

INFORMATION AND COMMUNICATION TECHNOLOGY IN HEALTH: A REVIEW OF THE LITERATURE

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Abstract

Information and communication technology has been shown to be increasingly important in the education and professional practice of healthcare workers. The World Health Organisation (WHO) discusses the benefits of using ICT in the Primary Healthcare setting in terms of better access to information, improved communication between colleagues, facilitating continuing professional development and providing learning tools for healthcare professionals, patients and the community as a whole. This review of the literature describes the role of information and communication technology (ICT) in the education and professional practice of healthcare workers and goes on to outline the challenges facing the widespread adoption of ICT. The conclusion is that ICT does indeed have a positive role to play in both the education and professional practice of healthcare workers, including physiotherapists, as long as it is implemented as an adjunct to established and proven practice, and not a replacement.

Key Words: information and communication technology, education, healthcare, professional practice.

Introduction

It is widely recognised that the role of information and communication technology (ICT) in the future of healthcare will be significant and that healthcare professionals will need to be computer literate in order to function effectively in an increasingly digital environment (National Health Service, 1998). One estimate is that by 2010, 30% of a medical practitioners time will be spent using ICT (Skinner, Biscope, & Poland, 2003). It also seems clear that today's students are well suited to make use of

technology, as they were the first to grow up in a period of unprecedented access to information and computer use (Coomes, 2004). There is general agreement that they are more comfortable with technology and that they use it almost constantly (Prensky, 2001; Foehr, 2006). They also have distinctive ways of thinking, communicating and learning (Barnes, Marateo & Ferris, 2007), which may have an impact not only in their social lives, but also in the ways in which they learn and how they will practice their profession. Thus, determining how ICT can be used to educate healthcare

professionals and support their professional development and evidence-based practice, is important. The World Health Organisation (WHO) has discussed the benefits of ICT within the healthcare sector and states that it has the potential to improve the exchange of data leading to better access to information and to improve the cost-effectiveness of institutions. It can also facilitate the continuing professional development (CPD) of healthcare professionals by allowing the transfer of training materials to rural areas, as well as enhancing communication between teachers and students or professional colleagues. Other benefits of ICT in healthcare include providing learning tools for healthcare professionals, students, patients and the community as a whole and providing the opportunity for primary healthcare centres to have access to clinical specialists, through teleconferencing (WHO, n.d.).

The use of ICT within the field of healthcare is becoming an increasingly important aspect of clinicians professional practice, improving the delivery of health services and communication between healthcare workers, as well as enhancing the decision making process through the efficient flow of information. The purpose of this article is to highlight some of the ways in which ICT is currently being used globally in the education and practice of healthcare professionals, with an emphasis on its use in the field of physiotherapy in South Africa. Sources were drawn from academic papers and books published in the fields of healthcare, education and technology, through online searches using keywords relevant to the topic.

ICT in the training of health professionals

The South African government has recognised the importance of ICT in education, stating in its "*Draft White Paper on e-Education*" that "...ICT has the potential to improve the quality of education and training" and specifically names the healthcare sector as a focus area in which development needs to take place (Department of Education, 2004). The use of ICT in education is generally known as e-learning, where content can be distributed in several formats (for example digital video, audio, images and text) through several channels (for example telephone, radio, TV, compact discs and the Internet). E-learning can be described as any teaching or learning scenario in which the teacher and student are separated in time and space and the gap between the two is bridged by some form of online technology (Wikipedia², n.d.). Web-based teaching and learning brings several benefits to the educational process, including allowing students to engage more actively with the content, rather than learning being a passive process. This encourages "deep learning"³ through activities such as problem-solving and information-gathering. Finally, coursework is accessible to students anywhere, at any time (Johns, 2003).

A study of the use of e-learning at two South African universities indicated that it has a positive role to play as an alternative mode of instruction in higher education (Rohleder, Bozalek, Carolissen, Leibowitz & Swartz, 2007). The main advantage reported by students taking part in this study was an improvement in communication between students and facilitators through the use of online

2. The use of Wikipedia as a resource for academic work has been the subject of much debate. However, in a 2005 study by the British scientific journal, *Nature*, Wikipedia was found to be "...about as accurate as the Encyclopedia Britannica...", particularly with regards scientific and technological entries (British Broadcasting Corporation [BBC], 2005).

3. Deep learning describes an enhancement of the learning process whereby knowledge acquires meaning, is analysed and conceptualised. It contrasts with surface learning, which is the reproduction of knowledge by rote learning (Prosser & Trigwell, 1999).

forum discussions and email. Other advantages included a cost saving of working in a paperless environment, as well as easier submission of assignments. However, the authors found that some students experienced difficulty with e-learning as there was a strong preference for face-to-face interaction that would be problematic for this method of teaching. This preference for face-to-face contact was also found by Sweeney, O'Donaghue and Whitehead (2004), and in a study among South African physiotherapy students (Rowe, 2008).

