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Sustained Technical Support: Issue and Prospects for E-Learning in HEIs

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Abstract

e-Learning tools in HEIs are sophisticated therefore demand technical expertise for their effective use. The university constituents (teachers, students and administrators) are given e-training but this is not enough. Every e-learning system establishes a basic 'infrastructure' of computers, networks, communications and a technical department filled with ICT professionals to consistently maintain and upgrade the infrastructure, train the users and continuously provide technical support as and when required by them. Given the non-stop nature of technical support for e-learning, HEIs are facing issues in creating robust infrastructural facilities that are both competitive with the external environment and compatible with the internal user requirements. This article is a compendium of the touchy aspects in sustained technical support for e-learning in HEIs.

Keywords: ICTs, educational technologies, e-teaching, e-pedagogy, e-learning, e-Education, higher education institution

Abstrak

Kepakaran teknikal adalah amat diperlukan untuk memastikan keberkesanan penggunaan peralatan pembelajaran elektronik yang canggih di institusi pengajian tinggi. Walaupun kakitangan di universiti yang merangkumi pensyarah, guru, pelajar dan pentadbir diberi latihan yang berkaitan, tetapi ia tidak mencukupi. Setiap sistem pembelajaran elektronik memerlukan prasarana asas seperti komputer, jaringan, komunikasi dan bahagian teknikal yang dianggotai tenaga profesional teknologi dan komunikasi maklumat yang sentiasa perlu menjaga dan memperbaiki prasarana tersebut di samping melatih para pengguna dan menyediakan segala bentuk sokongan teknikal bila diperlukan. Memandangkan pentingnya sokongan teknikal tanpa henti terhadap pembelajaran elektronik, institusi pengajian tinggi menghadapi isu dalam membentuk kemudahan prasarana yang teguh dan mampu bersaing dengan persekitaran luar tetapi tetap sesuai dengan keperluan pengguna dalaman. Artikel ini menonjolkan isu tersebut berkaitan

sokongan teknikal yang mampan untuk pembelajaran elektronik di institusi-institusi pengajian tinggi.

Kata kunci: ICTs, teknologi pendidikan, e-pengajaran, e-pedagogi, e-pembelajaran, e-pendidikan, institusi pengajian tinggi

Introduction

Given the global availability of educational technologies, researchers are reporting that instructional technologies have staged a platform of opportunities for all the Higher Education Institutions (HEIs) in the world (Tinio, 2002) and these are more profitable for the developing countries in terms of solving their long standing education issues along with other economic and political problems. For example, online education facilities are helping the developing nations to solve their problems of accessing masses for execution, which has not been possible through providing physical education facilities at that large scale (Hvorecký et al., 2005). Similarly, ICTs are helping less advanced countries to reduce their sense of isolation in the world by connecting the world community online through internet facilities to learn, enjoy and do business and politics (Sife et al., 2007).

The success of the e-learning projects is "often dependent on the skills and quality of technical support provided to end-users (Gray et al., 2003)." Without proper technology support and maintenance of even the most current and sophisticated hardware and software, the ability of teachers and students to access and use technology is severely compromised (Valdez et al., 2004). Furthermore, there is communication and knowledge-gap between developers and users in adopting the new systems (Nawaz et al., 2007). In a study of four institutions, the successful development of online programs was attributed to providing adequate levels of pedagogical guidance and technical support. Though institutional variations exist, defining technical support is a rather straightforward proposition (Phillips et al., 2008).

The need for assistance and support in using technology is most important in the beginning of studies therefore, it is important to create an environment which helps students to "learn how to learn" effectively (Sirkemaa, 2001). However, educational technologies do not start working

just as they are purchased and possessed by the users or organisations. They have to be harnessed and tamed (Stephenson, 2006) in accordance with the requirements of the user and environment where they are supposed to work. There is along array of such technologies and all are not good for every institution rather there needs to be a rational choice of relevant hardware, software and networking facilities (Nyvang, 2006).

Furthermore, there is the problem of 'leading-edge-syndrome' around the world (Tinio, 2002). It refers to the selection of cutting-edge technologies for e-learning projects. Although research suggests again and again that 'tested technologies' are better than the new and untested options, most of the institutions are opting for latest technologies, which are not only sophisticated, complicated but also expensive. The research suggests that most of the time these 'leading-edge technologies turn into bleeding-edge technologies because of over costs, problems of learning and issues of their integration with the existing traditional systems effectively (Ezziane, 2007). However, this is a big problem for the developed states and not the developing countries.

