How does Information Technology impact the methods, potential and purpose of education?

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Abstract: *It is evident that information technology has affected changes to the methods, purpose and the perceived potential of education. While various authors differ in their opinion on the degree, desirability and destiny of these changes, all agree that change processes have certainly been underway. However, the process of change is far from over. Numerous authors auger grave peril for education institutions that refuse to integrate information technology into every level of the education institution. Some authors argue that the very nature of education itself will change. Information technology, whether perceived as a power for good or a power for evil, certainly has not been neutral. While effecting change has been difficult in many situations, contemporary information technology has by its very nature, been an agent of change in education institutions.*

Introduction

Lyon (1988) argues that the term "Information technology" refers to "the cluster of computing and communications technologies based on microelectonics" (p. 40). In recent years, this convergence of technologies has provided the infrastructure for significant change in our society and education in general. Our society has become increasingly centred around the management and manipulation of knowledge (Smart, 1992; Wresch, 1996). In educational contexts, the changes brought by the introduction of information technology have variously been perceived as either: a great good (Hill, 1999), a virilent evil (Brabazon, 2002), or neither (Shields, 2000). Regardless of its relative value, all authors agree that information technology has greatly impacted education activities, aims and aspirations. This paper shall critically analyse the impact of contemporary information technology, particularly on the methods, purpose and potential of education.

Information Technology and the access and storage of information

Kroeker (2000) argues that the arrival of the personal computer, together with World Wide Web (WWW) browser technology, has fuelled the demand for faster, cheaper, more reliable computing technologies accessible to nearly everybody. Lyon (1988) argues that the increased capacity, rapid development and expansion of these information technologies, has led to notions of an "information society". Smart (1992) argues that these technological and cultural innovations have caused our society to become increasingly centred around knowledge, instead of the production of goods. In contrast to previous eras of economic development, where money was made in creating new ideas and information, now significant profit can be made in finding, packaging and delivering information (Wresch, 1996). Even where information technology is utilised to sell actual products via the internet, Niederman and Rollier (2001) note that the technology required to facilitate these transactions is based on very complex database management systems. The existence of such information technology has led many researchers and practitioners to consider how best to integrate this technology into educational contexts.

Kroeker (2000) argues that "integration" is an inappropriate term to use when considering the impact of modern communication technologies on education. Instead, Kroeker (2000) favours a question such as "How does the very nature of this new technology force us to change?" (p. 143). Duderstat (1999) agrees, suggesting that education institutions have been and will continue to be transformed by information technology. Kroeker (2000) argues that new technologies are both a creative force bringing about new opportunities and methodologies, as well as a destructive force –

causing the cessation of older methodologies, or at the very least, old ways of perceiving education. So just how has information technology affected education methodologies?

Information Technology and the methods of education

As information technology has developed, it has provided increasing opportunities, options and strategies for education (Hill, 1999, p. 234). Kroeker (2000) argues that the prevalence of information technology has generated an expectation that all education institutions will have a virtual as well as a physical location, and that students can now access most of the information they need via their web browser. This capacity of information technology to modify traditional understanding of the "location" of education, suggests the need for a completely different set of social and institutional infrastructures with which learning can be facilitated (Shields, 2000). School, like work, is now not necessarily something one "goes to" – information technology means that both work and education has the potential to be delivered directly into the homes of most Australians.

Dertouzos (1998) argues that the current reformation of information technology directly impacts education, since it mediates the way information is accessed, organised, stored and transmitted; while Watson (2001) argues that information technology brings about change in the way information is also learnt and taught. These changes of access, learning and teaching have particular bearing on education and therefore require further examination.

Changes to accessing education services

Brabazon (2002) argues that information technology enables access to thousands of on-line journals that would otherwise not be available for students – particularly in Australian contexts. Furthermore, this access is available 24 hours a day, seven days a week. Information technology provides the opportunity for asynchronous learning – the ability for students to learn the same material at different times in different places (Niederman & Rollier, 2001), thus negating the need to be at a particular place at a particular time. Dertouzos (1998) argues that students can no longer say they don't have reference material available since the Internet brings a wealth of information into every home. Likewise out-of-class work can now be disseminated and submitted from any place with internet access, making it difficult for students to argue that they "forgot" their work or were not informed about the out-of-class work (Dertouzos, 1998). The issue of access to education for students via information technology is seen as a vitally empowering one. This increased access to information technology also has the capacity to affect how students learn.

Changes to learning

Loveless, DeVoogd and Bohlin (2001) argue that being able to access large databases of information fundamentally changes education, since learners can now be creators and collaborators in the access and construction of discourses of information. Kapitzke (2000) argues that, due to their technological literacy, young people can derive cultural capital from their understanding of modern information technologies, and thereby have input into educational change. The same technology also facilitates the rapid exchange of information by researchers on specific topics, so that the speed of the dissemination of information is greatly increased (Hill, 1999, p. 235). Watson (2001) argues that the increased access to huge amounts of data means students need help selecting, evaluating and analysing information, and they need to learn how to determine the currency, validity and veracity of the information itself. All of these changes in learning have implications for teaching practice as well.

