much was due to the faculty based on the registered students. Thus expending the resources at unit level applied other means to monitor the processes. These entailed the use of minutes of meetings of the planning and finance committee that was composed of the faculty dean, deputy deans, heads of departments and a

student representative. Importantly, corrective feedback (single loop) was possible through the university internal auditor who verified all payments to be made by the subunits before they could be approved by the university bursar (chief finance officer). This was another example of a governing value against which errors in financial transactions would be detected and corrected.

Transformative (double loop) feedback was not directly evident in the university ITEM system. Rather informational feedback from the environment was responsible for the changes in the governing values or parameters themselves. For instance, whenever there were delays in the subventions from government to the university, the central administration responded by cutting the disbursements to the faculties or by remitting to funds to the academic units without consideration of the sharing ratios but based on the priority demands of the subunit. Similarly, when there was concern that quality was declining or new mechanisms for accreditation were being established, the information requirements for the academic units, for example as they proposed new programmes or changed existing ones triggered new mechanisms that were capable of causing modifications in the institutional strategy. This is an example of change in the values themselves as double loop feedback would envisage. This kind of change definitely requires substantial time.

Based on the perceptions from the deans that demonstrate the theoretical elements, the following conclusions can be made.

- a. Information is a crucial resource in the regulation and integration of the processes of the academic units. Such information may not necessarily come from the ITEM system but, the information from the ITEM system remains highly valuable in providing the bases for decision processes. It is such information that can reduce on the ambiguities and conflicts within which the deans function. The information needs of the deans in this case generally concern management perhaps illuminating the focus of the ARIS and FINIS.
- b. ITEM systems may be sophisticated but their use may only elicit a few tools for defining the controls and feedback processes. In such scenarios, other means are sought that can contribute to monitoring and ensuring that there is integration of the activities within the academic units.
- c. A combination of the ITEM system and other supporting dimensions discussed illuminate the applicability of the organizational learning framework in contributing to understanding the self-regulative capacities of the university organization. What is more is that we need to pay attention to the uniqueness of the context as we deploy vendor-evolved systems.

More studies on the application of organizational theory to ITEM research are needed both in environments with advanced ITEM systems in terms of infrastructure and use, and in settings where these are not readily available. Only then can we have a clearer understanding of the capacities of ITEM and also be in position to conceptualize such capacities. There is need for more case studies and more applications of different organization theories. Organizational learning is just one of the theories.



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# Bridging the Knowledge Gap for African Researchers through Open Access Publishing: The Case of African Higher Education Research Online (AHERO)

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**Abstract.** This paper reports on African Higher Education Research Online (AHERO), an innovative web based open access project that facilitates the communication of research on African higher education that is otherwise invisible. In addition, the paper demonstrates the functionality of the AHERO website, to show how and why authors may deposit their papers; and provides a report of the methods used to populate the archive, how AHERO deals with copyright and the progress that has been made thus far. Some experiences are shared. It ends with the conclusions and recommendations drawn from an assessment survey.

**Keywords:** Digital libraries; e-resources; digital repository.

## 1 Introduction

The need for research, to inform development endeavors in the developing world, cannot be over emphasized, since knowledge is a key ingredient in the pursuit of sustainable development. Nonetheless, researchers need adequate access to information resources that are relevant to their work and to publication outlets if they are to make a meaningful contribution in the area of research. Since a significant body of literature is locked behind copyright licenses and exorbitant journal subscription fees, however, in Africa, many researchers do not have adequate, let alone convenient, access to many of these information resources. Besides, many journals are membership based and levy membership and publication fees that many African researchers cannot easily afford. Resultantly, information flows to and from African academics are blocked by the intellectual hegemony and *gate-keeping* practices of the journals that have good visibility, usually based in Europe and North America. Moreover, poor bibliographic control and weak dissemination systems curtail the circulation of the few publications by African researchers. Nevertheless, the departure from the traditional mode of publishing to an open access mode (through which researchers can publish, disseminate and access research free of direct cost) is seen as presenting an opportunity for overcoming these challenges.

## 1.1 The Problem – Scarcity and Invisibility of Knowledge in Africa

**Knowledge scarcity:** As part of their three track mandate, academics in Africa are expected to generate and disseminate new knowledge. To live up to this expectation, however, these academics need convenient access to information resources, to inform their research efforts; and publication outlets, to disseminate their findings. Over the last three decades, however, many African academics have found it difficult to access quality information resources, because, for a host of reasons, many libraries, and academics, are unable to procure *quality* information resources. Consequently, the academics ignore the research dimension of their job; or do it albeit improperly, often with significant duplication of efforts. Incidentally, the tendency not to undertake research, and to produce poor quality manuscripts, compounds the shortage of the information resources that are available to academics in Africa, since poor quality manuscripts are commonly rejected by the more *visible* publication outlets. Already, for example, Altbach (2007) and Mohamed (2009) have decried that academics in Africa do not have access to both information materials and publication outlets. Unfortunately, even in cases where the academics are able to do some research, little gets to be known about the research beyond the settings in which it is carried out, since it is usually published in journals that have limited international, and national, distribution. This could discourage researchers, since they do not receive feedback from their colleagues. Even in the few instances where academics in Africa are able to publish in the more widely disseminated journals, their colleagues on the continent are kept away from these works, since the works are locked behind exorbitant licence fees.

Knowledge is a major resource for development. In universities worldwide, knowledge forms the basis of their missions of teaching, research and community engagement. In Sub-Saharan Africa, however, knowledge scarcity is one of the main challenges facing universities (Abrahams et al., 2007). This is despite the fact that new knowledge is built on existing knowledge, which must be accessible to those involved in the creation of new knowledge (i.e. flowing from where it is produced to where it is needed). This is manifested by the scarcity of knowledge transmission channels on the African continent, especially when comparison is drawn with Europe, America, and Asia. From 26 African countries, for instance, African Journals Online (AJOL) enumerates 353 journals. Indeed, several studies (e.g. Fullard, 2009) show that the creation, distribution and utilization of knowledge in Africa are still low. African researchers produce only 1.8% of the world's total scholarly publications, according to an article in the journal of *Scientometrics* on the state of science and technology across the continent.

According to Altbach (2007), this is due to: difficulties in distributing scholarly knowledge because of small markets that are often dispersed over wide geographical areas; low intellectual literacy rates to utilize available knowledge; language problems due to multiple tribes each with their own language dialects; dependency on the industrialized countries for knowledge creation and distribution; and deliberate policies of industrialized nations to maintain their power. Indeed, according to the AJOL site, AJOL was started to address difficulties of accessing African-published

research papers which were under-utilized, under-valued and under-cited in the international and African research arenas. Although the Internet is a good way to change this, many hundreds of worthy, peer-reviewed scholarly journals published from Africa cannot host their content online in isolation because of resource limitations and the digital divide (Agaba, Kigongo-Bukenya and Nyumba, 2004). Valuable information has not reached the people who need it. At the same time as online academic resources from the developed Global North are made available to Africa (such as HINARI, AGORA and OARE), there needs to be corresponding online availability of information from Africa. AJOL was developed so that African countries could collectively play a greater role in the global online scholarly environment. Furthermore, African researchers also needed access to their own continent's scholarly publications.

**Knowledge visibility:** On the surface, the problems above seem to justify the existence of a scarcity of knowledge in Africa. Yet, as Kasozi (2009) argued, in this digital age, higher education is the necessary tool for the generation, storage and retrieval of knowledge for development. Kasozi (quoting Economist, 4 October 1997:S3) goes on to say that universities are the factories where knowledge is created and skilled workers manufactured. Unless universities in Africa with their mandate of teaching, carrying out research, and community engagements to solve societal problems are not playing their roles, the numerous graduates at the highest levels provide proof that knowledge is indeed being produced. The numerous theses and dissertations, produced before degree awards in universities, research reports and varying local and international donor support to research activities are all evidence of knowledge production. Altbach (2002) in Kasozi (2009) talks of how most of the information African universities use is produced elsewhere and is not often fresh, thereby contributing to a lack of higher-quality and ground-breaking knowledge being delivered in African universities. This affects the quality of knowledge produced in African universities.

Unfortunately, little is publicly available to show the existence of such works in internationally known access channels (especially web based). We believe there is a lot of knowledge out there created from research and other efforts in Africa. What is lacking in Africa is an effective distribution method to make this knowledge visible to the wider society. Instead, most of the knowledge in Africa is stored away in record offices or scattered in (closed) library collections.

The Association of African Universities (AAU)'s efforts of building a knowledge base, DATAD (Database of African Theses and Dissertations) seem to be experiencing the same fate as that of AJOL because of its limitation on abstract, as well as the high costs in subscription. To reverse the visibility challenge, Mohrman, Ma and Baker (2007) believe that universities and their staff need to think further than the acquisition and development of new knowledge to pay attention to the transmission of this knowledge and the challenges of technological innovation so as to carry their innovations through to completion. In short, created knowledge needs to be easily distributed to those who need it.

## 1.2 AHERO – A Contribution towards the Solution

It is out of the scarcity and visibility challenges that the need for innovative approaches, through which academics in Africa can access quality information resources and disseminate their own research findings arises. AHERO was developed to create a knowledge base that brings together research information on higher education in Africa. AHERO is managed from the Centre for the Study of Higher Education (CSHE) at the University of Western Cape in South Africa together with the East African Institute of Higher Education Studies and Development (EAIHESD) at Makerere University in Uganda.

The AHERO project is one of over 900 interoperable open access archives. It is an international disciplinary repository for research texts that focus on the practice and development of higher education in Africa. Researchers upload their documents to AHERO through a semi-automated process. For the most part, this is intended as a supplementary, post-publication exercise to enhance the visibility of research articles, although conference papers, research reports, policy documents and theses may also be submitted. AHERO editors vet submissions for relevance, scholarly evidence and coherence, but do not otherwise practice editorial peer review.

## 2 Methods Used to Develop AHERO

The archive was developed in phases, first by staff at the CSHE, University of Western Cape, who currently host the website at <http://ahero.uwc.ac.za>. The first task was to identify experts in the field, to obtain their permission to include their work in the online archive and to either digitize or obtain an electronic file of such content. The Centre for Research on Science and Technology (CREST) at the University of Stellenbosch, Cape Town, was commissioned to undertake a search and a database of 1200 individuals who had published books, chapters, journal articles, conference and other occasional papers or research reports about African higher education in the past decade was supplied to the AHERO Project Team. This database served as a constructive instrument for the AHERO Team at CSHE, providing a starting point from which the search for current contact details for scholars began. Thereafter the team began contacting the researchers and informing them about the AHERO project. From the second year of the project in 2007, a project partner based at the EAIHESD, Makerere University in Uganda joined to aid the project with the identification of research information in the East African region and coordinate other project related activities. Currently, the team includes 3 administrators, whose duties include that of identification of suitable research documents and seeking permission from copyrights owners. Two assistants help with the digitization of documents that are submitted in hardcopy.

## 3 Experiences

Besides the subjective qualitative responses that can be offered through our direct daily experience, all correspondence and encounters with prospective authors and publishers was captured in a database. In this way we are able to run queries to

discover exact measures with regard to the number of authors contacted, successful deposits in the archive, the types of formats represented, author and publisher responses and the number of embargoed papers. An additional source of information is the responses we have received from presenting the project at a number of conferences and workshops. Following close to three years' experience of administering AHERO an evaluative survey was initiated in March 2009. Different questionnaires were sent to two distinct groups, namely, contributing authors, and identified users. The results of the survey are presented in the next subsection.

## 4 Survey Findings and Interpretations

At a very basic level, it is possible to gauge that we were moderately successful in engaging researchers' receptivity towards open access. Out of 661 overtures to authors, positive responses were achieved from 53% of these (i.e., the number of authors in AHERO). To date (2009) the archive holds 448 papers; however, it is worth mentioning that it may take weeks or even months before consent is secured from authors, publishers or commissioning bodies. They may only reply after the second or even third reminder. Therefore, securing permission and populating the archive is an iterative and time-consuming process.

It is also noteworthy that only 73 out of 350 authors have self-archived their papers. In all other cases, the resources have been deposited by proxy by project staff. In response to our invitation, authors attach their files to an email, relying on the AHERO team to deposit on their behalf. From the evaluative survey we conducted, it transpires that, for many, this is due to lack of confidence with computers. Furthermore, although an open invitation to contribute papers appears on the AHERO homepage, virtually no one will initiate or spontaneously deposit a paper.

**Copyright and open access:** It is possible that authors continue to feel uncertain about their right to self-archive, particularly where they have assigned copyright to a publisher. In such cases, it is necessary to consult the publisher's policy with regard to self-archiving. The British SHERPA-ROMEO project has created an online searchable directory that provides a comprehensive record of publishers' copyright conditions as they relate to authors archiving their work on-line. It is interesting to note that although major publishers such as Elsevier will permit authors to self-archive in an institutional repository; this freedom is not extended to a disciplinary repository. However, several publishers will allow the author's version of the post peer-reviewed article to appear on a non-profit site. Besides journal articles, we were also in direct liaison with publishers for permission to digitize chapters of books or papers from conference proceedings. Our experience has shown that book publishers, in comparison to the journal publisher would more readily concede to the use of a particular chapter in AHERO.

Where a publisher will not permit a journal article to be reproduced in the AHERO archive, we would embargo the full text but provide on-site functionality for users to request the full text from the author. The usage of this functionality is reported below. Only 37 papers in AHERO are embargoed where we have been unsuccessful in obtaining the author's post print consent.

Notwithstanding the difficulties associated with copyright and permissions, another sign of the growth in author awareness of the potential of open access is that the

archive is growing steadily with a substantial number of monthly deposits. AHERO also accepts unpublished materials such as, research papers and institutional research. Since authors are the major copyright holders of these types of documents, they are approached for consent. However, the AHERO administrator checks with conference organizers as to the conditions under which conference papers were presented. It may be necessary for permission to be secured from such persons. Alternatively, where papers have been made available via a Creative Commons License, it is not mandatory to obtain permission first before using the research. However, the AHERO administrator courteously informs the author that their paper(s) have been deposited in the archive, when contacts are available.

**How do authors respond to invitations to self-archive and share their research findings?** Participants to our evaluative online survey were from 26 different countries with Uganda, South Africa and Kenya furnishing most respondents. The study has informed us about possible improvements, authors and users' overall impression of the archive, usage and frequency of visits. The author survey provides a variety of significant information about their research practices. The majority (72%) of respondents were aware that their papers are housed in the archive. The following conclusions could be drawn: (a) Authors are generally satisfied with the database records in AHERO associated with their research. Ninety percent of author respondents have expressed acceptance and approval (b) All the authors expressed a willingness to contribute their research in the future.

**Enhancing the Visibility and Usage of Africa-based research:** AHERO aims to promote the communication of scholarship as the developing world remains at a disadvantage in terms of both the production and distribution of knowledge. The key to both of these is the functionality and performance of the AHERO platform. Because it is built according to the Open Archives Initiative (OAI) standards, AHERO is registered with OAISTER, and OpenDOAR and EIFL services. This means that the records in the archive are automatically harvested by other service providers and are also crawled and indexed by major search engines like Google and Yahoo. In this way, papers deposited in AHERO are more readily discovered and used by a global readership. Respondents to our user survey were specifically asked how they had first discovered the archive and 50% (15) answered that this transpired by using a search engine such as Google. The remaining users were either guided by a friend or colleague or were introduced to AHERO while visiting the CSHE or EAIHESD where the project team members are based. The metadata that is assigned to each record also contributes to the overall discoverability of the individual papers in the archive. For example, we enhance the discoverability of the archive by assigning both broad subject themes as well as indexing each item in the archive with a set of descriptive keywords. Users may thus navigate amongst papers in the archive by country, by author, by theme or by keyword descriptors.

Through the posting of documents online and the creation of additional access points, the individual papers become more visible. With this increased visibility comes a responsibility to ensure that the papers in the archive are of a high standard. Items that have already been peer-reviewed, as part of a publication process, are clearly marked with this status. Although the AHERO team does not conduct any form of expert peer review, each paper is vetted and reviewed to ensure that a



scholarly method has been employed and that it makes an original and useful contribution to AHERO. Furthermore, AHERO provides additional services that we believe serve to facilitate visibility and usage of the papers in the archive. These include the possibility of registering to receive email alerts of newly-deposited papers that coincide with specific research interests and the ability to email the full-text of a paper to a 3rd party.

**To what extent has AHERO content been broadcast and liberated?** Currently, statistics indicate that there have been approximately 25,000 visits to our site and 28% of these visits result in the downloading of files. File downloads are now experienced at a rate of between 50 to 100 each week. More particularly, we are encouraged that visits are recorded from several regions across Africa. To date, AHERO has been visited by users from 27 African countries. It has to be acknowledged that, owing to inadequate infrastructure in Africa, most African Internet traffic is routed through America, making it difficult to accurately track the destination of the downloads from AHERO. Notwithstanding the opacity of some data, where AHERO indicates direct visits from named African countries, we are able to determine a 71% download rate. This is a significant finding, showing that AHERO resources are indeed needed.

Our survey results indicate that 27% of all users and authors replied that they would visit AHERO on a regular basis. 28% visits occasionally; 22% accesses the site monthly and 23% have only visited once.

**Who is using the site?** Because of the way that Internet traffic is routed, with most African visits routed through aol.com (USA), it is difficult to accurately pinpoint where the files are being downloaded. Although visits have been registered from 153 countries worldwide, judging from the e-print requests received, most of the visits are from South Africa and Africa in general. Approximately 3 e-print requests are processed each week. By the end November 2008, close to 269 e-print requests had been received, and processed, from the areas shown in Figure 1.

We believe that through satisfying these e-print requests, AHERO is genuinely able to liberate embargoed texts.

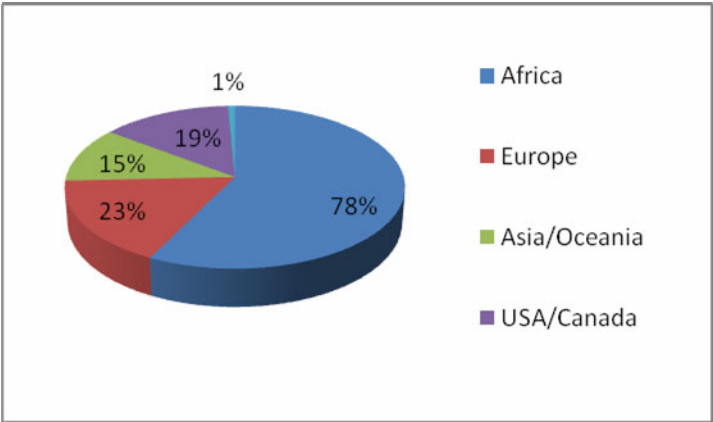


Fig. 1. Origin of E-print Requests

## 5 Conclusions and Recommendations

The results from the survey and user statistics support the conclusion that AHERO is delivering relevant content to African scholars. Furthermore, the analysis of the online survey is based on a relatively small sample of Africans who, by their very participation in the survey, show an active interest in open access. This is also underscored by the many positive and unsolicited emails we receive which convey much enthusiasm for the project. It can be deduced that our survey sample is a privileged one, yet it is clear that authors who have contributed material to the archive are satisfied with its display and usage. The challenge that remains is one of evolving AHERO into a self-sustaining digital library. Authors should spontaneously self-archive their research, rather than rely on mediated deposit and invitations. Feedback from the questionnaire and our statistics inform us that more advocacy is needed, to alleviate this challenge. Increased contribution from authors and stakeholder support for open access is essential for the growth of the archive. The experience of AHERO may provide a useful starting point for other disciplinary communities that wish to consolidate and optimize their scholarship through an open access approach. From the viewpoint of the progress being made in the mainstreaming of open access elsewhere, the authors are optimistic that open access strategies and initiatives will be placed on the agenda of local research funders and research committees, so that it achieves more recognition for the benefits that it brings to the community. Lastly, AHERO's scope is limited to higher education; this means that other disciplines should follow its example to increase their visibility so that the wider society can access them.

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# Moving towards 2020: A Tentative Approach to ITEM

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**Abstract.** A decade into the 21st Century, it seems that Humanity has given itself time to ensure that the rest of the century will pass by according to the universally accepted principles of equal opportunities and sustainable economic development. Year 2020 appears as a symbolic moment to attain this desired maturity, though it is, nevertheless, a complex goal to reach. Education is an essential area in any action that intends to accomplish this model of society, an instrument without which all efforts will be in vain. The outline of this paper is to try to glimpse which will probably be the determining factors of the worldwide economic situation and, therefore, what kind of professionals society will be demanding. The reply to this demand will structure future teaching and learning, and a series of needs will subsequently arise in Educational Management. Finally, according to this scenario we will propose improvements in Educational Management supported by Information Technology.

**Keywords:** Learning 2.0, Web 2.0, Education & Training, Information Technology, 2020, ITEM.

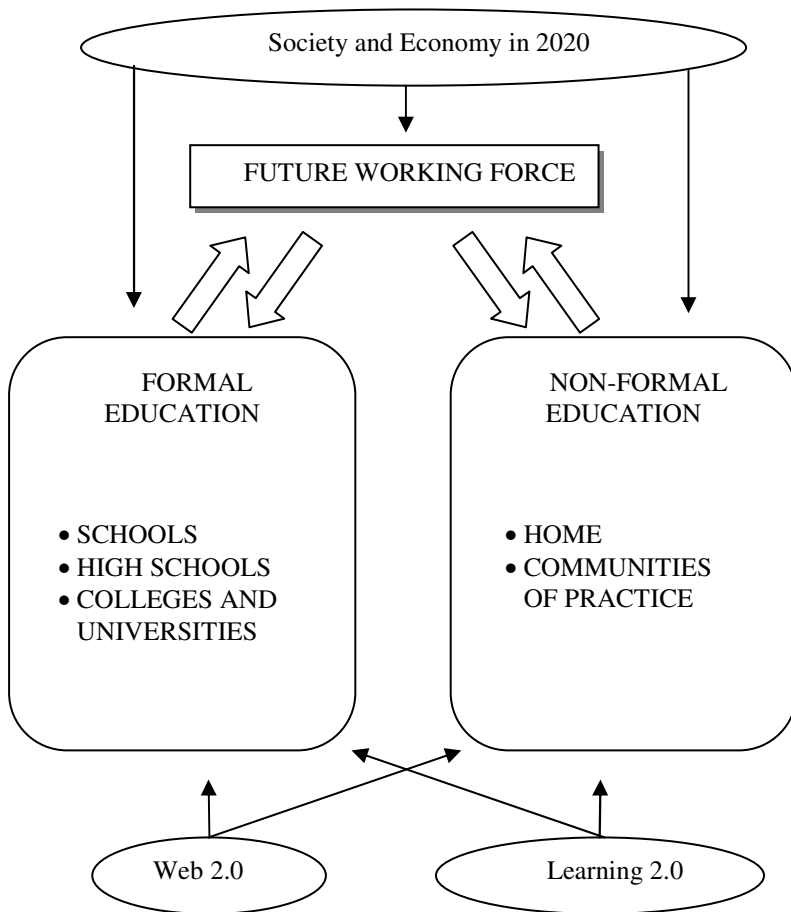
## 1 Introduction

Year 2020 has become an especially relevant date in which to accomplish certain indicators regarding climate change prevention and more environmentally aware lifestyles. The Copenhagen Climate Change Summit 2009 has been an important milestone that has contributed to reinforce 2020's iconic symbolism. Also, the United Nations Millennium Goals are another milestone to achieve. But 2020 is not only a key date to check if these internationally shared aspirations concerning the environment and society have been completed, but also a crucial date as regards education. Will we be ready by then to state that citizens are being offered an education that responds to the times? Moreover, we could include this query in the subsequent debate as to whether integrating people into a national education system to provide them with skills and competences, as well as accrediting their achievement, will make sense in 2020.

If we accept that an education system's aim is to train citizens and professional persons to carry out their work in such a way as to allow both individuals and

communities to benefit from the knowledge and competences so acquired, then we should firstly establish which could be the future working environment's main characteristics in a hypothetical scenario, setting year 2020 as a time reference.

Starting off from here we could then consider which should be the education system's goals for its different levels. After that the next step could be to deduce possible trends in education. At this point we could centre our attention on our specific interest, that is to say, establishing Information Technologies' role in Educational Management and, subsequently, what actions are required to ensure that Information Technologies effectively contribute to improve Educational Management. Figure 1 shows part of the aspects we have mentioned as well as the outline of this paper.



**Fig. 1.** Interrelated Challenges for Educational Management

## 2 Trends Regarding Skills and Competences Required by the Labour Market

The European Qualification Framework<sup>1</sup> gives a precise definition for the terms “skills” and “competences” in order to establish a common working language. According to these recommendations, skills means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualification Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments). On the other hand, competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualification Framework, competence is described in terms of responsibility and autonomy.

These two basic concepts have become important in the European and international educational picture as a form of agreement on a common language that will allow setting goals and indicators of their achievement, notwithstanding the educational level, whether it be primary, secondary or higher education. Having ascertained these basic concepts, we can now consider aspects that will influence education in our set time reference, such as the labour market. This will allow us to identify the challenges Educational Management will be facing and, more specifically, the challenges to ensure an optimal use of information technologies to support Educational Management.