In the developing states, educational technologies are not the problem in themselves rather their availability and then their taming for the individual and organisational requirements is challenge for both the developers and users. The biggest technological issue for the countries like Pakistan is the creation of country wide digital infrastructure, facilities and services at every HEI level (ADB, 2005; Hameed, 2007). At the institutional level, the widely reported technological problems relate to the existence and support of technical unit in the institute. Users need continuous and timely help from the technical department, which is reportedly mostly unavailable (Moolman & Blignaut, 2008). Thus the dependence on the technical department and staff is a big issue for the e-learning users.

Educational Technologies in HEIs

As a major consumer of software applications and web services, educators should join this movement by taking a stronger interest in learning about the usability of the technology they purchase (Buzhardt & Heitzman-Powell, 2005). High-quality IT literacy teaching requires the administration to provide support for faculty by adequately funding the staffing of IT services personnel to levels that can accommodate the

demands placed upon them (Ezziane, 2007). Information Technology is currently being used effectively in management education for information access and delivery in libraries, research and development, as a communication medium, and for teaching and learning. Increased access to and use of the Internet is making a unique contribution to the teaching and learning process and will be an important part of future strategies to provide services to increased number of students in very diverse locations (Mehra & Mital, 2007).

At the broader level, an e-learning solution for any HEI consists of three elements: Content, Technology and Services (Dinevski & Kokol, 2005).

1. **Content**: In the e-learning environment, the new forms of educational content (radio programs, Web-based courses, interactive multimedia on CDs or DVDs, etc.) are developed, existing contents are adapted and print-based content are converted into digital media (Tinio, 2002). Beside the classroom and published content the generic e-learning education and learning content (courses, events, resources, mentoring, etc.) is gaining momentum in the e-learning solutions. The trend of the learning content development is its interactivity and to serve the learners with different background knowledge (Dinevski & Kokol, 2005). In the e-learning environments, learning-contents are delivered via internet, intranet, extranet; satellite TV, and CDs, using web-based learning, virtual classrooms and digital collaboration (Manochehr, 2007).

2. **Technology**: Technology comprises the: 1 Infrastructure (Internet, Intranet or hybrid delivery platforms), facilities for offline and remote access, user interfaces and personalisation and customisation capabilities; 2 Learning content management systems (LCMS) (management of learning offerings - options for delivery, tracking, management and reporting of online content); 3 Learning management systems (LMS) (capabilities for skills dictionaries, competency definition and mapping, performance management, employee development plans, financial and activity tracking/ reporting, integration with other systems); 4 Learning technologies (mentoring, chatting and discussion forums, Web seminars, online meeting and classroom sessions (Pfeffer, 2004; Dinevski & Kokol, 2005; Dalsgaard, 2006; Barnes et al., 2007).

3. **Services**: Services include:

    a. Consulting (Strategy and design of the e-learning program);

    b. Support (assistance with implementation of the e-learning program (launch, marketing and promotion, technology platforms and infrastructure, management feedback and reporting, technical and implementation support);

    c. Design and build services (build of custom content for the specific education, transfer existing materials to online format, tailoring and customisation of the e-learning platform and delivery environment, and integration with other applications (Dinevski & Kokol, 2005).

Technical Support for e-Learning in HEIs

Technical support is essential both for the teachers and students (Sirkemaa, 2001). For teachers, technical support is needed to ensure that teacher has the resources and skills necessary for technology-integration into the class practices. For students, technical support helps in the acquisition of knowledge and skills necessary to fulfill their unique curriculum requirements (Valdez et al., 2004). Technical support includes "installation, operation, maintenance, network administration and security (Sife et al., 2007)." The ICT support covers resolving hardware problems, implementing software installations and helping users in common applications of ICTs in e-teaching, e-learning and e-education (Mokhtar et al., 2007).

Technological sustainability involves choosing technology that will be effective over the long term (Tinio, 2002). Gray et al. (2003) report, after studying a group of universities running successful e-learning projects that "the success of the project was often dependent on the skills and quality of technical support provided to end-users." Similarly, researchers suggest that the university constituents "need to get technical and human resource support for continuous technology integration after the training (Zhao & Bryant, 2006)". This support includes the technical-infrastructure manned with technical talent such as network managers, web administrators,

security specialists etc., but universities are facing challenges in preparing IT-workers for new digital environments (Ezziane, 2007).