Changes to teaching

Information technology is enabling new ways of teaching (Hill, 1999, p. 234). Knezek and Christensen (2002) argue that the highest level of change occurring in relation to information technology and education is in the way teaching is increasingly being seen as occurring via the medium of technology, rather than utilising technology as an additional extra in the classroom. Information technology particularly impacts course content and teaching methodology and the recruitment and training of teaching staff (De Landsheere, 1991) as well as the content of teacher education courses (Asselin & Lee, 2002).

De Landsheere (1991), Mitchell, Dipetta and Kerr (2001) and Kasim (2002) all suggest that information technology requires teachers to learn new sets of skills. At a practical level, Brabazon (2002) and Finkelstein (2003) both note that the advent of information technology, particularly emails, have dramatically altered the activities of a typical academic and teaching day. Loveless, DeVoogd and Bohlin (2001) further support this by suggesting that modern information technology can bring about change to the management of classrooms. Shields (2000) argues that utilising computer technology improves the educational experience of the students – not so much because of the media itself, but because software programs require teachers to think laterally and systematically, and produce better teaching materials. Thus, experientially, practically and pedagogically, teaching practices can be affected by information technology.

Bork (1999, as cited in Garson, 2000, pp. 180–181) argues that in the future, education will become increasingly interactive, individualised, flexible, accessible, computer-mediated (not assisted) and will displace campus-based schools. Dertouzos (1998) argues that simulators offer a fantastic teaching and learning methodology, where students can "experience" the consequences of actions in a virtual environment. While such simulators are currently reserved predominantly for the military and avionics, Dertouzos (1998) argues that they could have application in a wide range of educational situations including drug awareness, conflict resolution situations and even providing "automated apprenticeships". Garson (2000) and Dertouzos (1998) see the role of a teacher becoming that of an instructional designer, working with a team of people to create virtual educational experiences.

Aungles (1991) agrees that the role of teachers will change with the advances of information technologies but suggests a more pragmatic role. Students do not lack information, but rather the time to find, analyse, understand and apply information (Simon, 2002). A teacher's role is therefore to help students develop skills in order to determine how to find, analyse and interpret information. Turner and Handler (1997) argue that the role of the teacher is to establish learning environments which facilitate co-authors of meaning. Wharton (1994) summarises the main elements of this shift and suggests that the role of teaching in information technology enhanced learning environments is to develop a student-centred learning environment, demonstrate effective information management strategies, stimulate active learning, and facilitate group learning activities. More than just a tool, information technology is increasingly becoming the content of education, as educators seek to teach students how to use the technology that is available (Hill, 1999, pp. 234–235).

Information Technology and the purpose of education

While education has historically been centred on teaching and learning, Duderstat (1999) argues that information technology has affected changes to the aims of education, so that education is increasingly perceived as the process of creating, preserving, integrating, transmitting and applying knowledge. Loveless, DeVoogd and Bohlin (2001) extend this argument, arguing that perceptions of knowledge itself have also changed. Whereas knowledge could once have been perceived as unchanging, Loveless, DeVoogd

and Bohlin (2001) suggest information should now be perceived as "revisionary, creative, personal and pluralistic" (p. 74). Other authors have different perceptions however.

Shields (2000) argues that the future of education is not predetermined by modern information technology, but rather that this "future will hinge prominently on how we construct (and construe) the place of technology" in the education process (p. 172). Niederman and Rollier (2001, p. 64) take a different perspective, suggesting that the goals of education now need to more closely resemble that of a business. Duderstat (1999) disagrees, arguing instead that we are moving from "just-in-case" education to "just-for-you" education" where education is targeted to meet the needs of individual students. It is this targeting and "niching" of the education experience that draws some parallels with business, but retains some of the more traditional objectives of education. Research into how information technology can affect the purpose of education, presents a set of disparate views. However, the lack of consensus and the divergence in the debate, suggest that the purpose of education is undergoing considerable re-envisaging.

Information Technology and the potential of education

An education system that is experiencing greatly increased ability to store masses of data needs to pay increasing attention to developing students' ability to find relevant information amongst the mass that is available (Hill, 1999, p. 234). Hill (1999) argues that learning how to use information technologies is a key requirement for the immediate future; "learning how to handle, evaluate and exploit information, both new and old, is essential both for the short term and the long term future" of education (p. 249).

While no author is entirely certain of the future of education, a number have made predictions about what the future may hold – largely predicted on the untapped potential of information technology. Angus, Snyder and Sutherland-Smith (2004) suggest that predicting of the future of information technology has more to do with ideology than reality, but these are a minority of authors. Hill (1999) argues that in the future, education systems need to ensure that they give "students a sound and extensive store of information on which to base manual and intellectual skills and the powers of judgement, the ability to acquire more when needed, the skill to select, evaluate and utilise information and an understanding of how knowledge advances" (p. 240).

