ICT for education – the way ahead, but how?

Iwona Kolodziejczyk

Abstract

The application of Information Communication Technology (ICT) in the educational context has been in place for decades. Despite acclaimed benefits, there seems to be an existing tension between the ideology of technological determinism, which believes that computerization of educational institutions will automatically revolutionized education offered there, and real impact of ICT on education and educational institutions. Inspired by Divine Word University (DWU) students participating in an ongoing PhD research, this paper discusses new emerging issues associated with ICT application in contemporary academia and calls for deep reflection on how to translate financial investments in technology into educational success. The importance of such debate lies in the fact that DWU might be considered to be the leading university in Papua New Guinea (PNG) in terms of using ICT. The lessons learnt here are of great importance for other educational institutions which will follow DWU in technological development.

Key words: Information communication technology, education, ICT integration into teaching-learning contexts, Computer Practice Framework

Introduction: Technology in educational contexts

Technological innovations have been used in educational contexts for more than 70 years. Saettler (1968) and Cuban (1985) have documented the progress from radio, motion pictures, and slides to television, programmed instruction and computers. Each of the new forms of evolving technology has been heralded as a major breakthrough with a potential for revolutionizing education; they have been promulgated as a replacement for textbooks, an extension of the classroom to the world, or a complement for some of the instructional functions (Ely & Plomp, 1986, p.268).

However none of the listed technological innovations of the past have inspired such an extended debate about the role and potential of technology for education as information communication technologies (ICT). This paper seeks to present both extremes of the discussion spectrum – from the ideology of technological determinism which believes that computerization of educational institutions will automatically revolutionize education offered there to the real impact of ICT on education and educational institutions.

This debate is followed by presentation of part of the data collected for a doctoral research study that aims to provide a gender profile of and application

of and attitudes toward ICT in higher education institutions in Papua New Guinea. The paper is concluded with conceptual framework for successful implementation of ICT in higher education context.

Technological determinism versus a reality check of ICT presence in education

In the global village of the 21st century, a global knowledge and information society is emerging. It seems that 'more new information has been produced within the last three decades than in the last five millennia' (Haddah & Draxler, 2003, p. 4). ICT plays a leading role in the changes that reshape our world and daily activities. It is said to be largely responsible for the emergence of 'post-industrial society' and for an 'information revolution'. An ideology of technological determinism claims that productivity gains and social transformation will be automatic results of computerization (Edwards, 1994, p. 13).

When applied to educational contexts, this theory declares ICT as a panacea for educational success. In fact, the literature provides evidence of a widespread belief that ICT can and will shape the ways that knowledge is produced and transmitted. Consequently, ICT related changes that emerge in the information society recommend quality higher education which prepares students to stay competitive in new knowledge-based markets. Studies reveal that trends in techno-economic change favour, in general, highly educated people (Arocena & Senker, 2003, p. 25).

Therefore, universities are exhorted to adapt to the new challenges in order to play their role in the knowledge economy and to provide students with a 'flair for enterprise' (Clegg, Hudson, & Steel, 2003, p. 41) as well as ICT and other skills.

Benefits of ICT for education

There is widespread agreement in the literature that ICT applied to education offers a huge potential to stimulate and realize the human capital inherent in students (Loxley & Julien, 2004, p. vi). Fostered by ICT, student-centred learning involves new forms of learning and teaching in which students deal with knowledge in more active and constructive ways, so the results are more transferable to situations outside the learning environment.

Bransford et al. (1999) categorize the use of educational technologies according to the way they can help improve education and learning (Bransford, 1999, as cited in Volman & Eck van, 2001, p. 614). Haddad and Jurich (2003) summarize the potential and potency of ICT in educational contexts. One of the important aspects is the potential the technology has to expand education beyond physical limits of schools and university campuses. This process includes integrating those who have been traditionally excluded from education

for cultural and social reasons (Haddah & Jurich, 2003, p. 30). Becta (2007) as cited in Earp et al. (2007) sums it up:

> ICT is both a medium and a powerful tool in supporting inclusive practice. It provides wide-ranging support communication, assisting many learners to engage with learning, including those who are hard to reach, and helps to break down some of the barriers that lead to under-achievement and educational exclusion (Becta, 2007, as cited in Earp, Ott, Possi, & Tavella, 2007, p. 92).