Despite help from the IT centre most problems need to be solved at teachers or students level. Interestingly, student survival in the digital age seems to depend on how well one knows people who can help with different problems (Sirkemaa, 2001). Because, support to e-learning does not simply refer to bridging the hardware-divide rather the access to infrastructure and services should help users in getting knowledge, skills, and consistent support of organisational structures to achieve broader social and community objectives (Macleod, 2005; Ågerfalk et al., 2006). Technical support is an important part of the implementation and integration of ICT in education however; often technical support is not available requiring the teachers and students to command some basic troubleshooting skills to overcome technical problems when using ICTs (Sife et al., 2007).

Infrastructure and Facilities

A strategic plan for educational technology includes the technological infrastructure and the roadmap according to which new technologies will be adopted in the teaching and learning practices (Stockley, 2004). For this purpose, it is necessary to establish an infrastructure, which is reliable and loaded with interoperable repositories, publishing support services and quality control mechanisms (Pfeffer, 2004). Likewise, there is need to invest significantly in the central support like helpdesk, training, documentation, registration, authentication etc. (Valcke, 2004). Because high-quality digital literacy requires the HEIs to provide support to the faculty by adequately funding the IT department and professionals so that they can accommodate the demands placed upon them (Ezziane, 2007) thereby showing e-maturity in using ICT tools and techniques (Moolman & Blignaut, 2008).

In the digital age technology is changing fast. The result is that compatibility and flexibility to adapt to different devices and platforms are important issues in infrastructure (Sirkemaa, 2001) because reliability of equipment means that technical support staff can spend less time on maintenance and much more time for training teachers and students in the use of software (Lewis & Goodison, 2004). Furthermore, the adoption and maintenance of educational technologies is also expensive. The capital

cost of the entire infrastructure needed to initiate the process is quite obvious. A little less obvious is the high level of recurrent costs associated with the effective use of ICT (Ezziane, 2007).

ICT Division and Professional Staff

Whether provided by inside technical staff or external service providers, or both, technical support specialists are essential to the continued viability of ICT use in a given school. General competencies that are required for e-learning technical experts are installation, operation, and maintenance of technical equipment (including software), network administration, and network security. Without on-site technical support, much time and money may be lost due to technical breakdowns (Tinio, 2002). The success of an e-learning project is often dependent on the skills and quality of technical support provided to end-users (Gray et al., 2003) by "IT division (Juniu, 2005)." In the universities, e-learning environment requires technical staff like network managers, web administrators, e-commerce developers, and security specialists. The number of graduates in computer science and information systems is inadequate to meet worldwide demand of professionals (Ezziane, 2007).

Technical staff would assist lecturers in preparing material, and they would also maintain and develop the system. They are also responsible for the high-level architecture of the environment (Sirkemaa, 2001). The effectiveness of technology support staff is measured by the degree to which end-users detect their presence. In other words, when systems and resources operate seamlessly, users tend to take the staff supporting their technology use for granted. In many cases, the only interaction users have with such staff occurs at times when technology gives problems (Valdez et al., 2004). The current teaching force needs to be better supported through provision of technology integration specialists who can support classroom technology integration via mentoring and/or team teaching (Zhao & Bryant, 2006).

Issues for HEIs

Getting computers into the classroom is relatively easy but keeping them working is a greater challenge (Hawkins, 2002) because developing and implementing a strategic plan that includes educational technology is often a difficult and complex process (Stockley, 2004). HEIs are also very

preoccupied with the rate of technological change and its increasing cost over time (Sasseville, 2004). In most of the developing countries there insufficient technical support and services (Mokhtar et al., 2007) with very few technical experts (Sife et al., 2007). Across the literature, certain issues surface over and over in all the surveys of HEIs in developed and developing countries such as, changing technologies, leading-edge syndrome, professional-user communication and users' digital literacy (Hawkins, 2002; Klonoski, 2005; Mokhtar et al., 2007). An information system is not just built and thereafter operates without any interruption rather research has unfolded several technology-centric attitudes, human problems, cultural conflicts, and political maneuvering in the success and failure of an information system (Nawaz et al., 2007).