## 3 Anticipating and Adjusting the Labour Market and Necessary Skills

It's impossible to say for certain what the future holds in 2020 as regards labour matters, just as impossible as trying to predict our own future in any area of our lives. Nevertheless, it is generally agreed that we must try to anticipate and plan for the future in order to avoid undesirable results and, to the contrary, make the most of any opportunities that may arise. In the socioeconomic field, attempting to predict and plan is a strategic activity, due to the implications it has for the market and labour policies. In a wide sense, education is very sensitive to the labour market needs. Certainly, formal education of children, young people and adults cannot depend exclusively on such demands, as they are of a contextual nature, but it is also true that students are trained to carry out their professional activity under specific socioeconomic conditions and they must be fully qualified to offer their best in a defined professional environment.

Therefore, as previously mentioned, and although not a conclusive element, anticipating what the labour environment will be like towards 2020 can give us important clues as to some of the main aspects on which to build educational structures and systems that will provide students with skills and competences that will respond adequately to the labour challenges of the future. Consequently, we should

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<sup>1</sup> Recommendation of the European Parliament and the Council (2008) on the establishment of the European Qualifications Framework.

try at an early stage to identify the skills and competences required. Accordingly, we must also discover factors that may condition the future labour market and, as a result, the educational system. Some of these are as follows:

*Technological change.* Technological change is part of an equation in which the need for skilled workers is directly proportional to the magnitude of change required. In fact, technological change is considered the main reason stated to justify the need for highly skilled workers (Machin and Van Reenen, 2007).

*Organizational change.* Parallel to technological development, ways of organizing work evolve according to such varied criteria as the search for flexible production systems, product and service customization, quality improvement, production chain optimization, humanization of work, etc. All of them are usually associated with a body of knowledge that subsequently demands skilled workers who are capable of adapting to new situations (Breshanan *et al.*, 2002).

*Globalization and international commerce.* Over the past years we have witnessed an increase of international commerce without precedent in the World's economic history. Traditionally developed countries, which are specialized in turning out high added value products and services, have centred the demand for skilled workers, whereas emerging countries, with a less skilled workforce, have concentrated on a low added value production. Nevertheless, similarly to what happened in Japan during the 70's, the current trend is for developing countries to focus increasingly on generating high added value products and services and, therefore, they need to train more highly skilled students. Following the action-reaction mechanism, if developed countries want to continue being competitive, they will have to make a decided bet for innovation and superspecialization, which in turn requires developing more skills and competences.

*Climate change and environmental challenges.* Over the last few years both governments and citizens have become increasingly aware of the damage economy can suffer due to climate change. This has brought around a general effort to reduce climate change and combat environment degradation, a trend that could favour the surge of a green economy that would employ millions of skilled workers all over the world (UNEP, 2008).

All these factors are currently foremost, but will probably have taken second place as we approach 2020, when new circumstances and concerns will dominate the economic, social and, therefore, educational scenario. This does not mean we should ignore such factors, quite to the contrary it would be convenient to consider them a starting point to begin to plan for the future, though allowing for new variables as they appear.

In short, we can refer to the document published by the European Commission {COM(2008)868}, titled *New Skills for New Jobs: Anticipating and matching labour market and skill needs*, which explains that socioeconomic changes imply the need for more highly skilled workers with an increased capacity to add value through their work and, therefore, a greater demand of university graduates, the education level that will experiment the greatest growth. In this sense, the REFLEX report (ANECA, 2008) states that university graduates of the future will have to be competent in at least the following five areas: professional expertise, functional flexibility, innovation and knowledge management, mobilisation of human resources, and international orientation.

Although we don't want to study these aspects more in depth, and continuing with this paper's basic argument as put forward in the introduction, we would like to try to perceive the implications of socioeconomic trends for the education system as respects the skills and competences of future professionals, considering all educational levels and not just the university one.

## 4 Educational Institutions on the Horizon of 2020

As mentioned above, as a result of a series of circumstances towards 2020 the socioeconomic setting will point towards the need for graduates with highly specialized skills and competences, mainly because that society will no longer be dominated by the industrial era's logic based on mass production and mass consumption. Foreseeably, large scale production will cease to be the main guideline and will give way to the creation of added value, mostly at an individual level. And so, following our reasoning, the next step is how to develop the skills and competences required to suit this change of model. This is where we enter the field of education and learning. It is not excessive to say that the 21<sup>st</sup> Century society will be a Learning Intensive Society in which educational models of formal education will undergo a profound transformation and life-long learning will become a regular activity of all professionals, who will find it to be the only reasonable way to permanently update the skills and competences that the socioeconomic situation will generate continuously.

Together with the Learning Intensive Society concept another term has gained popularity after it appeared in a report published in 2006 by the Institute for Prospective Technological Studies, as a way to embrace a different view of future learning (Punie and Cabrero, 2006). This term is Learning Spaces, which intends to encompass such a multifaceted reality as learning by including both tangible and non tangible aspects, therefore separating itself from the idea that learning spaces can only refer to physical locations (classrooms, research laboratories, one's own home, etc). To the contrary, it shows that ideas, persons and objects are mobile and they come together in 24/7 asynchronous contexts.

It is not unreasonable to say that we are entering a setting in which the limits between educational institutions and people's homes, between formal, non-formal and informal learning and between teachers and students are all becoming blurred. One of the reasons that leads us to this hypothesis is the emergence of combined educational environments, in which the role of transmitting knowledge, that has traditionally been more or less monopolized by educational institutions, is gradually being taken over by other agents, not necessarily educational ones, that exist in the web and whose most relevant example is Web 2.0.

A possible consequence of the changes we have listed above could be a hypothetical scenario in which children's schooling would no longer be compulsory in 2020, whereas different communities would decide how to manage aspects concerning children's education and safety. The challenge for each Ministry of Education would then be how to handle the shift from large educational institutions, the school-factory type with a great number of students and homogeneous teaching-learning methods for them all, allocating resources for the take over of new unique



organizations which would offer distinct teaching-learning services to a much more reduced number of students. In such circumstances each Ministry of Education should also provide for mechanisms that can guarantee the development of evaluation, quality and accreditation systems that assure with utmost clarity that results are being achieved according to regional, national or supranational standards.

## 5 Significance of Web n.0 on the 2020 Educational Horizon

The uprise of combined learning environments, such as Learning 2.0, can be seen as a sign of the rupture of the highly consolidated notion as to the role institutions play in education and training, which could give way to a new educational culture. At present Web 2.0 tools have changed the rules of the game in the environment of Internet, communication and education. But we cannot exclude that this new environment may encourage novel learning and communication philosophies in Internet, so we will surely witness the rise and development of Web 3.0, 4.0 and so forth. All of which will be accompanied by related developments such as Learning 3.0, 4.0, etc. Therefore, although on the 2020 horizon we will probably be referring to Web n.0, right now we will concentrate on Web 2.0 and its present implications in order to explain the challenges the educational sector will have to face.

Learning 2.0 is a philosophy based on a Web 2.0 platform, as opposed to closed virtual learning environments and content management systems. Learning 2.0 favours creating and expanding interest groups and communities of practice that can remain active even after the lecture/course/module is over (Ala-Mutka *et al.*, 2008), thus promoting collaboration between peers. The key to the development of this collaboration can be found in the way the new available tools on which this teaching-learning philosophy is based motivate and hook people. The student takes control of the learning speed, structure and contents thanks to diverse audiovisual resources.

Probably one of the main challenges that Web 2.0 will bring regarding pedagogic and organizational innovation is the fact that learning seems to be surpassing the limits of formal education and traditional schooling systems. This means questioning matters such as: (a) what kind of learning can be found beyond the limits of formal education; (b) what role do educational methods play in today's society; and (c) which educational methods can best provide the skills and competences that our socio-economic environment is demanding (there is a growing demand to alter these methods towards more active ones that concentrate on the social construction of knowledge, instead of the more passive type, including traditional instructionist theories).

## 6 Challenges for ITEM in the 2020 Scenario

If we take a look at current educational institutions we can see that investment in Information Technology (IT) in primary, secondary and higher education is still at an initial stage (Miller *et al.*, 2008). Although there is abundant empirical evidence to show that investment in IT has had a positive impact, it is also widely agreed that it has not been developed to its full potential. This is because little attention has

been given to the pedagogic opportunities it offers, instead of which it has basically been used to give support to teaching structures and methods of the past and as a vehicle to improve communication while using traditional pedagogic and didactic resources. In this sense, IT investment seems to have had a greater impact on administrative services, such as admissions, registry, payment of fees, purchases, staff and timetable management, etc, rather than on the foundations of teaching and learning (Miller *et al.*, 2008; Balanskat *et al.*, 2006).

This leads us to a matter of utmost importance: what role shall Information Technology for Educational Management (ITEM) play on the 2020 horizon? As we have mentioned above, there is a risk that it may be used exclusively for administrative support purposes and, though this is a fundamental task which must be carried out as efficiently as possible, ITEM should not be reduced to this merely operative function. A shared strategic vision must be found to give ITEM long term meaning of added value.

At this point we should decide what part of the IT-EM equation should centre our efforts and in what way. In other words, should we concentrate on what technology (IT) can bring to education on the 2020 horizon, especially emerging technology that we have called Web n.0, or, on the other hand, should we focus on the educational side of this equation (EM). Our aim is to try to achieve a reasonable balance between both IT and EM in order to offer a unified vision of ITEM, but we must keep in mind certain aspects that will possibly set the pace of its development.

Firstly we must consider a basically technical matter regarding how to guarantee universal access to IT, the bandwidth, the use of open-software and author's rights in respect of the contents. Certainly, technological infrastructure evolves along its own channels. This way, even though in developed countries cable based nets have become well established, connectivity based on mobile technology is growing strong and is the main way of connecting to the Internet in developing countries. Universal access to the web brings about certain uniformity in educational management practices, thanks to an increased knowledge and replication of successful experiences in points of the globe that are geographically far apart. In such a context, the search for solutions other than owner software will bring an upsurge and prevalence of tools based on open-source software, which, in turn, will allow technological resources to become more democratically available to people all over the world. Lastly, within this democratising trend we will very likely reach a stage in which not only tools will be freely available, but also contents and, therefore, creative commons type formulas will certainly be more thoroughly developed.

Secondly, concerning educational management, it is necessary to support the design and development of new educational applications and also to actively involve teachers in the process of defining requirements and adopting iterative design approaches. In general terms, one of the main aspects of management is generating leadership that will encourage people to work towards corporate goals. In a similar manner, educational management must efficiently guide changes that are already occurring in the world of education and will continue to do so in coming years. A first class challenge in educational management concerns the fact that there are educators of different age groups and propensity profiles towards the use of information technology and, therefore, towards a cultural change in teaching methods and

organization. It will be necessary to establish methods that are recognized as effective to assist this change of attitude and in working ways. In this sense, the existence of communities of practice, as well as making known their results could be powerful ways of involving teachers in the new system.

Finally, if the trends we have mentioned are leading us towards new educational environments which may even place in doubt the figure of schools and other educational institutions, then we must consider how to manage them from the point of view of the institution itself, municipalities, regions and, lastly, countries. Undoubtedly this implies the appearance of new standards and models with which to manage educational activity. On the other hand, due to the foreseeable dispersal of educational institutions and the teaching methods that will be in use, Information Technology's position will be more important than ever in such circumstances, as it will be the only link to coordinate and run this immense network. So the convergence of IT and educational management (EM) reaches its high point because the means to achieve quality, coherence and interchangeability among future education systems must be based on technology, that is, IT as the facilitating element. In such a context, accreditation systems implemented by national and international agencies will be especially relevant. These systems must guarantee that students have, in effect, acquired certain competences, the consistency of goals achieved in different teaching communities and also the transnational validity of resulting certificates.

## 7 Conclusions

Present educational models reflect the needs of an industrial society, whose paradigm is progressively giving way to a knowledge based society. Learning in a knowledge based society has different requirements and, therefore, it is still to be defined. As well as this, constant changes in Information Technologies also alter what we consider to be the vision and mission of educational institutions. We don't yet know which will be the prevailing educational philosophy on the 2020 horizon, nor do we know what version of the Web will be supporting it. But we have little doubts that we do not know for sure what the educational model will be like then, even though it will retain many of the characteristics that inspire the present one.

We must be ready for what looks like a possible trend, that is, schools and teachers will lose importance in favour of more flexible structures managed according to business models, which will be much more competitive and transparent due to the inevitable need to gain students as clients. In such a context a new design of ITEM must be developed.

On the 2020 horizon, in order to reach its full development, the ITEM field must support technological infrastructure related standards, as well as the measures to promote cultural change associated to the new educational model. It must also be the means to ensure homogeneity in a highly fragmented environment in which customized education based on knowledge will break with the postindustrial educational model, according to which we have carried out learning processes for decades.

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# Innovation or Renovation? The Management of Strategic and Adoption Decisions within a University

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**Abstract.** Most universities make use of e-learning facilities to manage on-line learning, and this paper questions how decision are made to adopt this e-learning package rather than that one, and then how to make use of it. We suggest that educational technology adoption decisions are made at two levels: strategic decisions are made by the university to implement a particular package, and then individual academics made adoption decisions regarding those aspects of the package they will use in their teaching and how they will use them. In the paper we suggest that such technology should be regarded as an innovation and viewed through the lens of innovation adoption theory. We argue that analysis of these adoption decisions needs to be framed differently at each level, using an approach that is appropriate to that level.

**Keywords:** Management of e-learning, innovation theory, technology adoption, strategic decision making, actor-network theory.

## 1 Adoption and Use of e-Learning Technologies in a University

An Australian University, we will call it Albert University, made a strategic decision some years ago to adopt WebCT as its e-Learning platform. As most academics will know, the WebCT e-learning platform offers a number of facilities for the management of e-learning, including: discussion boards, an e-mail system, live chat, and the support of content including documents and web pages. The extent to which each of these facilities have been adopted and used varies from university to university and academic to academic.

Blackboard Inc, the company that owns the WebCT product, has indicated that they will soon withdraw support for it in favour of their main product: Blackboard. This will necessitate Albert University making another strategic decision: should the university adopt Blackboard or move to an open source product such as Moodle? While the decision to purchase and implement a particular e-Learning product by the university is a strategic one, this decision does not necessarily determine the extent to which each individual academic will make use of it in their teaching. In the case of Albert University, while there was a general policy requiring each subject to use WebCT, decisions on how to make use of it in their own teaching subjects have been left up to the academic co-ordinating each subject. While the overall adoption

decision by the university should be considered in terms of strategy, individual adoption decisions to use some aspects of the package but not others are best considered through the lens of innovation adoption.

In summary, at Albert University the adoption, implementation and use of an e-learning package involved a number of decisions, made at two different levels: the university level and the level of the individual academic.

1. The initial strategic decision by the university to adopt WebCT as an e-learning platform – this should be considered in terms of strategic decision making.
2. A decision by individual academic staff on how they will use WebCT in their teaching, or whether they will adopt it as an e-learning environment at all – this should be considered in terms of innovation adoption.
3. Another strategic decision to be made by Albert University to adopt a *new* e-learning platform as a replacement for WebCT.
4. An innovation adoption decision by academic staff on how they will use this new e-learning platform, or whether they will adopt it at all.

This paper investigates the strategies and innovation factors behind all these adoption decisions – strategic decisions made by the university administration and adoption decisions made by individual academic staff members. Following the university adoption decisions, we will consider whether complete adoption of this technology by individual academics necessarily follows.

## 2 Strategy for the Adoption of Technological Innovations

At the conceptual level strategic management is a process for co-ordinating decision making in what may be large, diversified organisations. Hanson et al. (2008) describe strategic management as the process of making and implementing strategic decisions. In this approach tactics and strategy are often distinguished: tactics being seen as short term adaptive actions while strategic decisions determine the overall direction of the organisation. The problem is that strategic decisions are made at all levels of the organisation and not always recognised as significant at that time (Boxall and Purcell, 2003). In other words, a decision can be either a planned activity or a series of events, which lead to a desirable objective. Deliberative strategy is consciously formulated while emergent strategy results from incremental decisions emergent through networks of actors (Latour 1996).

Many business texts concentrate on systematic planning and indeed these models have dominated consultants' prescriptions for both private and public organisations. The fact that many organisations do not systematically plan, or fail to implement plans leads to the adaptive type of models. Often strategies are formulated but not implemented because these cut across organisation units, information is inadequate and the control imposed by planning actually inhibits innovation and decision making. This leads to an understanding that the notion of strategy is not neutral. How it is defined and used in an organisation will impact on the conceptualisation of technological innovation in this organisation.

Albert University exists in the public domain: it is funded significantly by government and is effectively accountable to multiple constituents. This university

has experienced significant internal change over a period of 3-4 years with the notions of systematic strategic planning driving such changes. There is no doubt this approach has been driven by top management, with a mission for the whole organisation and plans for each business unit, and shared functions linked to this strategic plan. However, despite the range of plans a decision to adopt a particular innovation is not as straightforward as we might think. It certainly is an important decision that has ramifications for future educational practices and financial budgets within Albert University. In our investigation to date, it has been difficult to pinpoint when and how the decision will be made.

It is probably fair to say in the case of Albert University that there are a number of decisions that will come together to make 'the decision' on the adoption of a particular technology. The quality of the decision making is particularly important in this case because of the longer term educational and financial implications. Poorly researched decisions presented as rational and ordered often means that the organisation suffers. In this case as large diverse institutional decision making can be affected by the behaviour of the participants in many ways, as they may preserve, delay, stop a decision, and cover up the inconsistencies and the many more variations of influence. In this case it is difficult to tease out the decision making knowledge and power related decision making as the decision making process seems so unclear.

It is important to note here, the actual users of the system are not well represented in the decision making process. This approach of collecting together a particular grouping of people who in this case are from the corporate level of the organisation rather than the academic users of the system, assumes they can correctly forecast and interpret the changes for all levels, however people perceive these decisions in terms of the organisation and operation beliefs they come from. In other words, colloquially where you sit is where you stand. In relating this particular aspect back to the rational strategic management approach, this approach assumes the strategic leadership will provide the integrated leadership for decisions; in other words a balance. The problem in large, diversified organisations such as Albert University is that strategic leaders may not provide sufficient control to coordinate decision making or comprehend the entire strategic variable simultaneously. Quinn (1988) as far back as 1988 argues there are both cognitive and process limits to managers' ability to cope with these variables simultaneously.

The decision to adopt a new e-learning environment in Albert University will result more from an incremental series of decision with the construction of limited representation of decision makers from the corporate level structure to make the decision, with time imperatives imposed by the expiry of contractual arrangements and the inattention to the technology 'problem' decision earlier. This is a non-routine decision; an important one where the key players are looking around to see what the powerful are giving out about how they should act, and they are trying to do what they think is expected of them. It seems clear this big decision has been avoided for as long as possible. Senior management is now trying to involve a particular constructed group of decision makers so that if the decision goes bad the blame can be passed off or shared around. It is a culture of sidestepping decisions and trying to avoid being seen to make a mistake. It is certainly not about the users' needs or knowledge given they are largely excluded from the decision making process.

### 3 Innovation and Change: Adoption of Innovations

Just because a new e-Learning system has been built and made available, this does not mean that it can automatically be assumed that organisations or individuals will want to adopt or to use it. Even if an organisation does adopt a new innovation, it also cannot be assumed that its employees will want to use it, and even if they have no choice and are made to use it, that they will get the most out of it. The old saying: ‘*You can lead a horse to water but you can’t make it drink*’ comes to mind here.

Making any sort of change to the way things are done is always complex and can be quite difficult to achieve successfully. The successful adoption of any new technological innovation is often in doubt if people who might be prepared to support the innovator cannot be convinced to do so. Although writing of *political* change almost five hundred years ago Niccolò Machiavelli summed this up as follows:

*“There is nothing more difficult to handle, more doubtful of success and more dangerous to carry through than initiating changes ... The innovator makes enemies of all those who prospered under the old order, and only lukewarm support is forthcoming from those who would prosper under the new. Their support is lukewarm partly from fear of their adversaries, who have the existing laws on their side, and partly because men are generally incredulous, never really trusting new things unless they have tested them by experience.” (Machiavelli c1515)*

Innovation can be defined as “the alteration of what is established; something newly introduced” (Oxford 1973), or “introducing new things or methods” (Macquarie Library 1981). The process of innovation involves getting new ideas accepted and new technologies adopted and used (Tatnall 2009b).

### 4 Theoretical Approaches to Innovation Adoption

To investigate the adoption of new ideas or technologies it is useful to follow one of the theories of technological innovation (Al-Hajri and Tatnall 2007). A number of approaches exist to modelling how technological innovation takes place, including the Theory of Reasoned Action (Ajzen and Fishbein 1980), the Theory of Planned Behavior (Ajzen 1991), the Technology Acceptance Model (Davis 1986), Diffusion of Innovations (Rogers 2003) and Innovation Translation (Callon 1986; Latour 1996). In particular, both the Diffusion of Innovations and the Technology Acceptance Model (TAM) are very well known and widely used approaches to theorising technological innovation. One important difference between some of these theories though is the degree to which the adoption decision is seen as completely rational, and whether provision is made for partial adoption (Tatnall 2009a). A brief discussion of several approaches to theorising adoption of innovations follows.

#### 4.1 The Technology Acceptance Model (TAM)

The *Technology Acceptance Model* (TAM) is a theoretical model that evaluates “... the effect of system characteristics on user acceptance of computer-based information



systems” (Davis 1986 :7). TAM assumes that a computer user normally acts rationally and uses information in a systematic manner to decide whether or not to adopt a particular technology. Davis (1986) identifies major determinants of technology acceptance and specifies a basis for causal links between the technology’s *perceived usefulness* and *perceived ease of use* along with the individual’s attitude towards using technology and behavioural intention to explain technology adoption (Davis 1986; Davis 1989; Davis, Bagozzi and Warshaw 1989).

## 4.2 Diffusion of Innovations

Rogers’ classic work on the theory of *Diffusion of Innovations* (Rogers 2003) has been evolving now for over forty years. Rogers describes diffusion as: “... the process by which an innovation is communicated through certain channels over time among the members of a social system” (Rogers 2003: 5), and so a decision not to adopt an innovation relates to the rejection of the new idea. Rogers asserts that a technological innovation embodies information that has the potential to reduce uncertainty and that diffusion is thus an information exchange process amongst members of a communicating social network driven by a need to reduce uncertainty.

Rogers considers the main elements of diffusion to be: characteristics of the innovation, the communication channels through which information about the innovation pass, the passage of time, and the social system. To explain the rate of adoption of innovations Rogers suggests consideration of the following perceived characteristics of innovations: relative advantage, compatibility, complexity, trialability and observability.

## 4.3 Innovation Translation: Actor-Network Theory

Actor-Network Theory (ANT) was designed as an approach to socio-technical research that would address the need to treat the contributions of both human and non-human actors fairly and in the same way (Callon 1986). Innovation Translation (Latour 1986; Law and Callon 1988; Latour 1996), informed by Actor-Network Theory, makes use of a model of technological innovation which uses the concept of heterogeneity in a world that is full of hybrid entities (Latour 1993) containing both human and non-human elements. It notes that the process of innovation adoption is often not completely rational and that innovations are frequently not adopted in their entirety but only after ‘translation’ into a form that is more appropriate for use by the potential adopter. It then uses these notions in an explanation of the adoption, or non-adoption of technology (Tatnall and Davey 2007).

Callon et al. (1983) have proposed that translation involves all the strategies that an actor goes through to identify other actors and to work with or against them in order to achieve the adoption. Latour (1996) speaks of ‘chains of translation’ and suggests that with the translation model the initial idea hardly counts and the innovation moves only if it interests one group of actors or another. Callon (1986) suggests that the process of translation has four aspects or ‘moments’:

- **Problematisation** – the problem is re-defined (translated) in terms of solutions offered by those advocating its adoption.

- **Interessement** – involves interesting an entity by coming between it and some other entity (Law 1986). It attempts to impose identities and roles defined in the problematisation on the other actors.
- **Enrolment** will follow through a process of coercion, seduction, or consent (Grint and Woolgar 1997), leading to the establishment of a solid, stable network of alliances.
- **Mobilisation** finally occurs as the proposed solution gains wider acceptance and an even larger network of absent entities is created through some actors acting as spokespersons for others.

#### 4.4 The Problem of Partial Adoption

One of the difficulties faced in investigating the adoption of technological innovations is that not all innovations are adopted in the form in which they were proposed – not all are adopted without change. This raises the question of just what was adopted in each case if it was in some way different from what was proposed by its instigator. Neither TAM nor Innovation Diffusion, however, take this into account to any degree (Tatnall 2009b). Another problem with these approaches is that they assume that much of the reason for the adoption, or non-adoption, of the technology is due to characteristics of the innovation itself. This essentialist view (Grint and Woolgar 1997) leaves little room for a consideration of socio-technical issues and an investigation of why individual humans and organisations react differently to adoption of the same technology. In view of this, we will frame adoption considerations in this paper using Innovation Translation.

### 5 e-Learning Innovation Adoption Decisions at Albert University

We have already discussed how the strategic adoption decisions will probably be made at the university level, and the actors involved in these. Another factor that comes into it these decisions, however, is pressure from some individual academics even though they are not officially represented in the decision making process. At Albert University there are a number of academics who strongly believe in the benefits of open source software and so would favour a decision to adopt Moodle, while there are others who prefer the idea of sticking with the ‘tried and true’ commercial product of a large company. If these people feel strongly enough about this matter and have problematised (Callon 1986) the use of an e-learning environment in their own way then they will certainly apply pressure to the decision makers to try to enrol them (Callon 1986) into making the ‘right’ decision.

The first step in an actor-network analysis of the decisions by individual academics to adopt some, or all, of the e-learning package features is to identify the actors involved. Law (1987) describes an actor as any human or non-human entity that is able to make its presence individually felt by other actors. At Albert University the actors involved in this case include: course co-ordinators, subject co-ordinators, academics (teachers), sessionals, Faculty Deans and the university administration, technical staff from the Information Technology Services department, students,

computers, screens, computer laboratories, e-learning infrastructure (including remote access) and the e-learning environment itself. Each of these actors potentially has an influence on how or whether the adoption occurs.