Eksteen (2005) investigated the use of e-learning among physiotherapy students as a means of enhancing their clinical reasoning and lifelong learning skills, as well as their interaction with each other and lecturers. She concluded that while e-learning provides a well-structured way of working through problem solving and clinical reasoning situations, it does not provide the important interaction that is possible with direct face-to-face contact. In other words, e-learning may have an influential role to play in education but should be seen as a means of enhancing this process, rather than as an end in itself. It was also found that the response to e-learning is related to each student's individual style and approach to learning, suggesting that there is no "one size fits all" approach. Peacock and Hooper (2007) suggest that institutions using e-learning must prepare students to engage effectively with these systems, as they are unlikely to be familiar to the student. Rowe (2008) also found that the majority of physiotherapy students had not had regular access to ICT prior to beginning tertiary education. Induction programmes as part of the curriculum could be used to provide a framework upon which physiotherapy students can use online learning resources to assist their development as independent learners (Hamshire, 2008).

The use of video to enhance the learning process was demonstrated by Maeno, Fujita, and Iwatsuki (2004), who used videoconferencing to teach basic therapeutic techniques to first year physiotherapy students over a distance. Davies, Ramsay, Lindfield and Couperthwaite (2005) showed that traditional classroom teaching techniques could be combined with digital video to develop physiotherapy students' neurological and analytical skills. It was found that the use of video footage of real patients, combined with students' theoretical knowledge of neurological conditions gave them a better appreciation of what to expect on their clinical placements. Again, the studies suggest that digital multimedia resources should be used as a way to add value to already established teaching techniques, rather than trying to substitute one for the other.

In the United Kingdom (UK), Devitt and Murphy (2004) surveyed doctors' use of computers for clinical tasks at an acute hospital in the National Health Service (NHS). The study found that doctors mainly used computers to conduct literature searches, write clinical reports and prepare presentations. However, while clinicians and researchers often use online databases to support their practice, they sometimes lack the skills to do this well (Haynes, McKibbin, Wilczynski, Walter and Werre, 2005). This may be a result of not addressing the problem during undergraduate training, as was suggested by Giustini and Barsky (2007), who found that students are not taught how to search the literature effectively or to evaluate the credibility of search results. Mostert (2005) had previously highlighted the importance of teaching students the skills to manage the vast amount of information that is available online, although whether or not this practice has found its way into the curricula of health-related education is uncertain.

While the situation in Europe appears positive, medical students in Africa seem to be losing out on the benefits that ICT has to offer. Samuel, Coombes, Miranda, Melvin, Young and Azarmina (2004) looked at the use of ICT by medical students at a Tanzanian university, as well as a pilot ICT mentoring programme by elective UK medical students at the same university. They found that Tanzanian medical students had a low level of ICT literacy but that mentoring by the UK students had the potential to improve this situation, with only about five hours of input required to double ICT competency scores. The authors suggest that programmes to increase ICT skills are required, as well as improving access to computers for medical students. These results were similar to those of Ajuwon (2003), who found that first year medical and nursing students in Nigeria had not made full use of ICT as a means of enhancing their medical education. This was partly because of the high cost of accessing ICT services and low ICT penetration. The recommendations made were similar to those of Samuel et al. (2004), that is, to improve access to ICT by including computer education in medical and nursing training and the establishment of more computer laboratories for use by students.

The use of ICT in education has been shown to have several benefits and while there are some inherent problems with the e-learning paradigm, such as diminished opportunities for face-to-face contact, educators must recognise that ICT is the lens through which this generation views the world and should seek to incorporate it into their teaching practice. Clinical reasoning and problem solving skills, essential to the clinician, were found to be improved among physiotherapy students using an e-learning approach, which may have an impact on professional competence.

ICT in professional practice

ICT not only has the ability to enhance the education and training of healthcare professionals, but has also been shown to be a potential means of addressing several important problems in their professional practice (WHO, "*eHealth for Healthcare Delivery*", n.d.). These problems relate mainly to evidence-based practice (EBP), continuing professional development (CPD) and geographical and professional isolation.