Changing Technologies

In the digital age technology is changing fast therefore compatibility and flexibility to adapt to different devices and platforms are important issues in infrastructure (Sirkemaa, 2001). Given the rapid changes in ICTs, this becomes indispensable for professionals to fight the "threat of technological obsolescence (Tinio, 2002)." Likewise, in a developing country, a list of problems (relating to electrical spikes, viruses, dust, heat, and normal wear-and-tear) can bring "the computer lab to a screeching halt (Hawkins, 2002)." Having said that, in developing countries HEIs have to be in the forefront of ensuring ICT revolution, but they are unable and ill-prepared to play such a leadership role because of having poorly developed infrastructure (Sife et al., 2007). A system needs to be capable of being changed throughout its life (Nawaz et al., 2007).

Leading-Edge Syndrome

Furthermore, while developing and/or updating, most of the HEIs opt for cutting-edge technologies however, experience shows that mostly these 'leading-edge technologies turn into bleeding-edge technologies' by eating up budgets and delivering nothing special. Therefore researchers suggest that "go with tried and tested systems (Tinio, 2002)." At the same time latest digital options are expensive while, "the time is right for collaborative action because the time is wrong for any approach other than cost-sensitive, resource-smart deployments (Klonoski, 2005)." An effective technical support also means that users are not only trained in using technologies but continuously updated about the user and possibilities created by these gadgets (Kopyc, 2007).

Users' Digital-Literacy

The demand for a universal computer-literacy stems from the ways in which ICTs are dominating different aspects of the contemporary life and work (Oliver, 2002). The advocates of social inclusion through ICTs propose a focus on electronic literacy as a key to overcoming the digital divide (Macleod, 2005). Different groups of people: students, teachers, and employers–have different ideas about what computer literacy means. During the last 25 years, several models and approaches of computer and information literacy have started to merge (Ezziane, 2007). Now, digital literacy skills are considered necessary for effective and mindful learning in the emerging digital environments (Aviram & Eshet-Alkalai, 2006). People acquire their technology literacy in two ways: formally through school programs or in the workplace, and informally, whether at home, from friends, or by themselves (Ezziane, 2007).

The implementation of ICT can also be interpreted as redesign of an infrastructure with significant impact on both the work of the individual teacher and his or her surroundings (Nyvang, 2003). The emergence of Web services technologies enhances the possibility of bringing divergent participants together; these technologies make the ad-hoc integration of data and computer applications invisible to users so that they can enjoy a more user-specific experience (LaCour, 2005). In this environment and in order to perform new teaching functions, the teachers' "e-training" should focus on the development of specific abilities and skills: 1 Professional: knowing the material, the contents, activities, didactic methods and teaching plan, etc; 2 Technical: although it is not necessary for them to be as expert as the support personnel, they should have basic skills which allow them to carry out their function appropriately, etc; and 3 Personal: interacting, giving feedback, receptive capacity, initiative, creativity, empathy etc. (Blázquez & Díaz, 2006).

Prospects

Without proper support and maintenance of even the most current and sophisticated hardware and software, the ability of teachers and students to access and use technology is severely compromised (Valdez et al., 2004). The degree of dependence on technical support is defined and determined by the degree of users' digital literacy. Research shows that pragmatically,

there is too much dependence of e-learning users on the support and services of technical help-desk and which is sometimes frustrating for the teachers and students therefore the issue has to be resolved both at the users IT department/professional levels. "University constituents: teachers, students and staff (Juniu, 2005)" or "campus constituents (Carey & Gleason, 2006)" have to be trained again and again to become self-sufficient in handling the digital devices. Furthermore, if technical section and professionals are well-prepared, there will be least complaints from users and thus, reduced calls for help. If the infrastructures are skillfully maintained, the problems are less likely to occur. However, given the issues of user-training and weaknesses in infrastructure, technical department services and professionals, dependence of users on developers is proving a big issue.