Firstly consider the university hierarchy; if course or subject co-ordinators, or the Faculty Dean expresses a view on this then this must be taken into account, but this much is obvious. Not so obvious is the influence of some of the non-human actors. If the e-learning infrastructure requires too much effort to come to grips with, or the e-learning interface is too off-putting or non-intuitive then adoption becomes less likely.

Even if the package is adopted, however, how can partial adoption be explained? The less than friendly interface of WebCT has been one reason for only partial adoption of this package, and there are other alternatives to the e-mail it offers. The in-built testing/marketing facilities are of interest to some academics but not to others and so these may or may not be adopted as they will fit less well with their problematisation of what an e-learning environment should be about. On a human level, many of us prefer human to human interactions and are reluctant to use technology in this way for teaching and learning. There is then also the concern that students will no longer bother to come to lectures. All of this means that many academics will translate the e-learning package into something that suits their own needs.

## 6 Conclusion

Adoption, implementation and use of technology, such as an e-learning system, in a large organisation such as a university has both strategic and individual adoption aspects. In this paper we have argued that the initial decision by the organisation to invest in the technology is a strategic one, best considered in terms of strategic decision making theory, while the decisions regarding individual subjects and made by individual academics can be analysed using one of the models of innovation adoption – we have used innovation translation. Whichever analysis approach is used we have argued that with its socio-technical aspects, this must be one that gives adequate weight to all human and also technology (non-human) factors.

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# The ‘Educational Lot’ for Young People Who Are NEET: Quality Management and Roles of Management Information Systems

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**Abstract.** The United Kingdom (UK) government, in common with those in many other countries, recognises the significant numbers of young people who are not in education, employment or training (NEET) from the age of 16 years. Perceptions associated with this group of young people have often been negative, yet recent research suggests that reasons for the lack of involvement of this group of young people often arises from situations where there is extreme trauma, linking to desires of individuals to seek alternative forms of educational and economic involvement from the traditionally cognitively focused opportunities accessible normally in schools. Alternatives, sometimes involving uses of technology, are being offered in a range of school and support situations. The importance of management information systems in both identifying and positively tracking these young people is recognised, yet the development of systems to cope with policy and support needs is currently at an early stage. This paper offers an overview of the current, largely UK, context, and indicates how data management information systems are likely to support important policy, practice and research needs.

**Keywords:** Learning management systems, learner-centred learning, motivation, evaluation, policy.

## 1 Introduction

It is well recognised that many young people in the United Kingdom (UK) are not in education, employment or training (NEET) from the age of 16 years. The British Broadcasting Corporation (BBC) reported (Eason, 2007) that: “At the end of 2006 there were said to be 206,000 Neets aged 16 to 18 in England in the target group for the government’s new strategy”. Raffe (2003) found, in a study conducted in Scotland, that: “more than three in ten (31%) young people were NEET at some time during the three years after the end of compulsory schooling”. However, the exact numbers of young people who are NEET, particularly at any one point in time, are not at all clear. As the BBC article stated: “Shortcomings in the system that tracks what becomes of young people mean that officials do not know what 5% are up to - they are simply not on the databases”.

Many governments wish to address what is seen as a 'NEETs issue'. In 2000, heads of state and governments of the European Union (EU) agreed the 'Lisbon Objectives in Education and Training'; these objectives included the reduction of the high number of early school leavers aged 18 to 24 years to 10% by 2010, in order to reduce the danger of them 'being on the fringes of the knowledge society' (Commission of the European Communities, 2005). The second report on progress towards the meeting of those objectives indicated that in 2004 the EU average ratio of early school leavers (referred to as 'drop outs' in EU documentation and NEETs in UK documentation), for those with only 'lower-secondary education' was the same as that in 2003, and that the 2010 target would not be met if this trend were to continue. Within that report, the UK rate was reported as 16.7% for 2004 (16.4% for females, and 17.0% for males). In a UK context, concerns about this group, and perceptions associated with them, are themselves quite diverse. The approaches that can be taken by policy makers and those who support this group can be wide, and these approaches appear to be associated with perceptions of who constitutes this group. At times, perceptions of this group of young people have been painted in rather negative ways. But, as the BBC report stated: "We imagine them to be the idle feckless - good-for-nothing layabouts, content to subsist on benefits and/or family handouts. But the government's own strategy document makes it clear this is a misleading impression".

It is clear that many different individuals (and sub-groups) make up this wider NEET group. It is commonly believed that certain factors impact often at early stages, and the potential levels of impact of some factors is alarming; consider, for example, that "Some 78 million Europeans live at risk of poverty, 19 million of whom are children" (European Communities, 2008), or that "6 million young people leave school without any qualifications" (Commission of the European Communities, 2009). There have been a number of different attempts to categorise and characterise this group more exactly, in order that policy makers and support practitioners can be in a position to understand them in greater detail, and support them (or address issues associated with them) more effectively. The BBC report stated that: "Researchers working for the then Department for Education and Skills came up with various characteristics of youngsters who were likely to drop out: Angry young rebels; Quitters; Rebels without a cause; cool dudes; Hedgers; Settlers; Escapists; and Strugglers". A recent study that looked at uses of technology by this group of young people (Passey, Williams and Rogers, 2008) categorised them in ways that were concerned with a focus on potential future support. They suggested using four different categories: those young people who are employment and education ready (EERs); those who are nearly employment and training ready (NEERs); those who have chosen alternative lifestyles (ALTs); and those who have multiple long-term problems (MULPs).

Understanding the characteristics of this group of young people, to consider how to associate most appropriately the alternative forms of support available, is clearly likely to be of importance. The range of characteristics of this group is wide, and some of the features of this group bring particular challenges to any implementation approach. A phenomenon of note is that of NEET 'churn'. A report by the National Audit Office (2004) found that while the majority of young people do leave NEET status, this is not necessarily a permanent exit. They found that a substantial minority continued to join and rejoin the NEET group, with numerous short periods of

education or employment in between. The NEET group is not a stable group – young people are continually leaving and joining it. Sachdev, Harries and Roberts (2006) reported, for example, that only 1% of the group remain NEET right through from 16 to 18 years of age.

To positively support these young people, it is clear that there are potential roles for management information systems: to help identify the population more exactly; to identify characteristics that can suggest appropriate engagement; to track and record success as well as indications of weakness; and to provide research with opportunities to address key questions relating to this area. These key areas will be explored further within this paper. It should be noted in this context, however, that inappropriate or inadvertent uses of management information systems could create significant future issues. 'Escapists', for example, are a group of young people likely to be seeking ways to be (rightly) individual, related with high degrees of freedom. Data management systems used to track individuals so that those individuals feel that their freedom is being taken away from them are likely to feel negatively, they may well disengage further, rather than being encouraged to engage positively.

## **2 Understanding the Scope of the Problem**

There is a clear need to understand the scope of the problem, if it is to be addressed. Currently, the lack of detailed quantitative information is in itself a weakness. Within the UK, data management systems within schools retain detailed information on individuals. While individuals are within school systems, the recording and retaining of data is widespread and usually thorough. However, when individuals move outside a school system (to another school or beyond), the transfer of data has been less well developed technologically and operationally.

When young people leave the school system, local authority (LA) Connexions services are key agents in providing support for young people who are NEET. Connexions services generally would find it useful to have access to certain types of data that are not currently necessarily easily accessible to them. For example, having end of Key Stage 2 (at 11 years of age) and end of Key Stage 3 (at 14 years of age) subject attainment data would be helpful to them. Some services in some LAs and regions have started to look at how to address this type of need. There is a need, however, for appropriate transfer of data not just from schools to the Connexions services, but also from other LA services to the Connexions service. Currently, this form of transfer is not developed in any common form, but the importance of information and management systems in this respect is stressed by the government education department (DCSF, 2008a) through its website. The website states that: "Connexions has developed excellent case management systems for effectively tracking young people's progress. These systems formed the basis of the Client Caseload Information System (CCIS) specification which enables support to young people across local authority boundaries, ensures multi-agency working and gives better targeting of services; all of which form the heart of any integrated youth support service. Local authorities will be expected to ensure that the client tracking systems set up by Connexions services are maintained and developed to inform local planning and measurement of the NEET group. ... Local authorities must have in

place a robust client management system and client tracking arrangements that meet the Client Caseload Information System (CCIS) specification.” Some local exemplars do currently exist where implementation has been undertaken in particular ways. A report by Citizens Online and the National Centre for Social Research (2008) identified a number of key exemplars of technologies in LAs supporting young people who are NEET, including the YorOK Database (information sharing in multi-agency working). The DCSF (n.d.) website provides a range of case studies, including an example where data is transferred between schools and the Connexions service, called Pan London CCIS. In the state of Victoria in Australia, a Schools Interoperability Framework (SIF) is being used to support data transfer with a focal purpose of enabling the identification and tracking of young people who are NEET (Shoesmith, 2009). Although schools in the state record relevant data, details about young people are not held in the same software applications as data relating to attendance and to timetable. The SIF framework works by using a central Zone Integration Server, which reads data from different sources, and writes them to agreed applications. Each application across the system that contains data of value is read through the use of a SIF agent (a specific piece of software to read that agreed data). In this way, data already across the system can be read and written to other parts of the system, so that a more complete picture becomes accessible to users. This system is in use in certain local authorities and states in the UK, the United States, and Australia. Within the UK, SIF has now been agreed as the form of data transfer that will be central to national policy (see Becta, 2008). It is clear overall that, until this form of data transfer is more commonly accessible, the scope of the problem is not likely to be known exactly. However, even when this is the case, the forms of data retained, to fulfil specific purposes, will need to be considered carefully.

### **3 Tracking and Recording Success as well as Weakness**

Perceptions of ‘the NEET issue’ could well frame the forms of data that are retained in management systems. It is clear from those working within the Connexions and support services currently that tracking and recording success is as important a need as identifying those aspects of weakness that need to be addressed.

In the UK, the DCSF has set up a national dedicated website to support young people who are NEET, called Connexions Direct (CXD). As the DCSF (2008b) says, it: “offers advice, support and information for young people aged 13 to 19 on a wide range of issues relevant to their age group. CXD consists of a dedicated website - for online searching on subjects such as careers, learning, health, relationships, finance and leisure activities and a helpline where young people can access information, advice and support via the telephone, text messaging, webchat and email. The helpline operates from 8.00 am until 2.00 am, 365 days a year, offering useful out-of-hours support to complement local provision”. However, although this website clearly encourages contact with young people, the ways in which those contacts relate to records created, or how they are integrated with wider uses of a virtual learning environment to support e-portfolio provision, is not indicated there, although a recent report (DCSF, 2009a) states commitment to developing innovative online services, including a growing provision for young people to let others know of



their experiences, as well as a commitment to developing wider ranges of facilities to link existing online provision. Currently, and in the future, it is arguable that these forms of issue will need to be met and to be considered at a much more local level, with LAs and Connexions services considering the ways in which specific local technological facilities can be integrated. Some Connexions services have already looked at ways to support their needs, and the needs of young people in these respects. A report by Citizens Online and the National Centre for Social Research report (2008) identified an exemplar of use of a form of e-portfolio, called the Virtual Ruksak (allowing young people to record and retain examples of work done in a variety of situations, collected together so that employers and admissions tutors can easily view their achievements). Although these forms of technologies are likely to support these young people, they are not widely available currently. The transfer of records between such systems is also not widespread.

## **4 Identifying the Population More Exactly**

Connexions services use particular categories to maintain records of young people, which have been provided from the UK government department, for policy reporting purposes. Experience has shown that placing young people within these categories is not always easy or consistent. The category of 'unemployed' can be very wide, and this group is registered as unemployed with Connexions. Some will also be registered unemployed with Job Centre Plus (when they are post 18 years of age). Other young people may be grouped in categories of 'illness' (which in one Connexions service is used for short term illness), 'unavailable on religious grounds', 'not economically active' (which is used for long-term illness over 12 months or for disability), 'unavailable for other reasons' (which is used when it is not clear that any other category is appropriate), 'young carer' (which is concerned with those caring for relatives), 'young parents', 'pregnant', and 'personal development opportunity' (which covers voluntary work that is both paid and unpaid).

These forms of category, while necessary from a government record viewpoint, appear to be of much less value to those supporting the young people. There is currently no consistent recording approach used across Connexions services in the UK, for example, to identify features that will help those who support the young people. Yet important features of these young people are being identified, and could be considered in the formation of appropriate data recording elements. For example, young people who are NEET commonly exhibit limited capabilities to support decision-making (reported by Passey, Williams and Rogers, 2008). In addition to this limited capability (in terms of decision making), other factors such as traumatic backgrounds and poor experiences of learning environments can mean that young people who are NEET often do not sustain employment or educational opportunities when these are offered to them. These decision-making limitations tend to be linked for many young people who are NEET to particular ways of thinking. They do not tend to think in abstract or theoretical ways, and value 'real-world' experiences. Many young people who are NEET think along practical lines or creative lines, rather than theoretical or cognitive lines that are more abstract. Young people who are NEET

often engage most readily in practical and creative endeavour, and desire involvement in social environments. How these features can be related to recorded details for those who support these young people is a clear need.

## **5 Identifying Predictors of the Issues**

Some schools have already begun to take preventative action with regard to ‘the NEET issue’. Some schools are now involved in identifying young people who are not benefiting from the ‘traditional’ curriculum. They are involved in providing alternative curriculum opportunities, with the intention of supporting the needs of young people who might have moved into the NEET group. In one school federation, inclusion advocates in each school identify young people (through their behaviour patterns) who might in the future become NEET.

However, this identification of the group of ‘potential young people who will become NEET’ is based on particular assumptions. These assumptions are not necessarily universally held. Some managers of Connexions services, for example, feel that those young people who become NEET may actually be in a category in school associated with the quiet, low achievers, rather than those identified as disengaging and identifiable through their external behaviour patterns. There is clearly a role for management information systems in helping to explore and address this question; the data held in systems is likely already to enable a study to look at the match of these features. It is generally accepted that there is a need to identify early the characteristics which put young people at risk of becoming long-term NEET. UK government policy (DCSF, 2009b) now expects this group to be supported by alternative curriculum provision (including a range of new more practically focused diplomas accessible to young people 14 to 19 years of age); it is clear that research is needed in order to demonstrate much more precisely what the outcome of this provision will be for the young people. A long-term study of this form is currently being set up in Scotland (Longitudinal Studies Centre, 2009).

## **6 Ethical Issues, Positive Intentions and Engagement**

Although this paper is not specifically focusing on an in-depth discussion of ethical or wider issues concerned with engagement of young people who are NEET, it is worth highlighting a number of points of pertinence within this context. What is clear from background literature is that young people who are NEET may well have had negative experiences in school situations, have found concentrating within classrooms to be difficult, have sought engagement in training and employment that is practically, creatively or socially based, but have been hampered by their limitations with regard to a range of positive experiences and how to handle decision-making. If numbers of these young people are to be engaged positively (helping them to explore opportunities and find unrecognised areas of interest), then evidence of outcomes so far suggests that there is a need to do more; and that that need should include more positive support, using data management and associated research positively within

this context; the purpose of the use of data, and research using data, needs to positively support young people, rather than encroach on their privacy, or individualism, or to 'keep track of them'. Research in this context has a role in identifying answers that can be of benefit to the young people; this paper does not argue for widespread tracking, or for an encroachment that could lead to a generation of antagonism. In that respect there is a need to consider individuals, as well as to consider protection of data, appropriate use of data, and appropriate elimination of data when answers have been identified. While the rights of individuals need to be upheld, a further dimension to consider is the financial support that agencies and governments provide; it is arguable that those who provide funds have a right to know how those funds are used and what outcomes arise.

## **7 Research, Policy and Practice Needs**

Evidence indicates that roles for management information systems in supporting 'the issue of NEETs' are well and widely recognised, but that implementation, practice and features of use are only at early stages. The current situation indicates that there are some key potential roles in the areas of research, policy, and practice.

In terms of policy, key questions with regard to data management systems relate to the ways in which data transfer will be enabled, the details recorded to enable an understanding of scope, the forms of presentation that will be of value to different users of the system, how systems will track and record successes as well as weaknesses, how the details presented will be of direct value to those supporting the young people (or to the young people themselves even more ideally), and how the data systems will provide timely data to support prevention of severe situations arising. In terms of practice, key questions with regard to data management systems relate to the ways in which data will be accessible to the user, the details recorded to enable an understanding of scope within their localities, the forms of presentation that will offer value to that particular user, how systems will provide a view of the young people's successes as well as their weaknesses, and how the data systems will provide alerts of severe situations arising. In terms of research, key questions with regard to data management systems relate to the ways in which data can provide an exploration of scope of the issues, how the data can enable a more thorough understanding of the population and how support will relate to those features that are identified, how systems will provide a view of the young people's successes as well as their weaknesses to enable measures of success that can be made more widely accessible to the profession, and how the data systems can provide opportunities to explore predictors of 'the issues of NEETs', so that young people can gain from positive, supportive intervention. Data management systems have the potential to offer substantial future value to those concerned with 'NEETs issues' in policy, practice and research areas. Although there is likely to be a range of technological issues that will need to be addressed if they are to fulfil their widest potential, even exploring uses of current data management systems to look at some of the many assumptions that exist are likely to be fruitful at this stage.

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# Emerging Issues in the Utilization of Synchronous ICT in the Delivery of Distance Education at Public Universities in Uganda

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**Abstract.** This paper reports on the utilization of synchronous information and communication technologies (ICT) in the delivery of distance education at the two largest public universities in Uganda. This was an exploratory descriptive survey that aimed at establishing the emerging issues in the utilization. Applying Peter's theory of industrialization of distance education and Moore's theory of transactional distance as interpretive frameworks, the findings illuminate variations in ICT usage for communication among the learners, and with their instructors. This nascent use of ICT was mainly supported by telephones as well as text-based chat and projectors, but on a smaller scale. It was concluded that learners and instructors should be given training in basic utilization of the available and accessible synchronous ICT. Besides, more studies on the changing patterns of distance education in Ugandan universities and comparative studies with other African universities concerning their distance education trajectories were needed.

**Keywords:** Transactional distance, distance education, synchronous ICT.

## 1 Introduction

Integration of ICT into distance education in Uganda has been on a small scale and distance education has been limited to first generation approaches such as print and face-to-face sessions. But this trend has been changing with the emergence of ICT-related project initiatives by the WorldLinks in schools and ConnectED in Teachers' colleges to integrate ICT in teaching and learning through distance education (Aguti and Fraser, 2006; Bbuye and Mango, 2005). Related developments have shown that Uganda is one of the countries with active markets for the Internet, which is a valuable tool in distance education. Moreover, the two largest Ugandan public universities in terms of enrolment and distance education programmes have enhanced their ICT infrastructure pertinent to distance education (Aguti and Fraser, 2006; Binns and Otto, 2006; Mayende, 2007; Saint, 1999). Despite these budding developments in ICT for distance education, little systematic inquiry has been done on the interactive

processes between the learners, and between the learners and their instructors. Additionally, while this current study builds on available research evidence, unlike some of the earlier studies, it takes a theoretical orientation by applying two theoretical frameworks to interpret the emerging issues in the utilization of synchronous ICT in distance education. In this paper, synchronous ICT denotes the direct exchange or real time communication between teachers and learners and includes text-based chat, videoconferencing, projectors and telephone. Distance education has been defined as an education process in which a significant portion of the teaching is conducted by someone removed in space and/or time from the learner (Perraton and Robinson, 2002). Thus, we attempt to answer the question “how does synchronous ICT facilitate distance education in public universities in Uganda?” The rest of the paper is structured as follows. First, the theoretical framework is provided. Second, the methods used in gathering evidence are discussed. Third, the findings from the study are given and fourth, conclusions are made.

## **2 Theoretical Framework**

Peters' (1994) Theory of Industrialization of Distance Education portrays the role of mechanization in distance education and indicates that distance education cannot take place without the use of machines. Examples such as duplicating machines and transport systems are pre-requisites to distance education and additional facilities of modern means of communication and electronic data-processing installations are later forms of distance teaching. Therefore machines which are in this case ICT are inseparable with distance education. Peters suggests that machines ensure efficient dissemination of knowledge and education becomes accessible to as many people as possible. Moore's (1996) Theory of Transactional Distance entails dialogue, structure and autonomy of learners in distance education and therefore it is used to explain the relationship between ICT and distance education. It looks at the real teaching and learning process and how it is done in distance education. The transaction which here is the communication between the teachers and the learners is explained in terms of dialogue that is the way in which the communication is carried out; structure, which is how the program is designed to accommodate all learners' needs; and learner autonomy that implies the degree to which learners can learn on their own. In this case, ICT is presumed to be useful in the transactional distance between the learner and fellow learners and between the learner and the teacher. In other words, dialogue, structure and autonomy in the process of all these interactions during distance education can be interpreted as being facilitated by ICT. Recent studies on the use of synchronous ICT in distance education have evaluated ICT in terms of flexibility, improving perceptions about instructional approaches and efficacy in terms of levels of cognitive process and meta-cognition in distance teacher education in Uganda (Gudula, 2006). Prior to this, Ouma (2003) found out that emphasis was on ICT for enhancing face-to-face delivery and that Makerere and Kyambogo Universities were advancing towards introducing ICT in the management and teaching/learning processes. Building on these earlier studies, we concentrate on the role of the budding

synchronous ICT infrastructure and resources in reducing the transactional distance in the teaching and learning process in distance education. In this study, synchronous ICT was conceptualized in terms of telephone, text-based chat, video conferencing and projectors while distance education was conceptualized as the use of print, face to face sessions, student groups and individualized learning. It was hypothesized that the ICT resources enhance dialogue, provide better structure and promote autonomy in distance education.

### 3 Methods

This was an exploratory descriptive survey in which self-administered questionnaires and structured interview guides were designed and distributed to the students and lecturers respectively. The instruments were designed in such a way that they had a main title, an introduction to the study which included background information, a section on ICT (independent variable) synchronous ICT and the last section on distance education (dependent variable). The population of students on distance education in Makerere university was approximately 6000 (Aguti, 2006) and in Kyambogo University there were over 5026 distance education students (Binns and Otto, 2006). According to Krejcie and Morgan (1970), with a population of 11,000, the sample should be 370. Out of the 370 targeted respondents, a total of 188 students responded and 10 lecturers were interviewed out of the approximated 20 in both universities. Data was collected from both students and lecturers of distance education. Students are those in Makerere University offering Bachelor of Science, Bachelor of Commerce and Bachelor of Education and those in Kyambogo University offering Diploma in Education- primary (External) and Diploma in Special Needs Education (External). Data obtained using questionnaires was analyzed by use of frequency distributions generated through the use of Epi-data and Statistical Package for Social Scientists (SPSS) software package. Interview data was coded and emerging themes were identified.

### 4 Findings

A number of questions were put to both the instructors and the students from Makerere and Kyambogo universities, to find out if they really use these ICT, what they use them for and if they do not, why. Over 63% of the students were from Makerere University and about 37% of the students were from Kyambogo University. The difference was mainly due to the fact that there are more students and at the same time, more courses offered through distance education at Makerere compared to Kyambogo. Male respondents comprised 57% whereas 43% were female. Over 70% of the respondents were below 30 years of age, 24% between the age of 30 and 45, while only one per cent was over the age of 45 years. The modal age of the students is below 30 years which implies that majority of those who are currently upgrading through distance education are quite young. This may also be attributed to the



increasing demand for higher education in the recent years by secondary school leavers as seen in the rising enrolments in universities. Out of all the students contacted, about 39% were offering Bachelor of Education followed by those of the Diploma in Education Primary (External). Bachelor of commerce (B COM) and Bachelor of education (BED) are courses offered at Makerere University in the distance education department. Diploma in Education Primary (External) (DEPE) and Diploma in Special Needs Education (DSNEE) are courses offered at Kyambogo University distance education department. Table 1 shows the percentage of students participating in the study enrolled in the different courses. All these courses utilize these ICT. According to the table, majority of the respondents were offering Bachelor of Education, Diploma in Education Primary (External) and Bachelor of Commerce.

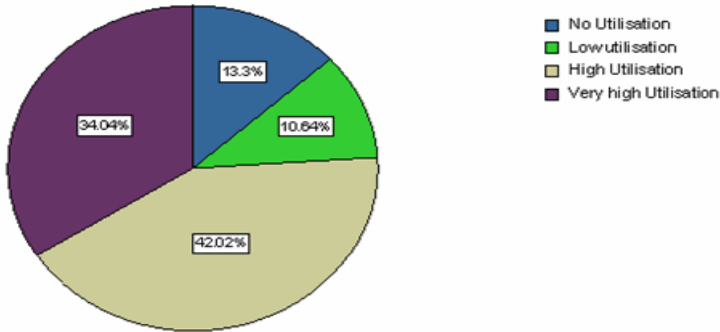
**Table 1.** Respondents in the different Distance Education Courses

	B COM	BED	DEPE	DSNEE	Total
Frequency	47	74	63	4	188
Percentage	25	39	34	2	100

Throughout the different courses these respondents were currently offering, they were asked their years of study and 29% of the respondents were in their first year. In second year we had around 18% of the respondents and 41% of the respondents were actually in their third year. A small percentage was in their fourth year and that is about 12% of all the respondents. The respondents were again asked their highest level of education so far and 34% of them had acquired certificates, 53% had a diploma, while those who had attained a degree status were over 12% of the respondents. A small percentage of the students, 0.5% had a post graduate diploma as their highest level of education so far attained.