Other benefit of technology application in educational contexts, as pointed out by Hannah and Jurich (2003), is ICT's potential to foster revolutionary changes in the traditional educational paradigm. Hannah and Draxler (2003) see it as evolution of the new paradigm as presented in Table 1.

Table 1 Evolution of the new paradigm

From	To
A school building	A knowledge infrastructure (schools, labs, radio, television, Internet…)
Classrooms	Individual learners
A teacher (as provider of knowledge)	A teacher (as a tutor and facilitator)
A set of textbooks and some audiovisual aids	Multimedia materials (audio, video, digital…)

(Table adapted from Haddah & Draxler, 2003, p. 8)

In this new paradigm, ICT has the potential to bring the products of the best teachers to students anywhere in the world. There is evidence that use of ICT can foster learner autonomy for certain learners (Trucano, 2005, p. 7). For those who are self-motivated and self-disciplined, ICT can speed the path toward a degree and expand their learning options through self-study.

Finally, Hannah and Jurich discuss the ICT potential to intensify educational quality by 'increasing motivation, facilitating acquisition of basic skills, promoting inquiry and exploration, and preparing individuals for the technology-driven world' (Haddah & Jurich, 2003pp. 32-34).

Similar benefits of using technology for students learning enhancement are reported widely in the literature. Hug *et al.* (2005) point out that learning technology can help students to create multiple representations of their understanding; they can help students to conduct scientific investigations, and develop products. ICT applications provide simulations that make it possible to visualize complicated abstract concepts and relationships – such as force and movements in physics, complex mathematical functions and genetic concepts – and to actively manipulate processes in such areas of the curriculum (Volman & Eck van, 2001, p. 615). Some researchers conclude that using ICT to explore natural phenomena can potentially motivate students and make them more engaged in the learning process (Hug, Krajcik, & Marx, 2005, p. 449).

Despite presented optimistic theories about the progressive role of ICT in higher education, there seem to be growing scepticism about the potential of ICT to revolutionise education. This point of view is discussed in the next part of this paper.

Reality-rhetoric gap

Despite the fact that the advent of new technologies has been heralded as a major breakthrough with a potential for revolutionizing education, after decades of ICT being employed in educational contexts, there is not much evidence of revolutionary use of various communication and information technologies in education. Literature provides isolated and much publicized projects involving the application of ICT in learning-teaching processes (Potashnik, 1996; Condie & Livingston, 2007; Turney, Robinson, Lee, & Soutar, 2009).

However, the major educational innovation or movements which promise to bring about the desperately needed changes, are still to come (Ely & Plomp, 1986, p. 232). Cheol Oh (2003) argues that while there is tremendous potential of ICT for education, it can be sometimes overstated. The developments of the past couple of decades may not represent the revolution of methods and media that were expected (Oh, 2003, p. 138). Trend *et al.* (1999) described this mismatch between the aspirations one commonly hears for what ICT is going to do for education and what is achieved as a 'reality-rhetoric gap'(Trend et al., 1999, as cited in Twining, 2002, p. 103).

One of the leading characteristics of this rhetoric is that it bestows no importance on existing social conditions, assuming that equipping people with computers will suffice to leapfrog them into the technological world of opportunities (Alzouma, 2005, p. 339). With such rhetoric an assumption was created that problems related to the learning-teaching process could be solved in ways similar to other sectors of society where new technologies had intervened to help find solutions to problems of transportation, food production and family planning.