THE ISSUES OF SUSTAINED TECHNICAL SUPPORT FOR e-LEARNING IN HEIs

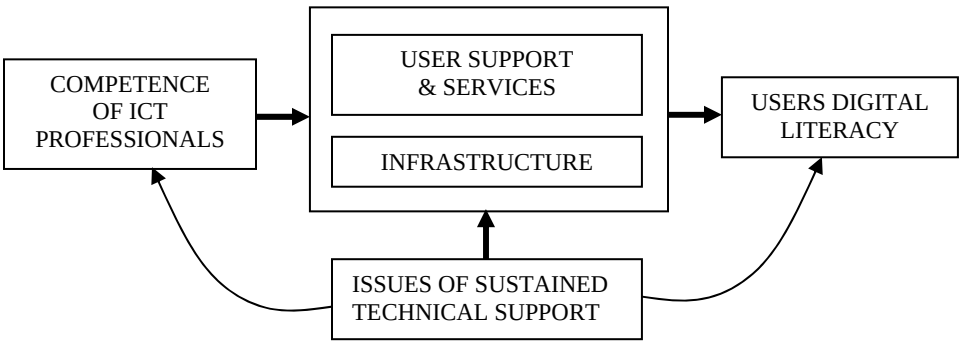

Figure 5.1 Technical Support & Issues of e-learning in HEIs

Furthermore, although the prices of computers are falling and the developing countries are finding a variety of technologies with low budgets however, new and advanced technologies and their availability in abundance requires a lot of finances. At the same time, governments are reducing the funding of public universities therefore affording an expensive e-learning infrastructure is becoming an uphill task for the HEIs

in public sector. To resolve this issue, Carey and Gleason (2006) argue that since it is not possible for the individual universities to duplicate leading edge technologies at every institute level, therefore, universities are relying on third-party solutions to meet student demands more economically and on a level that cannot be duplicated by an individual institution. Thus, outsourcing is the collaboration with the outsiders who are specialised in a particular e-learning technology or service, for example:

1. **Applications**: HEIs have to control costs, reduce the burden on their technical staff, and improve services. Enterprise resource planning (ERP) and campus management systems (CMS) applications and more importantly, the existence of free and open source systems (FOSS), an open architecture can enable partial outsourcing of the application-base, and HEIs will easily be able to switch from one third-party service provider to another if they are dissatisfied with the services.

2. **Integration-services**: A big issue for HEIs in adopting e-learning solutions is the integration or interfaces of a multitude of software applications. This integration layer can be outsourced to a third-party service provider. The interfaces within and outside the institutions must conform to the higher education industry standards for messaging, security and privacy.

3. **Outsourcing the processing layer**: Every HEI generally performs the same administrative functions and similar processes to support those functions. This work can be outsourced easily and cheaply to an agency that performs the same tasks for multiple institutions.

Effective technology support is concerned with planning, development, and maintenance of technology systems and resources; providing immediate support for the use of those systems on an as-needed basis; and enhancing teacher and student competency in technology integration through long-term development courses and programs (Valdez et al., 2004). So far most of the HEIs in developing countries have basic ICT infrastructure such as Local Area Network (LAN), internet, computers, video, audio, CDs and DVDs, and mobile technology facilities that form

the basis for the establishment of e-learning (Sife et al., 2007). Normally it is expected that as the institute builds up its infrastructure over the years and the faculty gains experience the pedagogy followed shifts from pure lecture method to instructional technology (Mehra & Mital, 2007).

There is also great uncertainty among decision-makers and managers as well as among developers, trainers and learners: instructors find themselves confronted with a new role in which they are tutors and facilitators for learning processes (Ehlers, 2005). Technology training alone cannot necessarily ensure that these teachers would infuse technology into their routine instruction and a radical change in their instructional practices would occur. However, they need to get technical and human resource support for continuous technology integration after the training (Zhao & Bryant, 2006). Given the premise that IS development is a learning process, it requires an open environment wherein all the participants have the opportunity to make sense of the new technological work environment (Nawaz et al., 2007).

Conclusions

The research shows that ICT professionals in universities have no knowledge of what is common practice elsewhere (Gray et al., 2003) and most of the university administrators and information technology departments provide services to the classroom in isolation from the educators (Juniu, 2005). Similarly, developers rarely report errors to the users apprehending that it may emphasise the shortcomings of their products (Buzhardt & Heitzman-Powell, 2005). The weaknesses in communication between developers and users can run into many problems like confusions, misunderstandings and conflicts leading the projects towards information system failure (Nawaz et al., 2007).