Synchronous ICT involved here are telephones, text- based chat, video conferencing and projectors. Telephones are highly used in distance education according to both students and instructors. Approximately 76% of the students showed that they use telephones as shown in Figure 1 and about the same percentage of instructors (70%) also showed their use of telephones. These mainly are mobile telephones that are used in the communication between the learners and instructors. This is probably because mobile telephones have got a wider coverage and are convenient for any location. Besides, the information exchanges are synchronous since they involve real time communication between the instructors and the learners and between the learners themselves.

Considering Text based chat which is a two way communication involving the use of text, it has low utilization according to the responses obtained during the research. Actually only around 30% of the students show its utilization. Over 60% of the instructors on the other hand indicate its usage. However, most of the respondents who say they use text based chat might mean the use of Short Message Service (SMS) because text-based chat technology is not so much in use in Uganda and



**Fig. 1.** Utilization of telephones in distance education by students

especially in both Makerere and Kyambogo universities for distance education. Video conferencing involves communication between the learners and instructors using a video but in any case it is easy for the learners to communicate directly to their instructors. This is not common in Uganda and in this case, it is also not used in distance education in our universities. A limited percentage of students (about 20%) show that they use it in their studies. This is not in line with what prevails at the universities or the study centres. This might mean that the respondents use this type of ICT in their other business and not in education. Instructors on the other hand do not show any use of video conferencing in their delivery and development of distance education.

Projectors are mainly used for communication between the instructor and a large group of students. It conveys the message to a big number of students and it is controlled by the instructor. The students get a chance to ask for clarification there and then. There is little utilization of the projectors in distance education in Ugandan universities. Only 20% of the students show their use of projectors though about 40 % of the instructors show that they use them. When asked as to why there is no or low utilization of synchronous ICT especially video conferencing, instructors had reasons to give which include, the lack of video conferencing facilities though these have been found at the Uganda Management Institute in Uganda, ICT not being properly developed in Ugandan universities and computer literacy still being low among others. The utilization of synchronous ICT has been curtailed by the fact that the current nature of distance education has been mainly first-generation that is, print and second-generation, face-to-face and less on the other forms of distance education. Therefore, the synchronous ICT like telephones, projectors, text-based chat and video conferencing that would have been exploited to enhance distance education have been underutilized. Students and instructors were contacted to present their opinions on the purpose of synchronous ICT in distance education in both Kyambogo and Makerere universities. The purposes were access to learning materials, interaction with the instructor, interaction with other students, assessment and research and these were rated accordingly by both students and instructors. Table 2 below shows how instructors rated the purpose of ICT to their delivery and development of distance education.

**Table 2.** The purpose of synchronous ICT in distance education as rated by the Instructors

	Access to teaching materials	Interaction with other instructors	Interaction with students	Assessment	Research
Frequency	8	6	8	6	8
Missing	1	1	1	2	1

Most instructors agree that synchronous ICT are important in the delivery and development of distance education as shown in Table 2.

Therefore:

- a. Students and instructors utilize synchronous ICT on a large scale
- b. Telephones and text based chat (can be taken to mean SMS) are the most highly utilized synchronous ICT by both students and instructors
- c. The utilization of synchronous ICT by students does not vary much from the utilization of synchronous ICT by instructors
- d. The main reason for none or low utilization of synchronous ICT especially video conferencing and projectors is because they are not available and those which are available are inaccessible.
- e. Most students give the main purposes of synchronous ICT as being to interact with other students and also to access learning materials. Instructors give the main purposes of synchronous ICT as being to access teaching materials, to interact with students and to do research.
- f. For purposes of accessing learning materials, interaction, assessment and research in distance education, students use synchronous ICT more than instructors.

Respondents were also asked on their learning activities in distance education and a lot was gleaned from them. Printed material is used mostly by instructors and students find it easy to follow it. Again, most of the students do not find problems in face to face sessions as they can understand the content delivered and follow the instructors as well as refer to the content given later. Most instructors also find it easy to develop content for face to face sessions, deliver it and refer to it later. Most of the students can again understand the content given on their own, can follow that given by instructors later on their own and find it easy to add on it later on their own. Most instructors (50%) however say that it is not easy for students to refer to content given on their own. However, they say that it is easy for these students to search for content to add on that delivered to them. Most of the students find it easy to understand content given in organized study groups and can always refer to content given in class in their organized study groups and can search for more to add on in these groups. Instructors also agree with students that it is easy to understand content given in organized study groups and to refer and add to it later in these groups. With reference to audio methods like the use audio cassettes, students indicate that they do not find it

easy to understand content provided using audio methods. Even when the instructors use audio methods, content is not easy to understand and thus making it difficult to refer to it. On the other hand, instructors find it easy to deliver content using audio methods. They also think that students learn more with the use of these methods and find them to be good for reference by the students.

The high use of telephones in distance education emphasizes the fact that machines are very important in distance education as suggested by Peters (1994). They also create a dialogue between the learners and instructors which is an essential element in distance education (Moore, 1996). Video conferencing usage is not available hence making it hard to show the relationship between ICT and distance education. However, Projectors are available and are used mostly with face to face sessions. They therefore bring out Peters' (1994) Theory since they are machines and also structure and dialogue (Moore, 1994) are emphasized here. Overall, the available synchronous ICT and as used in Ugandan universities, enhance distance education as predicted.

## 5 Conclusion

The opinions from Makerere University and Kyambogo University presented in this paper have various implications on the teaching and learning process in distance education. The discussion presents an overview of the meaning, implication and views of the respondents in both universities. The use of ICT in the enhancement of distance education is very essential if the process of learning and teaching is to be effective and efficient. This means that one cannot disintegrate ICT from distance education if one is to achieve what is advocated for in both Peters (1994) Industrialization of distance education Theory and Moore's (1996) Transactional Theory. Peters (1994) here suggests that ICT are really needed and are part of the industrialization process of distance education. It has also been discovered that to achieve autonomy of the learner, dialogue and a good structure, ICT are very important (Moore, 1996). From the findings of this study, we can conclude that:

1. The use of the telephone is paramount in distance education more especially the mobile telephone. This is a big step in the incorporation of ICT into distance education and it shows that there is always room for more ICT to be integrated into the program if we are to achieve industrialization and the dialogue advocated for in this kind of education.
2. Some ICT are not being used at all like video conferencing technology in the process of teaching and learning in distance education in Ugandan public universities. This is because they are not available or are inaccessible. Yet, in order to industrialize distance education (Peters, 1994) and to develop learner autonomy as per Moore's (1996) theory, some of these are the best ICT that can be exploited. Dialogue can also be created between the learner and the instructor using technology as video conferencing.

3. Synchronous ICT are used mainly for interaction between students and students, students and instructors and instructors and instructors. This is probably due to their being able to provide a dialogue for real time communication. This direct exchange between and within both parties concerned with distance education make its transaction easy and clear. At the same time, to achieve that needed dialogue, more industrialization through the use of ICT is essential.

Putting into consideration the findings of this study, in order to improve on the utilization of ICT in the enhancement of distance education, the following recommendations can be made. To the policy makers, it is recommended that all the available ICT on the market that are expected to improve learning should be made available to institutions of learning for easy exploitation. This means that, all institutions that provide distance education should be equipped with technology that is fully supported for its easy transaction as suggested by Peters (1994). In practice, it is recommended that instructors involved in distance education should have knowledge on the use of different technology and should always be ready to learn whenever a need arises. This can be achieved through training programmes on the use of the distance education technologies. All the available technology at the disposal of instructors should be exploited in the delivery and development of distance education to the maximum. This will make it easier for the learners to learn its use and use it as expected. Again, synchronous ICT would be the best to consider since they allow real time communication between the learners and instructors. With respect to research, more empirical research should be done on the extent and strength of the relationship between ICT utilized and distance education. Also research on the trends in distance education and ICT in Uganda is recommended in addition to comparative studies with other African Universities.

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# eLearning Attitudes in Botswana's Private Sector

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**Abstract.** The study investigated eLearning attitudes in Botswana's private sector. Selected companies in Gaborone, (Botswana) served as the unit of analysis. The study used a multi-pronged approach for data collection. The results show positive attitudes towards eLearning. However, current organizational policy did not accommodate training via eLearning. The results also suggest that eLearning counters threat of national and international private seizure of employee markets. All respondents agreed that integrating eLearning technologies in training would prepared better employees and increase access to education in a cost effective way. Respondents further alleged that eLearning created and supported new research opportunities, and that organizations required intellectual property rights policy. Most respondents reported readiness to implement eLearning, and suggested that eLearning would alleviate increasing administrative and training pressures. Finally, results show that eLearning would increase the success rate and quality of training, and that eLearning was not just a fad that would disappear shortly.

**Keywords:** Activity Theory, Change Laboratory Method, Competence, Developmental Work Research, eLearning, Intellectual property rights, Information Technology, multimedia, occupational skills, Private sector, Public-Private Partnerships, transformation, validity and Vocational orientation.

## 1 Introduction

The potential of Information Technology (IT) to provide a solution to the educational supply problem has been recognized and many governments have invested heavily in promoting IT as a tool to lever educational output. As developed economies have looked to IT supported learning to bolster economic advantage, many less economically developed nations have looked towards the educational potential of IT as a means to renegotiate their role within the global division of labour and many have sought to develop eLearning strategies with varying levels of success (Selwyn, 2002).

In pursuit of these new advancements, Botswana sought to diversify its economy to reduce dependence on earnings from mineral exports, especially diamonds and copper-nickel. The emphasis being on private sector development and foreign investment for much needed managerial and technical expertise. Botswana has alleged that the nation's major resource is its people and that investment in their

education and training is a necessary condition of national development (Republic of Botswana, 1994). The application of technology would increasingly be important and that the workforce would need to be adaptable and receptive to change. Botswana's aspirations are enshrined in the Vision 2016 and *Maitlamo* Policies, and there is therefore need for research to guide these aspirations of Botswana becoming ...`an educated, productive, innovative and informed nation` (Republic of Botswana 1997 and 2005). The expansion of educational opportunity has also provided aspects of vocational and technical education which colonial education had neglected. The Commissions on Education (1977 and 1994) had reviewed the curriculum to this respect. Some suggestions put forward by the 1994 Commission on Education regarding how students would acquire knowledge of occupational opportunities, and the basic personal competencies and attitudes for entering employment and for being trained in occupational skills were:

- Vocational orientation of all subjects
- Inclusion of practical subjects
- Development of foundational skills
- Familiarization with the world of work, and
- Receiving careers guidance

A distinctive feature of vocational training provision in Botswana is the Brigades which are associated to Education with Production (EWP), and Training with Production (EWP). However, there also exists in Botswana and other developing countries, negative attitudes among both young and old people, associating vocational education as some second class education for less able students.

The significance of eLearning and knowledge management at the workplace cannot be overemphasized. With the rapid change in all types of working environments, especially in private sector where processes are technology driven, there is constant need for developing countries to rapidly train and retrain people in new technologies, products, and services found within the environment. Private sector companies in Botswana have recently opted to provide internet connectivity to selected educational institutions and this is a recipe for the emergence of Public-Private Partnerships (PPP's). This study has therefore sought to investigating eLearning attitudes in Botswana's private sector as this aspect has been identified as being an important attribute of eLearning (Nleya, 2009).

## 2 Purpose and Limitations of Study

The study solicited critical information regarding eLearning attitudes in Botswana's private sector training. The findings are intended to guide the planned growth of eLearning initiatives in the private sector, provide benchmarks from developed countries; and thus integrating them with the curricular function of tertiary institutions and other levels of the educational system as main producers of the human resources in the country.

One limitation of the study was to only target selected private sector companies in Gaborone due to funding and distance. Secondly, the lacking evidence that research in



eLearning attitudes in the private sector was ever conducted in the Southern African region, thus comparisons of the study findings being based on studies conducted abroad. The study was therefore limited to exploring the research questions; what is the nature of eLearning attitudes in Botswana's private sector; and what are lessons learnt from developed countries?

### 3 Theoretical Framework of Study

The trend of using eLearning as some learning and/or teaching tool is rapidly expanding into education and training. Shu-Sheng Liao et al (2007) reported that although eLearning environments are popular, there is minimal research on instructors' and learners' attitudes toward such learning environments. They studied attitudes of instructors' (30) and learners' (168), toward eLearning usage. The results demonstrated that instructors had very positive perceptions toward using eLearning as a teaching assisted tool. Furthermore, behavioral intention to use eLearning was influenced by perceived usefulness and self-efficacy. Learners' attitudes, self-paced, teacher-led, and multimedia instruction were major factors affecting learners' attitudes toward eLearning. The research also proposed guidelines for developing eLearning environments.

A United Kingdom (UK) survey reported that the majority of eLearning occurs at the work place, although nearly a third did most of their eLearning in the comforts of their homes. The Web was the most preferred means for people to do their eLearning; however, directed learning methods such as packaged courses in CD-ROMs were also favored by a significant number of participants especially those working in the private sector. Involvement with eLearning tended to be work-related and on those required by employers. The survey found that facilities were in place for eLearning in most organizations. Almost all had computing facilities for employees to access eLearning materials, although this was limited.

Furthermore, eLearning providers, employers, and employees all believed that the main disadvantage of eLearning is that it is not sufficiently developed yet to be able to replace other forms of training. Other disadvantages include prohibitive development and setting-up costs, prohibitive cost of hardware as well as lack of knowledge about the possible opportunities available from eLearning (Attitudes to eLearning, 2000). Despite new eLearning developments in Botswana, the attitudes of private sector employees towards *eLearning* had not been investigated.

Another study conducted in Sweden concluded that Subject Matter Experts (SMEs) are a heterogeneous group and yet they also seem to have some common characteristics. A very strong characteristic is the need to see an immediate return on investment for them to invest in eLearning and/or IT. Another feature uniting SMEs was their regard to human relations as a portal to learning. However, there are also more differences between SMEs in Sweden than there are similarities. Obvious differences, which probably influence the way in which learning with IT is regarded, seem to be geographical location, sector, level of education of employees, the company's age, and age of the company's employees. The impact of these factors upon learning with IT has yet to be explored. Furthermore, the emphasis being placed

on the connection of learning/training of the SME with IT must be viewed as a part of the business. In relation to this, the question emerges of how the learning of the individual is related to the learning of the organization? Does competence development for individuals result in business development? (Katzeff Cecilia, 2004) E-Learning in SMEs in Sweden <http://www.navreme.net/downloads/Vol58-E-Learning.in.SMEs.in.Sweden.pdf> Retrieved 20/01/2010.

## **4 Research Methodology**

Both qualitative and quantitative research methods, (interviews, seminar and questionnaire) were used to complement each other. Perceptions of private sector respondents were solicited to assess their attitudes regarding eLearning. The combination of methods was essential in that qualitative research plays a discovery role while quantitative plays a confirmatory role, and they thus complement each other (Cohen and Manion, 1994). Descriptive research used also affords to produce statistical information about phenomena that interest policy makers and educators, and the design is also less expensive (Borg, Gall, and Gall 1996).

### **4.1 Sampling**

The unit of analysis was a sample of private sector companies in Gaborone (Botswana) as potential employers of graduates from tertiary institutions country-wide. Purposive sampling also referred to as judgmental sampling by Gay and Airasian (1996) was used. Forty (40) companies in Gaborone were selected using the Botswana Confederation of Commerce, Industry and Manpower (BOCCIM) Directory 2002 – 2003. The sample size was found to be adequate for the purpose. Borg, Gall and Gall (1996) stated that for surveys, there should be at least hundred (100) subjects. Complimentarily, Cohen and Manion (1994) purport that:

There is ...no clear cut answer, for the correct sample size depends upon the purpose of the study and the nature of the population under scrutiny...a sample size of thirty is held by many to be the minimum number if researchers plan to use some form of statistical analysis on their data (p. 90).

However, the return rate was twenty-three (23), and slightly lower than the required minimum. Descriptive statistics (frequencies) were used to provide a descriptive analysis of the data. The brief interviews held where aspects of eLearning were explored also provided complementary data used for triangulation purposes.

### **4.2 Instrumentation**

The major instrument of the study was the questionnaire. The questionnaire categories were also used as a guide for conducting interviews. Questionnaires have advantages over interviews for collecting data. Borg et al (1996) state that “the cost of sampling respondents over a wide geographical area is lower and time required to collect the data typically is much less” (p. 289).

Focus group interviews according to May (1993), "provide qualitative depth by allowing interviewees to talk about the subject in terms of their frames of reference" (p. 94). Furthermore, Cohen and Manion (1994) state "...it is believed that in an interpersonal encounter, people are more likely to disclose aspects of themselves, their thoughts, their feelings and values than they would in a less human situation as respondents feel at ease" (p. 282). Regarding complementarily, May (1993) purports:

Group interviews constitute a valuable tool of investigation, allowing the researcher to focus upon group norms and dynamics around issues, which they wish to investigate (p. 94).

Seminar and questionnaire were therefore used to complement each other. A pre-data collection focus group seminar was conducted where few participants (4) attended. However, some brief interviews were held with the respondents either at the time of delivering or collecting the questionnaire instrument.

### **4.3 Validation and Reliability of Instruments**

According to Borg et al (1996) "Validity is the appropriateness, meaningfulness and the specific inferences made from the instruments". (p. 290). The questionnaire was piloted on selected individuals for validation purposes. The instrument was validated on the basis of the statement of the content, construct, readability, clarity and precision of expression. It was also important to determine whether several rates could be used on the content with a high degree of consistency (reliability). Points of ambiguity in the content of the instruments were identified and clarified through the mini pilot conducted using selected individuals.

### **4.4 Data Collection Procedures and Analysis**

The researchers sought verbal permission to use Information Technology (IT) departments in the selected private sector companies. Covering letters were also attached to the questionnaire instrument to serve as some formal request to private sector companies to respond to the questionnaire instrument. Thirty (30) questionnaires were distributed and twenty-three (23) questionnaires were collected for coding which constitute a seventy-seven percent (77%) return rate.

### **4.5 Data Analysis**

The data were analyzed using the Statistical Package for Social Scientists (SPSS). Frequency counts were used as the major statistical data and brief interviews were also used to complement the quantitative data source in the exploratory study.

## **5 Results of Study**

The results firstly, provide the demographic data and secondly detailed findings of the research question that sought to investigate the eLearning attitudes in the Botswana private sector. The results are reported under selected headings.

### 5.1 Demographic Characteristics of Respondents

Almost half of the respondents forty-eight percent (48%) were between ages 26 and 35 years, while thirty-nine percent (39%) were between ages 36 and 45 years. Four percent (4%) were between the ages 46 and 55 years and nine percent (9%) were missing. The majority (70%) were male while only seventeen percent (17%) were female. Twenty-six percent (26%) had Masters and Post Graduate qualification, while fifty-seven percent (57%) had diploma and degree qualification. Only four percent (4%) had certificate qualification while thirteen (13%) was reported missing. Finally, the findings suggest that the majority of respondents were in the Information Technology management level of the sampled private sector companies and were better placed to provide the required professional judgment.

### 5.2 Results on Private Sector eLearning Attitudes

This part reports results on private sector attitudes on eLearning implementation and support as illustrated in table 1.

**Table 1.** Attitudes on eLearning Implementation and Support

Item	Response in percentage		
	Strongly agreed/agreed	Strongly disagreed/disagreed	Missing
I feel ready to implement eLearning into my training and work place	83	17	0
Need for reward/incentive program in organization before eLearning projects start	39	61	0
Lack of interest by- staff to use eLearning technologies for training	30	70	0
Availability of eLearning support system in organization	17	78	4
Trainer belief that eLearning is just a fad and will disappear after a short period	0	100	0

The findings show that most private sector respondents (83%) were ready to implement eLearning. However, thirty-nine percent (39%) felt the need for a reward/incentive program before the implementation while (61%) strongly disagreed/disagreed. However, the study reported low confidence in the use of eLearning skills as their readiness levels were reported moderate to low (Nleya, 2009).

Only thirty percent (30%) strongly disagreed/disagreed that there was lack of interest among their staff to use eLearning technologies for training, while the majority (70%) strongly disagreed/disagreed. Finally, none of the trainers in the sample believed that eLearning was just a fad that would disappear after a short period. Table 2 provides results on attitudes regarding integration of eLearning in the private sector.

**Table 2.** Attitudes regarding Infusion/Integration of eLearning

Item	Response in percentage		
	Strongly agreed/agreed	Strongly disagreed/disagreed	Missing
Infusing eLearning technologies in training better prepare employees for society	100	0	0
eLearning increases access to education in Botswana in a cost effective way	100	0	0
Organization to develop policy on intellectual property rights to support eLearning	91	9	0
Adequate intellectual property rights to acknowledge joint ownership of projects	87	9	4
Organization to consider work created with eLearning technologies in staff evaluation	77	13	0
Current organizational policy does not accommodate training via eLearning for all staff	65	35	0
Trainer support for adopted training strategy in the use of ICTs by their organization	48	48	4
eLearning counters threat of national and international private seizure of employee markets	65	35	0
eLearning will create and support new research opportunities in organizations	96	4	0
eLearning will alleviate increasing administrative and training pressures on training	78	22	0

All respondents in the selected private sector companies not only strongly agreed/agreed that integrating eLearning technologies in training better prepared employees for society; but also that eLearning could increase access to education in a cost effective way. The majority (91%), reported the need to develop an intellectual property rights policy to support eLearning and eighty-seven percent (87%) preferred adequate intellectual property rights to acknowledge joint ownership of eLearning projects.

Furthermore, seventy-seven percent (77%) reported that organizations could consider work created with eLearning technologies in staff evaluation as some form of reward mechanism. About half (48%) were satisfied with trainer support for adopted training strategy in the use of IT by their organization while the other half disagreed. Sixty-five percent (65%) reported that eLearning counters threat of national and international private seizure of employee markets. A majority (96% and 78% respectively), reported that eLearning could not only create and support new research opportunities, but also alleviate increasing administrative and training costs.

## **6 Summary of Findings and Conclusion**

The findings suggest positive attitudes towards eLearning in the private sector. Firstly, that current organizational policy does not accommodate training via eLearning, and also that eLearning counters threat of national and international private seizure of employee markets. Secondly, respondents agreed that integrating eLearning would not only prepare better employees for society, but also increase access to education in a cost effective way. eLearning would also create and support new research opportunities, and that organizations required a policy on intellectual property rights, and some consideration of eLearning products in conducting staff evaluation to support eLearning implementation. The findings also suggested that intellectual property rights policy should acknowledge joint ownership of projects. The study further reported private sector's readiness to implement eLearning in the work place and alleged that it would alleviate increasing administrative and training pressures on training. Finally, the majority of respondents reported that eLearning would increase the success rate and quality of training in their organizations and that eLearning was not just a fad that would eventually disappear with time.

However, the relative eLearning readiness level in Botswana's private sector were reported to be at their initial stages and that trainee requirements were still to be met as organizations tended to continue using useful but archaic technologies for training (Nleya 2009).

## **7 Conclusion**

The study concluded that despite minimal research conducted on eLearning environments, there is evidence that instructors and private sector organizations have

positive attitudes toward using eLearning as a learning tool. The intention to use eLearning tended to be influenced by its perceived usefulness and self-efficacy. Lessons learnt from developed countries show that the majority of eLearning occurs at the workplace, although nearly most eLearners do most of their eLearning at their homes. However, to invest in eLearning and/or IT, requires an obvious business focus, and the provision of necessary policy guidelines to assist in developing effective eLearning environments. Research also identified several variables influencing the way learning with IT is regarded (i. e. geographical location, sector, level of education of employees, company's age, and age of the company's employees). Their impact upon learning with IT has yet to be explored. A major disadvantage of eLearning has been associated with its being not sufficiently developed to replace other forms of training; and also the prohibitive development and setting-up costs; cost of hardware as well as the lack of knowledge about possible opportunities available.

Munro (2010) has cautioned that Information Technology in education is being explored and assessed and woven into the fabric of education. Developing and integrating IT in education is expensive and will have to prove its educational and cost effectiveness. IT integration cannot be effected satisfactory without guidance and support from rigorous research, and this research has to be evidence-based rather than assertion led.

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# Using Information Technology in Education to Manage a Professional Learning Community (PLC)

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**Abstract.** This paper considers professional learning communities (PLC) and the role that they have in a developing secondary School in New South Wales, Australia. A brief identification and discussion of the importance of professional learning is presented, together with an examination of the effects of professional learning on teachers and subsequent classroom practice. Models and frameworks that have been utilised along with the implementation of information technology as a tool to manage the PLC are presented, and the sustainability of such structures considered. Practical examples will be used to further support and illustrate how the developing School embraced professional learning to build a culture, a discourse and a community.

**Keywords:** Professional Learning Community (PLC), educational management, information technology, Moodle, model, framework.

## 1 Introduction

*“Collaboration is a way to generate knowledge and examine and build theories about educational practice. Ideas are challenged and ideologies and historical views of current practice are critically examined. What is taken for granted about language, culture, power and learning is critiqued”.*  
(Hill, 1992)

As professionals, teachers must continually update, deepen, and refine their knowledge and skills through professional development (Timperley, Phillips, Wiseman and Fung, 2003, p.1). The goal of professional development should be to raise student achievement. To be judged effective, therefore, professional development must result in ongoing benefits as measured by improvements in student achievement. However, there is a growing body of research that shows that much professional development does not lead to long-term changes in teaching that improve student achievement. DuFour (2004) states that “the idea of improving schools by developing professional learning communities is currently in vogue”. The term has been used broadly and ubiquitously, so that researchers believe that “... it is in danger of losing all meaning”.