Brown (1997) argues that even the largest universities and libraries in the world cannot cope with the sheer amount of information available, or soon to be available. Niederman and Rollier (2001) argue that the best solution for this conundrum is for libraries to identify the most relevant sites of information in order to assist students in accessing the most relevant and reliable. Brown (1997) agrees and suggests that the best response is for education institutions to become conduits, or filters, of digital information exchange.

Brown (1997) sees the strength of education institutions in the future lies in their ability to create learning communities, and to act as trusted gatekeepers of information systems. Kroeker (2000) further argues that educational libraries will become access, facilitation and filtration points of knowledge, rather than repositories of knowledge. Watson (2001) argues that education institutions will increasingly take a central position in facilitating adaptation to uncertain and changeable situations.

Virtual institutions

Duderstat (1999) notes that information technology frees education institutions from the constraints of space and time, and enables the delivery of education services anywhere, anytime. Denning (1997, as cited in Garson, 2000, p. 181) foresees a future where physical libraries would be replaced by digital libraries available to anyone; and that scholars could cease to be located around a geographical focus and will probably become increasingly "located" around a specialisation, but physically located anywhere in the

world. Hill (1999) envisages the day when modern technology will enable students in a given location to access the best of teachers in a given field and to interact with them, whether "live" or via video (p. 234). Niederman and Rollier (2001) note that the largest university in the world, currently has three million students, and conducts its training programs entirely on line (p. 68).

From asynchronous learning to ubiquitous learning

Kroeker (2000) predicts that computers will become ubiquitous, and will be integrated into all of our daily lives. Duderstat (1999) envisages a future of ubiquitous learning – learning for everyone, everyplace, all the time. Niederman and Rollier (2001) suggest that in the future, students will be able to take advantage of wireless computing and complete and send assignments from almost anywhere at any time; access digital video archives and view these on line; and utilise virtual reality for a range of education activities (p. 70). This is a move from just-in-time education to just-about-anywhere education.

Changing the educational institution

The sheer scope of change underway in communication technology, with changes to the methodology, modes and mores of education (Katz, 1999), suggests that the education institution itself may need to be revised at the organisational level as well. Katz (1999) foresees a future of increased competition and alliances in which education institutions eschew monolithic approaches to education, and embrace more strategic and collaborative approaches. Duderstat (1999) agrees, discussing the possibility of "unbundling" education activities: determining the true strengths of each education institution and outsourcing the rest of the activities. Niederman and Rollier (2001, p. 70) see the future involving coalitions of universities offering joint programs; and that education institutions will become more like brokers – providing facilities for buyers and sellers of education services.

Brown (1997) argues that information technology will undermine the roles of schools, in that they enable commercial companies to deliver educational products directly to homes, at reduced prices, thereby making large educational institutions economically unviable. Niederman and Rollier (2001) agree, suggesting that there are two possible outcomes for the future of education: one being that only four out of five universities would have the capacity to support a significant student population on the web; the other being that there could be a profilgation of universities enabled by modern communication technologies.

The end of the university as we know it?

Dezell (1990) argues that the future of education lies in moving towards the integration of information technology into all aspects of education. Farrington (1999) adds a cautionary note that those education institutions that fail to incorporate aspects of educational technology to all aspects of their teaching and learning face a bleak and untenable future. Reddy and Goodman (2002) go further, arguing that educational organisations that do not initiate change that embraces information technology at all levels of the educational process, will simply cease to exist. Larson and Strehle (2002) argue that the very nature of education as we know it will change. And yet, as many authors have noted, change is not easily achieved in an education context (Anderson, 2001; Carlson, 1994; Gayeski, 1996; Gray, 1992; Holzberg, 1997; Larson & Strehle, 2002; Poole, 1995; Sherwood, 1992; Simon, 2002).

Conclusion

In considering the impact of information technology, changes have been evident in the methods (Aungles, 1991; Hill, 1999; Shields, 2000; Watson, 2001), purpose (Loveless, DeVoogd & Bohlin, 2001; Dunderstat, 1999; Hill, 1999; Rollier, 2001; Shields, 2000), and the perceived potential of education (Niederman & Rollier, 2001; Brown, 1997; Duderstat, 1999; Hill, 1999; Katz, 1999; Kroeker, 2000). While various authors have differed in their opinion of the degree, desirability and destiny of these changes, they all agree that change processes have certainly been underway.

However, the process of change is far from over. Numerous authors auger grave peril for education institutions that refuse to adopt information technology and integrate it into every level of the education institution (Farrington, 1999; Reddy & Goodman, 2002). Larson and Strehle (2002) argue that the very nature of education itself will change. Information technology, whether perceived as a power for good or a power for evil, certainly has not been neutral (Shields, 2000). While change has been difficult in many circumstances (Larson & Strehle, 2002; Poole, 1995) contemporary information technology by its very nature, has been an agent of change in education institutions around the world (Kroeker, 2000).

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