There seemed to be a role for technology in instructional improvement, however, that role was never clearly stated (Ely & Plomp, 1986, p. 239). In reality, many of the technical innovations in higher education fall within a category described as 'uncritical acceptance'. It embraces ideas of student centred learning as a component of the change in pedagogic practice that complements the move towards the new learning technologies. Lectures, seminars and tutorials, with their real time and labour intensive practices, are replaced by on-line learning which often merely mirrors simple information giving functions and is falsely associated with lectures, in the new environment. This kind of "technofix" type in technology is posited *a priori* as being the solution to flexibility and efficiency savings problems in education (Clegg, Hudson, & Steel, 2003, pp. 48-49).

Thinking up clever ways of using computers in traditional courses devolves technology to a supplemental role that fails to capitalize on its most potent strength (Strommen & Lincoln, 1992, p. 467). Often, potentially interactive technologies are used to present one-way lectures. A good example of such under-abuse of technology is the application of PowerPoint. The latest version of PowerPoint software is very multimedia capable. However, used as a lecture platform it remains a form of a passive learning. As Boylan (2004) summarizes:

> Sitting through a PowerPoint presentation is an act of passive learning in the same way that sitting in a lecture is passive. Another issue is that as instructors refine and embellish their slide shows with repeated use, the number of slides tends to grow, and the content on each slide may grow also. If an instructor goes beyond the ideal pace of presentation to cover more material, the learning value of the presentation drops as the economy of words diminishes.
>
> (Boylan, 2004, p. 413)

Data from doctoral research activities

The discussion in this paper has been inspired by part of the data which has been collected for an ongoing Doctor of Philosophy (PhD) project on gender related issues in information communication technology application in tertiary education institutions in Papua New Guinea. The study investigates the access to, use of and attitude toward computers and the Internet among female and male students and academic staff. The data was collected through Web-based and paper based questionnaires and interviews at six institutions of higher education in PNG.

The discussion will be guided by the answers collected through a survey questionnaire administered among students at Divine Word University (DWU) in Madang. DWU is one of six national universities in PNG and has 1200 fulltime undergraduates on its main campus. The importance of this analysis lies in the fact that DWU might be considered to be the leading university in the country in terms of using ICT in teaching and learning across the curriculum. The lessons learnt are of great importance for other educational institutions which will follow DWU in technological development.

Open question responses – obvious contradiction

The idea of this paper came to light when the author was recording collected data, especially data from the survey's open questions. An obvious contradiction became apparent as an intriguing phenomenon. On the one hand most of participants expressed their admiration for ICT, its importance in their life and enthusiasm to use it for educational enhancement. However, on the other hand, the recorded current practices seemed to challenge the expressed opinion.

Open questions asked – overview

The questionnaire administered to students contained a total of three open questions. The first one invited students to summarize their attitude toward computers. The second question sought students' opinion about the Internet. Finally, participants were requested to justify their choice of a paper based questionnaire rather than a Web-based questionnaire. This paper investigates answers to the first and the last of the open questions.

There was the total number of 275 (100%) students participating in this research; among them, 145 female students (53%), and 130 (47%) male students. Since the research seeks to investigate gender related issues in ICT application, the results were recorded separately from female and male participants. In this manner they will be presented in this paper.

Not all participants attempted all the open questions. The total number of attempts for each of the questions is reported in this paper. To better appreciate each piece of datum, additional information is provided about the authors of each of citations in brackets that follow a quote. The information consists of questionnaire number (#...), participant's age (…yrs), attended year of study (…st, year uni).

Female students' responses

There were 117 female students (81%) who expressed their favorable opinion about computers.

Two of the third year students stated:
> (The computer) *Speeds up work and assists in calculations* (#225, 21yrs, 3rd year uni).

> *I like to use the computer to do my assignments and make notes of presentations, because it's very clear and readable done using a computer. It's more professional. It's very easy and fun when you know how to use all the programs* (#258, 24yrs, 3rd year uni).

However, the same students when asked about choosing a paper-based questionnaire rather than a Web-based questionnaire, claimed:

> (A paper-based questionnaire) *It is easier to understand. Very logical and information is easier to put in place* (#225, 21yrs, 3rd year uni).

> *Because writing on a paper is faster than web-based. You think faster as you write* (#258, 24yrs, 3rd year uni).