Although the digital era has bridged some of the digital divide but it has also created unequal distribution and access to technological knowledge. For example, one of the key problems that higher education faces today is that the use of sophisticated technologies brings the need to rely on IT department technological expertise, an uneven relationship (Juniu, 2005). Researchers are identifying problems “such as user dissatisfaction with newly introduced systems, mismatches between a new technology and the existing work practices, underestimating the technological complexity for

employees, and inefficient end-user support (Bondarouk, 2006)." Furthermore, ICT has penetrated education, but its more impact is on administrative services like admissions, registration, fee payment, purchasing rather than on the pedagogy in the classroom (Dalsgaard, 2006). Thus, there needs to be a level of "e-readiness" to go for "e-maturity" of HEIs, which is the ability to utilise ICTs (Moolman & Blignaut, 2008).

Without proper support and maintenance of even the most current and sophisticated hardware and software, the ability of teachers and students to access and use technology is severely compromised (Valdez et al., 2004). The IT division would contribute technical support and knowledge of new applications according to theories and strategies established by the pedagogues. Such a process of communication between teachers and the technical staff will help providing sustainable technical support for e-pedagogy, e-learning and digital education administration in the information society (Juniu, 2005) because learning cannot be managed rather facilitated by technologies (Dalsgaard, 2006).

Although success of e-learning in HEIs depends on the human element rather than technological sophistication (Sirkemaa, 2001) however, there is need for the existence of a supportive and responsive technical and/or teaching and learning unit, which is able to respond to the needs of individual staff (Lewis & Goodison, 2004). All the successful e-learning projects are reported to have "organisational support provided through allocation of resources and symbolic support reflected in an institution's systems, policies and processes (Lynch et al., 2005)." Furthermore, "because system start-up costs and scalability issues weigh heavily on system sustainability, we needed to design a technology-based model within the context of the existing support and resource infrastructures (Tran et al., 2005)."

Furthermore, the implementation of ICT is not just about the individual teacher but about an organisation that affects and is affected by the process (Nyvang, 2003). Therefore, when designing and implementing learning software, software developers have to look beyond the paradigms of their own discipline through an interdisciplinary exchange with teachers, authors and learners (Ehlers, 2005). Similarly, research suggests that for a successful e-project of e-learning, people are the most important asset

thus project managers must possess soft skills such as, communication, conflict resolution, motivation, getting along with others, and leadership (Jewels & Ford, 2006). For example, despite the availability of the technical infrastructure, support staff, and training facilities, there is low use of technology, which suggests that there are peculiarities to the academic digital divide that need to be identified before it can be dismantled (Kopyc, 2007).

References

ADB 2005. Sector assistance program evaluation for the social sectors in Pakistan SAP: PAK 2005–2008 (July). Operations evaluation department. Asian development bank. http://www.adb.org/Evaluation/methods.asp. (accessed 11 May 2007).

Ågerfalk, P. J., Goldkuhl, G., Fitzgerald, B. and Bannon, L. 2006. Reflecting on action in language, organisations and information systems. *European Journal of Information Systems* 15: 4–8. http://www.palgrave-journals.com/ejis/. (accessed 11 May 2007).

Aviram, A. and Eshet-Alkalai, Y. 2006. Towards a theory of digital literacy: Three scenarios for the next steps. *European Journal of Open, Distance and e-Learning*, http://www.eurodl.org/. (accessed 11 May 2007).

Barnes, K., Marateo, R. C. and Ferris, S. P. (2007). Teaching and learning with the net generation. *Innovate Journal of Online Education* 3(4). http://Innovateonline.info. (accessed 10 April 2007).

Blázquez, F. E. and Díaz, L. A. 2006. A training proposal for e-learning teachers. *European Journal of Open, Distance and e-Learning*. http://www.eurodl.org/. (accessed 10 April 2007) .

Bondarouk, T. V. 2006. Action-oriented group learning in the implementation of information technologies: results from three case studies. *European Journal of Information Systems* 15: 42–53. http://www.palgrave-journals.com/ejis/. (accessed 10 April 2007).

Buzhardt, J. and Heitzman-Powell, L. 2005. Stop blaming the teachers: The role of usability testing in bridging the gap between educators and technology. *Electronic Journal for the Integration of Technology in Education* 4: 13. http://ejite.isu.edu/Volume3No1/. (accessed 10 April 2007).

Carey, P. and Gleason, B. 2006. Vision 2010: The future of higher education business and learning applications. *Innovate Journal of Online Education* 3(1). Oct/Nov. http://Innovateonline.info. (accessed 10 April 2007).

Dalsgaard, C. 2006. Social software: E-learning beyond learning management systems. European Journal of Open, Distance and e-Learning. http://www.eurodl.org/. (accessed 10 April 2007).