Evidence based practice

EBP is fast becoming the standard by which assessment and treatment interventions in healthcare are measured. It is "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients" (Sackett, Rosenberg, Gray, Haynes & Richardson, 1996). According to the Health Professions Council (HPC) in the UK, physiotherapists must "be able to use research, reasoning and problem solving skills to determine appropriate actions" (Chartered Society of Physiotherapists [CSP] website, 2008). In addition to the skills just mentioned, regular access to information is essential in EBP, and clinicians are increasingly turning to the Internet to find content that supports their clinical practice (Martin, 2004). In addition to this, a study by Kulier et al. (2008) found that an e-learning programme focusing on the teaching and learning of evidence-based medicine across five European countries improved the knowledge, attitudes and skills among postgraduate medical students. This demonstrates that ICT is not only an effective means of facilitating EBP, but has also been useful in teaching it.

In a study of the attitudes and barriers of evidence based practice (EBP) among physiotherapists in Tanzania, Maigeh (2003) showed that the majority

of participants (91.3%) considered EBP to be useful in their practice, and that although most physiotherapists surveyed had a good knowledge of EBP, lack of access to literature limited them from incorporating this into practice. This common barrier has been highlighted in several other studies (Guyatt, Meade, Jaeschke, Cook, & Haynes, 2000; Grimmer-Somers, Lekkas, Nyland, Young, & Kumar (2007). It has been suggested that electronic knowledge bases or increasingly, Health Information Systems⁴ (HIS) could be used to conduct research (Guyatt et al., 2000). However, in a survey of South African physiotherapists working in community service placements, some reported having "no" or "minimal" access to the Internet, universities or libraries and no opportunities for even basic research (Steyn, 2005). This lack of access to information limits the potential to engage in EBP, a cause for concern among newly graduated therapists. Peacock and Hooper (2007) have suggested that employers have a vital role in encouraging EBP by supporting ICT-based initiatives to promote the "...sharing of expertise and practice that is evidence based".

It seems clear that EBP is being recognised as a requirement for good practice among healthcare professionals and that the role of the Internet in providing access to research upon which to base their practice is becoming increasingly important. However, there are obstacles when it comes to incorporating EBP into professional practice, including a lack of access to relevant content. It has been suggested by some authors that increased use of ICT may provide greater access to resources with which to conduct research.

Continuing professional development

ICT not only has the ability to enhance the education and training of healthcare professionals, but can also provide a channel by which CPD can be effected, through the use of telemedicine and teleconsultation (WHO, "eHealth for Healthcare Delivery", n.d.).

In her survey of 52 physiotherapists working in community service in KwaZulu-Natal Province in South Africa, Steyn (2005) found that there were no CPD courses offered specifically to accommodate rural physiotherapists, and sometimes not even textbooks were available for reference. The physiotherapists also reported that the few courses available to them were too expensive, too far away and unrelated to community work.

These results were similar to those of Hill and Alexander (1996), who found that health professionals in rural parts of Australia were disadvantaged when it came to accessing CPD, mainly because of their geographical isolation. They implemented a solution whereby rural nurses and community members used the telephone network to access a CPD module on diabetes care, which allowed students and experts to interact and share information. Mitchell, Robinson, McEvoy, and Gates (2001) used a combination of videoconferencing, telephone, video-tapes, the Internet and printed material to show how telemedicine⁵ was able to play a role in the professional development of health, education and welfare professionals in two small mining towns. These studies demonstrate that the use of ICT (in its various forms) is able to facilitate the CPD

4. Health Information Systems are used to efficiently manage information such as patient records, billing and appointment scheduling within healthcare. They are also increasingly used for research, as well as seeking to guide and inform the decision making process (Wikipedia, 2008).

process through the transfer of information and experience to remote areas.

Geographical and professional isolation

The problem of geographical isolation was found to be an influential factor affecting the recruitment and retention of healthcare workers to remote areas of Australia (Struber, 2004), which are often associated with lower numbers of healthcare workers than cities (Australian Institute of Health and Welfare, 2001). Struber (2004) also identified several disincentives to rural work, including a lack of professional supervision, support and/or mentoring, difficulties accessing professional development opportunities, a lack of support for ongoing/postgraduate education, professional isolation and a lack of resources.

Together with the points related to professional practice mentioned above, social and cultural isolation and a lack of access to entertainment have also been identified as other factors related to geographical isolation in both Australia and South Africa (Mitchell, 1996; Mitchell, Robinson, McEvoy & Gates, 2001; Struber, 2004; Steyn, 2005). It was suggested by Taylor and Lee (2005) that the use of ICT may influence the recruitment and retention of occupational therapists who work under difficult conditions. Together with this, the transfer of information to rural areas through the use of telemedicine may be an effective means of improving the medical care provided to patients (Fraser, 2002).

WHO, in their document "*eHealth for Healthcare delivery*" (n.d.), have suggested that the use of ICT

in healthcare may have a role to play in minimising the problems associated with geographical isolation, including the effects of professional isolation. The challenges to recruiting and retaining healthcare workers in rural areas can be overcome through the implementation of online support networks, such as interactiveCSP (CSP, 2008), but physiotherapists need to be provided with the skills, time and resources to participate in these services (Peacock & Hooper, 2007).