## 2 Professional Learning Communities (PLCs)

Gabelnick, MacGregor, Matthews, and Smith (1990) have defined professional learning communities as being opportunities to “purposefully restructure the curriculum to link

together courses or course work so that students find greater coherence in what they are learning as well as increased intellectual interaction with faculty and fellow students". At their core, learning communities involve "co-registration or block scheduling that enables students to take courses together" (Tinto, 1998). In practice, learning communities vary in scope and services. Some provide courses linked by a common theme while others offer academic and student supports embedded in the linked courses.

## 2.1 Models and Frameworks

Figure 3 depicts a 'Professional Learning Framework' taken from CEASA (The council of Education Associations of South Australia) which has been designed to support teachers, through the activities of their professional association to plan teacher learning programs for sustainable changed pedagogy. It was developed in partnership with the "Teacher Quality" Unit within *Organisation & Professional Development Services* (OPDS) of DECS. It is OPDS which oversees the contract between CEASA and DECS. The Framework is based on current research of the elements that best support sustainable professional learning. The Framework supports teachers to reflect on their knowledge, skills, practice, values and beliefs through inquiry processes. It provides a comprehensive, structured approach teacher learning and has been developed to inform the design of association CEASA funded activities in 2006.

The six elements of the 'Professional Learning Framework' call for professional learning that is collaborative, planned, focused on the classroom, based on inquiry processes, data collection and analysis and supported by quality leadership. Each of the six elements of the Framework works together to produce high quality professional learning that is sustainable. The Framework provides opportunities for educators to engage in dialogue and explore current research related to curriculum

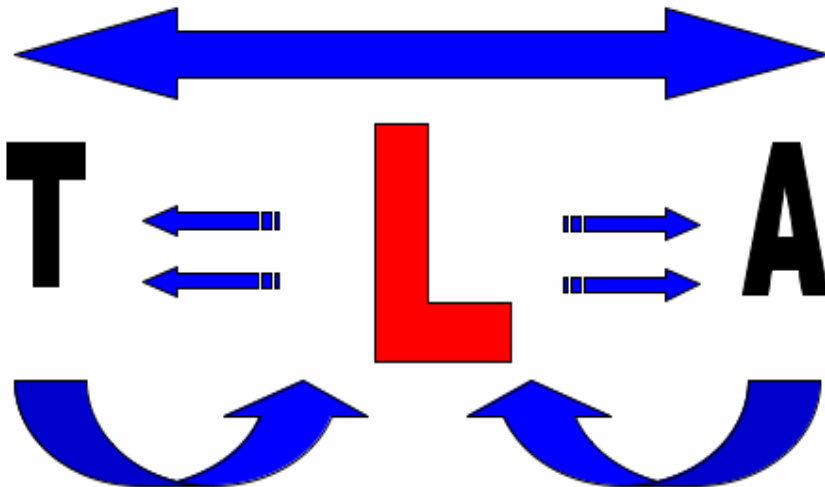


Fig. 1. TLA overview

# Effective Professional Learning

7 Principles of Highly Effective Professional Learning	Teacher Knowledge and Skills	Effective Professional Learning Models
Focused on student outcomes	PEDAGOGICAL KNOWLEDGE	•Professional learning teams •action learning •study groups •case discussions •Peer observation
Focused on and embedded in teacher practice		
Informed by best available research on effective teaching and learning		
Collaborative, involving reflection and feedback	DISCIPLINE KNOWLEDGE	•Mentoring •Coaching •In-house programs •External consultant/critical friend •External workshops •Accredited courses •Structured professional reading •Personal professional reading •Practicums/school visits •Online learning •Professional conversations
Evidence based and data driven to guide improvement and measure impact	PEDAGOGICAL CONTENT KNOWLEDGE	
Ongoing, supported and fully integrated into the culture and operations of the system – schools, networks, regions and the centre		
An individual and collective responsibility at all levels of the system		



Adapted from „DET-South Australia (2005) Professional Learning in Effective Schools

Fig. 2. 7 Principles

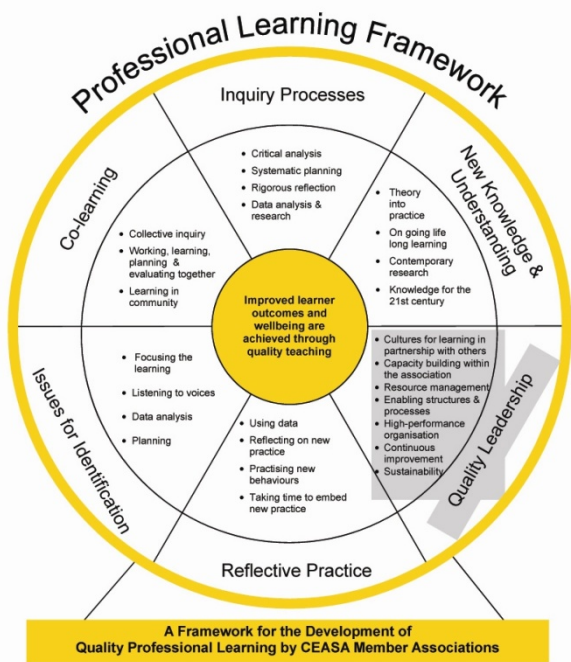


Fig. 3. Framework of Professional Learning

design and pedagogical practices. There is no *single* starting point. When planning for learning using the Framework. The starting point may come from data, from an issue, from research, from a “system” requirement, or from the setting up of a professional learning community. The starting point could come from teachers or individuals analysing an element or descriptor of the Professional Standards for Teachers.

### 3 Importance and Effects of Professional Learning

The importance and effects of professional learning have focused on several areas including:

- Teachers
  - Educational goals: classrooms, students, subject area
- Transformation of teaching
  - Encouragement and support
  - Improvement in student outcomes
- Four interconnected factors:
  - Student learning
  - Authentic pedagogy
  - Organisational capacity
  - External support
- Results
  - Challenging learning experiences for all students
  - A school culture that nurtures staff collaboration and decision making
  - Meaningful opportunities for professional growth

### 4 Professional Learning and Professional Standards

The initiative’s ‘Self-assessment Framework’ articulates how schools can use their data to align teachers’ individual learning needs with school priorities, goals for student learning and teacher professional learning. The accreditation process comprises five elements:

1. induction for teachers new to the school;
2. use of multiple sources of feedback on teacher effectiveness for individual teachers and teams of teachers;
3. customised individual teacher development plans based on individual development needs;
4. quality professional development to meet individual development needs; and
5. belief by teachers that the school has a performance and development culture.

### 5 The Context and Using Information Technology

McCrea (2009) identifies that “... with technology evolving at the speed of light, and everyone looking to benefit from the latest, greatest hardware and software, keeping up can be challenging for educators, administrators, and school districts themselves”.

Wenger (2001) states that “... new technologies such as the Internet have extended the reach of our interactions beyond the geographical limitations of traditional communities, but the increase in flow of information does not obviate the need for community. In fact, it expands the possibilities for community and calls for new kinds of communities based on shared practice”. He believes that the concept of community of practice (CoP) is influencing theory and practice in many domains. From humble beginnings in apprenticeship studies, the concept was grabbed by businesses interested in knowledge management and has progressively found its way into other sectors. It has now become the foundation of a perspective on knowing and learning that informs efforts to create learning systems in various sectors and at various levels of scale, from local communities, to single organisations, partnerships, cities, regions, and the entire world. Within my own current work environment the use of ‘Moodle’ as a learning portal has been implemented to break down the barriers of what seen to be “three campuses, but one school”. In providing an online interface for the delivery of professional learning materials and updates, together with opportunities for signing up online for staff workshops. The models presented in section 2.1 have been used as a basis for the professional learning opportunities.

## 6 Sustainability of a PLC

Effective professional learning is grounded within a range of principles, processes, structures and activities that have as their focus the development of the knowledge, values, relationships and practices that will have a positive impact on the learning outcomes of all students. Sustainable professional learning and development needs to be planned. It is about the direction and implications of change and is not about the maintenance of the status quo. Teachers that make a difference are those who work together, have a sense of responsibility for their students’ learning and a sense of efficacy in achieving desirable outcomes.

When designing professional learning for teachers planning needs to ensure that each of the elements is addressed and incorporated to ensure that the learning is sustainable, that pedagogical change happens and student outcomes are improved. No one element is more important than another, planning can start at any element, but all elements must be included.

## 7 Lessons Learnt

### *The Vision*

- Focus on the students
- Set priorities
- Nurture the staff and the students → develop the community
- Engender confidence in those that you are working with and for

### *Relationships*

- Build an atmosphere which provides a caring and productive environment
- Develop trust and relationships that reflect this
- Encourage collaboration
- Reduce isolation → bonding

*Empowerment + ownership + opportunities*

- Promote increase quality
- Set (high) expectations

*Academic Focus*

- Make connections
- Encourage professional reading; Develop a discourse
- Awareness and knowledge of purpose and philosophy (by all)
- Encourage informed decision making about adoption and implementation
- Continuous learning, continuous interactions → assimilate ideas and support
- Identify new practices → conduct action research

*Feedback*

- Should be meaningful and constructive
- Provide a safe forum for discussion; Reinforce the values of the community
- Develop procedures for management and the resolution of conflict; Peer mediation; Linking – identify, form → action research

*Leadership*

- Be at the centre, not the top
- Share, be available, have a physical presence (accessibility is the key)
- Provide opportunities for stimulating conversation about T&L → bind ; Persistence; Role of supporter and provider of assistance

*Inclusivity*

- Provide foresight and personal involvement in nurturing the expansion process
- Fashion meaningful ways for teachers to come together to focus on issues and work that concerns all of them
- Start with those ready to start *BUT* note and remember it is imperative to include ALL staff in a school → avoid fragmentation

*Significance Factor*

- The role of the Principal or other designated leader who is best positioned to help guide toward new forms of PL → share with staff in a democratically participatory way; Leadership; Power; Authority; Decision making

## 8 Building ... Reflecting ...

*“To create a professional learning community, focus on learning rather than teaching, work collaboratively, and hold yourself accountable for results”.*

(DuFour, 2004)

Remember four crucial questions that drive the work of those within a PLC when engaging and exploring. They are:

1. What do we want each student to learn?
2. How will we know when each student has learned it?
3. How will we respond when a student experiences difficulty in learning?
4. How will we deepen the learning for students who have already mastered the essential knowledge?

The answer to the third question separates learning communities from traditional schools. Critical to the PLC culture is the commitment to continuous improvement. The process of reflection is also important. Hord (1997) refers to a quick-fix mentality, especially prevalent in US culture, resulted in many schools being poorly prepared for their plans for change and therefore implementing change in a superficial and less-than-high-quality way. This approach might be called the “microwave oven” theory of school improvement: pop a new program in for four minutes with a designated hero to manage it and improvement is done. What then?

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# Does Personality Type Affect Teachers' Information Systems Utilization in Pedagogy? The Makerere University Lecturers' Experience

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**Abstract.** This article reports on personality types and their influence on lecturers' information systems utilization in pedagogy in Makerere University. Findings are drawn from analyses of data that was collected from 244 lecturers who were purposively selected from six faculties. A self administered questionnaire, standardized tests, analytical interviews and inferential analyses were done by using Analysis of Variance (ANOVA) and Student -t test techniques. Findings indicate that as lecturers' personality type preferences change, their attitudes and actual utilisation of information systems also change. Reasons that explain significant variation in both attitude and actual utilisation of specific MISs basing on particular bi-polar personality type dimensions are given, as the article also suggests appropriate Information system tools and integration strategies that should be adopted in pedagogy by this oldest and biggest university in Uganda.

**Keywords:** Personality types, Learning Management Information System and Pedagogy.

## 1 Introduction

To ensure maximum utilization of Management Information Systems [MISs], and to leverage all its units' effectiveness, Makerere University - Uganda's oldest and biggest university (Established in 1922, now with a total number of 36,878 registered students in 22 academic units, operating on an annual budget of approximately US\$ 56 million as of June, 2009, < <http://mak.ac.ug> >), has set in its ICT Policy to fully integrate Management Information Systems in all its administrative, instruction and learning activities. The extent to which personality types affect its lecturers' selection and use of particular information systems, what particular personality types work, how and why they work, in relation to the integration of Learning Management Information Systems [LMISs] in teaching in this university, are the key concerns of this paper.

Through a number of MISs, Makerere University is set to improve on both the efficiency and effectiveness of most of its day to day operations. Indeed, the University ICT policy is set to improve on the university's library operations and services through the implementation of an integrated online Library Information



System (LIBIS), streamlining and improving on students' teaching, learning and assessment by using a number of Learning Management Information Systems for instance Blackboard <http://blackboard2.mak.ac.ug> KEWL <http://nextgen.mak.ac.ug> Moodle <http://muele.mak.ac.ug> and the implementation of an integrated Academic Records Information System (ARIS). The university is also set to streamline its financial management processes through the use of an integrated Financial Information System (FINIS) and to improve on the human resource management and administrative activities through the implementation of a Human Resource Information System (HURIS). The University Directorate for ICT is charged to ensure the efficiency and effectiveness of all the above management systems and is tasked with the responsibility of carrying out training and providing technical and end-user support to all university staff in their respective faculties in the use of these information systems and to give general training in the use of generic office computer applications to promote office computing all over campus.

Baryamureeba (2004) emphasizes that training in the use of ICT and the use of modern MISs has been given a high priority in the Makerere University ICT policy. In fact, the ICT Master Plan Policy Phase II of Makerere University clearly states that all the academic staff should be trained on a continuing basis to equip them with ICT requisite skills to the level that before appointment to Assistant Lecturer position or any further, academic staff are required to demonstrate the prescribed level of competence in technology enhanced interactive teaching techniques (Makerere University ICT policy master plan 2004). Today, it is also required that each faculty, school or institute has at least 1 computer per 5 students enrolled for undergraduate degree and postgraduate diploma courses, and 1 computer per Masters or PhD student enrolled.

Consequently, Makerere University and the government of Uganda have injected in a lot of finances to ensure successful utilization of these information systems by annually committing close to shs 1 billion in addition to development partner funds (Tusuubira, 2002). However, Baryamureeba (2003) reports that this amount has been growing from year to year.

Regrettably to note on the other side is that despite the time investment and the enormous funds set aside by the university to train and facilitate its academic staff to incorporate technology as an integral tool in the teaching and learning processes, very few lecturers at Makerere University actually use available LMISs in teaching (Tusuubira, 2008).

## **2 Addressing the MISs – User Mindset and Personality Type Predispositions**

Tusuubira (2008) acknowledges that addressing the ICT users' mindset is probably the greatest challenge to the integration of MISs in Education. Implementation of MISs is not simply an introduction of new technology and training of its users, but a complete re-thinking of how the institution's activities are achieved. Nicolle (2005) also has the view that successful usage of ICTs in institutions only comes when users are able and willing to change their working habits and thinking processes. This partly explains why even up to now with the continued trainings and extended ICT

infrastructure, a big number of lecturers at Makerere University have remained reluctant to adopt these new innovations into their pedagogical practices. In fact despite the free and open user trainings offered by the Directorate of ICTs to equip lecturers with the requisite skills needed to use the Blackboard <http://blackboard2.mak.ac.ug> and KEWL <http://nextgen.mak.ac.ug> Learning Management Systems, only 14% of 1,714 academic staff have received and used these learning platforms in teaching (Kabugo, 2008). This article presents analysis and discussion of findings on how lecturers' personality type predispositions and their mindset influence their attitude and actual utilization of LMISs in pedagogy at Makerere University.

### 3 Key Study Questions

The major questions that guided this study were formulated on the foundation of the four key personality type issues of Myer's Personality Type Indicator Inventory (<http://www.personalitypathways.com>), namely; how individuals (lecturers in this case) relate to others, how they take in information, the way they make decisions and how they order their lives. Each of these questions has a bi-polar dimension. These dimensions were crafted relation to the key components of Knezek & Christensen (1998) Teachers' attitude and use of information Technology (TAT) guide. The key components of this guide include; recognition of the value of technology and information systems in learning, determination of the type of information tools they need for their work, establishing how they can get their information from existing information systems, accessing and interpreting information for their professional growth, ability to use available Learning Management Systems, among other key components of the guide. The major questions that guided the study are;

- i. Are there significant variations in lecturers' attitude and actual utilization of Learning Management Systems in teaching because of their personality types?
- ii. How and why don't lecturers' personality types influence their actual use of LMISs in pedagogy?

### 4 Method and Data Analysis

The study involved non-probability sampling in which the purposive sampling method was used to select units for a sample of respondents, referred to as a working population (Rea and Parker, 1997). Purposive sampling is where samples are assembled by intentionally seeking individuals or situations likely to yield new instances or greater understanding of a dimension or concept of interest by selecting information rich cases for in-depth study (Krathwohl, 1998). Consequently, out of the 22 academic units / faculties in Makerere, the researcher identified six academic units whose type and size suggested that they could be using the information systems in management of students' teaching, assessment and records. The units included Faculty of Computing and Information Technology (FoCIT), Faculty of Technology

(FoT), Faculty of Social Sciences (FoSS), School of Education (SoE), Institute of Adult and continuing education (IACE) and Faculty of Arts (FoA). Purposive sampling was used in these academic units since these units have averagely higher numbers of students compared to others and besides, both FoCIT and FoT have reasonably adequate ICT infrastructure and are more technically oriented, thus their potential for use of ICT should ideally be at a high rate. The SoE and IACE on the other hand have the mandate of improving pedagogy at the university and thus should be at the fore front of integrating and promoting the use of LMISs and ICTs in pedagogy at the university.

A questionnaire was constructed consisting of two main sections, the first section testing the respondent's personality type and the other section testing the respondents' attitude and actual use of Learning Management Information Systems in pedagogy. The questionnaire was then administered to 244 out of the 285 lecturers whom the researcher actually sought to sample, following Morgan and Krejcie (1970) in Amin (2005) table for determining appropriate sample size for a given research.

Basing on Myers Personality Type Inventory, for each of the four key questions having a bi-polar dimension, that is to say; Extroversion (E) / Introversion (I) as the dimension that answers whether an individual is social or reserved, Intuition (N) / Sensory (S) as the dimension that answers whether an individual processes information by focusing on the relationships between facts or the facts themselves, Feeling (F) / Thinking (T) as the dimension that answers whether some one makes decisions subjectively or objectively and, Perceiving (P) / Judging (J) as the dimension that describes those individuals whose preference is to be flexible or rigid respectively, these responses were entered and run using the electronic personality test <<http://www.personalitypathways.com>>. Thus, if an individual prefers to focus on the outside rather than the innerself, takes in information by focusing on the relationships between facts, makes decisions subjectively and likes to be spontaneous and flexible in his / her actions, then, s/he is described as an ENFP type. Out of the 244 respondents whose questionnaires were returned, 229 of them had complete personality type preferences that were generated, and these were distributed as follows;

ENFP 16, ISTJ 12, ENTJ 12, ISFP 32, ENTP 52, INFP 16, ESFP 20, INTJ 4, ESTP 49 ISTP 16. The other 15 preferences were incomplete because of missing values in the questionnaires.

Using the Statistical Package for Social Sciences (SPSS) computer program, the descriptive statistics of respondents given by faculty were generated and Analysis of Variance (ANOVA) test carried out to test whether faculties / schools were significantly different in terms of attitude and actual use of computers in teaching, as the background variable. To establish whether attitude and actual use of LMISs in teaching depends on lecturers' personality type preferences, the student t- test was carried out. The test was also applied because personality type preferences take on a bi-polar dimension (Myers, 1998). Thus, two complete personality type preferences were compared at a time, for example INTJ vs. ESFP to establish whether their LMISs usage is statistically different. Semi structured interviews were conducted to supplement the questionnaire data. The qualitative data obtained from the interviews was coded and indexed according to the responses made during the interview process. The transcripts were manually coded into categories which were interpretative.

### 4.1 Results and Discussion of Findings

#### Lecturers' Personality Types and their Attitude towards MISs in Pedagogy

For the ten complete personality type preferences presented in this section, two bi-polar dimensions were compared at a time. Their means, statistical value, degrees of freedom and levels of significance in their attitudes and actual LMISs utilisation in pedagogy are stated in table 1 and 2 respectively. Analyses and discussions of findings follow these presentations.

**Table 1.** Descriptive statistics, -t test and significance values of lecturers' personality preferences and their attitude toward using LMISs in teaching

Attitude towards utilization of LMISs	Personality Type Preferences	N	Mean	- t	df	Sig-Value
Equal variances assumed	ENFP	16	6.8125	-.2490	26	.020
	ISTJ	12	8.9167			
Equal variances assumed	ENTJ	12	9.3333	2.908	42	.006
	ISFP	32	7.1875			
Equal variances assumed	ENTP	52	7.1875	1.318	66	.192
	INFP	16	6.8125			
Equal variances assumed	ESFP	20	5.7000	-3.763	22	.001
	INTJ	4	9.7500			
Equal variances assumed	ESTP	49	7.3673	-3.704	63	.000
	ISTP	16	9.7500			

E = Extrovert, N = Intuition, S = Sensor, F = Feeler  
 I = Introvert, T = Thinker J = Judger P = Perceiver

Table 1 indicates that there is a big mean difference in lecturers' attitudes toward using LMISs basing on contrasted pairs of the generated personality type preferences. Each of these mean differences in attitude (ENFP vs. ISTJ, ENTJ vs. ISFP, ENTP vs. INFP, ESFP vs. INTJ and ESTP vs. ISTP) is statistically significant (.020, .006, .192, .001, .000) is ( $< .05$ ), apart from that of the ENTP vs. INFP category, but which is also almost significant (.192) This implies that lecturers' personality types greatly influence their attitude towards using LMISs in teaching. The proceeding table presents means, statistical value, degrees of freedom and levels of significance in lecturers' actual LMISs utilisation in pedagogy.

**Lecturers' Personality Types and their actual usage of LMISs in Pedagogy****Table 2.** Descriptive statistics, -t and sig-values of lecturers' actual use of ICT in teaching

Actual use of MISs in teaching	Personality Type Preferences	N	Mean	-t	df	Sig-Value (2-tailed)
Equal variances assumed	ENFP	16	18.5000	-3.424	26	.002
	ISTJ	12	23.0000			
Equal variances assumed	ESTJ	12	24.3333	9.829	22	.0009
	INFP	12	13.3333			
Equal variances assumed	ENTP	52	20.5385	1.518	68	.134
	INFP	16	18.5000			
Equal variances assumed	ESFP	20	14.0000	-4.848	22	.000
	INTJ	4	24.0000			
Equal variances assumed	ESTP	49	20.0000	-3.704	63	.824
	ISTP	16	20.3125			

E = Extrovert, N = Intuition, S = Sensor, F = Feeler  
 I = Introvert, T = Thinker J = Judger P = Perceiver

With the null hypothesis stated; there are no variations in actual use of LMISs in teaching depending of lecturers' personality types, table 2 presents pairs of generated personality type preferences (ENFP vs. ISTJ, ENTJ vs. ISFP, ENTP vs. INFP, ESFP vs. INTJ and ESTP vs. ISTP) and their respective means. Using the -t test and corresponding degrees of freedom, the table indicates that these means are statistically different and significant at .05 (.002, .0009, .000<.05) apart from the ENTP vs. INFP type of (.134>.05) and the ESTP vs. ISTP (.824>.05) respectively. This therefore implies that personality type preferences greatly influence lecturers' use of LMISs in teaching.

Unlike with attitude where almost all the tested personality type combinations were significant, with the actual use, the ENTP vs. INFP, and ESTP vs. ISTP preferences are not statistically significant (>.05). This therefore implies that a positive attitude may not necessarily mean actual use. Reasons that explain these significant variations were investigated in the follow up interview and are discussed below;

It was revealed that many of the introverted lecturers are reserved people and hence, because of their personality, they find computers and other related technologies more appealing to them because they enable them to communicate in a

more quiet modality when teaching students especially of large classes. On the contrary, the extroverts tend to be outgoing but give up very first on every thing. They prefer physical interactions with the world of things and people (Myers, 1998). This is basically why there was a sharp contrast in the actual use of computers between introverts and extroverts. Where as the introverted ones found computers more appealing, the extroverted preferred usual face to face interaction with students than using computers and other related technologies. Such a variation was so sharp so much that one typical introvert remarkably said;

*Although in the past I preferred communicating silently to my students through course works and handouts, my knowledge of moderating online communities has now helped me to fully develop my personality. I loved discovering all ways that could enable me teach at a distance without necessarily meeting students and I can now do it with ease. I am aware of some lecturers who move on with them and perpetuate their bad habits to learners because of face-to-face classroom interactions. Yes, although even with the electronic platforms, some lecturers can merely use the online environments as dumping sites for content, in my opinion, I still think that this can be solved if such lecturers learn about multimedia technologies in education. What fails many of us here, I think when they move to lecture halls, they take themselves as experts in variety of fields when in fact they still have a lot more to learn online (Interviewed in 2009).*

On the other hand, it was revealed that feelers are sceptical about using LMISs in teaching than the thinking type and hence they use the internet and other related multimedia platforms and technologies in teaching less frequently. One respondent of the feeling type revealed that she finds the internet impersonal and a value free environment and therefore unattractive, yet her counterpart a thinking type said that she finds the internet more interesting to use because it links her to more open educational resources freely and at the end of several clicks on a given web navigation, she feels more skilled.