When writing about their main activities on computers, 29 of the female participants (25%) admitted that their main focus stays on entertainment.

One of the first year students stated:

> *I use computer for doing academic work often; however, I keep my entertainment folder like games and music on in the background. Anyway, I use computer for entertainment in most cases* (#21, 20yrs, 1st year uni).

Another participating third year student stated:

> *I like being in front of a computer screen, it's never boring. There are always interesting things to do like checking out your email, surfing the Internet for the latest songs and their lyrics, typing out assignment* (#253, 21yrs, 3rd year uni).

Male students' responses

There were 116 (89%) male students who attempted the open questions and expressed their favourable opinion about computers. The following are some samples of theirs perspectives.

A third year student observed:

> *Computers are increasingly becoming the main mode of education and of fulfilling educational requirements. As such, they are vital for successfully completing one's studies* (#50, 20yrs, 3rd year uni).

Another student reflected:

> *Computers provide and save time for other work. Computers overall make life easier for work, assignments, research and other work* (#54, 25yrs, 3rd year uni).

However, similarly to female students, male students seemed to feel more comfortable with a paper based questionnaire in terms of understanding questions and expressing themselves. More than half of them expressed it clearly when justifying their choice of survey mode.

One of them claimed:

> (A paper-based questionnaire) *It's easier to read and comprehend* (#50, 20yrs, 3rd year uni).

Yet, another third year student commented:

> *It helps me write more clearly. Also provides more conveniently the time – to express clearly my thoughts than in a web-based questionnaire* (#54, 25yrs, 3rd year uni)

When describing their use of computers, 36% of male students admitted that they concentrated mainly on playing games and other entertainment activities.

A second year student acknowledged:

> *I see myself as a slave to computers mainly listening to music and playing games and using Photoshop* (#180, 22yrs, 2nd year uni).

Another second year student said:
> *I use the computer mainly to pass time or for leisure activities and it has become a hobby for me using computer everyday* (#139, 21yrs, 2nd year uni).

Yet another second year student described his attitude to computers in the following way:
> *Computers really make me weak to do my school work because of email and other thing distracting my studies* (#134, 22yrs, 2nd year uni).

To complete a picture that might be drawn from cited responses, it should be noted that none of 275 participating students at DWU chose the Web-based questionnaire though they had, at the time of data collection, free access to the Internet, and invitations to use this mode with a link to the Web-based questionnaire posted on student notice boards around the campus and an electronic notice board at least a week prior to commencing data collection with the paper-based questionnaire.

Discussion

Reflection on the contradictions described in the previous section, gives rise to two questions:

- Are we ready to engage technology in the teaching-learning processes at DWU, if every third student spends most of their time on using a computer for entertainment activities?

- Where is the key to successful ICT integration into university teaching-learning contexts?

Literature that discusses attitudes to and use of computers seems to share a notion that learning and working at a computer always involves a playful element that contributes to a strong fascination with computers particularly for young people (Wahler & Tully, 1991, p. 268). Presented earlier opinions shared by students participating in the study seem to 'fit in the trend' and the trend itself might justify students' extensive use of computers for entertainment activities. It would be too idealistic to expect that students will limit their use of computers to academic tasks only.

Students' choice of a paper-based questionnaire rather than a Web-based questionnaire and their justifications, though at first disappointing, seems to be in line with results of research studies done in other parts of the world. Dilon (1996) discusses a growing field of literature which challenges misconceptions attached to ICT usage in educational contexts. One of them is an assumption that electronic documents have the potential to limit the use of paper. Jonassen (1982) predicted that 'in a decade or so, the book as we know it will be as obsolete as is movable type today' (Jonassen, 1982, as cited in Dillon, 1996, p. 2).

However, after decades of using computers, research studies discussed by Dilon (1996) have proved that reading from screens is usually slower than from the paper (Gould et al., 1987), less accurate (Willkinson and Robishaw, 1987) and more fatiguing (Dillon, 1996, p. 2). Similar comments were provided by DWU students participating in my study.