The importance of access to the Internet at work was highlighted by Louw and Hanmer (2002), who suggested that South African provincial government departments allow unrestricted use of the Internet for healthcare professionals to access relevant health information. While it seems self-evident that access to the vast resources on the Internet, as well as the ability to enhance communication between healthcare professionals can only enhance patient care and professional development, it is a concern that this resource is often not available to South African healthcare professionals.

Challenges of implementing ICT solutions in healthcare

Not everyone is singing the praises of ICT in health education and practice. Coyne (1995) argued that the implementation of ICT can lead to a widening of the gap between rich and poor, as well as of the "digital divide", described by WHO as being "more dramatic than any other inequity in health or income" (Edejer, 2000). The tragedy is that those who need the vast resources of the Internet the most, are often the ones with the least access

5. Telemedicine is defined by the American Telemedicine Association (ATA) as "...the use of medical information exchanged from one site to another via electronic communications to improve patients' health status" (ATA, n.d.). It includes videoconferencing between healthcare workers, the transfer of digital images, access to educational resources to facilitate CPD, monitoring of vital signs over a distance and nursing call centres (Fraser, 2002).

(Samuel et al., 2004). Coyne (1995) also argued that the vast amounts of often contradictory information available on the Internet, often published by dubious authors, can actually lead to more difficulty in the ability to make decisions. Edejer (2000) agreed and suggests that the "...quality of health information available on the web is inconsistent" and highlighted the fact that the results of research from developing countries can be difficult to find. This would suggest that the technology, while increasingly pervasive, is still unevenly distributed and in itself, is not a solution to the problems found in either education or healthcare.

While e-learning has often been portrayed as the answer to many problems, it has also been associated with loneliness, time management issues, poor physical examination skills and difficulty following the study material. Students have also struggled to take responsibility for their own independent learning, as well as finding that access to technology was limited and their technological literacy, low (Mostert, 2006). Unfortunately, among those students who are ICT literate, academic dishonesty has become alarmingly widespread over the past three decades (Stephens, 2004). Milliron and Sandhoe (2008) discussed these challenges to educators and found that a combination of technological solutions and behavioural changes through education based on respect, honesty, trust and responsibility can have a positive effect. The impact of this is that educators must themselves be aware of the potential avenues for cheating in the digital age.

Another potential barrier to the widespread penetration of ICT into healthcare is the high cost of equipment ("Tygerberg children's hospital," 2003). While this is certainly the case, Fraser (2002) points

optimistically to the falling cost of hardware and bandwidth, better imaging devices and compression technology, the increasing use of the Internet and the use of appropriate technology in developing countries, as important factors in the adoption of ICT. Even though the telephone network is still inadequate for the wholesale adoption of all Internet technologies, in particular the transmission of digital video, South Africa's communications infrastructure is the "best developed and most modern in Africa" (World Factbook, 2008), which is a positive indication of the potential to improve. While Nel ("Tygerberg children's hospital," 2003) mentioned the difficulty of accessing networks from areas with poor Internet connectivity because of a lack of infrastructure, wireless and satellite networks could be considered as alternatives (Louw and Hanmer, 2002).

Conclusion

The use of ICT in education has been shown to have several benefits, including the potential to enhance communication, improve access to information and facilitate deep learning. While there are some inherent problems with the e-learning paradigm, for example diminished opportunities for face-to-face contact and increased opportunities for academic dishonesty, if it is used as an adjunct (rather than a replacement) to proven methods of education, ICT in education can be a powerful tool. Educators need to recognise that ICT is the lens through which this generation of students views the world and should seek to incorporate it into their established teaching practice.

The use of ICT within the field of healthcare is becoming an increasingly important aspect of a clinician's professional practice, improving the delivery of health services and communication

between healthcare workers, as well as enhancing the decision making process through the efficient flow of information. Other important benefits include facilitating EBP through access to information for research, allowing CPD in rural areas and diminishing the disadvantages of geographical and professional isolation. While there are barriers to widespread adoption of ICT in healthcare, such as the high cost of equipment, and concerns about the credibility of information, these obstacles are not prohibitive.

It is evident that the role of ICT in both the professional education and practice of healthcare professionals is becoming increasingly important. However, evidence is lacking in terms of specific technological innovations or tools to enhance healthcare education and consequently, professional practice, through deeper understanding of the content, was not found to be evident from the literature. It is recommended that further investigation into the use of ICT and its specific implementations in education and professional practice are carried out in order to better inform clinicians and educators with regards the beneficial potential of technology in healthcare.

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