On the other dimensions, it was observed that intuitive lecturers use computers more often than sensors. It was learnt that lecturers who prefer depending on their intuition as a basis of processing their information perceive MISs as a tool for facilitating their imaginative and creative works. One respondent of this category from the Faculty of Computing and Information Technology was asked what he actually uses the MISs for and he said;

*For example, I use the blackboard and kewl learning platforms and the internet to figure out imaginative works like simulations, games and fancy, fancy work of the kind especially in building Mathematics and Physics learning models. I find the test tools and auto response or feedback extremely important for the evaluation of my students (Drawn from a questionnaire response).*

On the contrary, when asked whether MISs motivate one to teach his courses, one Sensor explicitly said;

*If motivation encompasses the determination and zeal of getting what you expected to get and the likelihood of getting it, then we sensibly need real work and not getting back to imaginations. You know, until we appreciate the fact that*

*computers are just tools that manipulate existing knowledge then, we can create our own art facts. For me I know how to use computers but I always try to do my own work the way I know it and resort to computers if I cant do it the other way. You know, they have their own limitations as well. I think I am self motivated and with or without computers, I still do my own work. (Interviewed in 2009).*

Nearly the majority of the judging types in the sample mentioned the importance of computers in data entry, editing, analysis and manipulation of information for teaching learners. However, not a single perceiving lecturer mentioned this. They acknowledged the pitfalls of MISs in terms of power failure and data loss and ended it there. It was only one thinking type professor from the faculty of Arts who elaborated on the influence of his personality type on his use of information systems and teaching. This professor had this to say;

*About three - five years ago I filled a questionnaire that subsequently revealed I was an introverted intuitive thinking judging type --- INTJ in the code of the Myers-Briggs type indicator. The description of the INTJ was extremely flattering. Last year, I asked my students to fill this questionnaire and it revealed that most of my students are extraverted, Sensing, Feeling, Perceiving types – ESFP, which implied that many were my real opposites! I suddenly recalled the complaint they normally pose when I give them assignments; ‘But we don’t know what you want...just tell us what you want and we shall do it’. I had always viewed this as a sign of low intelligence and poor scholarship residing in my students but from that moment I appreciated that we were trying to communicate across an immense gulf of personality difference – different ways of perceiving the world and using information. I also think that ninety percent of the University professors are Intuitive types and sixty percent of our students are Sensing types and I think, the effects of this difference is worth exploring. I think the effect of personality on the way we teach, do research and conduct our selves as university teachers is very crucial. (Interviewed in 2009).*

All the above quantitative and qualitative data obtained from observation and interview responses indicate that personality type is instrumental in influencing lecturers' use or non use of technologies in the teaching of university students at Makerere University. The results imply that where as a positive attitude may influence one's actual integration of MISS in teaching, it may not necessarily guarantee use as only 14 % of the sampled population was found to be actually using LMISs yet over 65 % had a positive attitude towards it in teaching.

## 5 Conclusion and Recommendations

From the discussion above, the following conclusions were made in line of two the two research objectives;

Personality type preferences (ENFP vs. ISTJ, ENTJ vs. ISFP, ENTP vs. INFP, ESFP vs. INTJ and ESTP vs. ISTP) significantly affect lecturers' attitude towards using MISs in teaching. This means that besides the technology specific variables like hardware, software and accessibility, human factors are also very paramount in explaining variations in attitude towards use of MISs in teaching.

Personality types influence lecturers' actual use of MISs in pedagogy in Makerere University. As personality type preferences change, lecturers' actual use of MISs in teaching also changes. It was observed that direct bi-polar patterns of personality preferences have strong variations in actual utilization of LMISs. For example, the direct opposite ordered personality preference type of ESFP vs. INTJ, exhibited a very sharp variation ( $.001 < .05$ ) and ( $.000 < .05$ ) in both attitude and actual usage levels of LMISs respectively. Results revealed that the INTJ types work more comfortably with LMISs in teaching than other types. On the contrary, the ESFP types were the least performers in actual utilization of LMISs into pedagogy.

On the basis of the above conclusions therefore, the investigator here boldly recommends that the integration of educational technology and or instructional media in pedagogy, most of which are relatively new, expensive, complex to use, and not widespread, should proceed to be done with caution. The characteristics of both the teachers and learners are very important factors in choosing a medium of instructional to enable effective teaching and learning (Laurillard 1993). These characteristics include learner preferences, styles, experiences, interest, and level of motivation, to mention a few and to highlight the role of personality types of both the instructor and the learner in any successful learning activity. In context, addressing lecturers' mindset and understanding their personality types is probably the greatest challenge for maximum, efficient and effective integration of LMISs into pedagogy in Makerere University. Effective integration of LMISs into teaching at Makerere would only come when lecturers are able and willing to change their teaching styles and work habits. Integration of ICT into pedagogy is not simply an introduction of new technology in classrooms, but a complete re-thinking of how effective learning is achieved. There is therefore need to solicit for intended user input as any management information system is being developed. Particular attention in this regard should be put on lecturers' personality types, characteristics and preferences as the University develops and trains lecturers to use LMISs in pedagogy.

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# Optimization Technique for Implementation of Blended Learning in Constrained Low Bandwidth Environment

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**Abstract.** This paper proposes a novel optimization technique that addresses the most critical issue that impedes the process of technology integration in the universities in developing countries. The problem is addressed by optimizing the network efficiency and multimedia performance that matches with the challenges of constrained low bandwidth environment. The Paper also provides a comprehensive review of the existing blended learning frameworks.

**Keywords:** Blended Learning, Constrained Low Bandwidth Environment, Optimization.

## 1 Introduction

Growing demand together with flexible and cost effective higher education with increased accessibility of educational content has redefined the spectrum of university education. In response to the radically changing environment, universities are attempting to adapt new innovative methods of course delivery using increasingly available new learning technologies that exist in the world. Although the first phase of online learning embraced a number of benefits, the lessons learned proved that to facilitate a successful learning process, a single mode of instructional delivery may not provide sufficient choices and social contact [17]. As a result, blended learning, a new educational paradigm emerged as an attractive model in higher education.

Whilst blended learning offers a number of benefits, it is not a panacea, there are some obstacles such as; constrained low bandwidth environment which can be a key challenge to its adoption, particularly, in the context of organizations in Least Developed Countries (LDCs) [9], [14]. Although several techniques (e.g., [9], [10], [11], [12], [13]) have been proposed, the issue of implementing an effective and efficient blended learning process in constrained low bandwidth environment has not been adequately addressed. In relation to this research, the process may include optimizing the multimedia performance in an attempt to develop the content relevant to the challenges of developing countries [31] and optimizing the network efficiency. And as such there is a significant need for a new technique [16] that addresses the above issue.

After reviewing and making a comparative study of various existing blended learning strategies, this paper proposes a new optimization technique that focuses on critical factors not currently addressed that are obstacles to the adoption of

technology enhanced learning in constrained low bandwidth environment with particular focus on university settings.

## **2 Technological Concepts (TC)**

### **2.1 E-Learning**

E-learning can be instructor led synchronous learning in which instructor and learners both communicate directly with each other by using electronic means, or asynchronous learning where they can communicate with time delay but not in real time. In literature, numerous terms are used to define e-learning [6]. However, the e-learning definition used in this paper is; “a combination of network and multimedia learning”.

### **2.2 Blended Learning**

The term blended learning refers to a thoughtful combination of best experiences in traditional face-to-face class room learning and e-learning to enhance the learning process.

### **2.3 Constrained Low Bandwidth Environment Multimedia (CLBEM)**

This study used a Multi Level Systematic Approach (MLSA) for identification of the most suitable multimedia compatible with the context of constrained low bandwidth environment. At level I, we identified a huge database of video formats [19] clustered into 4 groups; commonly used, very commonly used, average, and rare. At level II, we selected most commonly used video formats namely; Audio Video Interleave (.avi), Advanced System Format (.asf), Windows Media Video (.wmv), Apple Quick time Movie (.mov), Moving Pictures Expert Group 4 (.mp4), Moving Pictures Expert Group1, 2 (.mpg), Real Video (.rv), The Shockwave (Flash) Format (.swf), and Real Media (.rm). At level III, we investigated the above selected video formats more critically using different characteristics. The level III investigation was based on the following characteristics; Developer, Platform operatability, Non-Proprietary, International standards, No packet data dependency, and Mix media encoding ability. The deep analysis of level III investigation revealed that only one video format namely, .mp4 has all these characteristics and is compatible with the prevailing constrained low bandwidth environment associated with many developing countries.

## **3 Existing Blended Learning Frameworks (Techniques) (EBLF)**

This study identified several blended learning implementation strategies such as; 4 Factor Blended Learning Framework (4FBLF) [9], A Framework For Success (FS) [10], A Blended Learning Framework (BLF) [11], The National Youth Development Learning Network (NYDLN) [12], and A Blended Learning Model (BLM) [13]. The

reason for selecting these techniques among others is that they are inter-related and pinpoint the essential factors related to three main categories; educational, managerial, and technological required for introducing a successful blended learning intervention in a Higher Education Institution [15].

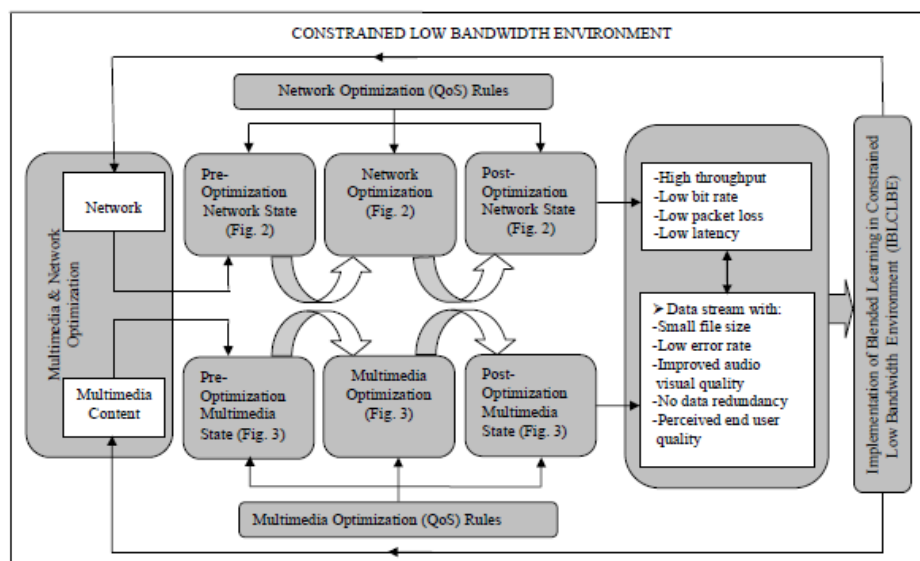
The issues addressed by these frameworks seem to fall under the titles shown in the first column of the matrix in Table 1. An analysis of the indicators of the reviewed literature suggests that important similarities exist between them; they address the similar issues under different titles and do not address the issue of constrained low bandwidth environment. Hence justifying the need to develop a new blended learning technique which addresses the core issue not addressed by the existing blended learning frameworks effecting the implementation of a new educational paradigm in low economies [16].

**Table 1.** An overview of identified existing blended learning frameworks

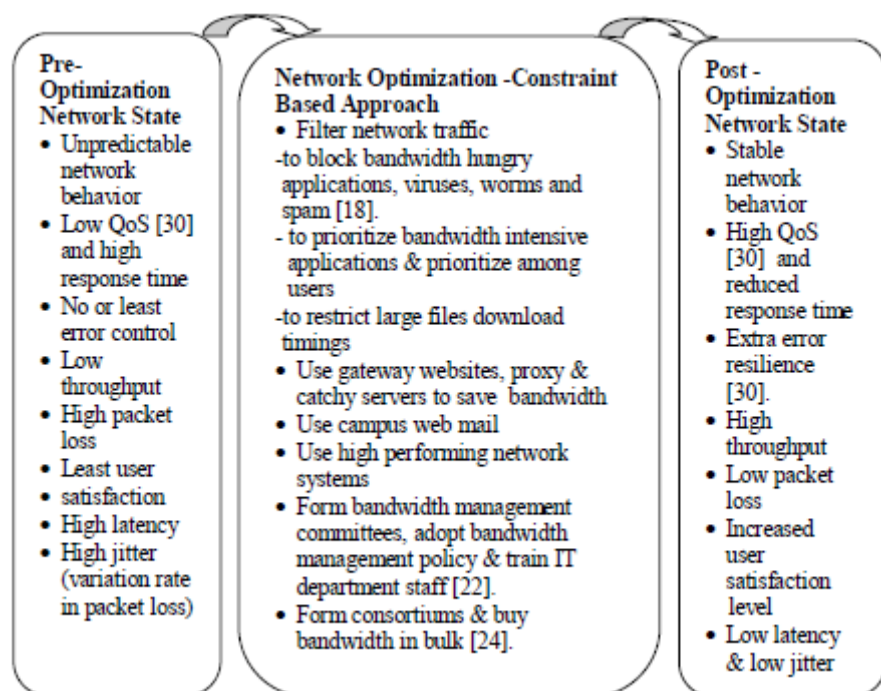
Indicators	FS	BLM	BLF	4 FBLF	NYDLN
Institutional (Organizational readiness, administrative & academic affairs etc.)	x	✓	✓	✓	✓
Learners & lecturers concerns (Audience analysis; characteristics & needs)	x	✓	✓	✓	✓
Pedagogical (Content analysis, design & learning objectives)	x	✓	✓	✓	✓
Technological infrastructure (Hardware & software)	✓	✓	✓	✓	✓
Learning Content (Teaching, learning or training material)	✓	✓	✓	✓	✓
Management & evaluation (Logistics, learners support service, registering, and assessment)	✓	✓	✓	✓	✓
Ethical (Copy rights, cultural diversity & equal opportunity)	x	x	✓	x	✓
Communication (Marketing & change management communication)	✓	x	x	x	x
Resources (Human & financial resources)	✓	✓	✓	✓	x
Constrained low bandwidth environment	x	x	x	x	x

#### 4 Proposed Technique for Implementing Blended Learning in Constrained Low Bandwidth Environment

The proposed technique is an extended form of Khan’s framework [11], [17]. Fig. 1 shows the pre-optimization states of network and multimedia which act as an input to the optimization process governed by both Network and Multimedia Quality of Service (QoS) Rules, followed by their outputs which turn into inputs for the next process of interaction between optimized states of the two components of the technique, facilitating the process of implementing an effective and efficient blended learning process in a constrained low bandwidth environment.



**Fig. 1.** Constrained Low Bandwidth Environment Optimization Technique for Implementation of Blended Learning



**Fig. 2.** Three Different Network States

#### 4.1 Network Optimization

Fig.2 provides the details of three network states mentioned in the proposed technique, and in subsequent sections, the technical details of network optimization process are discussed briefly with an emphasis on filtering the traffic passing through the network to reduce network congestion caused by; Internet worms, viruses and spam, misuse and mismanagement of bandwidth [18] due to non-existent or ineffective bandwidth management policies [22], [23]. Network congestion is an overloaded network state when resource (bandwidth) demand exceeds the supply resulting into huge consecutive packet loss [7].

**Packet Filter Firewalls and Access Control Lists (ACLs).** Information over the network system travels in form of discrete packets (cluster of bits) characterized by many attributes. Packet filter firewalls are devices used to enhance the security of the network system that filters the inbound and outbound network traffic based upon the rules that may be called Quality of Service Rules (QoS), commonly known as Access Control Lists (ACLs) [1], [2].

*Authentication.* User Authentication System (UAS) can be introduced by issuing log in passwords to authorized users to restrict the access to network resources from unauthorized users under the policy rules [3].

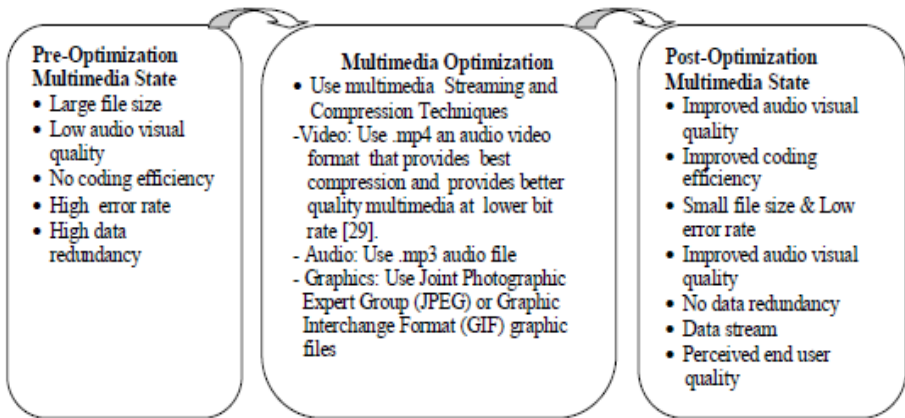
*Prioritizing network traffic.* Prioritization technique is used to enhance the Quality of Service (QoS) for real time applications such as VoIP and video by processing it before all other data streams. Similarly, the technique is used to prioritize among various categories of users based upon their associated privileges [3], [4].

*Time Based ACLs (TBA).* Time-Based ACLs are configured on router interfaces in the network to restrict the heavy file download timings to save the bandwidth.

**Cache and Proxy.** Cache and proxy are local memory devices that can considerably save bandwidth in low bandwidth environments [5]. The cache stores the digital contents most frequently required by the students while proxy servers save the recently or more visited Web Pages. When using cache and proxy method, all user requests pass through cache and proxy servers.

#### 4.2 Multimedia Optimization (MO)

Fig. 3 describes the details of three different multimedia states stated in the proposed new technique. In education, multimedia refers to present information using variety of media which includes; text, graphics, audio, and video [28]. The transmission of multimedia applications such as; video and audio over the network in the context of a constrained low bandwidth environment is still a challenge. However, the course performance can be enhanced by using multimedia streaming and compression techniques [20] explained in the following sections.



**Fig. 3.** Three Different Multimedia States

**Multimedia Streaming.** Streaming techniques are applied for delivering audio and video files efficiently that start playing one after another in the form of a stream on the client's computer when full contents are not downloaded completely. However, before streaming, multimedia contents must be compressed as these files are very large and data is again decoded (decompressed) before viewing by the user.

**Multimedia Compression.** Multimedia compression refers to reducing of the multimedia file size that can significantly reduce the bandwidth requirements.

*Video.* For digital videos, compression is achieved by removing the redundant data from the video files until the minimal compression level is achieved under Quality of Service rule. MPEG-4 (.mp4) [25] as identified in section 2.3 is to be used as the standard compression format that can efficiently encode (compress) mixed media and is "error resilient to enable robust transmission of compressed data". And has an inbuilt technique where many macro blocks are grouped together such that there is no packet data dependency on the previous packet [26], [27]. In addition to that MPEG-4 also provides better quality media at low bit rate [29].

*Audio.* Audio files should be saved as Mono Audio Files (MAF) because they are smaller as compared to Stereo Audio Files (SAF). For compression MPEG-3(.mp3) format should be used.

*Graphics.* Optimize the performance of graphics by reducing size, resolutions and number of colors. Joint Photographic Expert Groups (JPEG) and Graphic Interchange Format (GIF) type graphic files provide better compression.

## 5 Conclusion

This paper has proposed a novel technique showing how to implement a successful blended learning intervention in low bandwidth economies by underpinning the most critical issues not addressed by other techniques. Currently, most organizations in LDC's have not strategically implemented online learning or blended learning in their programme offerings, although there is need [8], and therefore this research besides

the scientific, has its highly pragmatic justification. The implementation of the proposed technique will lead African Universities to increase access to their own demand-driven programs in a “sustainable and cost-effective manner” and to convert millions of human resources from liability to become pivotal in their country’s economic development [21].

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# The GES Connect Digitally Programme: Shaping Parental Engagement through Technology

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**Abstract.** The engagement of parents with the education and learning of their children is known to have beneficial effects (Harris & Goodall (2007), Ofsted (2007) and DfES (2007a)). Following on from the article by Strickley (2009) which looked at the holistic view of a parental Gateway to Educational Services (GES) this paper focuses on the work, during 2009, towards the GES Connect Digitally vision (GES, 2009a). It looks, specifically from a technological standpoint, at the programme's core services namely Online School Admissions (OSA), Online Free School Meals (OFSM), Cashless Schools and Online Payments. It then sets out the approach used by the technology workstream and examines the work done so far in establishing best practice, developing and enhancing existing technology standards and looking at new and innovative initiatives. Utilising the above framework the paper attempts to resolve the question of what the minimum features and relationships are for establishing a portal that enables the vision of multi-channel access to a core set of services for parents (GES, 2009a). It concludes that, whilst there is still a year to go for the programme, increased take-up for OSA and use of the OFSM Eligibility Checking Service (ECS) are very encouraging with signs that work on the other two areas will result in the vision stated above becoming a reality. However this needs to be tempered with the significant technological challenges of digital inclusion, identity management, open standards and interoperability.

**Keywords:** GES Connect Digitally; Gateway; Education; Online; Admissions; Free School Meals; Eligibility Checking Service (ECS).

## 1 Introduction

The reports of Harris & Goodall (2007), Ofsted (2007) and DfES (2007a) conclude that the outcomes of parental involvement in the education and learning of young people are that of raising achievement, increasing attendance and improving behaviour.

In addition The Children's Plan (DCSF, 2007a) considers that a more flexible approach to parental engagement is critical to the key strands of education policy targeted to 2020.

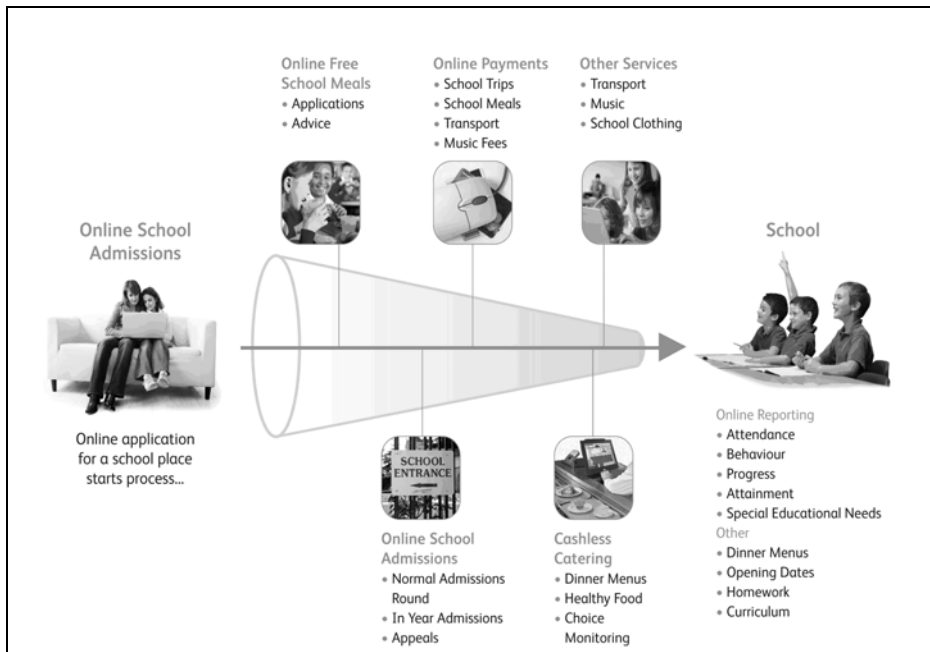
Strickley (2009) describes the holistic view of a parental gateway in 2008. Since then funding has been secured from the Department for Children Schools and Families (DCSF) for a GES Connect Digitally programme with a vision that:

*'by 2011 parents/carers in England will have access to a core set of services, accessible through a variety of channels and technologies' GES (2009a).*

The core services of the GES Connect Digitally programme have been defined as, enhanced Online School Admissions (OSA), Online Free School Meals (OFSM), Cashless Schools and Online Payments. Other key services are being managed through partner organisations such as Becta for the Home Access (Becta, 2009a) and online reporting initiatives (Becta, 2009b).

Figure 1 shows the GES Connect Digitally vision in a pictorial manner (GES, 2009b). As Strickley (2009) describes the figure moves from left to right from school admissions, which is the most mature and established application and as a result is the most utilised online educational portal, through the various other services as shown. The figure tends to move from the wider Local Authority (LA) provision at the left, through a school emphasis, to a pupil focus at the far right.

As can be seen the four core service within the GES Connect Digitally programme constitute over half of those seen as important to the vision.



**Fig. 1.** The GES Connect Digitally vision

## 2 Workstream Structure

In order to facilitate the services envisaged the technological infrastructure needs to be considered, tested and implemented. This is the role of the technology workstream within the GES Connect Digitally programme.

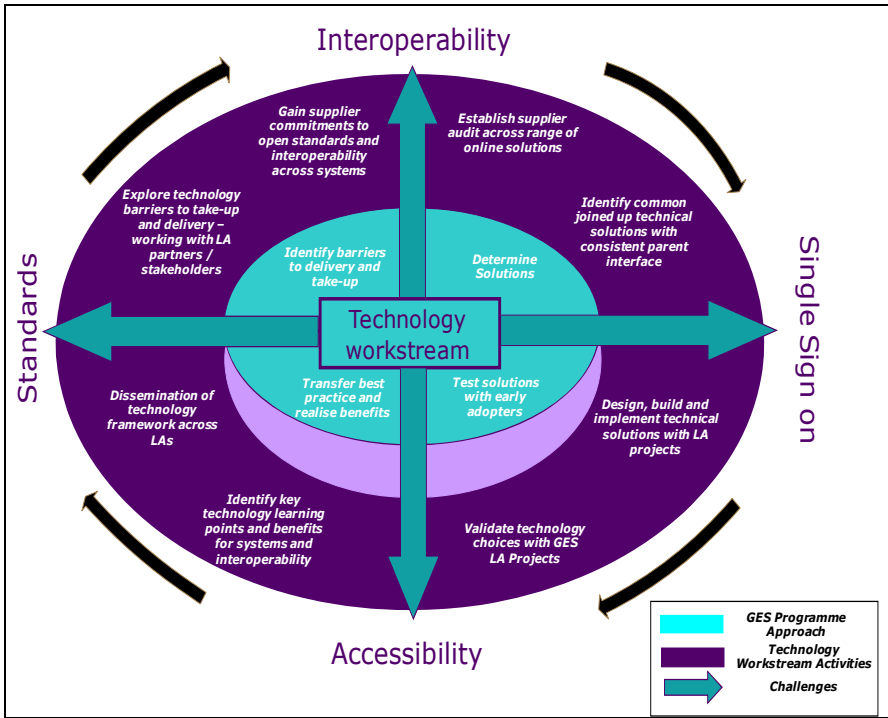


Fig. 2. Technology approach

Technology is one of several workstreams within the Programme. The aim of the workstream is to help LAs transition from the present to a future state, by enabling the ICT required to deliver the vision.