With such a justification for paper use on the one hand, and the fact that a huge investment in ICT has been made (the current student:computer ratio at DWU is 3:1) on the other hand, the first question asked at the beginning of this section loses its validity and the focus should be placed on the second question. With technology being heavily employed, our task is now to find the best possible way to successfully implement ICT in the teaching-learning processes. It could be concluded, and literature offers an extensive support, that successful implementation of ICT into educational contexts requires deep reflection upon and participation of two major contributors of success in education.

First, the teacher is the ultimate key to educational change and successful blending of technology into education (Condie & Livingston, 2007, p. 343). The second is the focus on the pedagogy to ensure that the instructions are tied to the appropriate media prior to the implementation of technology to the learning environment (Turney, Robinson, Lee, & Soutar, 2009, p. 72). Thus, although inspired by students' reflections about their attitudes and use of ICT, I will focus further discussion on teachers and their new role in a technology oriented teaching-learning environment as well as present some successful pedagogical solutions.

New teachers for new technology-based learning

The ideology of technological determinism, which was mentioned in an earlier section, led in 1960 and 1980 to a belief that the use of technology would bring a major productivity boost. However, since the late 1980s there has begun a growing realization that heavy investment into ICT was not being translated into a profit; a phenomenon described as 'productivity paradox' in organizations. Agbonlahor (2006) following observations of Agarwal and Karahanna (2000) remarks:

> The value of any organization's investment in IT is realized only when information systems are utilized by their intended users in a manner that contributes to the strategic and operational goals of the organization.
>
> (Agbonlahor, 2006, p. 263)

Based on such an assumption, Agbonlahor (2006) draws a conclusion that a university's investment in ICT can only generate meaningful returns when technology is used by its users in manners that augment the university's major goals. Thus the successful integration of ICT into an academic setting is largely dependent not only on availability but most of all upon the extent to which major players of educational set-ups – faculty members and students – are willing to embrace these technologies (Sooknanan, Melkote, & Skinner, 2002,

p. 558; Agbonlahor, 2006). In the discussion about the role of ICT in contemporary academia, teachers remain the focus of the debate.

Literature identifies two ways in which technology and teachers are interacting. Some believe that computers should support current teaching practices. However, there is a growing consensus that ICT is redefining teachers' roles with a shift towards resource management and more independent learning by students (Twining, 2002, p. 96).

In a traditional teaching-learning paradigm, a teacher was seen as the sole giver of knowledge and a student as a passive recipient (Strommen & Lincoln, 1992, p. 469). In a new emerging role, a teacher is perceived more as a guide rather than a source of knowledge, as a facilitator who helps to organize and assist students throughout the whole learning process.

Technology, especially multimedia, has the potential to support this new role of a teacher as a coach and moderator and make the transition from broadcast learning to interactive learning (Pagliarello, 2007, 72). Some research studies done in the area suggest that this new role of a university teacher is an inevitable answer to the demand of a new 'digital generation' of students who are growing up surrounded by technology and who approach learning as 'plug-and-play' experience. They are able to learn through participation and experimentation; more, they demand interaction (Duderstadt, 2001, p. 60). Thus, tomorrow's faculty members need to be able to provide a collective learning experience, as described by Thompson (1999):

> The goal is to articulate a new, more fertile intra-mental understanding by both learners and teachers. Preparation of the 'online' material should permit both teacher and learner to reflect on the new material, discuss tentative understanding with others, actively search for more information to throw light on areas of interest of difficulty, and build conceptual connections.
>
> (Thompson, 1999, p. 7)

As mentioned earlier, the discussion about the new role of a teacher goes on concurrently with ICT application into education. However, there is extensive research done that shows teachers' reluctance to accept both the new technology and consequently the shift into the new role (Trucano, 2005; Agbonlahor, 2006; Condie & Livingston, 2007; Mogombo, 2007; Pagliarello, 2007).