Dinevski, D. and Kokol, D. P. 2005. ICT and lifelong learning. *European Journal of Open, Distance and E-Learning*. http://www.eurodl.org/ (accessed 10 April 2007).

Ehlers, U. 2005. Quality in e-learning from a learner's perspective. *European Journal of Open, Distance and E-Learning*. http://www.eurodl.org/. (accessed 10 April 2007).

Ezziane, Z. 2007. Information technology literacy: Implications on teaching and learning. *Journal of Educational Technology and Society* 10(3): 175–191. http://www.ask4research.info/. (accessed 10 April 2007).

Gray, D. E., Ryan, M. and Coulon, A. 2003. The training of teachers and trainers: Innovative practices, skills and competencies in the use of e-learning. *European Journal of Open, Distance and E-Learning*. http://www.eurodl.org/. (accessed 10 April 2007).

Hameed, T. 2007. ICT as an enabler of socio-economic development. http://www.itu.int/osg/spu/digitalbridges/materials/hameed-paper.pdf. (accessed 24 June 2007).

Hawkins, R. J. 2002. Ten Lessons for ICT and Education in the Developing World. http://www.cid.harvard.edu/cr/pdf/gitrr2002_ch04.pdf. (accessed 14 July 2007).

Hvorecký, J., Manažmentu, V. S. and Cesta, P. 2005. Can e-learning break the digital divide? *European Journal of Open, Distance and e-Learning*. http://www.eurodl.org/. (accessed 10 April 2007).

Jewels, T. and Ford, M. 2006. The development of a taxonomy of desired personal qualities for it project team members and it's use in an educational setting. *Journal of Information Technology Education* 5. http://jite.org/documents/Vol5/. (accessed 14 July 2007).

Juniu, S. 2005. Digital democracy in higher education bridging the digital divide. *Innovate Journal of Online Education* 2(1), October/November. http://Innovateonline.info. (accessed 10 April 2007).

Klonoski, E. 2005. Cost-saving collaboration: Purchasing and deploying a statewide learning management system. *Innovate Journal of Online Education* 1(4), April/May. http://Innovateonline.info. (accessed 10 April 2007).

Kopyc, S. 2007. Enhancing teaching with technology: Are we there yet? *Innovate Journal of Online Education*. December 2006/January 2007, *3*(2). http://Innovateonline.info. (accessed 10 April 2007).

LaCour, S. 2005. The future of integration, personalization, and ePortfolio technologies. *Innovate Journal of Online Education* 1(4), April/May. http://Innovateonline.info. (accessed 10 April 2007).

Lewis, D. and Goodison, R. 2004. Enhancing learning with information and communication technology (ICT) in higher education. Research Report RR533, Department for Education and Skills. © University of Wolverhampton 2004, ISBN 1 84478 225 5. http://www.dfes.gov.uk/research/data/uploadfiles/RR533.pdf. (accessed 14 July 2007).

Lynch, J., Sheard, J., Carbone, A. and Collins, F. 2005. Individual and organizational factors influencing academics' decisions to pursue the scholarship of teaching ICT. *Journal of Information Technology Education* 4. http://jite.org/documents/Vol4/. (accessed 14 July 2007)

Macleod, H. 2005. What role can educational multimedia play in narrowing the digital divide? *International Journal of Education and Development using ICT* 1(4). http://ijedict.dec.uwi.edu//. (accessed 11 May 2007).

Manochehr, N. 2007. The influence of learning styles on learners in e-learning environments: An empirical study. *Computers in higher education and economics review*, 18. http://www.economicsnetwork.ac.uk/cheer.htm. (accessed 10 April 2007).

Mehra, P. and Mital, M. 2007. Integrating technology into the teaching-learning transaction: Pedagogical and technological perceptions of management faculty. *International Journal of Education and Development using ICT* 3(1). http://ijedict.dec.uwi.edu//. (accessed 11 October 2007).

Mokhtar, S. A., Alias, R. A. and Abdul-Rahman, A. 2007. Academic computing at Malaysian colleges. *International Journal of Education and Development using ICT* 3(2). http://ijedict.dec.uwi.edu//. (accessed 11 May 2007).

Moolman, H. B. and Blignaut, S. 2008. Get set! e-Ready, … e-Learn! The e-readiness of warehouse workers. *Journal of Educationa. Technology and Society* 11(1): 168–182. http://www.ask4research.info/ (accessed 10 April 2007).