Figure 2 (GES, 2009c) shows the technology approach to delivering solutions that will enable the vision. Essentially it explores barriers, gains supplier commitment to open and interoperable standards, establishes an audit of existing technical and online solutions, designs, builds, implements and validates technology options and then identifies key lessons learned to inform an overall technological framework.

It shows how this workstream fits into the overall GES Connect Digitally programme approach of identifying barriers, determining solutions and testing and transferring outcomes. The technology workstream objectives are as follows:

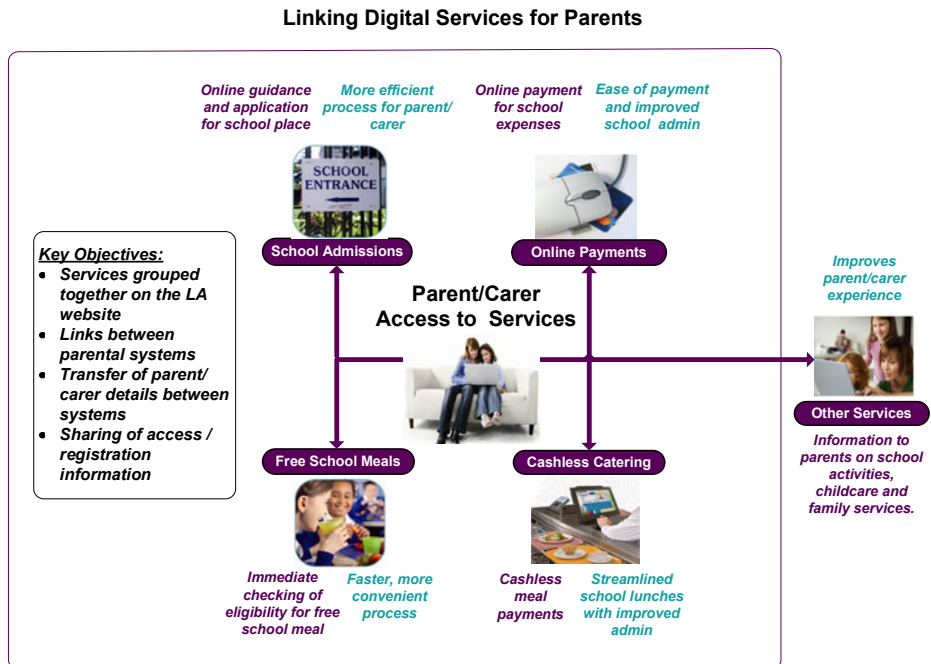
- To help local authorities join up and improve parental services through the use of technology whilst building upon existing platforms.
- To enhance and improve online school admissions services for parent/carers enabled by technology.
- To enhance and improve the efficiency of systems and processes within local authorities.
- To identify common features for application across local authorities.
- To produce specifications to support development work.

- To provide guidance based on LA project experience.
- To transfer guidance and learning from LA projects into the GES Connect Digitally delivery framework.

In order to achieve these the workstream has utilised a combination of projects within partner LAs, case studies with trailblazers, questionnaires, workshops, site visits and desk-based research and has in particular focused on:

- Research into existing practice in schools and LAs.
- Projects investigating new initiatives.
- Review and development of existing materials.
- Evaluation and review of existing and emerging technologies.
- Promotion and marketing of good practice.
- Creation of and participation in the GES Connect Digitally Community of Practice (IDEA, 2009)

The results of these have been fed into the following recommendations.



**Fig. 3.** Linking digital services to parents

### 3 Linking Services

One of the key areas of the GES Connect Digitally vision is the linking of the various services together so that the parent has a single point of entry or gateway.

Figure 3 (GES 2009d) shows how this may be visualised. As can be seen the four main services are shown linked together with other related services and areas.

In order to streamline the systems and ensure a seamless journey, using the evidence from the work described in section 2, the workstream has developed a series of ‘standards’ for the core services.

## **4 Generic Features and Guidance**

Generic proposed features which apply to each core service when delivered online are itemised below.

### **4.1 Form Design and Usability**

Online forms should include field level validation to improve the quality and consistency of data. They should use language which is clear and concise with help and guidance that is contextual, succinct and provided at the point where it is needed.

They should pass strict usability testing by the supplier, LA and users before release to the public website (COI, 2009) and provide guidance to the parent/carer which ensures that the consistency of core data captured for the online process is of a high quality. In addition they should provide meaningful and useful error messages and include the ability for parents/carers to consent to the sharing of their data where appropriate.

### **4.2 Data Sharing**

Subject to legal considerations data may be shared across systems where appropriate and it should adhere to the LA data management strategy. In addition online forms may be pre-populated with existing data for parents/carers who are already known to the LA.

### **4.3 Parent/Carer Contact**

There should be a contact facility available to support parents/carers using a variety of access channels.

### **4.4 Access and Security**

A registration process should exist to establish secure access to any online forms where parents/carers must be able to enter, save and retrieve the application at any time where the business process allows this. There should be a statement of standards for LA access, security and authentication including the protection of all databases and processes. In particular data should be protected to prevent destruction or corruption and this should include frequent file saves and amendment logs to ensure the ability of the system to re-create itself. These specific security processes should be included as part of a wider contingency plan and data should be protected by LA database access and authentication protocols.

## **4.5 Links**

Links between online services may be established across parental systems operated by the LA such as OSA, online reporting, OFSM, cashless catering and online payments. Within the LA website links with other relevant services including Parent Know How Directory (now Family Information Direct, DCSF, 2009a), schools' websites and to national websites containing information pertaining to benefits, parental services and the child's education e.g. Directgov. (Directgov, 2009).

## **4.6 Compliance and Compatibility**

LAs should consider legal guidelines, including the Disability Discrimination Act (HMSO, 2005) and the World Wide Web Consortium (WAI, 2009) and whether software is compatible with industry recognised internet browsers. e.g. Internet Explorer; Firefox; Safari; Opera.

## **4.7 Service Availability**

LAs should consider service level agreements to ensure any system downtime is kept to an agreed minimum and should utilise appropriate protective technology to minimise service disruption as a result of usage peaks or disruptive forces such as hackers, malware and viruses.

## **4.8 Dependencies and Guidance**

The detailed specific requirements for each online system will be different in each LA and will be dependent on a number of factors. These will include processes, procedures and policies, local systems, existing online forms, infrastructure and overall strategy and standards.

## **4.9 Minimum Features for Each of the Core Services**

In addition to the work in section 2 the development of the minimum features for each service has applied findings from:

- Experience and lessons learned through Hertfordshire County Council's and a number of other LA implementations of online systems and processes (IDEA, 2009).
- Compliance with Data Protection (HMSO, 1998) and Freedom of Information Acts (HMSO, 2000).
- Documentation from the DCSF Eligibility Checking Service (ECS) (DCSF, 2009c).
- School Food Trust guidance on Cashless Catering. (School Food Trust, 2009).

The following sections give a brief synopsis of the specific service and features that are desirable for its online parental portal.

## 5 Online School Admissions

OSA is a key element of the overall strategy of engaging parents/carers in educational services for their children. Referenced as a key priority in the Digital Britain (DCMS, 2009) report it is integral to the provision of multi access channels for citizen access.

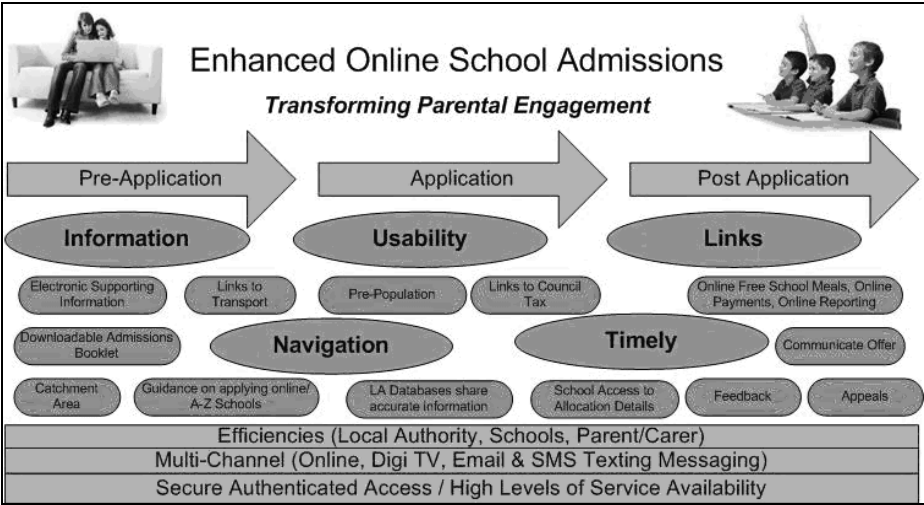


Fig. 4. Enhanced online school admissions

Building on the successes achieved by the eAdmissions project which delivered outstanding results with 150 LAs going live with OSA in 2006 (eAdmissions, 2006) the GES Connect Digitally programme has engaged in a series of LA projects with a view to enhance the OSA process and ultimately the take-up from an already impressive 30% in 2008, 44% in 2009 and a target of 50% in 2010.

Figure 4 shows how the OSA process may be broken down into the 3 main sub-processes of pre-application where the parent/carer will search for information about the prospective schools available; application during which the actual application will be made and submitted; and post-application during which the offer and subsequent preparation for the school place occurs. The figure shows the links and possible channels that may be part of this process.

The list below outlines how LAs can enhance the service beyond the Minimum Feature List set agreed in 2004 (eAdmissions, 2006) to deliver a service transformation for parental engagement.

Using the broad headings described above these are:

- Support for pre-application research including improved links to a downloadable admissions booklet and information about applying online - FAQs, processes, registration, Fair Processing Notices (DCSF, 2009b), Data Protection (HMSO, 1998). Clearly presented opening and closing dates, an A-Z of schools' websites within the LA, Ofsted, DCSF, EduBase etc (Edubase, 2009), school uniform information and application processes, home-school transport service and catchment area information for each parent/carer based on their address.



- Support for the application process including the ability to define areas of allowable applications based on the child's date of birth or correct LA application form based on the home address and postcode. A PIN/password supplied to the parent/carer either with the registration pack or as part of the online registration. Online validation within the form for a range of fields together with facilitation, where possible, of all transactions to be undertaken electronically e.g. proof of residency, religious affiliation, birth certificates, pre-admission application, and any other certificates or evidence.
- Additionally there should be an optional alert prior to allocation day to remind the parent/carer that the results will be available online on results day via email, SMS or automated phone message and the ability to view the current school catchment area details, if applicable, within a defined area together with previous longest home to school distance for over subscribed schools. Other alerts should also be available, on request, to advise the parent/carer of important dates such as the closure of the form, tests and appeals and electronic links to Choice Advisers or similar via email, telephone or SMS Text Message.
- Post application processes should be supported by the confirmation of application receipt containing information useful to the parent/carer e.g. application reference number, contact information, synopsis of information transferred, next steps and links to other information. Allocation (offers) details should be available online together with useful information, links to other services such as online free school meals, offered school website, online payments and details regarding online reporting.
- There should be a facility for schools to view a limited version of all applications online irrespective of how they were made and they should also be able to view allocation details, when available
- Parents/carers should have access to an online email facility to deal with queries throughout the admissions and appeals process and there should be the opportunity to lodge an appeal online should they be dissatisfied with their allocated place.

Many of the above features are already included in admissions online forms. However the list is intended as a blueprint for future developments and not a minimum feature list.

## **6 Cashless Catering**

School cashless catering systems make lunchtime in schools more efficient and mean children do not need to carry dinner money. As a result benefits are realised for children, members of staff, schools and parents (School Food Trust, 2009).

Minimum features may include links to online payment systems where parents/carers pay online for school catering using credit and debit card and the ability to accept cheques and Bank Automated Credits (BACs).

There should also be the provision of a reporting functionality for the school so that catering can be managed electronically and similar reporting functionality for parents/carers so that they can have access to menus and other catering related information.

More work needs to be done in this area and cashless catering will be a focus of the workstream in the second year of the programme.

## 7 Online Free School Meals

Historically the application for FSM by a parent/carer for their child involved a lengthy application process including time consuming paper-based evidence for eligibility checking. This would need to be repeated on an annual basis (GES, 2009a). The result of this process was often stigma for the parent and child resulting in some non take-up of the benefit.

The DCSF has developed an FSM online Eligibility Checking Service (ECS) (DCSF, 2009c) which checks the eligibility for FSM against Her Majesty's Revenues and Customs (HMRC), Department for Work and Pensions (DWP) and Home Office databases. This supports LAs in the delivery of an efficient service to parents/carers, which streamlines eligibility checking when processing applications.

The long term vision for OFSM is of a seamless 'end-to-end' service enabling parents/carers to apply online for FSM in one quick, simple and easy process incorporating real-time eligibility checking. Parents/carers and LAs will be rapidly informed of eligibility and, by automated notification to schools, children will be offered a FSM by the start of the next working week.

Figure 5 below shows the proposed system described above from start to finish.

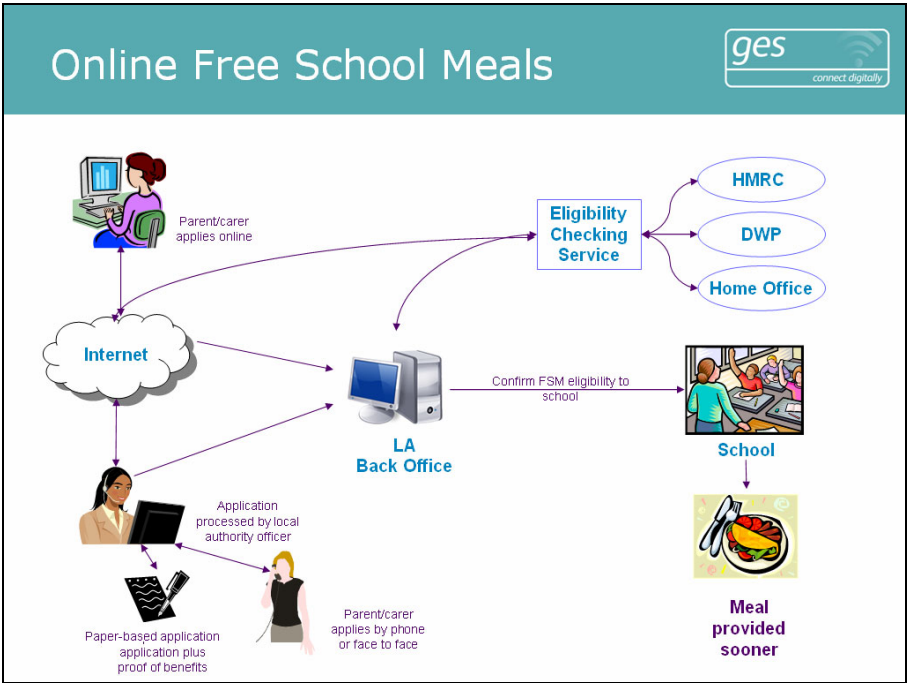


Fig. 5. Online Free School Meals process

The following outlines the suggested minimum features required to establish an OFSM service for parents/carers delivered through an online form provided by the LA:

- The form may be deployed as an internally developed LA web-form or as part of an OFSM system. (Some LAs have developed a single form to capture applications across a range of benefit areas). It should include guidance to the parent/carer regarding the OFSM application process, eligibility criteria and on specific areas of the process (GES 2009e) and should give confirmation of application receipt.
- Following the confirmation of eligibility, the process should provide guidance to the parent/carer on how the process will proceed within the LA and the school through to the provision of FSM for the child. The process should integrate with the ECS to provide immediate eligibility checking of an application.
- 109 LAs in England used the ECS in September 2009, this is a 50% increase year on year, with 93% of checks resulting in an eligibility match. Early adopters will be implementing a full online service (as in figure 5) early in 2010.

## 8 Online Payments

Online Payment systems enable parents/carers to pay for a range of school-related items, such as their child's school dinners, trips, music lessons, clubs, and uniforms online.

Minimum features may include:

- The ability to make payments online using credit or debit cards or the direct payment of money into a specified central account including optional reminders for payments which are due. The system should integrate with cashless catering systems and management information systems allowing the provision of reporting functionality for parents/carers and schools including the ability for the school to identify and manage non-payments.
- Systems should also consider the potential for integration with other products such as PayPoint, enabling retailers to accept payment on schools' behalf, the ability to manage and administer FSM for schools and parents/carers and the ability to make regular payments e.g. standing orders.
- Whilst the advantages of Online Payments are clear the implementation across LAs appears to be somewhat inconsistent and this will be a key area of investigation in the next year of the programme.

## 9 Success Measures

In order to measure progress the programme has put into place a series of success measures. These are that by 2011:

- OSA, over 50 % of parents/carers nationally will apply for a school place online.
- OFSM, 60 % of LAs will have removed the need for parents/carers to provide paper proof of benefit
- Grouping services, 75 % of LAs will signpost other parental services from GES Connect Digitally core services e.g. advice on OFSM and other relevant services during the schools admissions application process.

## 10 Conclusions

Good progress has been achieved in the first 12 months of the programme including:

- OSA take-up figures show 44% of parents nationally applied online in 2009-2010 with some LAs achieving 90% and higher.
- Increase in the use of the ECS is increasing month on month.
- The use of cashless catering and Online Payments, although less mature than the than OSA and FSM, are becoming increasingly significant in LA and school transactions.

It is clear that the work done so far in responding to the question of what the minimum features and relationships for the core services should be is assisting the implementation of the programme's vision. However there are areas that need urgent review:

- Digital inclusion is key for the high take-up and participation required to make this programme effective and efficient. The Becta (2009a) 'Home Access' project together with the use of non-PC based internet access devices will be key to this.
- A single portal requires a single sign on and the issues of identity management and security are high on the agenda. Alignment with the Information Standards Board (ISB, 2009), Becta, Office for Government Commerce (OGC) and enterprising implementations existing within LAs are to be a focus for next year's project areas.
- Open standards and interoperability will not only allow the seamless combination of different services but should also enable the key links between LAs, schools and parents. In this respect the Systems Interoperability Framework (SIFA, 2009), ISB (2009) and Becta are important partners.

The success of the programme will inevitably hinge on resolving these important issues and the next twelve months will be critical. It is hoped that a subsequent paper will review the progress achieved in the second year of the programme.

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# **A Comparative Study of Access to Web-Enabled Services in Botswana and the UK: Issues, Obstacles and Solutions**

## **Conference discussion group paper**

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**Abstract.** This paper looks at the issue of access to internet based services in Botswana and the UK. It provides an overview of current infrastructure and demographics in each country, the particular issues and obstacles that each faces and considers the initiatives currently being pursued. It concludes that although the two countries may be very different many of the problems they face with regards to web access are similar.

**Keywords:** UK, Botswana, web, access, internet, channels, e-government.

## **1 Introduction to the Two Countries**

Botswana is a country with an area of 581,730 square kilometres and a population of 1,990,876 whilst the UK has an area of 243,610 square kilometres and a population of 62,041,708.

Whilst on the face of it they are two very different countries in terms of size and population, many of the challenges surrounding access to ICT services and participation in web-channel engagement are similar.

This paper looks at the issues, obstacles and solutions to engaging the whole of the populations of these two countries in using new technology for education, training, business, employment and social inclusion.

## **2 Botswana**

### **2.1 Introduction**

The Government of Botswana has adopted Information and Communication Technology (ICT) as one of the major tools to propel its economic growth and development. In that regard, the National ICT Policy dubbed 'Maitlamo' was adopted in 2007 with the main goals being to provide an enabling environment to assist in the implementation of key strategies essential for achieving the country's national development targets within the scope of ICT. The Maitlamo policy also addresses the subject of community access to ICT, which is critical to promote citizen access to Government services in the country. The implementation of the policy during the current planning period is expected to help the public sector to deliver quality services

by allowing citizens to access government information and services at any time of the day, and without having to travel long distances, or to wait in long queues to receive services. The following sections address key issues, obstacles and solutions to the provision of web-enabled services, or e-Government, in Botswana.

## 2.2 Issues

While Botswana is still categorized as a developing country, there exists great potential for the country to grow through ICT. Generally, an ICT framework has been developed to support the provision of web-enabled services, though there are still issues of poor connectivity and low internet penetration in the country. The Maitlamo policy aims to propel Botswana to become "...a globally competitive, knowledge and information society where lasting improvement in social, economic and cultural development is achieved through effective use of ICT" (Botswana Government, 2007). The Government intends to achieve this through a multi-pronged strategy that includes seven robust objectives dealing with issues of connectivity, access and enhanced service delivery.

According to the e-Readiness Report compiled in 2004, Botswana is one of the few developing countries which have a good coverage of highly sophisticated fibre network coverage. This is further expected to be strengthened through connections to the West African Cable System (WACS) and the East Africa Submarine Cable System (EASSy) that will be providing high performing broadband networks between Botswana and the rest of the world. However, current statistics show that access to ADSL/Broadband connection is only around 1 -2%, computer home ownership is at 3% and internet penetration at a low of 6%. This therefore implies that usage of the internet for web-enabled services is still very low. Interestingly, Botswana is ranked number three (3) in Africa and one-hundred and seventeen (117) in the world which could be attributed to mobile telephony. Further information reveals that the country may well overtake South Africa and Nigeria in cellular phone penetration which is above 85% currently. This provides ample opportunity for internet penetration through what some countries have labelled 'm-Gov' or mobile Government. Though accessibility is on the increase, the country has been slipping consistently in terms of global connectivity ranking, which should be a wake-up call for the country to do more in order to realize benefits from web-enabled services.

Several initiatives are currently being pursued to promote the use of the internet which is the gateway to web services. Among the most prominent are:

**Thuto Net:** involves exposing young children and adults to the internet both at school and community levels. Among some of the projects under the programme are the refurbishment of computers from Government offices for re-allocation to primary schools, and broadband connectivity to all schools. Significant progress has been made so far with almost all secondary schools and a substantial number of primary schools connected.

**e-Health:** aims at providing better healthcare to citizens through the transformation of health care systems, enabling excellent patient care, improving online access to health services and information and providing a national health surveillance network to systematically manage emerging issues in health care.

e-Business: online transactions between government and business following models adopted in the private sector where procurement and payments for goods and services can be made online

e-Legislation: an initiative to remove all legal impediments to the implementation of e-Government such as the introduction and recognition of electronic signatures.

As the biggest employer in Botswana, Government has also introduced an initiative to promote computer ownership among its employees by allowing workers to purchase computers at subsidized rates. The initiative, called “ i-Partnership, Computer for Me”, is currently being reviewed to make it more responsive to current challenges.

On the public service front, citizens have for a long time been decrying lack of efficient and effective service in Government. It is a fact that customer expectations are always on the rise. In 2005, the Public Service Customer satisfaction survey recorded a rating of 25%, and in 2008/09, this rating increased by only 2 percentile points to 27%. One of the most effective ways to match customers’ demands is the use of ICT in business, and hence the Government’s decision to adopt an e-Government strategy. In essence, e-Government strategy has the transformational ability of ‘taking Government to the people’, and offers an opportunity for reduced Government red-tape and increased delivery. Our current national development plan sets high goals and a target of 75% of customer satisfaction rating for the year 2016. To a large extent, the pace at which the country excels at implementing the National ICT Policy, or Maitlamo, will determine the success and service delivery outcomes for 2016.

## 2.3 Obstacles

As a developing country, Botswana has many factors hampering the use of ICT for efficiency and effectiveness gains. Despite the many efforts that the Government is pursuing, there are still challenges relating to some of the following issues:

Access to ICT infrastructure, internet penetration and telephone coverage

While the country is surrounded by fibre, the network only goes to major villages and towns, leaving out the majority of citizens who stay in remote areas. The general internet penetration is also very low. The issue is aggravated by the fact that Botswana as a landlocked country depends on South Africa for its bandwidth, and the supply is dependent on the needs of the South Africans. Whenever they require more bandwidth, Botswana will get less. To address these, a rural connectivity programme was launched to connect 197 villages to the telecommunications grid, and hopefully this will extend ICT reach to all parts of Botswana. Botswana has also taken part in the procurement of international under-sea cable connectivity (EASSY and WACS) which should remedy the issue of bandwidth shortage by 2012.

Unavailability of electricity in some of the localities

Of the 800 public primary schools in Botswana, only 500 schools have got electricity. This means that about 300 schools might not benefit from the computer refurbishment project due to this issue. The country is also very large, with a low population density. The connection of electricity to all villages is therefore financially and geographically challenging.