Scholars point out to a number of factors that contribute to such an attitude, like 'a lack of confidence in the technical aspects of using ICT, a level of scepticism about the benefits of ICT use in their subject, reluctance to relinquish the role of expert transmitter of knowledge, or a lack of understanding of how to work with ICT to promote learning' (Condie & Livingston, 2007, p. 343).

One of the possible solutions to teachers' hesitation to willingly accept and incorporate ICT is appropriate and ongoing training. However, traditional one-time workshops that provide training in technical skills are not good enough. Those faculty members who want to face the challenges of the new academia of the 21st century do need professional development in the pedagogical application of technical skills. The investment into technology can not bring expected changes without an investment into human resources able to incorporate and fully utilize the potential that ICT brings into the educational context.

Technology for education – the way ahead, but how?

The question posed at the very beginning of this paper guided this discussion through the potential of ICT for educational change and the part technology plays in the emerging new role of a future teacher. Despite presented obstacles it is obvious that computer technology is a must for contemporary education.

The challenge ahead is how to creatively exploit and constructively interweave technology into an educational system. The literature provides some research-based recommendations for successful implementation of ICT. One of them is the Computer Practice Framework (CPF) explored and described by Twinning (2002). Originally designed in the context of primary schools, the CPF has been applied successfully in the context of higher education in the United Kingdom (UK).

The CPF consists of three core dimensions: quantity, focus and mode.
- *Quantity:* which is concerned with the proportion of the school day during which one or more computers are used by a student or with a student
- *Focus:* which deals with the objectives supported by the computer use. The focus dimension consists of three further subcategories:
    - IT: using computers in a way to develop students' IT skills, knowledge and understanding. The main emphasis is here on computer skills, learning how to operate hardware and how to use the software applications
    - Learning tool: the use of computers as *curriculum tools* (help students to develop skills, knowledge and understanding in other than an IT curriculum area), *mathematics tools* (tools to develop students' ability to learn and enhance their learning approaches), and *affective tools* (supporting affective aspects of students' learning, like developing their confidence and self-esteem).
    - Other: using computers in a way that is not covered by IT or Learning Tool. It may include practical aspects of the learning situation or the larger context in which the computer use is taking place.
- *Mode:* which concerns the impact that computer use has on the curriculum, its content and the processes.

With its three dimensions, the CPF provides a platform which on the one hand can enhance the planning process prior to investing in ICT use, and on the other hand has the potential to explore the impact that an investment in ICT has on practice. The author argues that 'being able to identify changes in educational practice, as a result of investments in ICT, is clearly vital in order to demonstrate that such investments are worthwhile (Twining, 2002, p. 107).

Due to limited scope of this paper, the intention was ~~is~~ not to explore fully the potential of the CPF but to stress the significance of a coherent framework for describing ICT application in education and to provide an example of such an existing successful practice.

Conclusion

The introduction of computer technology within educational contexts is not only inevitable; it is a reality. Some huge investments in technology have been made; more are going to happen with DWU administration planning to provide each student with a laptop in 2010. Such circumstances call for an urgent yet deep reflection on how to translate financial investments into educational success. It is hoped that this paper will provide a voice in the discussion and will inspire more debate about the use of ICT in higher education.

References

Agbonlahor, R.O. 2006. Motivation for use of information technology by university faculty: a developing country perspective. *Information Development, 22*(4).

Alzouma, G. 2005, Myths of digital technology in Africa: leapfrogging development? *Global Media and Communication, 1*(3), 339-356.

Arocena, R. & Senker, P. 2003, Technology, inequity, and underdevelopment: the case of Latin America, *Science, Technology, & Human Values, 28*(1), 15-33.

Boylan, M. 2004, What have we learned from 15 years of supporting the development of innovative teaching technology? *Social Science Computer Review, 22*(4), 4005-4425.

Clegg, S., Hudson, A. & Steel, J. 2003, The Emperor's New Clothes: globalisation and e-learning in higher education, *British Journal of Sociology of Education, 24*(1), 39-53.

Condie, R. & Livingston, K. 2007, Blending online learning with traditional approaches: changing practices, *British Journal of Educational Technology, 38*(2), 337-348.