Nawaz, A., Kundi, G. M. and Shah, D. B. 2007. Metaphorical interpretations of information systems failure. *Peshawar University Teachers' Association Journal* 14: 15–26.

Nyvang, T. 2003. Implementation of ICT in higher education: A case study of teachers implementing ICT into their teaching practice. http://www.intermedia.uib.no/cscl/doc/files/Nyvang.pdf. (accessed 24 June 2007).

Nyvang, T. 2006. Implementation of ICT in higher education as interacting activity systems. http://www.networkedlearningconference.org.uk/abstracts/pdfs/P27%20Nyvang.pdf (accessed 24 June 2007).

Oliver, R. 2002. The role of ICT in higher education for the 21st century: ICT as a change agent for education. http://elrond.scam.ecu.edu.au/oliver/2002/he21.pdf. (accessed 14 April 2007).

Pfeffer, T. 2004. Open sources for higher education. Do information technologies change the definition of public and private goods? CHER 17th Annual Conference, Enschede, The Netherlands, 17–19 September 2004. http://www.iff.ac.at/hofo/pfeffer/2004_Pfeffer_open_sources_CHER.doc. (accessed 7 April 2007).

Phillips, P., Wells, J., Ice, P., Curtis, R. and Kennedy, R. 2008. A case study of the relationship between socio-epistemological teaching orientations and instructor perceptions of pedagogy in online environments. *Electronic Journal for the Integration of Technology in Education* 6: 3–27. http://ejite.isu.edu/Volume6No1/. (accessed 10 April 2007).

Sasseville, B. 2004. Integrating information and communication technology in the classroom: a comparative discourse analysis. *Canadian Journal of Learning and Technology* 30(2), Spring. http://www.cjlt.ca/. (accessed 14 May 2007).

Sife, A. S., Lwoga, E. T. and Sanga, C. 2007. New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International Journal of Education and Development using ICT* 3(1). http://ijedict.dec.uwi.edu//. (accessed 21 July 2007).

Sirkemaa, S. 2001. Information technology in developing a meta-learning environment. *European Journal of Open, Distance and e-Learning*. http://www.eurodl.org/. (accessed 10 April 2007).

Stephenson, R. 2006. Open Source/Open Course: Learning lessons for educators from free and Open Source Software. *Innovate Journal of Online Education* 3(1), Oct/Nov. http://Innovateonline.info. (accessed 10 April 2007).

Stockley, D. 2004. Strategic planning for technological innovation in canadian post secondary education. *Canadian Journal of Learning and Technology* 30(2), Spring. http://www.cjlt.ca/. (accessed 14 May 2007).

Tinio, V. L. 2002. ICT in education. Presented by UNDP for the benefit of participants to the World Summit on the Information Society. UNDP's regional project, the Asia-Pacific Development Information Program (APDIP), in association with the secretariat of the Association of Southeast Asian Nations (ASEAN). http://www.apdip.net/publications/iespprimers/eprimer-edu.pdf. (accessed 14 July 2007).

Tran, T., Baker, R. and Pensavalle, M. 2005. Designing e-Portfolios to Support Professional Teacher Preparation. *Innovate Journal of Online Education* 2(2), December 2005/January 2006. http://Innovateonline.info. (accessed 10 April 2007).

Valcke, M. 2004. ICT in higher education: An uncomfortable zone for institutes and their policies. In R. Atkinson, C. McBeath, D. Jonas-Dwyer & R. Phillips (Eds.), Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference (pp. 20–35). Perth, 5–8 December. http://www.ascilite.org.au/conferences/perth04/procs/valcke-keynote.html. (accessed 10 April 2007).

Valdez, G., Fulton, K., Glenn, A., Wimmer, N. A. and Blomeyer, R. 2004. Effective technology integration in teacher education: A comparative study of six programs. *Innovate Journal of Online Education* 1(1). http://Innovateonline.info. (accessed 10 April 2007).

Zhao, Y. and LeAnna Bryant, F. (2006). Can teacher technology integration training alone lead to high levels of technology integration? A qualitative look at teachers' technology integration after state mandated technology training. *Electronic Journal for the Integration of Technology in Education* 5: 53–62. http://ejite.isu.edu/Volume5No1/. (accessed 10 April 2007)