Shortage of trained personnel and limited ICT skills



Competent personnel are required to teach and support ICT related training in schools, especially in rural areas. Also, our largely rural population still lack ICT skills which would enable them to access Government online services.

#### Financial limitations

As a developing country with priorities still set largely on provisions of basic goods and services such as education, healthcare and infrastructure, the country faces financial constraints which would otherwise help the Government to move at a much faster pace. As a developing nation and highly dependent on mineral exportation, Botswana was not spared of the recent global economic crisis. This however, may not be used as an excuse for provision of e-Services even though developing countries by default have this challenge of unavailability of funds.

#### Slow or inefficient project implementation

Generally, Botswana has very good and robust development plans in place. However, implementation has been found to be wanting in most cases, with the resultant slow delivery of projects and associated cost overruns.

#### High cost of ICT services

Botswana has got a high penetration of mobile phones, but the challenge is the cost of calling and procuring the smart phones which can allow access to both internet and other media. This is mainly because Botswana's tariffs are tightly dependant on the South African ones.

#### Mindset and Attitudinal issues

A strategy to take the nation through a transformational process to use and adapt to ICT needs to be developed.

#### Lack of e-Legislation

Though the country plans to enact e-Laws to support its e-Government framework, this component is still lagging behind thus inhibiting the use and recognition of electronic signatures.

#### Poor internet connectivity and low bandwidth

Ministries attempting to deliver web-enabled services experience low bandwidth which results in prolonged downtime of their systems. As a result, citizens find it difficult to access available online services.

## 2.4 Solutions

Clearly, there are many issues affecting the use of ICT and delivery of web-enabled services in Botswana. However, much has been done and continues to be done in order to address bottlenecks so far experienced. Among the many solutions put in place to address these problems are:

E-Government Programme: to leverage on ICT for delivering service to citizens. The e-Government Programme is structured in three (3) main streams among them an e-Legislation component specifically to address all legal issues in e-Gov.

Connection of the country to undersea cable systems to boost internet bandwidth and connectivity.

Use of cellphones (m-Gov) to deliver some services as cellphone penetration is very high in the country.

A rural electrification programme to connect all areas with a population of more than two-hundred and fifty inhabitants to the national power grid. Opportunities for

the use of solar are also available as the country is blessed with sunshine throughout the year.

Implementation of a national human resource development strategy, to include ICT skills for Teachers and the rest of the citizens.

Establishment of Kitsong Centres, Sesigo and such other initiatives to provide convenient centres that provide local residents access to computers and other ICT equipment in Public Libraries and Post Offices which can be found in almost all localities of the country.

Establishment of a National Strategy Office with a robust M&E system to manage project implementation.

Partnerships with development partners are also promoted in order to share costs and results of e-Government.

## **2.5 Conclusions**

It is clear from the picture presented above that while opportunities exist for the promotion of web-enabled services in Botswana, there are still some challenges. However, it is important that learning and experiences from countries that have advanced in this sphere can be used to deliver effective service to citizens. The Government of Botswana also has good plans in place which can benefit even some of the advanced economies such as that of the United Kingdom.

## **3 United Kingdom**

### **3.1 Issues**

Most schools and colleges within the UK have wide access to the internet and use e-learning across the curriculum. As a result access to web services within education are high. However access at home may not be available to all learners.

In this respect it has been shown (Harris & Goodall, 2007, Ofsted, 2007 and DfES, 2007) that home access can enhance learner achievement, increase motivation and improve parental engagement, which can in turn raise children's attainment. Recent evidence has also suggested that having home access to a computer could help learners achieve a two grade improvement in one subject at GCSE. Effectively, a pupil that would have got a D, could, through the effective home use of technology, now get a B at GCSE. (Becta, 2010) Longer term, Price Waterhouse Coopers [Race Online, 2010] estimate that increases in educational attainment could result in lifetime earnings increases of £10.5 billion.

Parental engagement in the learning and education of their children can improve their educational outcomes. Research shows that children achieve more highly when their parents talk to them about their experience of school and learning. However, a recent report (Becta 2010b) showed that 82% of parents felt 'left in the dark' when it comes to their child's schooling. The introduction of online reporting means that parents are able to have secure online access to information on their child's progress, achievement, attendance and behaviour. It enables parents to get closer to and support

their child's learning, enabling them to work as equal partners in improving learning outcomes for their child. This can be achieved through the effective use of established management information systems, without increasing the workload of teaching staff.

With additional access to personalised learning which includes assessment, teaching, curriculum and school strategies, designed to ensure that the talents of every individual can be fully realised, standards can be raised for all by setting high expectations based on a sound knowledge and understanding of every child (Milliband. 2010). The use of e-learning packages through a Virtual Learning Environment (VLE) can help to assist in this objective.

As a result the position for those in education is good. In addition (Race Online, 2010) 58% of UK adults buy goods and services online spending an estimated £4.4 billion in April 2010, 87% of UK internet users make travel plans over the internet and 25 million have facebook accounts. Of the 40 million internet users, there are about 30 million using it every day.

Therefore there are over 10 million people in the UK who have never been online for any purposes representing about 20% of the population. Yet there are some compelling advantages to using the internet estimated at over £22 billion in terms of consumer, educational, employment and government efficiency (Race Online, 2010).

Indeed more than 90% of new jobs require basic internet skills with many new jobs being offered initially on the internet or in some cases only online. This further illustrates the statistic that 270,000 people on job seekers allowances have not used the internet (Race Online, 2010).

Therefore there is a compelling case for introducing those in the 20% of non-users to use the internet and also to increase presence, particularly for public services, into web-based access channels.

### **3.2 Obstacles**

The UK has a good broadband infrastructure (see Figure 1) and availability is clearly not an obstacle in accessing web services.

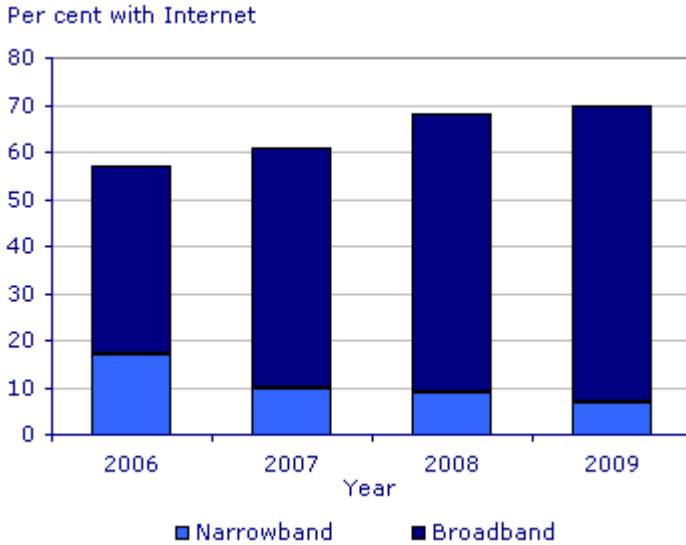
Reasons for the lack of usage range from lack of skills, access and motivation. Non-usage studies suggest that the highest concentrations of the working age population are in socially derived areas whilst the highest concentration of older people (65 and over) with non-usage is concentrated in rural and coastal areas.

Older people often perceive that the internet is not suited to them. However this may not be the case with home shopping, medical advice and cheaper prices being available through this access channel.

An additional obstacle is the administrative structure of the UK, with LAs having control over the content and structure of local services, meaning that there is a non-uniform structure to the provision of web-based council services.

### **3.3 Solutions**

The UK has a widespread cabled broadband infrastructure with 18.3 million households in the UK (70 per cent) having Internet access in 2009.



**Fig. 1.** Households with access to the Internet, UK (OFNS, 2009)

The use of mobile internet access is also widespread with 2G covering 99% of the UK population and 3G around 90%. However isolated areas will not be covered (BBG, 2010).

Clearly the issues are not merely about availability of service. However the issues of hardware, education and awareness are key.

There are a number of initiatives that are attempting to increase web usage amongst the population. These are:

**e-Government:** This programme ran until 2006 and was tasked with ensuring that all council services were available electronically by the end of the programme. Some LAs got round this by creating downloadable forms or documents. However the eAdmissions project was a major success achieving a transactional online admissions form in all 150 LAs in England.

**Putting the Frontline First: Smarter Government (HMSO ,2009)** was an initiative by the previous administration to increase online take up with an input of £30 million and included targets of 80% for tax and admissions online usage.

**Race Online 2012 (2010):** This is an initiative from the current administration that aims to get 10 million more people online by 2012 and 100% take up of a number of online services. There appears to be little funding for this initiative though.

**Connect Digitally:** This programme has set targets for 50% take-up of online admissions, 60% Free School Meals and 75% linked services across all LAs in England by 2011. Now in its second year the programme is making good progress through partnership working with local authorities in England.

**Home Access (Becta 2010a):** This initiative is a government drive that helps low-income families who currently lack access to a computer and/or internet to get online at home to support learning. It involves a grant for a computer, internet access and

support for 270,000 households. Whilst the programme is primarily aimed at school age pupils, it is hoped that usage will extend within the household to parents.

Reporting to Parents: The statutory provision of real-time reporting to parents through web-enabled channels will not only help pupil achievement but will encourage parental involvement in the use of the internet.

## 4 Conclusions

Clearly the initiatives are there and it is to be seen how effectively they will be in extending the use of web-based services in the UK in a time of financial restraint.

### 4.1 General Conclusions

Both countries are embarking on initiatives to enable access to government information and services in order to facilitate 24/7 availability, convenience and efficiency. To this end they are both striving towards being globally competitive through the use of ICT. Both see the importance of universal access to web-based services and have initiated programmes to enable access through educational establishments, communities and business including making e-communication more available through legislation and free/assisted purchase of personal computers for home use.

Botswana clearly has a less mature infrastructure both in terms of broadband and in some cases more basic utilities such as electricity. As a developing country ICT competencies and financial limitations are obstacles. However the problems surrounding ICT projects and the challenges of attitudes and mindsets are a common theme.

It is clear that both countries have progressive policies regarding the inclusion of all of their populations into the use of the internet and whilst there may be some differences, there is much that the two countries can learn from each other.

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# Justification of ICT Expenditure: Input and Outputs

## Conference discussion group paper

Jacques Bulchand (Chair), Omponye Kereteletswe, Antonio Castro,  
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## 1 Challenges in Justifying the ICT Expenditure

The discussion commenced by discussing matters affecting the decisions to spend on ICT by government. Dr Kereteletswe indicated that we need to be in a position to justify to the Ministry of Finance and Development Planning the ICT expenditure. The chairman further added that currently the entire world is recovering from the economic melt-down hence this factor is used to justify the ICT budget cuts. Mr Balebetse supported the matter adding that we need to question why ICT is always targeted when budget cuts are made. This tendency shows that the decision makers do not have appreciation of the value-addedness or benefits derived from investing in ICT. The chairman added that this is due to the fact that the benefits from ICT are not immediate as compared to other investments or projects like roads construction, building schools. All the mentioned projects, upon completion one already derives satisfaction that they are having value for the money generated in their development. Hence this results in further challenges to justify the ICT expenditure.

The chairman lamented that in most cases when ICT budgets are presented, only 50% of the entire expenditure is requested and this normally covers procurement costs, development costs excluding maintenance costs. With this elimination of some essential services required by ICT departments, it means there will be a need to make further requests to cover the remaining costs after completing the implementation or development of projects for which the budget was intended. This ‘coming-back’ for more habit is the one that makes decision makers hesitant to release more funds as at this point they are expecting benefits and not more spending. This shows that there is a tendency of requesting less than what we need. Ms Molebatsi asked why now as IT Managers since we know that on top of the implementation /development costs there will be additional costs of maintenance not cover all costs upon request for funding. In answering, Dr Kereteletswe responded that this is due to poor planning by the entire system. He added that if the budget is not results based, it is definitely going to fail. Maintenance costs when included in the budget, the decision makers believe the costing is exaggerated and unrealistic giving an example with the current e-Government Project. The cost is estimated at €102 million but it will take a few years before the real benefits are experienced.

Mr Maedza commented that much attention is not paid to joint planning. We have one government but when we plan, this is done in silos. Dr Kereteletswe added that a holistic view of the entire government ICT demand is ignored hence challenges to make a justification holistically. Ministries make their own demands and plan in isolation.

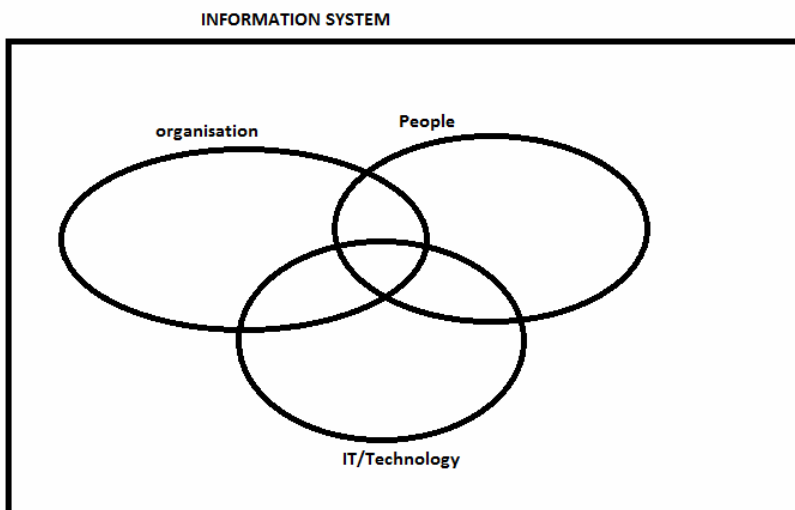
Mr Castro highlighted that it is always difficult to justify investment especially for ICT because it is very difficult to measure it. The chairman supported the point adding that there is a huge difference in ICT measurements as compared to other projects like building a road and using it upon completion. We need to know how to measure the Return on Investment (ROI) for ICT. Dr Kereteletswe added that the main challenge is that the politicians need immediate results. He added that there are two important factors to be considered namely

- Cost effectiveness
- Accrued benefits

Dr Kereteletswe continued that it is essential to always plan strategically as per the balance score card where it states that you require the right human resources to drive the systems to get your desired results. The chairman said the Information system is made up of 3 components namely

- Organisation
- Technology
- People

But within our organizations, the main focus is on technology, forgetting that the people need to be trained to be able to use the technology to improve the organizational performance. Mr Castro added that when we invest in Information systems we need to see that as an opportunity to start developing our human resource. (Refer to the below diagram (Information system))





The chairman threw a question that ‘Can we archive innovation without IT?’ In response, the group responded in affirmation. He said that in the past 15 years, innovation has been IT driven but innovation can be achieved without using IT. This can be a challenge because people are resistant to change. Dr Kereteletswe lamented that the politicians are interested in input and output alignment but for IT real benefits can take up to 7 years hence not a priority to be added on their 5year development roadmaps (manifestos). The chairman gave an example that there is currently a proposal in Spain to have a fibre optical cable build in each road construction. This initiative is cost effective. Another advantage of IT is that it eases access to the remote areas within the country according to Mr Maedza. Mr Castro added that we need to develop infrastructure first and this will allow service delivery at the end.

Ms. Molebatsi added that currently in Botswana, government is investing more in ICT in secondary schools leaving out the primary schools. The primary school students are only given refurbished computers as a way of introducing them to information technology but this is always having challenge of untrained teachers. In his response Dr Kereteletswe said that our leaders need to have a change of mindsets and attitudes because it would be ideal to introduce the students to ICTs at a tender age and not when they are at secondary schools. Mr Balebetse responded that this is normally due to lack of funding. There are more primary schools in the country compared to secondary schools. The chairman added that other alternative can be taken by parents to buy computers for their children and connect internet in their homes as majority of them can afford it.

Mr. Balebetse added that at primary schools the other main challenge is power supply. Most of the primary schools in the country do not have electricity hence making it a challenge to operate ICT infrastructure. Currently the government is trying to come with ways of addressing this challenge by piloting with the use of solar power to assist the Community kitsong centres (internet access points in villages) and primary schools giving an example of the Kaudwane village in the Kweneng region. The other main challenge with bringing primary school ICT infrastructure to the same level as secondary schools is due to lack of proper coordination of the project since it is made up of 3 main stakeholders. These are Ministry of Education and Skills Development (driving the education ICT policy), Ministry of Local Government (responsible for bringing infrastructure at primary schools) and Ministry of Transport and Communications (responsible for providing ICT infrastructure to government institutions).

Mr. Balebetse continued saying that his ministry (Ministry of Transport and Communications) is taking advantage of the rural electrification project spearheaded by Ministry of Minerals, Energy and Water Resources.

Mr. Balebetse added that the other challenge is the high tax rates. Currently the tax makes up 30% of the purchase price hence making it expensive to procure ICT equipment especially that it is always sourced from outside the country. Dr Kereteletswe responded that if there is buy-in from the decision makers, ICT equipment could be exempted from taxes or reduced to make them affordable to government. Customs duty is at 20% and the VAT at 12%. Another alternative is to have the equipment entering the country at the Martin’s Drift free-tax border post.

## 2 Solutions

Be realistic with costs of ICT projects; Refrain from under-budgeting

Sensitize / train our politicians about costs for ICTs since they have long term benefits

Benchmarking and best practices: Since Africa is slightly behind in technology countries can benchmark with more developed countries to copy ideas and plans

When planning, we need to link outputs to results especially when presenting to politicians

Planning together of all stakeholders (politicians and public service) for long term eg Vision 2016, National Development Plans.

Link ICT costs to outputs that accrue as a result of the use of ICTs

Give ICT technicians training in strategic management to improve their management skills; IT officers to be part of organizational management

Phased implementation of projects;

# Online Learning Features and Factors in Getting the Blend Right

## Conference discussion group paper

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## 1 Introduction and Context

This presentation discusses online learning provision using blended approach in educational settings. Online learning provision in the African setting includes both the traditional e-Learning management systems (e. g. proprietary – blackboard and webCT), and Open Source (i. e. Moodle, KEWL etc.). Online learning can feature at primary, junior and senior secondary as well as tertiary levels. However, within the African context, much emphasis is placed on the tertiary level and the scope of this paper focuses on eLearning provision within the tertiary level where it is believed that necessary resources are available. The paper *firstly* outlines the features of online learning, *secondly* outlines several factors that would determine the level and success of online provision in tertiary institutions in Africa; and *lastly*, discusses *challenges and blended learning trends* regarding online provision given the several factors in place.

## 2 Features of Online Learning Settings

There exist several features of online learning provision that make it a distinct mode of delivery. Certain prerequisite requirements would enable adequate online provision and the following have been identified as critical attributes of online learning:

- Smart classrooms/Laboratory
- Learning management system (proprietary or open source)
- Course learning tools (synchronous and asynchronous)
- Designing of online course/s
- Geographical barriers are eliminated
- Learning is self-directed
- Learning is self-paced
- On-demand access to learning
- Fostering greater student/instructor contact
- Overall student costs frequently less (tuition, residence, food, child care)
- Learner support

- Management of course
- Tutor requirements (e. g. uploading of material and editing);
- Moderation of course
- Variety of assessment modes
- Discussions/forums and monitoring
- Contact between students and instructor
- Reciprocity and cooperation among students and staff
- Active learning activities
- Provision of prompt/immediate feedback
- Emphasizes time on task
- Communicates high expectations, and
- Respect for diverse talents and ways of learning
- (Pam Vesely, Lisa Bloom and John Sherlock, 2007)

These above features constitute critical aspects of online delivery and there is need for a basic structure to support online learning provision without which there will be no adequate provision.

### **3 Factors Determining Online Learning Provision**

Several general factors tend to determine the level of provision of online learning and the following have been identified:

- Strategic policy Frameworks
- Implementation strategy
- Hacking (changing results, copyright, computer/online literacy)
- Awareness and capability to implement
- Availability of resources
- Technical support
- Age and gender of learners
- Motivation (teacher preparation and students) on how to use online mode
- Previous success on online learning
- Engagement in online activities
- Interaction
- Bad or non-existent advising
- Attitude towards computers ( Phobias)
- Training for capability building
- Infrastructure-(telecommunications, electricity etc.)
- Learning styles of students, and
- Online literacy (Eva Martinez-Caro, 2009)

The identified factors also tend to determine the blending of online learning as there can be no 'one size fits all solution' in online provision. Each institution will have to weigh its capability so as to strike an adequate balance regarding a blending configuration that best fits its needs. Furthermore, some key success factors regarding online learning provision have also been identified as follows:

**Institutional support** – addresses technological infrastructure issues, a technology plan, and professional incentives for faculty.

**Course Development** – this category involves benchmarks for the development of courseware which is produced largely either by individual faculty (or groups of faculty members) on campus, subject experts in organizations and/or commercial enterprises.

**Teaching/Learning Process** – this category addresses the array of activities related to pedagogy, the art of teaching. Included in this category are process benchmarks involving interactivity, collaboration, and modular learning.

**Course Structure** – addresses those policies and procedures that support and relate to the teaching/learning process. They include course objectives, availability of library resources, types of material provided to students, response time to students, and student expectations.

**Student Support** – this category includes the array of student services normally found on a college campus including admissions, financial aid, etc. as well as student training and assistance while using the Internet.

**Faculty Support** – address activities that assist faculty in teaching online, including policies for faculty transition help as well as continuing assistance throughout the teaching period.

**Evaluation Assessment** – this category relate to policies and procedures that address how, or if, the institution evaluates Internet-based distance learning. Masoumi D. (n. d.)

## 4 Getting the Blending Right

Creating a blended learning strategy is viewed as an evolutionary process. One needs to explore the *capabilities of the team*, the *organization's infrastructure*, and *learners' receptiveness to the new learning formats*. For many, the first stage in their blended learning program initiative is to supplement their current programs, either traditional classroom or self-paced content libraries, with live eLearning activities (*coaching*, *virtual classrooms* or workshops) to extend the learning process and better integrate it with the work environment (Lily Wong and Arthur Tatnall, 2010). There are critical factors that have some bearing on blending configurations that institutions have adopted. These range from *staff/students awareness levels* to the capacity of the institution in terms of *available resources*. Some institutions will have acquired higher *readiness levels* and would therefore aspire to have a blending that is biased in favor of technology while some will have less readiness levels in technology applications and will infuse/integrate less technological applications. *Motivation of students and staff* regarding the use of technology is also another factor and the time taken by teachers to organize materials online.

*Availability of resources* has some bearing on online provision. Given that institutions have varying levels of provision of resources. Furthermore, some resources are restricted as laboratories close early while other institutions have open access and unrestricted access to resources and therefore have the potential of integrating more technologies that promote eLearning at an accelerated rate and leading to some rich blending. *Technical and pedagogical support* is also critical as

some institutions provide eLearning centres that not only train staff and students, but also assist with instructional design, graphics and other online aspects critical in blended learning. There is need for both *technical and pedagogical* support in eLearning infusion. This could provide the required *capacity building* in the eLearning initiatives of institutions of higher learning.

The *pedagogical* aspect in the implementation of online learning is a critical attribute. Every learning tool has its own modalities and users (students and staff) therefore require training on how to use it in the most effective way. Some *areas of specialization* (e. g. Math and Science) have the reputation of promoting aspects of online learning while some areas lag behind, and yet technology could be integrated in all areas. Some *instructional technologies* are commonly used in eLearning while others have not been used significantly for learning purposes despite their being available (e. g. mobile telephone). Both *asynchronous and synchronous technologies* are used in eLearning together with other convergence technologies depending on how they suit the institution. *Copyright/plagiarism and intellectual property* issues have become critical when planning online learning delivery. Online courses also require *accreditation* to make them authentic given the prevalence of *fraudulent tendencies* practiced by some online institutions.

The critical question for institutions of higher learning to ask is; to what extent can online learning replace classroom teaching (face-to-face)? Blended learning has become the popular mode given that online learning has not yet developed to the extent of replacing face-to-face delivery mode in recent years. Blended learning is viewed as learning that is facilitated by the effective combination of different modes of delivery, models of teaching and styles of learning, and is based on transparent communication amongst all parties involved with a course. The potential of blended learning is almost limitless and represent a naturally evolving process from traditional forms of learning to a personalised and focused development path.

Some professionals merely upload materials onto available online management systems without examining what to put online and how to use it to enhance learning. There is also need for strategic eLearning policies that would guide implementation of effective online practices. One of the most important factors in creating blended learning is to find out where it fits in the broader context of organisational learning and development. The interplay of these factors in institutions of higher learning will determine the appropriate mix of blended learning as there is no one size fits all situation.

## 5 Challenges in Online Learning

Several challenges tend to exist regarding the implementation of eLearning provision at the tertiary level within the African setting. Some of these challenges are as follows:

- Technophobia - attitude towards computers (lecturers and students)
- Computer literacy level for users
- Access to resources
- Cultural changes

- Skills and expertise for technical support
- Cost of proprietary learning management systems
- Policies issues, (institutional and pedagogical)
- Copyright
- Plagiarism
- Intellectual property
- Data security
- Quality control and assurance issues
- Access to connectivity
- Discomfort with self-directed learning activities, and
- Accreditation of programmes (Stephen Asunka and Hui Soo Chae, 2009)

## 6 Conclusion

The paper has *firstly* outlined the *characteristic features* of online learning in the context of tertiary institutions in developing countries with some focus on the African context. *Secondly*, it discusses *several factors* that would determine the level and success of online learning provision and *lastly*, the resulting *blended learning trends* regarding online provision within tertiary institutions in the African setting. Several challenges have also been associated with the implementation of online learning provision at the tertiary level. It can be concluded that creating a blended learning strategy in online learning provision at the tertiary level in Africa and other developing countries is an evolutionary process, and that there is no ‘*one size fits all solution*’.

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