Dillon, A. 1996, Myths, misconceptions and an alternative perspective on information usage and the electronic medium, in J. F. Rouet (Ed.), *Hypertext and Cognition* (pp. 25-42). Mahwah NJ: Lawrence Erlbaum.

Duderstadt, J.J. 2001, The future of the university in the digital age, *American Philosophical Society, 145*(1), 54-72.

Earp, J., Ott, M., Possi, F. & Tavella, M. 2007, School inclusion in the era of e-learning 2.0: is myth becoming reality? *Scottish Online Journal of e-Learning, 1*(1), 90-99.

Edwards, P.N. 1994, From 'impact' to social process: computers in society and culture, in S. Jasanoffet (Ed.), *Handbook of Science and Technology Studies* (pp. 1-41), Sage Publications, Beverly Hills, CA.

Ely, D. P. & Plomp, T. 1986, The promises of educational technology: a reassessment, *International Review of Education, 32*(3), 231-249.

Haddah, W.D. & Draxler, A. 2003, The Dynamics of Technologies for Education, Retrieved 21.06.2004, from http://www.aed.org/publications/TechnologiesForEducation/TechEdChapters/01.pdf

Haddah, W.D. & Jurich, S. 2003, ICT for Education: Potential and Potency. Retrieved 21.06.2004, from http://www.aed.org/publications/TechnologiesForEducation/TechEdChapters/03.pdf

Hug, B., Krajcik, J.S. & Marx, R.W. 2005, Using innovative learning technologies to promote learning and engagement in an urban science classroom, *Urban Education, 40*(446), 446-472.

Loxley, W. & Julien, P. 2004, *Information and Communication Technologies in Education and Training in Asia and Pacific*, Asian Development Bank. Retrevied 06.06. 2009, from http://www.adb.org/Documents/Reports/ICT-Education-Training/ict-education-training.pdf

Mogombo, J. 2007, *Use of Information and Communications Technologies (ICTs) in Teacher Education in Sub-Saharan Africa: case studies of selected African Universities.*

Oh, C.H. 2003, Information Communication Technology and the New University: A View on eLearning. *Annals of the American Academy of Political and Social Science, 585*, 134-153.

Pagliarello, M.C. 2007, Reluctant teachers and traditional learning methods: the multimedia teaching as a crossroads between the old and the new. *Scottish Online Journal of e-Learning, 1*(1), 68-83.

Potashnik, M. 996, *Chile's Learning Network*, World Bank, Human Development Department Education Group, Education and Technology Team, Washington, DC.

Sooknanan, P., Melkote, S.R. & Skinner, E.C. 2002, Diffusion of an educational innovation in Trinidad and Tobago: the role of teacher attitudes and perceptions toward computers in the classroom, *International Communication Gazette, 64*(6), 557-571.

Strommen, E.F. & Lincoln, B. 1992, Constructivism, technology, and the future of classroom learning. *Education and Urban Society, 24*(4), 466-476.

Thompson, H. 1999, The impact of technology and distance education: a classical learning theory viewpoint, *Educational Technology & Society, 2*(3).

Trucano, M. 2005, *Knowledge Maps: ICT in Education*, World Bank, Washington, DC.

Turney, C. S., Robinson, D., Lee, M. & Soutar, A. 2009, Using technology to direct learning in higher education: The way forward? *Active Learning in Higher Education, 10*(1), 71-83.

Twining, P. 2002, Conceptualising computer use in education: introducing the computer practice framework (CPF), *British Educational Research Journal, 28*(1), 95-110.

Volman, M. & Eck van, E. 2001, Gender equity and information technology in education: the second decade, *Review of Educational Research, 71*(4), 613-634.

Wahler, P. & Tully, C.J. 1991, Young people's attitudes to technology, *European Journal of Education, 26*(3), 261-272.

Author

Iwona Kolodziejczyk
Lecturer in Information Systems
Divine Word University
Email: ikolodziejczyk@dwu.ac.pg